z/OS
Version 2 Release 3

Language Environment
Programming Reference

IBM
<table>
<thead>
<tr>
<th>Language runtime option mapping</th>
<th>93</th>
</tr>
</thead>
<tbody>
<tr>
<td>XPLINK</td>
<td>91</td>
</tr>
<tr>
<td>VCTRSAVE</td>
<td>90</td>
</tr>
<tr>
<td>USRHDLR</td>
<td>NOUSRHDLR</td>
</tr>
<tr>
<td>UPSI (COBOL only)</td>
<td>88</td>
</tr>
<tr>
<td>TRAP</td>
<td>86</td>
</tr>
<tr>
<td>TRACE</td>
<td>84</td>
</tr>
<tr>
<td>THREADSTACK</td>
<td>81</td>
</tr>
<tr>
<td>THREADSTACK64 (AMODE 64 only)</td>
<td>83</td>
</tr>
<tr>
<td>TRERUS (COBOL only)</td>
<td>65</td>
</tr>
<tr>
<td>SIMVRD (COBOL only)</td>
<td>66</td>
</tr>
<tr>
<td>STACK5</td>
<td>67</td>
</tr>
<tr>
<td>STACK64 (AMODE 64 only)</td>
<td>69</td>
</tr>
<tr>
<td>STORAGE</td>
<td>70</td>
</tr>
<tr>
<td>TERMTHDACT</td>
<td>73</td>
</tr>
<tr>
<td>TEST</td>
<td>NOTEST</td>
</tr>
<tr>
<td>THREADHEAP</td>
<td>80</td>
</tr>
<tr>
<td>THREADSTACK</td>
<td>81</td>
</tr>
<tr>
<td>TRERUS (COBOL only)</td>
<td>65</td>
</tr>
<tr>
<td>SIMVRD (COBOL only)</td>
<td>66</td>
</tr>
<tr>
<td>FILETAG (C/C++ only)</td>
<td>30</td>
</tr>
<tr>
<td>FILEHIST (Fortran only)</td>
<td>30</td>
</tr>
<tr>
<td>FILETAG (C/C++ only)</td>
<td>30</td>
</tr>
<tr>
<td>FLOW (COBOL only)</td>
<td>32</td>
</tr>
<tr>
<td>HEAP</td>
<td>32</td>
</tr>
<tr>
<td>HEAP64 (AMODE 64 only)</td>
<td>34</td>
</tr>
<tr>
<td>HEAPCHK</td>
<td>36</td>
</tr>
<tr>
<td>HEAPPOOLS (C/C++ and Enterprise PL/I only)</td>
<td>38</td>
</tr>
<tr>
<td>HEAPPOOLS64 (C/C++ and AMODE 64 only)</td>
<td>40</td>
</tr>
<tr>
<td>HEAPZONES</td>
<td>41</td>
</tr>
<tr>
<td>INFOMSGFILTER</td>
<td>43</td>
</tr>
<tr>
<td>INQPCOPN (FORTRAN only)</td>
<td>44</td>
</tr>
<tr>
<td>INTERRUPT</td>
<td>44</td>
</tr>
<tr>
<td>IOHEAP64 (AMODE 64 only)</td>
<td>44</td>
</tr>
<tr>
<td>LIBHEAP64 (AMODE 64 only)</td>
<td>46</td>
</tr>
<tr>
<td>LIBSTACK</td>
<td>47</td>
</tr>
<tr>
<td>MSGFILE</td>
<td>48</td>
</tr>
<tr>
<td>MSGQ</td>
<td>51</td>
</tr>
<tr>
<td>NATLANG</td>
<td>51</td>
</tr>
<tr>
<td>OCTSTATUS (Fortran only)</td>
<td>52</td>
</tr>
<tr>
<td>PAGEFRAMESIZE</td>
<td>53</td>
</tr>
<tr>
<td>PAGEFRAMESIZE64</td>
<td>55</td>
</tr>
<tr>
<td>PC (Fortran only)</td>
<td>57</td>
</tr>
<tr>
<td>PLIST</td>
<td>57</td>
</tr>
<tr>
<td>PLITASKCOUNT (PL/I only)</td>
<td>59</td>
</tr>
<tr>
<td>POSIX</td>
<td>59</td>
</tr>
<tr>
<td>PROFILE</td>
<td>60</td>
</tr>
<tr>
<td>PRTUNIT (Fortran only)</td>
<td>61</td>
</tr>
<tr>
<td>PUNUNIT (Fortran only)</td>
<td>61</td>
</tr>
<tr>
<td>RDRUNIT (Fortran only)</td>
<td>61</td>
</tr>
<tr>
<td>RECPAD (Fortran only)</td>
<td>62</td>
</tr>
<tr>
<td>REDIR</td>
<td>NOREDIR</td>
</tr>
<tr>
<td>RPTOPTS</td>
<td>62</td>
</tr>
<tr>
<td>RPTSTG</td>
<td>63</td>
</tr>
<tr>
<td>ERRUNIT (Fortran only)</td>
<td>29</td>
</tr>
<tr>
<td>ERRCOUNT</td>
<td>28</td>
</tr>
<tr>
<td>EXECOPS</td>
<td>NOEXECOPS</td>
</tr>
<tr>
<td>RPTOPTS</td>
<td>62</td>
</tr>
<tr>
<td>RPTSTG</td>
<td>63</td>
</tr>
<tr>
<td>RTERUS (COBOL only)</td>
<td>65</td>
</tr>
<tr>
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<td>73</td>
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<td>80</td>
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<td>81</td>
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</tr>
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<td>70</td>
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<td>73</td>
</tr>
<tr>
<td>TEST</td>
<td>NOTEST</td>
</tr>
<tr>
<td>THREADHEAP</td>
<td>80</td>
</tr>
<tr>
<td>THREADSTACK</td>
<td>81</td>
</tr>
<tr>
<td>THREADSTACK64 (AMODE 64 only)</td>
<td>83</td>
</tr>
<tr>
<td>TRERUS (COBOL only)</td>
<td>65</td>
</tr>
<tr>
<td>SIMVRD (COBOL only)</td>
<td>66</td>
</tr>
<tr>
<td>STORE64 (AMODE 64 only)</td>
<td>69</td>
</tr>
<tr>
<td>STORAGE</td>
<td>70</td>
</tr>
</tbody>
</table>
# Chapter 3. Quick reference tables for Language Environment services

<table>
<thead>
<tr>
<th>Service Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bit manipulation routines</td>
<td>97</td>
</tr>
<tr>
<td>Condition-handling callable services</td>
<td>97</td>
</tr>
<tr>
<td>Date and time callable services</td>
<td>98</td>
</tr>
<tr>
<td>Dynamic storage callable services</td>
<td>99</td>
</tr>
<tr>
<td>General callable services</td>
<td>99</td>
</tr>
<tr>
<td>Initialization and termination services</td>
<td>100</td>
</tr>
<tr>
<td>Locale callable services</td>
<td>100</td>
</tr>
<tr>
<td>Math services</td>
<td>101</td>
</tr>
<tr>
<td>Message handling callable services</td>
<td>102</td>
</tr>
<tr>
<td>National Language Support callable services</td>
<td>102</td>
</tr>
</tbody>
</table>

# Chapter 4. Using Language Environment callable services

<table>
<thead>
<tr>
<th>Service Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locating callable service information</td>
<td>103</td>
</tr>
<tr>
<td>General usage notes for callable services</td>
<td>104</td>
</tr>
<tr>
<td>Invoking callable services</td>
<td>104</td>
</tr>
<tr>
<td>Parameter list for invoking callable services</td>
<td>107</td>
</tr>
</tbody>
</table>

# Chapter 5. Callable services

<table>
<thead>
<tr>
<th>Service Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE3ABD—Terminate enclave with an abend</td>
<td>113</td>
</tr>
<tr>
<td>CEE3AB2—Terminate enclave with an abend and reason code</td>
<td>116</td>
</tr>
<tr>
<td>CEE3CIB—Return pointer to condition information block</td>
<td>119</td>
</tr>
<tr>
<td>CEE3CTY—Set the default country</td>
<td>122</td>
</tr>
<tr>
<td>CEE3DLY—Suspend processing of the active enclave in seconds</td>
<td>126</td>
</tr>
<tr>
<td>CEE3DMP—Generate the dump</td>
<td>129</td>
</tr>
<tr>
<td>CEE3GRO—Get name of routine that incurred condition</td>
<td>143</td>
</tr>
<tr>
<td>CEE3GRN—Get offset of condition</td>
<td>147</td>
</tr>
<tr>
<td>CEE3GRC—Get the enclave return code</td>
<td>136</td>
</tr>
<tr>
<td>CEE3INF—Query enclave information</td>
<td>151</td>
</tr>
<tr>
<td>CEE3LNG—Set national language</td>
<td>155</td>
</tr>
<tr>
<td>CEE3MDS—Get default and international currency symbols</td>
<td>164</td>
</tr>
<tr>
<td>CEE3MC2—Get default currency symbol</td>
<td>167</td>
</tr>
<tr>
<td>CEE3MI2—Get default decimal separator</td>
<td>169</td>
</tr>
<tr>
<td>CEE3MTS—Get default thousands separator</td>
<td>172</td>
</tr>
<tr>
<td>CEE3PRM—Query parameter string</td>
<td>174</td>
</tr>
<tr>
<td>CEE3PR2—Query parameter string long</td>
<td>177</td>
</tr>
<tr>
<td>CEE3RPH—Set report heading</td>
<td>180</td>
</tr>
<tr>
<td>CEE3SPM—Query and modify Language Environment hardware condition enablement</td>
<td>185</td>
</tr>
<tr>
<td>CEE3SRC—Set the enclave return code</td>
<td>185</td>
</tr>
<tr>
<td>CEE3SRP—Set resume point</td>
<td>186</td>
</tr>
<tr>
<td>CEE3USR—Set or query user area fields</td>
<td>190</td>
</tr>
<tr>
<td>CEE3CBLDY—Convert date to COBOL Integer format</td>
<td>193</td>
</tr>
<tr>
<td>CEE3CM1—Store and load message insert data</td>
<td>197</td>
</tr>
<tr>
<td>CEE3RPH—Create new additional heap</td>
<td>201</td>
</tr>
<tr>
<td>CEE2CST—Reallocate (change size of) storage</td>
<td>205</td>
</tr>
<tr>
<td>CEE3DATM—Convert seconds to character timestamp</td>
<td>205</td>
</tr>
<tr>
<td>CEE3DAYS—Convert date to Lilian format</td>
<td>215</td>
</tr>
</tbody>
</table>
List of Figures

1. Effect of DEPTHCONDLMT(3) on condition handling................................................................. 23
2. First example moving resume cursor using CEEMRCR............................................................. 321
3. Second example moving resume cursor using CEEMRCR......................................................... 322
4. Third example moving resume cursor using CEEMRCR.......................................................... 323
5. type_FEEDBACK data type as defined in the leawi.h header file.......................................... 333
## List of Tables

1. How to use z/OS Language Environment publications ............................................................... xiii
2. Syntax examples ............................................................................................................................. xv
3. Quick reference table for runtime options - AMODE 31 ............................................................... 3
4. Quick reference table for runtime options - AMODE 64 ............................................................... 6
5. Condition handling of 0Cx ABENDS .......................................................................................... 75
6. Handling of software-raised conditions ....................................................................................... 75
7. TRAP runtime option settings ..................................................................................................... 86
8. Bit manipulation routines ........................................................................................................... 97
9. Condition-handling callable services .......................................................................................... 97
10. Date and time callable services ................................................................................................. 98
11. Dynamic storage callable services .......................................................................................... 99
12. General callable services ........................................................................................................... 99
13. Initialization and termination services ..................................................................................... 100
14. Locale callable services ........................................................................................................... 100
15. Math services .......................................................................................................................... 101
16. Message handling callable services .......................................................................................... 102
17. National Language Support and National Language Architecture callable services .............. 102
18. Files used in C/C++, COBOL, and PL/I examples ................................................................... 105
19. Imbedding files in your routines ................................................................................................ 105
20. Data type definitions for C/C++ ............................................................................................... 108
21. Data type definitions for COBOL ............................................................................................. 109
22. Data type definitions for PL/I .................................................................................................. 110
23. Symbol table ............................................................................................................................ 131
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>24. National language codes</td>
<td>160</td>
</tr>
<tr>
<td>25. S/370 interrupt code descriptions</td>
<td>182</td>
</tr>
<tr>
<td>26. HEAP attributes based on the setting of the options parameter</td>
<td>198</td>
</tr>
<tr>
<td>27. Sample output of CEEDATE</td>
<td>210</td>
</tr>
<tr>
<td>28. Sample output of CEEDATM</td>
<td>215</td>
</tr>
<tr>
<td>29. Examples of calls to CEESLOG</td>
<td>384</td>
</tr>
<tr>
<td>30. C/C++ examples</td>
<td>416</td>
</tr>
<tr>
<td>31. COBOL examples</td>
<td>416</td>
</tr>
<tr>
<td>32. PL/I examples</td>
<td>418</td>
</tr>
<tr>
<td>33. Defaults currency and picture strings based on COUNTRY setting</td>
<td>419</td>
</tr>
<tr>
<td>34. Picture character terms used in picture strings for date and time services</td>
<td>425</td>
</tr>
<tr>
<td>35. Examples of picture strings recognized by date and time services</td>
<td>426</td>
</tr>
<tr>
<td>36. Japanese Eras used by date and time services when &lt;JJJJ&gt; is specified</td>
<td>426</td>
</tr>
</tbody>
</table>
About this document

This publication provides application programmers with a detailed description of each Language Environment® runtime option and callable service, as well as information about how to use them. It also provides programming examples that illustrate how each callable service can be used in routines that are written in Language Environment-conforming high-level languages (HLLs) and assembler language. Before using Language Environment, you should be familiar with the HLLs in which your applications are written. You should also understand the operating systems and any subsystems in which you plan to run Language Environment applications.

Using your documentation

The publications provided with Language Environment are designed to help you:

- Manage the runtime environment for applications generated with a Language Environment-conforming compiler.
- Write applications that use the Language Environment callable services.
- Develop interlanguage communication applications.
- Customize Language Environment.
- Debug problems in applications that run with Language Environment.
- Migrate your high-level language applications to Language Environment.

Language programming information is provided in the supported high-level language programming manuals, which provide language definition, library function syntax and semantics, and programming guidance information.

Each publication helps you perform different tasks, some of which are listed in Table 1 on page xiii.

<table>
<thead>
<tr>
<th>To ...</th>
<th>Use ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evaluate Language Environment</td>
<td>z/OS Language Environment Concepts Guide</td>
</tr>
<tr>
<td>Plan for Language Environment</td>
<td>z/OS Language Environment Concepts Guide</td>
</tr>
<tr>
<td>Install Language Environment</td>
<td>z/OS Program Directory in the z/OS Internet library (<a href="http://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosInternetLibrary">www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosInternetLibrary</a>)</td>
</tr>
<tr>
<td>Customize Language Environment</td>
<td>z/OS Language Environment Customization</td>
</tr>
<tr>
<td>Understand Language Environment program models and concepts</td>
<td>z/OS Language Environment Concepts Guide</td>
</tr>
<tr>
<td></td>
<td>z/OS Language Environment Programming Guide</td>
</tr>
<tr>
<td></td>
<td>z/OS Language Environment Programming Guide for 64-bit Virtual Addressing Mode</td>
</tr>
<tr>
<td>Find syntax for Language Environment runtime options and callable services</td>
<td>z/OS Language Environment Programming Reference</td>
</tr>
</tbody>
</table>
### How to read syntax diagrams

This section describes how to read syntax diagrams. It defines syntax diagram symbols, items that may be contained within the diagrams (keywords, variables, delimiters, operators, fragment references, operands) and provides syntax examples that contain these items.

Syntax diagrams pictorially display the order and parts (options and arguments) that comprise a command statement. They are read from left to right and from top to bottom, following the main path of the horizontal line.

For users accessing the Information Center using a screen reader, syntax diagrams are provided in dotted decimal format.

#### Symbols

The following symbols may be displayed in syntax diagrams:

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>►►───</td>
<td>Indicates the beginning of the syntax diagram.</td>
</tr>
<tr>
<td>──►</td>
<td>Indicates that the syntax diagram is continued to the next line.</td>
</tr>
<tr>
<td>───►</td>
<td>Indicates that the syntax is continued from the previous line.</td>
</tr>
<tr>
<td>───◄</td>
<td>Indicates the end of the syntax diagram.</td>
</tr>
</tbody>
</table>

#### Syntax items

Syntax diagrams contain many different items. Syntax items include:

- **Keywords** - a command name or any other literal information.
- **Variables** - variables are italicized, appear in lowercase, and represent the name of values you can supply.
- **Delimiters** - delimiters indicate the start or end of keywords, variables, or operators. For example, a left parenthesis is a delimiter.

---

<table>
<thead>
<tr>
<th>To ...</th>
<th>Use ...</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop applications that run with Language Environment</td>
<td><em>z/OS Language Environment Programming Guide</em> and your language programming guide</td>
</tr>
<tr>
<td>Debug applications that run with Language Environment, diagnose problems with Language Environment</td>
<td><em>z/OS Language Environment Debugging Guide</em></td>
</tr>
<tr>
<td>Get details on runtime messages</td>
<td><em>z/OS Language Environment Runtime Messages</em></td>
</tr>
<tr>
<td>Develop interlanguage communication (ILC) applications</td>
<td><em>z/OS Language Environment Writing Interlanguage Communication Applications</em> and your language programming guide</td>
</tr>
<tr>
<td>Migrate applications to Language Environment</td>
<td><em>z/OS Language Environment Runtime Application Migration Guide</em> and the migration guide for each Language Environment-enabled language</td>
</tr>
</tbody>
</table>
- Operators - operators include add (+), subtract (-), multiply (*), divide (/), equal (=), and other mathematical operations that may need to be performed.
- Fragment references - a part of a syntax diagram, separated from the diagram to show greater detail.
- Separators - a separator separates keywords, variables or operators. For example, a comma (,) is a separator.

Note: If a syntax diagram shows a character that is not alphanumeric (for example, parentheses, periods, commas, equal signs, a blank space), enter the character as part of the syntax.

Keywords, variables, and operators may be displayed as required, optional, or default. Fragments, separators, and delimiters may be displayed as required or optional.

### Item type
**Definition**

**Required**
Required items are displayed on the main path of the horizontal line.

**Optional**
Optional items are displayed below the main path of the horizontal line.

**Default**
Default items are displayed above the main path of the horizontal line.

### Syntax examples
The following table provides syntax examples.

<table>
<thead>
<tr>
<th>Item</th>
<th>Syntax example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Required item.</td>
<td>Required items appear on the main path of the horizontal line. You must specify these items.</td>
</tr>
<tr>
<td>Required items</td>
<td>![Example of required items]</td>
</tr>
<tr>
<td>Required choice.</td>
<td>A required choice (two or more items) appears in a vertical stack on the main path of the horizontal line. You must choose one of the items in the stack.</td>
</tr>
<tr>
<td>Required choice</td>
<td>![Example of required choice]</td>
</tr>
<tr>
<td>Optional item.</td>
<td>Optional items appear below the main path of the horizontal line.</td>
</tr>
<tr>
<td>Optional items</td>
<td>![Example of optional items]</td>
</tr>
<tr>
<td>Optional choice.</td>
<td>An optional choice (two or more items) appears in a vertical stack below the main path of the horizontal line. You may choose one of the items in the stack.</td>
</tr>
<tr>
<td>Optional choice</td>
<td>![Example of optional choice]</td>
</tr>
<tr>
<td>Default.</td>
<td>Default items appear above the main path of the horizontal line. The remaining items (required or optional) appear on (required) or below (optional) the main path of the horizontal line. The following example displays a default with optional items.</td>
</tr>
<tr>
<td>Default items</td>
<td>![Example of default]</td>
</tr>
<tr>
<td>Variable.</td>
<td>Variables appear in lowercase italics. They represent names or values.</td>
</tr>
<tr>
<td>Variables</td>
<td>![Example of variable]</td>
</tr>
</tbody>
</table>
### Table 2: Syntax examples (continued)

<table>
<thead>
<tr>
<th>Item</th>
<th>Syntax example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Repeatable item.</td>
<td><img src="repeatable_item.png" alt="Diagram" /></td>
</tr>
<tr>
<td>An arrow returning to the left above the main path of the horizontal line indicates an item that can be repeated.</td>
<td></td>
</tr>
<tr>
<td>A character within the arrow means you must separate repeated items with that character.</td>
<td></td>
</tr>
<tr>
<td>An arrow returning to the left above a group of repeatable items indicates that one of the items can be selected, or a single item can be repeated.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Fragment.</th>
<th><img src="fragment.png" alt="Diagram" /></th>
</tr>
</thead>
<tbody>
<tr>
<td>The fragment symbol indicates that a labelled group is described below the main syntax diagram. Syntax is occasionally broken into fragments if the inclusion of the fragment would overly complicate the main syntax diagram.</td>
<td></td>
</tr>
</tbody>
</table>

### z/OS information

This information explains how z/OS references information in other documents and on the web.

When possible, this information uses cross document links that go directly to the topic in reference using shortened versions of the document title. For complete titles and order numbers of the documents for all products that are part of z/OS, see [z/OS Information Roadmap](https://www.ibm.com/support/knowledgecenter/SSLTBW/welcome).

To find the complete z/OS® library, go to IBM Knowledge Center (www.ibm.com/support/knowledgecenter/SSLTBW/welcome).
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- The following deliverable title and order number: z/OS Language Environment Programming Reference, SA38-0683-30
- The section title of the specific information to which your comment relates
- The text of your comment.

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- Contact your IBM service representative.
- Call IBM technical support.
Summary of changes

This information includes terminology, maintenance, and editorial changes. Technical changes or additions to the text and illustrations for the current edition are indicated by a vertical line to the left of the change.

Summary of changes for Language Environment for z/OS Version 2 Release 3 (V2R3)

The most recent changes are listed at the top of each section.

New

- APAR PH05611 provides support for the new Japanese era, REIWA. See Table 34 on page 425 and Table 36 on page 426 in Appendix B, “Date and time services tables,” on page 425.
- Language Environment now enforces the same security rules that are enforced by ABEND dump processing. To reflect that change, usage notes were added to the following runtime options:
  - “DYNDUMP” on page 23.
  - “TERMTHDACT” on page 73

Changed

- The CEE_Version_ID parameter for the CEEGPID callable service was updated to reflect the current release. See “CEEGPID—Retrieve the Language Environment version and platform ID” on page 265.
- APAR PI89400 updated the z/OS UNIX considerations for the following runtime options to clarify that the SET OMVS command might affect the output value that is returned.
  - “CEEGETO—Get offset from Greenwich Mean Time to local time” on page 262
  - “CEEOCT—Get current local date or time” on page 304
- Due to changes to the compiler, the phrase "C only" was removed from the following runtime options:
  - “ARGPARSE | NOARGPARSE ” on page 14
  - “ENV ” on page 26
  - “EXECOPS | NOEXECOPS ” on page 29
  - “PLIST ” on page 57
  - “REDIR | NOREDIR” on page 62
- Updates were made to more clearly describe the performance implications of using the STORAGE runtime options to set initial values in heap and stack storage. See “Performance considerations” on page 72.
- Various updates were made to replace IBM Debug Tool for z/OS with IBM z/OS Debugger.

Summary of changes for Language Environment for z/OS Version 2 Release 2 (V2R2) as updated December, 2015

New

- A new callable service, CEERCDM, was added. See “CEERCDM—Record information for an active condition” on page 346.
Summary of changes for Language Environment for z/OS Version 2 Release 2 (V2R2)

New
• The CEE_Version_ID parameter for CEEGPID was updated for V2R2. See “CEEGPID—Retrieve the Language Environment version and platform ID” on page 265.

Changed
• An usage note was updated in “PAGEFRAMESIZE64” on page 55.
• An usage note was updated in “PLIST ” on page 57.

Deleted
No content was removed from this information.

z/OS Version 2 Release 1 summary of changes
See the Version 2 Release 1 (V2R1) versions of the following publications for all enhancements related to z/OS V2R1:
• z/OS Migration
• z/OS Planning for Installation
• z/OS Summary of Message and Interface Changes
• z/OS Introduction and Release Guide
Language Environment supports z/OS (5650-ZOS).

IBM Language Environment (also called Language Environment) provides common services and language-specific routines in a single runtime environment for C, C++, COBOL, Fortran (z/OS only; no support for z/OS UNIX System Services or CICS®), PL/I, and assembler applications. It offers consistent and predictable results for language applications, independent of the language in which they are written.

Language Environment is the prerequisite runtime environment for applications that are generated with the following IBM compiler products:

- z/OS XL C/C++ (feature of z/OS)
- z/OS C/C++
- OS/390® C/C++
- C/C++ for MVS/ESA
- C/C++ for z/VM®
- XL C/C++ for z/VM
- AD/Cycle C/370
- VisualAge® for Java™, Enterprise Edition for OS/390
- Enterprise COBOL for z/OS
- Enterprise COBOL for z/OS and OS/390
- COBOL for OS/390 & VM
- COBOL for MVS™ & VM (formerly COBOL/370)
- Enterprise PL/I for z/OS
- Enterprise PL/I for z/OS and OS/390
- VisualAge PL/I
- PL/I for MVS & VM (formerly PL/I MVS & VM)
- VS FORTRAN and FORTRAN IV (in compatibility mode)

Although not all compilers listed are currently supported, Language Environment supports the compiled objects that they created.

Language Environment supports, but is not required for, an interactive debug tool for debugging applications in your native z/OS environment. Debug Tool is also available as a stand-alone product as well as Debug Tool Utilities and Advanced Functions. For more information, see the IBM z/OS Debugger (developer.ibm.com/mainframe/products/ibm-zos-debugger).

Language Environment supports, but is not required for, VS FORTRAN Version 2 compiled code (z/OS only).

Language Environment consists of the common execution library (CEL) and the runtime libraries for C/C++, COBOL, Fortran, and PL/I.

For more information about VisualAge for Java, Enterprise Edition for OS/390, program number 5655-JAV, see the product documentation.
Part 1. Language Environment runtime options

The following sections contain detailed information about how to use the Language Environment runtime options.
## Chapter 1. Summary of Language Environment runtime options

The quick reference tables for each of the Language Environment runtime options and information help you read syntax diagrams and specify the runtime options. The tables list the location of the options and briefly state their function.

### Quick reference table for AMODE 31 runtime options

Table 3 on page 3 provides a quick reference of the Language Environment runtime options for AMODE 31 applications.

<table>
<thead>
<tr>
<th>Runtime options</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABPERC</td>
<td>Percolates a specified abend. See “ABPERC” on page 9.</td>
</tr>
<tr>
<td>ABTERMENC</td>
<td>Sets the enclave termination behavior for an enclave ending with an unhandled condition of severity 2 or greater. See “ABTERMENC” on page 10.</td>
</tr>
<tr>
<td>AIXBLD</td>
<td>NOAIXBLD</td>
</tr>
<tr>
<td>ALL31</td>
<td>Indicates whether an application does or does not run entirely in AMODE(31). See “ALL31” on page 11.</td>
</tr>
<tr>
<td>ANYHEAP</td>
<td>Controls allocation of library heap storage not restricted to below the 16M line. See “ANYHEAP” on page 13.</td>
</tr>
<tr>
<td>ARGPARSE</td>
<td>Specifies if arguments on the command line are to be parsed in the usual C format. See “ARGPARSE</td>
</tr>
<tr>
<td>AUTOTASK</td>
<td>Specifies if Fortran Multitasking Facility is to be used by your program and the number of tasks that are allowed to be active. See “AUTOTASK</td>
</tr>
<tr>
<td>BELOWHEAP</td>
<td>Controls allocation of library heap storage below the 16M line. See “BELOWHEAP” on page 15.</td>
</tr>
<tr>
<td>CBLOPTS</td>
<td>Specifies the format of the argument string on application invocation when the main program is COBOL. See “CBLOPTS (COBOL only)” on page 16.</td>
</tr>
<tr>
<td>CBLPSHPPOP</td>
<td>Controls if CICS PUSH HANDLE and CICS POP HANDLE commands are issued when a COBOL subprogram is called. See “CBLPSHPPOP (COBOL only)” on page 17.</td>
</tr>
<tr>
<td>CBLQDA</td>
<td>Controls COBOL QSAM dynamic allocation. See “CBLQDA (COBOL only)” on page 17.</td>
</tr>
<tr>
<td>CEEDEMP</td>
<td>Specifies options to control the processing of the Language Environment dump report. See “CEEDUMP” on page 18.</td>
</tr>
<tr>
<td>CHECK</td>
<td>Indicates if checking errors within an application should be detected. See “CHECK (COBOL only)” on page 20.</td>
</tr>
<tr>
<td>COUNTRY</td>
<td>Specifies the default formats for date, time, currency symbol, decimal separator, and the thousands separator based on a country. See “COUNTRY” on page 20.</td>
</tr>
<tr>
<td>DEBUG</td>
<td>NODEBUG</td>
</tr>
<tr>
<td>DEPTHCONDLMT</td>
<td>Limits the extent to which conditions can be nested. See “DEPTHCONDLMT” on page 22.</td>
</tr>
<tr>
<td>Runtime options</td>
<td>Function</td>
</tr>
<tr>
<td>-----------------</td>
<td>----------</td>
</tr>
<tr>
<td>DYNDUMP</td>
<td>Provides a way to obtain IPCS readable dumps of user applications that would ordinarily be lost due to the absence of a SYSMDUMP, SYSUDUMP, or SYSABEND DD statement. See “DYNDUMP” on page 23.</td>
</tr>
<tr>
<td>ENV</td>
<td>Specifies the operating system that your C application runs under. See “ENV ” on page 26.</td>
</tr>
<tr>
<td>ENVAR</td>
<td>Sets the initial values for the environment variables. See “ENVAR” on page 27.</td>
</tr>
<tr>
<td>ERRCOUNT</td>
<td>Specifies how many conditions of severity 2, 3, and 4 can occur per thread before an enclave terminates abnormally. See “ERRCOUNT” on page 28.</td>
</tr>
<tr>
<td>ERRUNIT</td>
<td>Identifies the unit number to which runtime error information is to be directed. See “ERRUNIT (Fortran only)” on page 29.</td>
</tr>
<tr>
<td>EXCEOPS</td>
<td>Specifies if runtime options can be specified on the command line. See “EXCEOPS</td>
</tr>
<tr>
<td>FILEHIST</td>
<td>FILEHIST specifies whether to allow the file definition of a file referred to by a ddname to be changed during run time. See “FILEHIST (Fortran only)” on page 30.</td>
</tr>
<tr>
<td>FILETAG</td>
<td>FILETAG ensures control of untagged z/OS UNIX files and standard streams terminal files when set up for conversion, and for control of certain open functions which tag new or empty z/OS UNIX files. See “FILETAG (C/C++ only)” on page 30.</td>
</tr>
<tr>
<td>FLOW</td>
<td>NOFLOW</td>
</tr>
<tr>
<td>HEAP</td>
<td>Controls allocation of the user heap. See “HEAP” on page 32.</td>
</tr>
<tr>
<td>HEAPCHK</td>
<td>Specifies that user heap storage can be inspected for damage and request a heap storage diagnostics report. See “HEAPCHK” on page 36.</td>
</tr>
<tr>
<td>HEAPPOOLS</td>
<td>Specifies that (Quick) heap storage manager can be used. See “HEAPPOOLS (C/C++ and Enterprise PL/I only)” on page 38.</td>
</tr>
<tr>
<td>HEAPZONES</td>
<td>Turns on overlay toleration and checking for user heaps. See “HEAPZONES” on page 41.</td>
</tr>
<tr>
<td>INFOMSGFILTER</td>
<td>Allows the user to eliminate unwanted informational messages. See “INFOMSGFILTER” on page 43.</td>
</tr>
<tr>
<td>INQPCOPN</td>
<td>NOINQPCOPN</td>
</tr>
<tr>
<td>INTERRUPT</td>
<td>Causes attentions recognized by the host operating system to be recognized by Language Environment. See “INTERRUPT” on page 44.</td>
</tr>
<tr>
<td>LIBSTACK</td>
<td>Controls the allocation of the thread’s library stack storage. See “LIBSTACK” on page 47.</td>
</tr>
<tr>
<td>MSGFILE</td>
<td>Specifies the ddname of the runtime diagnostics file. See “MSGFILE” on page 48.</td>
</tr>
<tr>
<td>MSGQ</td>
<td>Specifies the number of ISI blocks allocated on a per-thread basis during execution. See “MSGQ” on page 51.</td>
</tr>
<tr>
<td>NATLANG</td>
<td>Specifies the national language to use for the runtime environment. See “NATLANG” on page 51.</td>
</tr>
<tr>
<td>OSTATUS</td>
<td>NOOSTATUS</td>
</tr>
<tr>
<td>PAGEFRAMESIZE</td>
<td>Indicates the preferred page frame size for certain types of storage requests. Note the statement of direction associated with this runtime option. See “PAGEFRAMESIZE” on page 53.</td>
</tr>
</tbody>
</table>
### Table 3: Quick reference table for runtime options - AMODE 31 (continued)

<table>
<thead>
<tr>
<th>Runtime options</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>PC</strong></td>
<td>Specifies that Fortran static common blocks are not shared among load modules. See “PC (Fortran only)” on page 57.</td>
</tr>
<tr>
<td><strong>PLIST</strong></td>
<td>Specifies the format of the invocation arguments received by your C application when it is invoked. See “PLIST” on page 57.</td>
</tr>
<tr>
<td><strong>PLITASKCOUNT</strong></td>
<td>Controls the maximum number of tasks active at one time while you are running PL/I MTF applications. See “PLITASKCOUNT (PL/I only)” on page 59.</td>
</tr>
<tr>
<td><strong>POSIX</strong></td>
<td>Specifies if the enclave can run with the POSIX semantics. See “POSIX” on page 59.</td>
</tr>
<tr>
<td><strong>PROFILE</strong></td>
<td>Controls the use of an optional profiler which collects performance data for the running application. See “PROFILE” on page 60.</td>
</tr>
<tr>
<td><strong>PRTUNIT</strong></td>
<td>Identifies the unit number used for PRINT and WRITE statements that do not specify a unit number. See “PRTUNIT (Fortran only)” on page 61.</td>
</tr>
<tr>
<td><strong>PUNUNIT</strong></td>
<td>Identifies the unit number used for PUNCH statements that do not specify a unit number. See “PUNUNIT (Fortran only)” on page 61.</td>
</tr>
<tr>
<td><strong>RDRUNIT</strong></td>
<td>Identifies the unit number used for READ statements that do not specify a unit number. See “RDRUNIT (Fortran only)” on page 61.</td>
</tr>
<tr>
<td><strong>REDIR</strong></td>
<td>Specifies if redirections for stdin, stdout, and stderr are allowed from the command line. See “REDIR</td>
</tr>
<tr>
<td><strong>RECPAD</strong></td>
<td>Specifies if a formatted input record is padded with blanks. See “RECPAD (Fortran only)” on page 62.</td>
</tr>
<tr>
<td><strong>RPTOPTS</strong></td>
<td>Specifies that a report of the runtime options in use by the application be generated. See “RPTOPTS” on page 62.</td>
</tr>
<tr>
<td><strong>RPTSTG</strong></td>
<td>Specifies that a report of the storage used by the application be generated at the end of execution. See “RPTSTG” on page 63.</td>
</tr>
<tr>
<td>**RTEREUS</td>
<td>NORTEREUS**</td>
</tr>
<tr>
<td>**SIMVRD</td>
<td>NOSIMVRD**</td>
</tr>
<tr>
<td><strong>STACK</strong></td>
<td>Controls the allocation and management of stack storage. See “STACK” on page 67.</td>
</tr>
<tr>
<td><strong>STORAGE</strong></td>
<td>Controls the contents of storage that is allocated and freed. See “STORAGE” on page 70.</td>
</tr>
<tr>
<td><strong>TERMTHDACT</strong></td>
<td>Sets the level of information produced due to an unhandled error of severity 2 or greater. See “TERMTHDACT” on page 73.</td>
</tr>
<tr>
<td>**TEST</td>
<td>NOTEST**</td>
</tr>
<tr>
<td><strong>THREAD HEAP</strong></td>
<td>Controls the allocation and management of thread-level heap storage. See “THREAD HEAP” on page 80.</td>
</tr>
<tr>
<td><strong>THREAD STACK</strong></td>
<td>Controls the allocation of thread-level stack storage for both the upward and downward-growing stack. See “THREAD STACK” on page 81.</td>
</tr>
<tr>
<td><strong>TRACE</strong></td>
<td>Determines if Language Environment runtime library tracing is active. See “TRACE” on page 84.</td>
</tr>
<tr>
<td><strong>TRAP</strong></td>
<td>Specifies how Language Environment routines handle abends and program interrupts. See “TRAP” on page 86.</td>
</tr>
<tr>
<td><strong>UPSI</strong></td>
<td>Sets the eight UPSI switches on or off. See “UPSI (COBOL only)” on page 88.</td>
</tr>
<tr>
<td><strong>USRHDLR</strong></td>
<td>Registers user condition handlers. See “USRHDLR</td>
</tr>
</tbody>
</table>
### Quick reference table for runtime options - AMODE 31 (continued)

<table>
<thead>
<tr>
<th>Runtime options</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>VCTRSAVE</td>
<td>Specifies if any language in an application uses the vector facility when user-written condition handlers are called. See “VCTRSAVE” on page 90.</td>
</tr>
<tr>
<td>XPLINK</td>
<td>Controls the initialization of the XPLINK environment. See “XPLINK” on page 91.</td>
</tr>
<tr>
<td>XUFLOW</td>
<td>Specifies if an exponent underflow causes a program interrupt. See “XUFLOW” on page 92.</td>
</tr>
</tbody>
</table>

### Quick reference table for AMODE 64 runtime options

Table 4 on page 6 provides a quick reference of the Language Environment runtime options for AMODE 64 applications.

<table>
<thead>
<tr>
<th>RunTime Options</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARGPARSE</td>
<td>Specifies if arguments on the command line are to be parsed in the usual C format. See “ARGPARSE</td>
</tr>
<tr>
<td>CEEDUMP</td>
<td>Specifies options to control the processing of the Language Environment dump report. See “CEEDUMP” on page 18.</td>
</tr>
<tr>
<td>DYNDUMP</td>
<td>Provides a way to obtain IPCS readable dumps of user applications that would ordinarily be lost due to the absence of a SYSMDUMP, SYSUDUMP, or SYSABEND DD statement. See “DYNDUMP” on page 23.</td>
</tr>
<tr>
<td>ENVAR</td>
<td>Sets the initial values for the environment variables. See “ENVAR” on page 27.</td>
</tr>
<tr>
<td>EXECOPS</td>
<td>Specifies whether runtime options can be specified on the command line. See “EXECOPS</td>
</tr>
<tr>
<td>FILETAG</td>
<td>FILETAG ensures control of untagged z/OS UNIX files and standard streams terminal files when set up for conversion, and for control of certain open functions which tag new or empty z/OS UNIX files. See “FILETAG (C/C++ only)” on page 30.</td>
</tr>
<tr>
<td>HEAP64</td>
<td>Controls allocation of the user heap. See “FILETAG (C/C++ only)” on page 30. See “FILETAG (C/C++ only)” on page 30.</td>
</tr>
<tr>
<td>HEAPCHK</td>
<td>Specifies that user heap storage can be inspected for damage and request a heap storage diagnostics report. See “HEAPCHK” on page 36.</td>
</tr>
<tr>
<td>HEAPPOOLS</td>
<td>Specifies that the (Quick) heap storage manager can be used to manage user heap storage above the 16M line and below the 2G bar. See “HEAPPOOLS (C/C++ and Enterprise PL/I only)” on page 38.</td>
</tr>
<tr>
<td>HEAPPOOLS64</td>
<td>Specifies that the (Quick) heap storage manager can be used to manage user heap storage above the 2G bar. See “HEAPPOOLS64 (C/C++ and AMODE 64 only)” on page 40.</td>
</tr>
<tr>
<td>HEAPZONES</td>
<td>Turns on overlay toleration and checking for user heaps. See “HEAPZONES” on page 41.</td>
</tr>
<tr>
<td>INFOMSGFILTER</td>
<td>Allows the user to eliminate unwanted informational messages. See “INFOMSGFILTER” on page 43.</td>
</tr>
<tr>
<td>IOHEAP64</td>
<td>Controls allocation of I/O heap storage. See “IOHEAP64 (AMODE 64 only)” on page 44.</td>
</tr>
<tr>
<td>LIBHEAP64</td>
<td>Controls allocation of library heap storage. See “LIBHEAP64 (AMODE 64 only)” on page 46.</td>
</tr>
<tr>
<td>NATLANG</td>
<td>Specifies the national language to use for the runtime environment. See “NATLANG” on page 51.</td>
</tr>
</tbody>
</table>
**Table 4: Quick reference table for runtime options - AMODE 64 (continued)**

<table>
<thead>
<tr>
<th>Runtime options</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>PAGEFRAMESIZE64</td>
<td>Indicates the preferred frame size for certain types of storage requests. See “PAGEFRAMESIZE64” on page 55.</td>
</tr>
<tr>
<td>POSIX</td>
<td>Specifies if the enclave can run with the POSIX semantics. See “POSIX” on page 59.</td>
</tr>
<tr>
<td>PROFILE</td>
<td>Controls the use of an optional profiler which collects performance data for the running application. See “PROFILE” on page 60.</td>
</tr>
<tr>
<td>REDIR</td>
<td>Specifies if redirections for stdin, stderr, and stdout are allowed from the command line. See “REDIR</td>
</tr>
<tr>
<td>RPTOPTS</td>
<td>Specifies that a report of the runtime options in use by the application be generated. See “RPTOPTS” on page 62.</td>
</tr>
<tr>
<td>RPTSTG</td>
<td>Specifies that a report of the storage used by the application be generated at the end of execution. See “RPTSTG” on page 63.</td>
</tr>
<tr>
<td>STACK64</td>
<td>Controls the allocation and management of stack storage. See “STACK64 (AMODE 64 only)” on page 69.</td>
</tr>
<tr>
<td>STORAGE</td>
<td>Controls the contents of storage that is allocated and freed. See “STORAGE” on page 70.</td>
</tr>
<tr>
<td>TERMTHDACT</td>
<td>Sets the level of information produced due to an unhandled error of severity 2 or greater. See “TERMTHDACT” on page 73.</td>
</tr>
<tr>
<td>TEST</td>
<td>NOTEST</td>
</tr>
<tr>
<td>THREADSTACK64</td>
<td>Controls the allocation of thread-level stack storage for both the upward and downward-growing stack. See “THREADSTACK64 (AMODE 64 only)” on page 83.</td>
</tr>
<tr>
<td>TRACE</td>
<td>Determines if Language Environment runtime library tracing is active. See “TRACE” on page 84.</td>
</tr>
<tr>
<td>TRAP</td>
<td>Specifies how Language Environment routines handle abends and program interrupts. See “TRAP” on page 86.</td>
</tr>
</tbody>
</table>

**How to specify runtime options**

When specifying runtime options, use commas to separate any suboptions of those options. If you do not specify a suboption, you must still include the comma to indicate the omission of the suboption. For example: `STACK (,,ANYWHERE,FREE,,)`. Trailing commas, however, are not required. `STACK (,,ANYWHERE,FREE)` is valid. If you do not specify any suboptions, they are ignored. Either of the following is valid: `STACK` or `STACK()`. If you run applications that are invoked by one of the exec family of functions, such as a program executed under the z/OS UNIX System Services shell, you can also use the _CEE_RUNOPTS environment variable to specify runtime options.

Refer to _z/OS Language Environment Programming Guide_ for a detailed description of the various ways in which you can specify Language Environment runtime options and program arguments, and use _CEE_RUNOPTS_.

**Restriction:** The double quotes character (") may not be part of the runtime options string for applications running under Turkish code page 1026. Use the single quote character ('') instead.

**Propagating runtime options with spawn and exec**

When going from AMODE 31 to AMODE 64 and back through the spawn or exec functions, Language Environment rebuilds the _CEE_RUNOPTS environment variable as a way to propagate runtime options to the new program. In the situations where AMODE 31 specific options or AMODE 64 specific options would...
be passed across to the other mode. Language Environment ignores these options. No messages are issued. For example, when the STACK option is sent across from AMODE 31 to AMODE 64, it is ignored. This is because the AMODE 64 application uses the STACK64 option. No attempt to convert the AMODE 31 option to the new AMODE 64 option is performed.
Chapter 2. Using the Language Environment runtime options

The Language Environment runtime options, their syntax, and their usage are described. IBM-supplied default keywords appear above the main path or options path in the syntax diagrams. In the parameter list, IBM-supplied default choices are underlined. The minimum unambiguous abbreviation of each Language Environment option is also indicated in its syntax diagram with capital letters (for example, ABPerc indicates that ABP is the minimum abbreviation).

ABPERC

Derivation: ABnormal PERColation

ABPERC percolates an abend whose code you specify. This provides Language Environment condition handling semantics for all abends, except for the one specified. TRAP(ON) must be in effect. When you run with ABPERC and encounter the specified abend:

• User condition handlers are not enabled.
• Under z/OS UNIX, POSIX signal handling semantics are not enabled for the abend.
• No storage report or the report for runtime option is generated.
• No Language Environment messages or Language Environment formatted dump output is generated.
• The assembler user exit is not driven for enclave termination.
• The abnormal termination exit, if there is one, is not driven.
• Files that are opened by HLLs are not closed by Language Environment, so records might be lost.
• Resources that are acquired by Language Environment are not freed.
• A debugging tool, if one is active, is not notified of the error.

Tip: You can also use the CEEBXITA assembler user exit to specify a list of abend codes for Language Environment to percolate. For more information about CEEBXITA, see z/OS Language Environment Programming Guide.

The default value for non-CICS applications is ABPERC(NONE).

ABPERC is ignored under CICS.

NONE

Specifies that all abends are handled according to Language Environment condition handling semantics.

NONE is the default.

abcode

Specifies the abend code to percolate. The abcode can be specified as:

Shhh

A system abend code, where hhh is the hex system abend code.
Udddd
A user abend code, where dddd is a decimal user abend code. Any 4-character string can also be used as dddd.

z/OS UNIX consideration
ABPERC percolates an abend regardless of the thread in which it occurs.

Usage notes
• Language Environment ignores ABPERC(S0Cx). In this instance, no abend is percolated, and Language Environment condition handling semantics are in effect.
• You can identify only one abend code with this option. However, an abend U0000 is interpreted in the same way as S000.

ABTERMENC

Derivation: ABnormal TERMination of the ENClave
ABTERMENC sets the enclave termination behavior for an enclave that ends with an unhandled condition of severity 2 or greater. TRAP(ON) must be in effect.
The default value for non-CICS applications is ABTERMENC(ABEND).
The default value for CICS applications is ABTERMENC(ABEND).

ABEND
When an unhandled condition of severity 2 or greater is encountered, Language Environment issues an abend to end the enclave. Default abend processing occurs as follows:
• Language Environment sets an abend code value that depends on the type of unhandled condition.
• Language Environment sets a reason code value that depends on the type of unhandled condition.
• Language Environment does not request a system dump.
• Language Environment issues an abend to terminate the task.
ABEND is the default.

RETCODE
When an unhandled condition of severity 2 or greater is encountered, Language Environment issues a return code and reason code to end the enclave.

z/OS UNIX consideration
In a multithreaded application with ABTERMENC(ABEND), Language Environment issues an abend on the task that is associated with the initial processing thread (IPT), regardless of which thread experienced the unhandled condition. All non-IPT threads, including the thread that encountered the unhandled condition if it is a non-IPT thread, are terminated without an ABEND. Outstanding updates to recoverable resources will be rolled back for all contexts associated with the non-IPT threads.

Usage notes
• You can use the assembler user exit, CEEAUE_ABND, to modify the behavior of this runtime option by setting the CEEAUE_ABND flag. See z/OS Language Environment Programming Guide for more information.
• To gather information about the unhandled condition, see “TERMTHDACT” on page 73.

For more information
For information about return code calculation and abend codes, see *z/OS Language Environment Programming Guide*.

### AIXBLD (COBOL only)

**Derivation:** Alternate Index Build

AIXBLD invokes the access method services (AMS) for VSAM indexed and relative data sets (KSDS and RRDS) to complete the file and index definition procedures for COBOL programs. AIXBLD conforms to the ANSI 1985 COBOL standard.

The default value for non-CICS applications is NOAIXBLD.

AIXBLD is ignored under CICS.

![AIXBLD Diagram](image)

**NOAIXBLD**

Does not invoke the access method services for VSAM indexed and relative data sets. NOAIXBLD can be abbreviated NOAIX.

NOAIXBLD is the default.

**AIXBLD**

Invokes the access method services for VSAM indexed and relative data sets. AIXBLD can be abbreviated AIX®.

**z/OS UNIX consideration**

If you also specify the MSGFILE runtime option, the access method services messages are directed to the MSGFILE *ddname* or to the default SYSOUT.

**Performance consideration**

Running your program under AIXBLD requires more storage, which can degrade performance. Therefore, use AIXBLD only during application development to build alternate indexes. Use NOAIXBLD when you have already defined your VSAM data sets.

For more information

• See the appropriate version of the COBOL programming guide in the COBOL library at Enterprise COBOL for z/OS library (www.ibm.com/support/docview.wss?uid=swg27036733).

• See “MSGFILE” on page 48 for information about the MSGFILE runtime option.

### ALL31

**Derivation:** ALL AMODE 31

ALL31 specifies if an application can run entirely in AMODE 31 or if the application has one or more AMODE 24 routines.
ALL31 should have the same setting for all enclaves in a process. Language Environment does not support the invocation of a nested enclave requiring ALL31(OFF) from an enclave running with ALL31(ON) in non-CICS environments.

The default value for non-CICS applications is ALL31(ON).

The default value for CICS applications is ALL31(ON).

**ON**

If the initial routine of the Language Environment application is AMODE 31, this setting indicates that no other routines in the application will be AMODE 24.

If the initial routine of the Language Environment application is AMODE 24, ALL31 is dynamically switched to OFF. No message will be issued to indicate this action. However, if you generate a Language Environment runtime options report using the RPTOPTS runtime option, the ALL31 option will be reported as "Override" under the LAST WHERE SET column.

When ALL31(ON) remains in effect:

- AMODE switching across calls to Language Environment common runtime routines is minimized. For example, no AMODE switching is performed on calls to Language Environment callable services.
- Language Environment allocates storage for the common anchor area (CAA) and other control blocks in unrestricted storage.
- COBOL EXTERNAL data is allocated in unrestricted storage.

**OFF**

Indicates that one or more routines of a Language Environment application are AMODE 24. When ALL31(OFF) is in effect:

- Language Environment uses more storage below the 16M line.
- AMODE switching across calls to Language Environment common runtime routines is performed. For example, AMODE switching is performed on calls to Language Environment callable services.
- Language Environment allocates storage for the common anchor area (CAA) and other control blocks in storage below the 16M line.
- COBOL EXTERNAL data is allocated in storage below the 16M line.

If you use the setting ALL31(OFF), you must also use the setting STACK(,,BELOW,,). AMODE 24 routines require stack storage below the 16M line.

**z/OS UNIX considerations**

- In a multithreaded environment, the ALL31 option applies to all threads in a process.
- In a multithreaded environment, the thread start routine specified in the C pthread_create() function call is invoked in AMODE 31.

**Usage notes**

- You must specify ALL31(OFF) if your COBOL applications contain one of the following programs:
  - VS COBOL II NORES
  - OS/VS COBOL (non-CICS)
  - If the Language Environment environment was initialized using ILBOSTP0
• PL/I considerations: For PL/I MTF applications, Language Environment provides AMODE switching. Therefore, the first routine of a task can be in AMODE 24.

• Fortran considerations: Use ALL31(ON) if all of the compile units in the enclave have been compiled with VS FORTRAN Version 1 or Version 2 and there are no requirements for 24-bit addressing mode. Otherwise, use ALL31(OFF).

• XPLINK considerations: When an application is running in an XPLINK environment (that is, either the XPLINK(ON) runtime option was specified, or the initial program contained at least one XPLINK-compiled part), the ALL31 runtime option is forced to ON. No AMODE 24 routines are allowed in an enclave that uses XPLINK. No message is issued to indicate this action. If a Language Environment runtime options report is generated using the RPTOPTS runtime option, the ALL31 option is reported as "Override" under the LAST WHERE SET column.

• ALL31 should have the same setting for all enclaves in a process. Language Environment does not support the invocation of a nested enclave requiring ALL31(OFF) from an enclave running with ALL31(ON) in non-CICS environments.

Performance consideration
If your application consists entirely of AMODE 31 routines, it will run faster and use less below-the-line storage with ALL31(ON) than with ALL31(OFF).

For more information
• See “STACK” on page 67 for information about the STACK runtime option.
• See “XPLINK” on page 91 for information about the XPLINK runtime option.

ANYHEAP
The ANYHEAP runtime option controls the allocation of unrestricted library heap storage (anywhere heap). Storage that is unrestricted can be located anywhere in 31-bit addressable storage.

The default value for non-CICS applications is ANYHEAP(16K,8K,ANYWHERE,FREE).
The default value for CICS applications is ANYHEAP(4K,4080,ANYWHERE,FREE).

\[
\text{ANYHEAP} \rightarrow \text{ANYWHERE} \rightarrow \text{ANY} \rightarrow \text{BELOW} \rightarrow \text{FREE} \rightarrow \text{KEEP} \rightarrow \text{init\_size} \rightarrow \text{incr\_size} \rightarrow (1)
\]

init_size
Determines the initial size of the anywhere heap. This value can be specified as \( n \), \( nK \), or \( nM \) bytes of storage. The actual amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

incr_size
Determines the minimum size of any subsequent increment to the anywhere heap. This value can be specified as \( n \), \( nK \), or \( nM \) bytes of storage. The actual amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

ANYWHERE|ANY
Specifies that anywhere heap can be allocated anywhere in 31-bit addressable storage. If there is no storage available above the 16M line, storage is acquired below the 16-MB line.
ANYWHERE is the default.

**BELOW**
Specifies that anywhere heap is allocated below the 16M line.

**FREE**
Specifies that an anywhere heap increment is released when the last of the storage within that increment is freed.
FREE is the default.

**KEEP**
Specifies that an anywhere heap increment is not released when the last of the storage within that increment is freed.

**CICS consideration**

- If ANYHEAP(0) is specified, the initial anywhere heap segment is obtained on the first use and will be based on the increment size.
- The maximum initial and increment size for the anywhere heap is 1 gigabyte (1024M).
- The default increment size is 4080 bytes, rather than 4096 bytes, to accommodate the 16 byte CICS storage check zone. Without this accommodation, an extra page of storage is allocated (only when the storage allocation is below the 16 MB line). If you choose to change the increment size, it is recommended that you adjust for the 16 byte CICS storage check zone.

**z/OS UNIX considerations**

- In a multithreaded environment, the anywhere heap is shared by all threads in the process.
- When ALL31(ON) is in effect, Language Environment allocates thread-specific control blocks from the anywhere heap.

**Performance consideration**
You can improve performance with the ANYHEAP runtime option by specifying values that minimize the number of times the operating system allocates storage. See “RPTSTG” on page 63 for information about how to generate a report you can use to determine the optimum values for the ANYHEAP runtime option.

**For more information**
For more information about heap storage and heap storage tuning with storage report numbers, see z/OS Language Environment Programming Guide.

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**ARGPARSE | NOARGPARSE**

**Derivation:** ARGument PARSE
ARGPARSE specifies if command-line arguments to a C/C++ program are to be parsed. This option does not apply to non-C/C++ languages and can be specified with the #pragma unopts directive or the ARGPARSE or NOARGPARSE compiler option.

**Restriction:** You cannot set this option at the system level, region level, or in the CEEBXITA assembler user exit interface.

The default value for non-CICS applications is ARGPARSE.

ARGPARSE is ignored under CICS.

The default value for AMODE 64 applications is ARGPARSE.
ARGPARSE

Specifies that arguments given on the command line are to be parsed and given to the main() function in the usual C argument format (argv and argc).

ARGPARSE is the default.

NOARGPARSE

Specifies that arguments given on the command line are not parsed but are passed to the main() function as one string. Therefore, argc has a value of 2, and argv[1] contains a pointer to the command-line string.

Note: NOARGPARSE is ignored for programs that utilize spawn() or exec() or for any program that is started by the z/OS UNIX System Services shell or by the BPXBATCH utility.

Usage notes

You must specify ARGPARSE for the REDIR runtime option to have an effect.

For more information

See “REDIR | NOREDIR” on page 62 for a description of REDIR.

AUTOTASK | NOAUTOTASK (Fortran only)

AUTOTASK specifies if Fortran multitasking facility (MTF) is to be used by your program and the number of tasks that are allowed to be active.

The default value for non-CICS applications is NOAUTOTASK.

AUTOTASK is ignored under CICS.

loadmod

The name of the load module that contains the concurrent subroutines that run in the subtasks created by MTF.

numtasks

The number of subtasks created by MTF. This value can range from 1 through 99.

NOAUTOTASK

Disables the MTF and nullifies the effects of previous specifications of AUTOTASK parameters.

NOAUTOTASK is the default.

BELOWHEAP

The BELOWHEAP runtime option controls the allocation of restricted library heap storage (below heap). Storage that is restricted must be located below the 16M line (24-bit addressable storage).

The default value for non-CICS applications is BELOWHEAP(8K,4K,FREE).
The default value for CICS applications is BELOWHEAP(4K,4080,FREE).

**init_size**
Determines the minimum initial size of the below heap storage. This value can be specified as \( n \), \( nK \), or \( nM \) bytes of storage. The actual amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

**incr_size**
Determines the minimum size of any subsequent increment to the area below the 16M line, and is specified in \( n \), \( nK \), or \( nM \) bytes of storage. This value is rounded up to the nearest multiple of 8 bytes.

**FREE**
Specifies that storage allocated to BELOWHEAP increments is released when the last of the storage is freed.

**KEEP**
Specifies that storage allocated to BELOWHEAP increments is not released when the last of the storage within that increment is freed.

**CICS consideration**
The default increment size is 4080 bytes, rather than 4096 bytes, to accommodate the 16-byte CICS storage check zone. Without this accommodation, an extra page of storage is allocated (only when the storage allocation is below the 16-MB line). If you choose to change the increment size, it is recommended that you adjust for the 16-byte CICS storage check zone.

**z/OS UNIX considerations**
- In a multithreaded environment, the below heap is shared by all threads in the process.
- When ALL31(OFF) is in effect, Language Environment allocates thread-specific control blocks from the below heap.

**Usage notes**
If BELOWHEAP(0) is specified, the initial below heap segment is obtained on the first use and is based on the increment size.

**Performance consideration**
You can improve performance with the BELOWHEAP runtime option by specifying values that minimize the number of times the operating system allocates storage. See “RPTSTG” on page 63 for information about how to generate a report you can use to determine the optimum values for the BELOWHEAP runtime option.

**For more information**
For more information about heap storage and heap storage tuning with storage report numbers, see z/OS Language Environment Programming Guide.

**CBLOPTS (COBOL only)**

**Derivation:** COBOL OPTIONS
CBLOPTS specifies the format of the parameter string on application invocation when the main program is COBOL. CBLOPTS determines if runtime options or program arguments appear first in the parameter string. You can only specify this option at the system level, region level, or in a CEEUOPT.

**CBLPSHPOP (COBOL only)**

**Derivation:** COBOL PUSH POP

CBLPSHPOP controls if CICS PUSH HANDLE and CICS POP HANDLE commands are issued when a COBOL subroutine is called. CBLPSHPOP is ignored in non-CICS environments.

Specify CBLPSHPOP(ON) to avoid compatibility problems when calling COBOL subroutines that contain CICS CONDITION, AID, or ABEND condition handling commands.

You can set the CBLPSHPOP runtime option on an enclave basis using CEEUOPT.

There is no default value for non-CICS applications because CBLPSHPOP is ignored.

The default value for CICS applications is CBLPSHPOP(ON).

**ON**

- Automatically issues the following when a COBOL subroutine is called:
  - An EXEC CICS PUSH HANDLE command as part of the routine initialization.
  - An EXEC CICS POP HANDLE command as part of the routine termination.

ON is the default.

**OFF**

- Does not issue CICS PUSH HANDLE and CICS POP HANDLE commands on a call to a COBOL subroutine.

**Performance consideration**

If your application calls COBOL subroutines under CICS, performance is better with CBLPSHPOP(OFF) than with CBLPSHPOP(ON).

**For more information**

- For more information about CEEUOPT, see *z/OS Language Environment Programming Guide*.

**CBLQDA (COBOL only)**

**Derivation:** COBOL QSAM Dynamic Allocation

CBLQDA controls COBOL QSAM dynamic allocation on an OPEN statement.

The default value for non-CICS applications is CBLQDA(OFF).

CBLQDA is ignored under CICS.
**CBLQDA**

- **OFF**
  - Specifies that COBOL QSAM dynamic allocation is not permitted.
  - OFF is the default.

- **ON**
  - Specifies that COBOL QSAM dynamic allocation is permitted. ON conforms to the 1985 COBOL standard.

**Usage notes**

- CBLQDA(OFF) is the recommended default because it prevents a temporary data set from being created in case there is a misspelling in your JCL. If you specify CBLQDA(ON) and have a misspelling in your JCL, Language Environment creates a temporary file, writes to it, and then z/OS deletes it. You receive a return code of 0, but no output.

- CBLQDA does not affect dynamic allocation for the message file specified in MSGFILE or the Language Environment formatted dump file (CEEDUMP).

### CEEDUMP

**Derivation:** Common Execution Environment DUMP

The CEEDUMP runtime option is used to specify options to control the processing of the Language Environment dump report.

The default value for non-CICS applications is CEEDUMP(60,SYSOUT=*,FREE=END,SPIN=UNALLOC).

The default value for CICS applications is CEEDUMP(60,SYSOUT=*,FREE=END,SPIN=UNALLOC).

The default value for AMODE 64 is CEEDUMP(60,SYSOUT=*,FREE=END,SPIN=UNALLOC).

**page_len**

Specifies the number of lines that a CEEDUMP report contains on each page. The number specified by page_len must be 0 or a whole number greater than 9. A value of 0 indicates that the dump report should contain no page breaks. The default is 60. The maximum length of page_len is limited to 9 digits.
**SYSOUT=**
Specifies SYSOUT attributes for a dynamically allocated CEEDUMP DD. SYSOUT has three possible parameters, but the second parameter should always be omitted:

- **class**
  Specifies a value that is one character in length. Valid values are A through Z, 0 through 9, and *. A SYSOUT class must not be specified inside quotation marks.
  - If class is not specified, it defaults to * for the dynamically allocated CEEDUMP.
  - If dynamic allocation for the specified SYSOUT class specified fails, SYSOUT=* is set and message CEE3785I is issued.

- **form-name**
  Provides a name assigned to an output form for dynamically allocated CEEDUMP DD. form-name is made up of 1-4 alphanumeric or national ($,#,@) characters according to JCL rules. If you want to allow separation of CEEDUMP output from other SYSOUT output for the same class in the JES spool, specify a form in addition to a class for a dynamically allocated CEEDUMP.

**FREE=**
Specifies that dynamically allocated CEEDUMPs will have one of the following JCL DD attributes:

- **END**
  The FREE=END DD attribute requests that the system unallocates the data set at the end of the last step that references the data set. This is the default value for this suboption.
  
  END is the default.

- **CLOSE**
  The FREE=CLOSE DD attribute requests that the system unallocates the data set when it is closed. Code the FREE=CLOSE suboption along with SYSOUT=class to make CEEDUMP a spinning data set.

- **SPIN=**
  Specifies that dynamically allocated CEEDUMPs will have one of the following attributes:

  - **UNALLOC**
    The SPIN=UNALLOC attribute indicates the system should make the SYSOUT data set available for processing immediately when it is unallocated. This is the default value for this suboption.

    UNALLOC is the default.

  - **NO**
    The SPIN=NO attribute indicates the system should make the SYSOUT data set available for processing as a part of the output at the end of the job, regardless of when the data set is unallocated.

**z/OS UNIX considerations**
The SYSOUT=, FREE= and SPIN= suboptions do not have any effect on a CEEDUMP report taken in a z/OS UNIX file system.

**CICS consideration**
The SYSOUT=, FREE= and SPIN= suboptions do not have any effect on a CEEDUMP report taken under CICS.

**Usage notes**
- If a CEEDUMP DD card is explicitly coded in a job step, Language Environment ignores any SYSOUT class, FREE, SPIN or form-name specified in the CEEDUMP runtime.
- The SYSOUT=class suboption is overridden by _CEE_DMPTARG when this environment variable is used at the same time to indicate the SYSOUT class.
• The `page_len` suboption is overridden by the CEE3DMP PAGESIZE option. For more information about CEE3DMP, see [z/OS Language Environment Customization](https://www.ibm.com/support/docview.wss?uid=swg27019599).

• Language Environment supports the use of a CEEDUMP DDNAME dynamically allocated with the XTIOT, UCB nocapture, or DSAB-above-the-line options specified in the SVC99 parameters (S99TIOEX, S99ACUCB, S99DSABA flags).

### CICS considerations

• `CEED(SYSOUT=X,FREE=CLOSE)`

  This dynamically allocates a CEEDUMP with SYSOUT class X and the FREE=CLOSE DD attribute. The other implicit suboptions are `page_len` and SPIN, which default to whatever values are currently set in the CEEDUMP runtime option.

• `CEEDUMP(40)`

  The CEEDUMP report contains a page length of 40 lines. The other implicit suboptions are SYSOUT=, FREE=, and SPIN=, which default to whatever values are currently set in the CEEDUMP runtime option.

### CHECK (COBOL only)

If your COBOL application was compiled with the SSRANGE compile option, specifying the CHECK(ON) runtime option enables range checking of each index, subscript, and reference modification.

The default value for non-CICS applications is CHECK(ON).

The default value for CICS applications is CHECK(ON).

#### ON

- Specifies that runtime range checking is performed.
- ON is the default.

#### OFF

- Specifies that runtime range checking is not performed.

**Usage notes**

CHECK(ON) has no effect if the NOSSRANGE COBOL compile option was specified.

**Performance consideration**

If your COBOL program was compiled with the SSRANGE compile option, and you are not testing or debugging an application, performance improves when you specify CHECK(OFF). For COBOL 4.2 and earlier you can disable the SSRANGE code with CHECK(OFF). For COBOL 5.1 and later, you cannot disable it.

### COUNTRY

Specifying a `country_code` with the COUNTRY runtime option determines:
COUNTRY

- Date and time formats
- The currency symbol
- The decimal separator
- The thousands separator

COUNTRY affects only the Language Environment NLS services, not the Language Environment locale callable services.

You can set the country value using the COUNTRY runtime option or the CEE3CTY callable service.

The default value for non-CICS applications is COUNTRY(US).
The default value for CICS applications is COUNTRY(US).

**country_code**
A 2-character code that indicates to Language Environment the country on which to base the default settings. Table 33 on page 419 contains a list of valid country codes.

**Usage notes**
- If you specify an unsupported `country_code`, Language Environment accepts the value and issues an informational message.

  If an unsupported `country_code` is specified on the COUNTRY runtime option and one of the services listed in “National Language Support callable services” on page 102 is called with the optional `country_code` parameter omitted, the called service returns its specified default value.

- Language Environment provides locales used in C and C++ to establish default formats for the locale-sensitive functions and locale callable services, such as date and time formatting, sorting, and currency symbols. The COUNTRY setting does not affect these locale-sensitive functions and locale callable services.

  To change the locale, you can use the `setlocale()` library function or the CEESETL callable service. These affect only C/C++ locale-sensitive functions and Language Environment locale callable services, not the COUNTRY runtime option.

  To ensure that all settings are correct for your country, use COUNTRY and either CEESETL or `setlocale()`.

  The settings of CEESETL or `setlocale()` do not affect the setting of the COUNTRY runtime option. COUNTRY affects only Language Environment NLS and date and time services. `setlocale()` and CEESETL affect only C/C++ locale-sensitive functions and Language Environment locale callable services.

- The COUNTRY setting affects the format of the date and time in the reports generated by the RPTOPTS and RPTSTG runtime options.

**For more information**
- For more information about the CEE3CTY callable service, see “CEE3CTY—Set the default country” on page 122.
- For more information about the RPTOPTS runtime option, see “RPTOPTS” on page 62.
- For more information about the RPTSTG runtime option, see “RPTSTG” on page 63.
- For a list of countries and their codes, see Appendix A, “IBM-supplied country code defaults,” on page 419.
• For more information about the CEESETL callable service, see “CEESETL—Set locale operating environment” on page 362.
• For more information about setlocale(), see z/OS XL C/C++ Programming Guide.

**DEBUG (COBOL only)**

DEBUG activates the COBOL batch debugging features specified by the USE FOR DEBUGGING declarative. The default value for non-CICS applications is NODEBUG. The default value for CICS applications is NODEBUG.

**NODEBUG**

Suppresses the COBOL batch debugging features.

NODEBUG is the default.

**DEBUG**

Activates the COBOL batch debugging features. You must have the WITH DEBUGGING MODE clause in the environment division of your application in order to compile the debugging sections.

**Usage notes**

• For information about specifying this option at the system or region level, see z/OS Language Environment Customization.
• For information about specifying this option in CEEUOPT, see z/OS Language Environment Programming Guide.
• Use DEBUG and NODEBUG only on the command line.

**Performance consideration**

Because DEBUG gives worse runtime performance than NODEBUG, you should use it only during application development or debugging.

**For more information**

See the appropriate version of the COBOL programming guide in the COBOL library at Enterprise COBOL for z/OS library (www.ibm.com/support/docview.wss?uid=swg27036733) for more information about the USE FOR DEBUGGING declarative.

**DEPTHCONDLMT**

**Derivation:** DEPTH of nested CONDITION LIMIT

DEPTHCONDLMT specifies the extent to which conditions can be nested. Figure 1 on page 23 illustrates the effect of DEPTHCONDLMT(3) on condition handling. The initial condition and two nested conditions are handled in this example. The third nested condition is not handled.
The default value for non-CICS applications is DEPTHCONDLMT(10).
The default value for CICS applications is DEPTHCONDLMT(10).

**limit**
An integer of 0 or greater value. It is the depth of condition handling allowed. An unlimited depth of condition handling is allowed if you specify 0.

A limit value of 1 specifies handling of the initial condition, but does not allow handling of nested conditions that occur while handling a condition. With a limit value of 5, for example, the initial condition and four nested conditions are processed. In this case, there can be no further nesting of conditions.

If the number of nested conditions exceeds the limit, the application ends with abend 4087.

**z/OS UNIX considerations**
The DEPTHCONDLMT option sets the limit for how many nested synchronous conditions are allowed for a thread. Asynchronous signals do not affect DEPTHCONDLMT.

**Usage notes**
- PL/I consideration: DEPTHCONDLMT(0) provides PL/I compatibility.
- PL/I MTF consideration: In a PL/I MTF application, DEPTHCONDLMT sets the limit for how many nested synchronous conditions are allowed for a PL/I task. If the number of nested conditions exceeds the limit, the application ends abnormally.

**For more information**
For more information about nested conditions, see *z/OS Language Environment Programming Guide*.
The DYNDUMP runtime option provides a way to obtain dynamic dumps of user applications that would ordinarily be lost due to the absence of a SYSMDUMP, SYSUDUMP, or SYSABEND DD statement. The dynamic dump is written when:

- Certain types of ABENDs occur. You can select if a U4039 ABEND or other U40xx ABEND types can cause a dump to be collected.
- The first suboption defines the high level qualifier of the dynamic dump data set name.
- The second suboption controls when dynamic dumps are taken for U4039 ABENDS.
- The third suboption controls when dynamic dumps are taken for other U40xx ABENDS.

Restriction: The dump is written to a z/OS data set. It cannot be part of a z/OS UNIX file system.

The non-CICS default value is DYNDUMP(*userid,NODYNAMIC,TDUMP).

DYNDUMP is ignored under CICS.

The AMODE 64 default value is DYNDUMP(*userid,NODYNAMIC,TDUMP).

hlq

is a high level qualifier for the dynamic dump data set to be created. This is concatenated with a time stamp consisting of the Julian day and the time of the dump. The job name or PID can also be part of the name if the combined length of hlq and the time stamp is 35 characters or less. The hlq value is limited to 26 characters including dot (.) separators. hlq allows three keywords:

*USERID
    Tells Language Environment to use the user ID associated with the job step task as the high level qualifier for the dynamic dump data set.

*TSOPREFIX or TSOPRE
    Tells Language Environment to use the TSO/E prefix. The prefix is only valid in a TSO/E environment. If the prefix is not available, the user ID is used.

Each keyword may be followed by additional characters to be used to create the dataset name. When appended to the USERID or the TSO prefix, they form the hlq used when creating the dump data set.

The data set name is limited to 44 characters. If the combined length of hlq and the time stamp is 35 characters or less, the job name or PID is added to the data set name. If the system is using multilevel security, the SECLABEL is used as the second qualifier. If hlq contains multiple qualifiers, only the first is used, followed by the SECLABEL. The format of the data set name is:

- When the application is not exec()ed and not multilevel security:
  
  hlq.Djjj.Thhmmssst.jobname

- When the application is exec()ed and not multilevel security:
  
  hlq.Djjj.Thhmmssst.Pppppppp

- When the application is multilevel security and not exec()ed:
  
  hlq.MLS-level.Djjj.Thhmmssst.jobname

- When the application is both multilevel security and exec()ed:
  
  hlq.MLS-level.Djjj.Thhmmssst.Pppppppp
For U4039 ABENDS
The following suboptions are used for U4039 ABENDS only:

**DYNAMIC**
Language Environment creates a dynamic dump automatically when the application has not already specified one of the dump ddnames, (for example, SYSUDUMP).

**NODYNAMIC**
Language Environment does not create a dynamic dump if no dump DD names are specified.
NODYNAMIC is the default.

**FORCE**
Language Environment always creates a dynamic dump even if other dump DD names have been specified. The SYSnnnnn DD card is ignored if it exists. FORCE should not be used as the default.

**BOTH**
Language Environment creates a dynamic dump and, if a SYSnnnnn DD name exists, a dump is also written to the DD. BOTH should not be used as the default.

For U40xx ABENDS
The following suboptions are used for other U40xx ABENDS only. Existing SYSnnnnn DD statements are also honored.

**TDUMP**
Language Environment creates a dynamic dump automatically.
TDUMP is the default.

**NOTDUMP**
Language Environment does not create a dynamic dump.

Usage notes

- Do not use FORCE or BOTH as the default for the U4039 ABENDS.
- Set up an *hlq* to which everyone can write.
- The DYNDUMP runtime option is ignored under CICS.
- When an ABEND occurs during Language Environment initialization, the dynamic dump is not created if runtime options have not been processed yet.
- When the dynamic dump fails, messages are written to the operator’s console or the job log (for batch). These are written by the IEATDUMP system service, by Language Environment, or by RACF®.
- When an ABEND is issued without the DUMP option, no dump is generated.
- When Language Environment terminates with a U4038 abend, the U4038 abend is issued without the DUMP option. Therefore, no system dump is generated, and DYNDUMP does not collect a dump for this ABEND.
- The job name is taken from the JOBNAME system symbol.
  - A dump for a TSO application uses the user ID of the JOBNAME.
  - For a batch job, JOBNAME is taken from the JOB card in the JCL.
  - In the shell, JOBNAME is the user ID with a suffix.
- Language Environment will suppress dynamic dumps for authorized applications under the following conditions:
  - A user is running a Language Environment application as a RACF-controlled program on a system where the IEAAABD.DMPAUTH resource was defined, but the user was not permitted access to this resource.
  - A user is running an authorized key Language Environment application in a non-started task address space but the user has not been permitted access to the IEAABD.DMPAKEY resource.
A user is running a Language Environment application in a non-started task address space that has the JSCBPASS indicator on, including applications whose PPT entry specifies bypassing security protection.

After Language Environment suppresses a dump, message CEE3880I is written to the application's programmer log. For more information, refer to the documentation for message CEE3880I in z/OS Language Environment Runtime Messages. Also refer to z/OS Security Server RACF Security Administrator’s Guide.

CICS considerations

- **DYNDUMP(smith, force, notdump)**
  A dynamic dump is generated only for ABEND code U4039. Other SYSnnnnn DD cards are ignored. Other ABENDs might cause a dump to be created if a SYSnnnnn DD card exists. The dynamic dump data set name will be similar to SMITH.D012.T112245.JOB11.

- **DYNDUMP(smith,DYNAMIC,TDUMP)**
  A dynamic dump is created if no SYSnnnnn is specified and the ABEND code is U4039. The data set name will be similar to SMITH.D117.T235900.JOBZ2.

- **DYNDUMP(*TSOPREFIX,NODYNAMIC,TDUMP)**
  A dynamic dump is generated only for ABEND code U40xx. The data set name will be similar to SMITH.D287.T234560.JOBZ2.

- **DYNDUMP(*USERID,NODYNAMIC,TDUMP)**
  A dynamic dump for a U4039 ABEND is taken to SMITH.D109.T234512.JOBZ3.

- **DYNDUMP(*USERID,HOT.DUMPS,NODYNAMIC,TDUMP)**

- **DYNDUMP(*TSOPRE.A1234567.B1234567,NODYNAMIC,TDUMP)**

**ENV**

**Derivation:** ENVironment

ENV specifies the operating system for your C application. z/OS XL C++ users can get the same behavior by using the z/OS XL C++ compiler option TARGET(IMS) to specify ENV(IMS).

**Restriction:** This option does not apply to non-C languages and can be specified only with the C #pragma runopts directive. You cannot set this option at the system level, region level, or in the CEEBXITA assembler user exit interface.

For non-CICS applications, the ENV option differs from other runtime options that it does not have a standard default. The default depends on the system (CMS, IMS, or MVS) in which compilation occurs. ENV is ignored under CICS.

**CMS**

Specifies that the C application runs in a CMS environment.

**IMS**

Specifies that the C application runs in an IMS environment. You do not need to specify the ENV option if your application is invoked under IMS but does not actually use IMS facilities.

**MVS**

Specifies that the C application runs in an MVS environment.
z/OS UNIX considerations

- In a multithreaded environment, the ENV option is shared by all threads in the process.

**ENVAR**

**Derivation:** ENvironmenal VARIables

ENVAR sets the initial values for the environment variables that can later be accessed or changed using the C functions getenv(), putenv, setenv, and clearenv.

The set of environment variables established by the end of runtime option processing reflects all the various sources where environment variables are specified, rather than just the one source with the highest precedence. However, if a setting for the same environment variable is specified in more than one source, the setting with the highest precedence is used.

The system() function can be used to create a new environment. Environment variables in effect at the time of the POSIX system() call are copied to the new environment. The copied environment variables are treated the same as those found in the ENVAR runtime option on the command level.

When you specify the RPTOPTS runtime option, the output for the ENVAR runtime option contains a separate entry for each source where ENVAR was specified with the environment variables from that source.

The default value for non-CICS applications is ENVAR('').

The default value for CICS applications is ENVAR('').

The default value for AMODE 64 applications is ENVAR('').

- **string**
  - Is specified as name=value, where name and value are sequences of characters that do not contain null bytes or equal signs. The string name is an environment variable, and value is its value.
  - Blanks are significant in both the name= and the value characters. You can enclose string in either single or double quotation marks to distinguish it from other strings. You can specify multiple environment variables, separating the name=value pairs with commas. Quotation marks are required when specifying multiple variables.

**z/OS UNIX considerations**

In a multithreaded environment, the environment variables are shared by all threads in the process.

**Usage notes**

- The entire value of the ENVAR operand, whether a single string or multiple strings, cannot exceed 250 characters.
- string cannot contain DBCS characters.
- If ENVAR is specified as part of the _CEE_RUNOPTS environment variable, it is ignored.
- The ENVAR option functions independently of the POSIX runtime option setting.
• C/C++ consideration—An application can access the environment variables using C function `getenv()` or the POSIX variable `environ`, which is defined as:

```c
extern char **environ;
```

You should access environment variables through the `getenv()` function, especially in a multithread environment. `getenv()` serializes access to the environment variables.

Environment variables that are passed to the exec or spawn family of functions replace those established by the ENVAR option in the new environment.

For more information
• For more information about the RPTOPTS runtime option, see “RPTOPTS” on page 62.
• For more information about `getenv()`, `putenv()`, `setenv()`, `clearenv()`, `system()`, and the exec and spawn family of functions, see z/OS XL C/C++ Runtime Library Reference.
• For more information about the order of precedence of runtime option sources, see z/OS Language Environment Programming Guide.

ERRCOUNT

Derivation: ERRor COUNTer

ERRCOUNT specifies how many conditions of severity 2, 3, or 4 can occur per thread before the enclave terminates abnormally. When the number specified in ERRCOUNT is exceeded, Language Environment ends with ABEND U4091 RC=B.

The default value for non-CICS applications is ERRCOUNT(0).

The default value for CICS applications is ERRCOUNT(0).

![ERRCOUNT Diagram]

number

An integer of 0 or greater value that specifies the number of severity 2, 3, and 4 conditions allowed for each thread. An unlimited number of conditions is allowed if you specify 0. If the number of conditions exceeds the limit, the application ends with abend 4091 RC=B.

z/OS UNIX considerations

Synchronous signals that are associated with a condition of severity 2, 3, or 4 affect ERRCOUNT. Asynchronous signals do not affect ERRCOUNT.

Usage notes
• Language Environment does not count severity 0 or 1 conditions toward ERRCOUNT.
• ERRCOUNT only applies when conditions are handled by a user condition handler, signal catcher, PL/I on-unit, or a language-specific condition handler. Any unhandled condition of severity 2, 3, or 4 causes the enclave to terminate.
• COBOL consideration: The COBOL runtime library separately counts its severity 1 (warning) messages. When the limit of 256 IGZnnnnW messages is reached, the COBOL runtime library will issue message IGZ0041W, which indicates that the limit of warning messages has been reached. Any further COBOL warning messages are suppressed and processing continues.
• PL/I consideration: You should use ERRCOUNT(0) in a PL/I environment to avoid unexpected
termination of your application. Some conditions, such as ENDPAGE, can occur many times in an
application.
• PL/I MTF consideration: In a PL/I MTF application, ERRCOUNT sets the threshold for the total number
severity 2, 3, and 4 synchronous conditions that can occur for each task.
• C++ consideration: C++ throw does not affect ERRCOUNT.

For more information
For more information about condition handling, see z/OS Language Environment Programming Guide.

ERRUNIT (Fortran only)

Derivation: ERROr UNIT

ERRUNIT identifies the unit number to which runtime error information is to be directed. This option is
provided for compatibility with the VS FORTRAN version 2 runtime.

The default value for non-CICS applications is ERRUNIT(6).

ERRUNIT is ignored under CICS.

number
A number in the range 0-99.

Usage notes
The Language Environment message file and the file that is connected to the Fortran error message unit
are the same.

EXECOPS | NOEXECOPS

EXECOPS specifies whether you can enter runtime options on the command line.

Restriction: This option can be specified only with the #pragma runopts directive. You cannot set this
option at the system level, region level, or in the CEEBXITA assembler user exit interface.

The default value for non-CICS applications is EXECOPS.

This option is ignored under CICS.

The default value for AMODE 64 applications is EXECOPS.

EXECOPS
Specifies that you can enter runtime options on the command line. Language Environment parses the
argument string to separate runtime options from application arguments. The runtime options are
interpreted by Language Environment and the application arguments are passed to the application.

The default is EXECOPS.
NOEXECOPS

Specifies that you cannot enter runtime options on the command line. Language Environment passes the entire argument string to the application.

For more information

For more information about the format of the argument string and how it is parsed, see z/OS Language Environment Programming Guide.

FILEHIST (Fortran only)

Derivation: FILE HISTory

FILEHIST specifies whether to allow the file definition of a file referred to by a ddname to be changed during run time. This option is intended for use with applications called by Fortran that reallocate the DD names supplied by Fortran.

The default value for non-CICS applications is FILEHIST.

FILEHIST is ignored under CICS

FILEHIST

Causes the history of a file to be used in determining its existence. It checks to see if:

- The file was ever internally opened (in which case, it exists)
- The file was deleted by a CLOSE statement (in which case, it does not exist).

The default is FILEHIST.

NOFILEHIST

Causes the history of a file to be disregarded in determining its existence. If you specify NOFILEHIST, you should consider:

- If you change file definitions during run time, the file is treated as if it were being opened for the first time.
- Before the file definition can be changed, the existing file must be closed.
- If you do not change file definitions during run time, you must use STATUS='NEW' to reopen an empty file that has been closed with STATUS='KEEP', because the file does not appear to exist to Fortran.

FILETAG (C/C++ only)

Derivation: FILE TAGging

FILETAG controls automatic text conversion and automatic file tagging for z/OS UNIX files. It activates the automatic file tagging, on the first write, of new or empty z/OS UNIX file system files open with fopen() or freopen(), or upon the first I/O to a pipe created with popen(). You should be familiar with the concept of file tagging, automatic conversion, and the program and file CCSIDs to use the runtime option properly. See z/OS XL C/C++ Programming Guide for more information.

The default value for non-CICS applications is FILETAG(NOAUTOCVT,NOAUTOTAG).

FILETAG is ignored under CICS.

The default value for AMODE 64 applications is FILETAG(NOAUTOCVT,NOAUTOTAG).
NOAUTOCVT
Disables automatic text conversion.
The default is NOAUTOCVT.

AUTOCVT
Enables automatic text conversion for untagged UNIX file system files opened using fopen() or freopen(). The conversion for an untagged file is from the program CCSID to the EBCDIC CCSID as specified by the _BPXK_CCSIDS environment variable. If the environment variable is unset, a default CCSID pair is used. See z/OS XL C/C++ Programming Guide for more information about the _BPXK_CCSIDS environment variable.

Restriction: Automatic conversion for untagged UNIX files can only take place between IBM-1047 and ISO8859-1 code sets. Other CCSID pairs are not supported. By default, automatic conversion for untagged UNIX file system files applies only to files opened in text mode. An untagged file opened in binary mode is not converted automatically. You can control the tagging by using the _EDC_AUTOCVT_BINARY environment variable. For more information about the _EDC_AUTOCVT_BINARY environment variable, see z/OS XL C/C++ Programming Guide.

This suboption also indicates that the standard streams should be enabled for automatic text conversion to the EBCDIC IBM-1047 code page when they refer to an untagged terminal file (tty).

This suboption does not affect untagged UNIX file system files that are automatically tagged by the AUTOTAG suboption. A UNIX file system file that is automatically tagged is already enabled for automatic text conversion.

The automatic text conversion is performed only if one of the following situations is also true:
• The _BPXK_AUTOCVT environment variable value is set to ON.
• The _BPXK_AUTOCVT environment variable is unset and AUTOCVT(ON) was specified in the active BPXPRMxx member on your system.

For more information about the _BPXK_AUTOCVT environment variable, see z/OS XL C/C++ Programming Guide.

NOAUTOTAG
Disables the automatic tagging of new or empty z/OS UNIX files.
The default is NOAUTOTAG.

AUTOTAG
Enables automatic file tagging, on the first write, of new or empty z/OS UNIX files opened with fopen(), freopen(), or popen().

Usage notes
• Avoid the following situations:
  – Setting this runtime option at the system or region levels.
  – Setting this runtime option using _CEE_RUNOPTS in a default profile for the UNIX shell users.
  – Exporting _CEE_RUNOPTS that specifies this runtime option. It can cause unexpected behaviors for the unknowing user or application.
• The application programmer should define this runtime option with the assumption that the application is coded to behave based on the option's setting.
• The application programmer should specify this runtime option at compile time using #pragma runopts or at bind using a CEEUOPT CSECT that has been previously created.
• The application user should not override this runtime option because it can change the expected behavior of the application.

• The default CCSID pair is (1047,819), where 1047 indicates the EBCDIC IBM-1047 codepage and 819 indicates the ASCII ISO8859-1 codepage.

• Automatic text conversion is enabled for the standard streams only when the application has been exec( )ed, for example, when the UNIX shell gives control to a program entered on the command line, and the standard stream file descriptors are already open, untagged, and associated with a tty.

• For the UNIX shell-owned standard streams that are redirected at program execution time, the shell includes added environment variables that control if the redirected streams are tagged. See z/OS UNIX System Services Command Reference for more information.

• Automatic tagging for a z/OS UNIX file is done by the system at first write. The CCSID used for the tag is the program CCSID of the current thread. Both text and binary files are tagged.

• When FILETAG(AUTOTAG) is in effect, fopen( ) or freopen( ) of a z/OS UNIX file fails if it cannot determine if the file exists or if it cannot determine the size.

FLOW (COBOL only)

FLOW controls the FLOW output produced by OS/VS COBOL programs. You cannot set this option at the system or region levels.

The default value for non-CICS applications is NOFLOW.

The default value for CICS applications is NOFLOW.

FLOW(n)

FLOW=n

FLOWn

NOFLOW

Suppresses the OS/VS COBOL FLOW output.

The default is NOFLOW.

FLOW(n)

FLOW=n

FLOWn

n

Specifies the number of procedures traced. The number can be any integer from 1 to 99, inclusive.

HEAP

HEAP controls the allocation of user heap storage and specifies how that storage is managed. Heaps are storage areas containing user-controlled dynamically allocated variables or data. Examples of these are:

• C data allocated as a result of the malloc( ), calloc( ), and realloc( ) functions

• COBOL WORKING-STORAGE data items

• PL/I variables with the storage class CONTROLLED, or the storage class BASED

• Data allocated as a result of a call to the CEEGTST Language Environment callable service

The default value for non-CICS applications is HEAP(32K,32K,ANYWHERE,KEEP,8K,4K).
The default value for CICS applications is \texttt{HEAP(4K,4080,ANYWHERE,KEEP,4K,4080)}.

	extit{init\_size}  
Determines the initial allocation of heap storage. This value can be specified as \(n\), \(n\,\textit{K}\), or \(n\,\textit{M}\) bytes of storage. If 0 is specified, the initial storage is obtained on the first use and is based on the increment size. The actual amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

\textit{incr\_size}  
Determines the minimum size of any subsequent increment to the user heap storage. This value can be specified as \(n\), \(n\,\textit{K}\), or \(n\,\textit{M}\) bytes of storage. The actual amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

\texttt{ANYWHERE} | \texttt{ANY}  
Specifies that user heap storage can be allocated anywhere in storage. If there is no available storage above the line, storage is acquired below the 16 MB line. \texttt{ANYWHERE} is the default.

\texttt{BELOW}  
Specifies that user heap storage is allocated below the 16M line in storage. The \texttt{HEAPPOOLS} option is ignored when the \texttt{BELOW} suboption is specified.

\texttt{KEEP}  
Specifies that an increment to user heap storage is not released when the last of the storage within that increment is freed. \texttt{KEEP} is the default.

\texttt{FREE}  
Specifies that an increment to user heap storage is released when the last of the storage within that increment is freed.

\textit{initsz24}  
Determines the minimum initial size of user heap storage that is obtained below the 16M line for AMODE 24 applications that specify \texttt{ANYWHERE} in the \texttt{HEAP} runtime option. This value can be specified as \(n\), \(n\,\textit{K}\), or \(n\,\textit{M}\) number of bytes. If 0 is specified, the initial storage is obtained on the first use and is based on the increment number. The amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

\textit{incrsz24}  
Determines the minimum size of any subsequent increment to user heap storage that is obtained below the 16M line for AMODE 24 applications that specify \texttt{ANYWHERE} in the \texttt{HEAP} runtime option. This value can be specified as \(n\), \(n\,\textit{K}\), or \(n\,\textit{M}\) number of bytes. The amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

\textbf{CICS consideration}  
- If \texttt{HEAP(,,ANYWHERE,..)} is in effect, the maximum size of a heap segment is 1 gigabyte (1024 MB).
- The default increment size under CICS is 4080 bytes, rather than 4096 bytes, to accommodate the 16 bytes CICS storage check zone. Without this accommodation, an extra page of storage is allocated when the storage allocation is below the 16 MB line.
If you choose to change the increment size, you should adjust for the 16 byte CICS storage check zone.

**z/OS UNIX considerations**

In a multithreaded environment, user heap storage is shared by all threads in the process.

**Usage notes**

- Applications running in AMODE 24 that request heap storage get the storage below the 16M line regardless of the setting of ANYWHERE | BELOW.
- COBOL consideration—You can use the HEAP option to provide function similar to the VS COBOL II space management tuning table.
- PL/I consideration—For PL/I, the only case in which storage is allocated above the line is when all of the following conditions exist:
  - The user routine requesting the storage is running in 31-bit addressing mode.
  - HEAP(,,ANY,,,) is in effect.
  - The main routine runs in AMODE 31.
- PL/I MTF consideration—In a PL/I MTF application, HEAP specifies the heap storage allocation and management for a PL/I main task.

**Performance consideration**

You can improve performance with the HEAP runtime option by specifying values that minimize the number of times the operating system allocates storage. See “RPTSTG” on page 63 for information about how to generate a report you can use to determine the optimum values for the HEAP runtime option.

**For more information**

- For more information about the CEECRHP callable service, see “CEECRHP—Create new additional heap” on page 197.
- For more information about the CEEGTST callable service, see “CEEGTST—Get heap storage” on page 276.
- For more information about the RPTSTG runtime option, see “RPTSTG” on page 63.

**HEAP64 (AMODE 64 only)**

HEAP64 controls the allocation of user heap storage for AMODE 64 applications and specifies how that storage is managed. Heaps are storage areas containing user-controlled dynamically allocated variables or data. An example is C data allocated as a result of the malloc(), calloc(), and realloc() functions.

The default value for AMODE 64 applications is HEAP64(1M,1M,KEEP,32K,32K,KEEP,4K,4K,FREE).
**init64**
Determines the initial allocation of heap storage that is obtained above the 2G bar. Specify this value as \( n \)M bytes of storage. If a value of 0 or less is specified, the default is used.

**incr64**
Determines the minimum size of any subsequent increment to the user heap storage obtained above the 2G bar. Specify this value as \( n \)M bytes of storage. If a value less than 0 is specified, the default is used.

**KEEP**
Specifies that an increment to user heap storage is not released when the last of the storage within that increment is freed.
KEEP is the default.

**FREE**
Specifies that an increment to user heap storage is released when the last of the storage within that increment is freed.

**FILL**
Specifies that an increment to user heap storage is released when the last of the storage within that increment is freed. In addition, when a storage request results in a new increment segment being created which is greater than the **incr64** size, the entire segment is filled by the single storage request. This option is available only for user heap storage above the bar.

**init31**
Determines the minimum initial size of user heap storage that is obtained above the 16M line and below the 2G bar. This value can be specified as \( n \), \( n \)K, or \( n \)M number of bytes. If 0 is specified, the initial storage is obtained on the first use and is based on the increment size. The amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

**incr31**
Determines the minimum size of any subsequent increment to user heap storage that is obtained above the 16M line and below the 2G bar. This value can be specified as \( n \), \( n \)K, or \( n \)M number of bytes. The amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

**init24**
Determines the minimum initial size of user heap storage that is obtained below the 16M line. This value can be specified as \( n \), \( n \)K, or \( n \)M number of bytes. If 0 is specified, the initial storage is obtained on the first use and is based on the increment size. The amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

**incr24**
Determines the minimum size of any subsequent increment to user heap storage that is obtained below the 16M line. This value can be specified as \( n \), \( n \)K, or \( n \)M number of bytes. The amount of allocated storage is rounded up to the nearest multiple of 8 bytes.
**z/OS UNIX considerations**

In a multithreaded environment, user heap storage is shared by all threads the process.

**Performance consideration**

You can improve performance with the HEAP64 runtime option by specifying values that minimize the number of times the operating system allocates storage. See “RPTSTG” on page 63 for information about how to generate a report you can use to determine the optimum values for the HEAP64 runtime option.

**For more information**

- For more information about heap storage and heap storage tuning with storage report numbers, see *z/OS Language Environment Programming Guide*.
- For more information about the RPTSTG runtime option, see “RPTSTG” on page 63.

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**HEAPCHK**

**Derivation:** HEAP storage CHecKing

HEAPCHK performs diagnostic tests against the user heap.

The default value for non-CICS applications is HEAPCHK(OFF,1,0,0,0,1024,0,1024,0).

The default value for CICS applications is HEAPCHK(OFF,1,0,0,0,1024,0,1024,0).

The default value for AMODE 64 applications is HEAPCHK(OFF,1,0,0,0,1024,0,1024,0).

**OFF**

Indicates that no heap checking or tracing is done regardless of the values of the remaining suboptions.

OFF is the default.

**ON**

Indicates that heap checking or tracing is activated based on the values of the remaining suboptions.

**frequency**

The frequency at which the user heap is checked for damage to the heap control information. It is specified as \( n, nK \) or \( nM \). A value of one (1) is the default and causes the heap to be checked at each call to a Language Environment heap storage management service. A value of \( n \) causes the user heap to be checked at every \( n \)th call to a Language Environment heap storage management service. A value of zero results in no check for damage to the user heap.

**delay**

A value that causes a delay before user heap is checked for damage, and is specified in \( n, nK \) or \( nM \). A value of zero (0) is the default and causes the heap checking to begin with the first call to a Language
Environment heap storage management service. A value of \( n \) causes the heap checking to begin following the \( n \)th call to a Language Environment heap storage management service.

**call depth**

Specifies the depth of calls displayed in the traceback for the heap storage diagnostics report. A value of zero is the default that turns heap storage diagnostics reporting off. The heap storage diagnostics report consists of a set of tracebacks. Each traceback is a snapshot of the stack (to a specified call depth) for each request to obtain user heap storage that has not had a corresponding free request. Use a value of 10 to ensure an adequate call depth is displayed so that you can identify the storage leak.

**pool call depth**

Specifies the depth of calls in the traceback for each trace entry of a heap pools trace. A value of zero is the default that turns heap pools tracing off. The heap pools trace is an in-core wrapping trace. Each heap pool has a separate trace table. The heap pools trace is only formatted from a system dump using the IPCS verbexit LEDATA. Use a value of 10 to ensure an adequate call depth is displayed so that you can identify the storage leak.

**number of entries**

Specifies the number of entries to be recorded in one heap pool trace table for the main user heap in the application. Each pool has its own trace table. If the number of entries is 0, the heap pool trace table is not generated.

**pool number**

Specifies which pools are traced for the main user heap in the application. You can either trace one pool or all pools. The value should be a valid pool number from 1 to 12. If the pool number is 0, all pools will be traced.

**number of entries 31**

Specifies the number of entries to be recorded in one heap pool trace table when an AMODE 64 application is using heap storage from 31–bit addressable storage (__malloc31()). Each pool has its own trace table. If the number of entries is 0, the heap pool trace table is not generated. This value is only supported in an AMODE64 environment.

**pool number 31**

Specifies which pools are traced when an AMODE 64 application is using heap storage from 31–bit addressable storage (__malloc31()). You can trace either one pool or all pools. The value should be a valid pool number from 1 to 12. If the pool number is 0, all pools will be traced. This value is only supported in an AMODE64 environment.

**Usage notes**

- When user heap damage is detected, Language Environment immediately issues an ABEND U4042 RC=0. To obtain a system dump of this abend, either specify TDUMP for the third suboption of the DYNDUMP runtime option or ensure that a SYSMDUMP DD is available.
- If HEAPCHK(ON) is used with STORAGE(,heap_free_value), all free areas of the heap are also checked.
- To request only a heap storage diagnostics report, you must specify a zero for frequency, a zero for pool call depth and a number \( n \) greater than zero for call depth. For example, (HEAPCHK(ON,0,0,10,0)).
- Under normal termination conditions, if the call depth is greater than zero, the heap storage diagnostics report is written to the CEEDUMP report, independent of the TERMTHDACT setting.
- You can also generate a heap storage diagnostics report by calling CEE3DMP with the BLOCKS option.
- Since HEAPCHK does not validate individual cells within a cell pool, you should specify HEAPPools(OFF) when running HEAPCHK to diagnose storage overlays in the heap.
- To request heap pools tracing, set pool call depth to a nonzero value and number of entries (for AMODE 64 applications, number of entries, number of entries 31, or both) to a value. To request only heap pools tracing, in addition, set frequency to zero and call depth to zero. The heap pools trace is only formatted from a system dump using the IPCS verbexit LEDATA.
- For AMODE 64 applications, number of entries and pool number control tracing for the set of heap pools located in storage above the 2-GB bar. Number of entries 31 and pool number 31 control tracing for the
set of heap pools located in storage above the 16-MB line and below the 2-GB bar. Pool call depth applies to both sets of heap pools.

• There is no interaction between specifying the HEAPZONES and HEAPCHK runtime options, but setting both at the same time is not recommended by IBM.

**Performance consideration**

Specifying HEAPCHK(ON) can result in a performance degradation due to the user heap diagnostic testing that is performed.

**For more information**

For more information about creating and using the heap storage diagnostics report, see z/OS Language Environment Debugging Guide.

**HEAPPOOLS (C/C++ and Enterprise PL/I only)**

**Derivation:** HEAP storage POOLS

The HEAPPOOLS runtime option is used to control an optional user heap storage management algorithm, which is known as heap pools. This algorithm is designed to improve the performance of multithreaded applications with a high frequency of calls to malloc(), __malloc31(), calloc(), realloc(), free(), and `new` and `delete`. When active, heap pools virtually eliminate contention for user heap storage.

HEAPPOOLS runtime option can be used by AMODE 64 applications to manage user heap storage above the 16 M line and below the 2 G bar.

The default value for non-CICS applications is

```
HEAPPOOLS(OFF,8,10,32,10,128,10,256,10,1024,10,2048,10,0,10,0, 10,0,10,0,10,0,10,0,10,0,10,0,10,0,10).
```

The default value for CICS applications is

```
HEAPPOOLS(OFF,8,10,32,10,128,10,256,10,1024,10,2048,10,0,10,0, 10,0,10,0,10,0,10,0,10,0,10,0,10,0,10).
```

The default value for AMODE 64 applications is

```
HEAPPOOLS(OFF,8,10,32,10,128,10,256,10,1024,10,2048,10,0,10,0, 10,0,10,0,10,0,10,0,10,0,10,0,10,0,10).
```

**OFF**

- Specifies that the heap pools algorithm is not used.
  - The default is OFF.

**ON**

- Specifies that the heap pools algorithm is used.

**ALIGN**

- Specifies that Language Environment will structure the storage for cells in a heap pool so that a cell less than or equal to 248 bytes does not cross a cache line. For cells larger than 248 bytes, two cells never share a cache line.

**cell size**

- Specifies the size of the cells in a heap pool, which is specified as n or nK. The cell size must be a multiple of 8, with a maximum of 65536 (64K).
**pool-count**

The number of pools to create for the cell size. The pool-count must be in a range from 1 to 255.

**percentage**

The size of this heap pool and any of its extents is determined by multiplying this percentage by the *init_size* value that was specified in the HEAP runtime option. The percentage must be in a range from 1 to 90.

**Usage notes**

- Cell pool sizes should be specified in ascending order.
- To use less than twelve heap pools, specify 0 for the cell size after the last heap pool to be used. For example, if four heap pools are desired, use 0 for the fifth cell size when setting the HEAPPOOLS runtime option.
- If the percentage of the HEAP runtime option init size values does not allow for at least one cell, the system automatically adjusts the percentage to enable four cells to be allocated.
- The sum of the percentages may be more or less than 100 percent.
- Each heap pool is allocated as needed. The allocation of a heap pool can result in the allocation of a heap increment to satisfy the request.
- The FREE suboption on the HEAP runtime option has no effect on any heap segment in which a heap pool resides. Each cell in a heap pool can be freed, but the heap pool itself is only released back to the system at enclave termination. To avoid wasting storage, see the heap pool tuning tips specified in *z/OS Language Environment Programming Guide*.
- The HEAPPOOLS runtime option has no effect when BELOW is specified as the location on the HEAP runtime option.
- Mixing of the storage management AWIs (CEEGTST(), CEEFRST() and CEECZST()) and the C/C++ intrinsic functions (malloc(), calloc(), realloc() and free()) are not supported when operating on the same storage address. For example, if you request storage using CEEGTST(), then you may not use free() to release the storage.
- Using the ALIGN suboption might cause an increase in the amount of heap storage that is used by an application.
- You should examine the storage report and adjust storage tuning when first using the ALIGN suboption.
- The HEAPCHK runtime option does not validate individual heap pool cells.
- Use of a vendor heap manager (VHM) overrides the use of the HEAPPOOLS runtime option.
- If the RPTSTG runtime option is specified while using HEAPPOOLS, extra storage is obtained from the ANYHEAP and is used to complete the storage report on heappools. This extra storage is only allocated when both HEAPPOOLS and RPTSTG are used.
- The HEAPPOOLS runtime option can be used by AMODE 64 applications to manage user heap storage above the 16M line and below the 2G bar.
- When cell-size is specified without parenthesis, pool-count defaults to 1 rather than being picked up from an earlier setting of pool-count. For example, specifying 128 is treated like specifying (128,1).
- When cell-size is specified with parenthesis, pool-count must also be specified.
- When pool-count is greater than 1, the size of each heap pool extent is determined by dividing the heap allocation for the cell-size by the pool-count.

**Performance considerations**

- To improve the effectiveness of the heap pools algorithm, use the storage report numbers generated by the RPTSTG runtime option as an aid in determining optimum cell sizes, percentages, and the initial heap size.
- Use caution when using cells larger than 2K. Large gaps between cell sizes can lead to a considerable amount of storage waste. Properly tuning cell sizes with the help of RPTSTG is necessary to control the amount of virtual storage needed by the application.
• When there are many successful get requests for the same size cell and the maximum elements used in the cell pool is high, this could be an indication that there is excessive contention allocating elements in the cell pool. Specifying pool-count greater than 1 might help relieve some of this contention. Multiple pools are allocated with the same cell size and a portion of the threads are assigned to allocate cells out of each of the pools.

HEAPPOOLS64 (C/C++ and AMODE 64 only)

**Derivative:** HEAP storage POOLS for AMODE 64

The HEAPPOOLS64 runtime option is used to control an optional user heap storage management algorithm, known as heap pools, for AMODE 64 applications. This algorithm is designed to improve the performance of multithreaded C/C++ applications with a high frequency of calls to malloc(), calloc(), realloc(), free(), and operators new and delete. When active, heap pools virtually eliminates contention for user heap storage.

The default value for AMODE64 applications is HEAPPOOLS64(OFF,8,4000,128,700,256,350,1024,100,2048,50,3072,50,4096,50,8192,25,16384,10,32768,5,65536,5).

**OFF**
- Specifies that the heappools algorithm is not being used.
- The default is OFF.

**ON**
- Specifies that the heappools algorithm is being used.

**ALIGN**
- Specifies that Language Environment will structure the storage for cells in a heap pool so that a cell less than or equal to 240 bytes does not cross a cache line. For cells larger than 240 bytes, two cells never share a cache line.

**cell-size**
- Specifies the size of the cells in a heap pool, specified as n or nK. The cell size must be a multiple of 8, with a maximum of 65536 (64K).

**pool-count**
- The number of pools to create for the cell size. The pool-count must be in a range from 1 to 255.

**count**
- Specifies the number of cells of the corresponding size to be allocated initially. The minimum cell count is 4.

**Usage notes**
- Cell pool sizes should be specified in ascending order.
- To use less than twelve heap pools, specify 0 for the cell size after the last heap pool to be used. For example if four heap pools are desired, use 0 for the fifth cell size when setting the HEAPPOOLS64 runtime option.
• Each heap pool is allocated as needed. The allocation of a heap pool can result in the allocation of a heap increment to satisfy the request.

• Using the ALIGN suboption might cause an increase in the amount of heap storage used by an application.

• Examine the storage report and adjust storage tuning when first using the ALIGN suboption.

• The HEAPCHK runtime option does not validate individual heap pool cells.

• If you specify the RPTSTG runtime option while using HEAPPOOLS64, extra storage is obtained from the LIBHEAP64 and is used to complete the storage report on heappools. This extra storage is only allocated when both HEAPPOOLS64 and RPTSTG are used.

• HEAPPOOLS runtime option can be used by AMODE 64 applications to manage user heap storage above the 16M line and below the 2G bar.

• When cell-size is specified without parenthesis, pool-count defaults to 1 rather than being picked up from an earlier setting of pool-count. For example, specifying 128 is treated like specifying (128,1).

• When cell-size is specified with parenthesis, pool-count must also be specified.

• When pool-count is greater than 1, the size of each heap pool extent is determined by dividing the heap allocation for the cell-size by the pool-count.

Performance considerations

• To improve the effectiveness of the heap pools algorithm, use the storage report numbers that are generated by the RPTSTG runtime option as an aid in determining optimum cell sizes and count.

• Use caution when using cells larger than 2K. Large gaps between cell sizes can lead to a considerable amount of storage waste. Properly tuning cell sizes with the help of RPTSTG is necessary to control the amount of virtual storage that is needed by the application.

For more information

For more information about heap storage and heap storage tuning with storage report numbers, see z/OS Language Environment Programming Guide.

HEAPZONES

Derivation: HEAP check ZONES

The HEAPZONES runtime option is used to turn on overlay toleration and checking for user heaps. When activated, the runtime option affects any obtained storage that can be controlled by the HEAP or HEAP64 runtime options. HEAPZONES also affects storage obtained from a heap pool.

A heap check zone is an additional piece of storage that is appended to an allocated element during a storage request. The size of the check zone depends on the size31 and size64 suboptions of HEAPZONES. The check zone can be examined for overlays when the heap element is freed.

The default value for non-CICS applications is HEAPZONES(0,ABEND,0,ABEND).

The default value for CICS applications is HEAPZONES(0,ABEND,0,ABEND).

The default value for AMODE 64 applications is HEAPZONES(0,ABEND,0,ABEND).
**size31**
Controls the size of the check zone for all user heap storage which is below the 2 G bar. The check zone size is rounded up to the nearest multiple of 8 bytes. The maximum size allowed for a check zone is 1024 bytes. Specifying a value of 0 indicates that no check zone is active.

**size64**
Controls the size of the check zone for all user heap storage which is above the 2 G bar. The check zone size is rounded up to the nearest multiple of 8 bytes with a minimum size of 16 bytes. The maximum size allowed for a check zone is 1024 bytes. Specifying a value of 0 indicates that the check zone is not active.

**ABEND**
Specifies that check zones are validated and if an overlay is detected, a U4042 ABEND reason code 3 is issued.

ABEND is the default.

**QUIET**
Specifies that a heap check zone is appended to every allocated element, but the check zone is not validated.

**MSG**
Specifies that check zones are validated and if an overlay is detected, informational messages are issued. For more information about the output for the HEAPZONES runtime option, see **z/OS Language Environment Debugging Guide**.

**TRACE**
Specifies that in addition to informational messages, a CEEDUMP containing only a traceback is produced.

**Usage notes**
- You cannot set HEAPZONES at the system level, region level, or in the CEEBXITA assembler user exit interface.
- You cannot specify an active HEAPZONES setting and RPTSTG(ON) simultaneously. An active HEAPZONES setting causes Language Environment to override RPTSTG to the value OFF and no storage report is produced.
- There is no interaction between specifying the HEAPZONES and HEAPCHK runtime options, but setting both at the same time is not recommended by IBM.

**Performance considerations**
Using heap check zones can result in a performance degradation and significant additional storage usage. IBM recommends setting the size of a heap check zone to the smallest amount feasible by the application.
INFOMSGFILTER

Note: INFOrmational MeSsaGe FILTER

INFOMSGFILTER allows you to activate a filter that eliminates unwanted informational messages. During normal operations, informational messages are sometimes written to the Language Environment message file. If these messages are routed to your terminal, you need to clear them often. If the messages are saved to a data set, they take up disk space and could make it difficult to browse the output for a specific message.

Informational messages are not limited to Language Environment (CEE) messages. They can also be written, using the CEEMSG interface, by other IBM program products or user-written applications.

The default value for non-CICS applications is INFOMSGFILTER(OFF,„„,). The default value for CICS applications is INFOMSGFILTER(OFF,„„,). The default value for AMODE 64 applications is INFOMSGFILTER(OFF,„„,).

OFF
Turns off message filtering for all environments.

ON
Turns on the message filtering for the specified environments.

Foreground
Selecting this keyword causes message filtering to be turned on for the TSO and z/OS UNIX environments.

Background
Selecting this keyword causes message filtering to be turned on for the MVS Batch environment.

CICS
Selecting this keyword causes message filtering to be turned on in the CICS environment. This option is ignored for AMODE 64 applications.

INQPCOPN (FORTRAN only)

Derivation: INQuire the Pre-Connected units that are OPeNed

INQPCOPN controls if the OPENed specifier on an INQUIRE by unit statement can be used to determine if a preconnected unit has had any I/O statements directed to it.

The default for non-CICS applications is INQPCOPN.

INQPCOPN is ignored under CICS.
**INQPCOPN**

Causes the running of an INQUIRE by unit statement to provide the value TRUE in the variable or array element given in the OPENED specifier if the unit is connected to a file. This includes the case of a preconnected unit, which can be used in an I/O statement without running an OPEN statement, even if no I/O statements have been run for that unit.

INQPCOPN is the default.

**NOINQPCOPN**

Causes the running of an INQUIRE by unit statement to provide the value FALSE for the case of a preconnected unit for which no I/O statements other than INQUIRE have been run.

**INTERRUPT**

INTERRUPT causes attention interrupts to be recognized by Language Environment. When you cause an interrupt, Language Environment can give control to your application or to a debug tool.

The default value for non-CICS applications is INTERRUPT(OFF).

INTERRUPT is ignored on CICS.

### OFF

Specifies that Language Environment does not recognize attention interrupts.

OFF is the default.

### ON

Specifies that Language Environment recognizes attention interrupts.

**z/OS UNIX considerations**

- In a multithreaded application, only one thread in the enclave is affected for a particular attention interrupt.

**Usage notes**

- PL/I consideration: Language Environment supports the PL/I method of polling code. The PL/I routine must be compiled with the INTERRUPT compiler option in order for the INTERRUPT runtime option to have an effect.

- PL/I MTF consideration: To receive the attention interrupt, the PL/I program must be compiled with the INTERRUPT compiler option, and the INTERRUPT runtime option must be in effect.

- PL/I MTF consideration: The INTERRUPT option applies to the enclave. However, only one thread in the enclave is affected for a particular attention interrupt.

- If you have specified the TEST(ERROR) or TEST(ALL) runtime option, the interrupt causes the debug tool to gain control. See “TEST | NOTEST” on page 78 for more information about the TEST runtime option.

**IOHEAP64 (AMODE 64 only)**

IOHEAP64 controls the allocation of I/O heap storage for AMODE 64 applications and specifies how that storage is managed. Language Environment uses this storage when performing I/O for AMODE 64 applications.
The default value for AMODE 64 applications is IOHEAP64(1M,1M,FREE,12K,8K,FREE,4K,4K,FREE).

**init64**
Determines the initial allocation of I/O heap storage obtained above the 2G bar. Specify this value as \(n\)M bytes of storage. If a value of 0 or less is specified, the default is used.

**incr64**
Determines the minimum size of any subsequent increment to the I/O heap storage obtained above the 2G bar. Specify this value as \(n\)M bytes of storage. If a value less than 0 is specified, the default is used.

**KEEP**
Specifies that an increment to I/O heap storage is not released when the last of the storage within that increment is freed.

KEEP is the default.

**FREE**
Specifies that an increment to I/O heap storage is released when the last of the storage within that increment is freed.

**init31**
Determines the minimum initial size of I/O heap storage that is obtained above the 16M line and below the 2G bar. This value can be specified as \(n\), \(n\)K, or \(n\)M number of bytes. If 0 is specified, the initial storage is obtained on the first use and is based on the increment size. The amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

**incr31**
Determines the minimum size of any subsequent increment to I/O heap storage that is obtained above the 16M line and below the 2G bar. This value can be specified as \(n\), \(n\)K, or \(n\)M number of bytes. The amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

**init24**
Determines the minimum initial size of I/O heap storage that is obtained below the 16M line. This value can be specified as \(n\), \(n\)K, or \(n\)M number of bytes. If 0 is specified, the initial storage is obtained on the first use and is based on the increment size. The amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

**incr24**
Determines the minimum size of any subsequent increment to I/O heap storage that is obtained below the 16M line. This value can be specified as \(n\), \(n\)K, or \(n\)M number of bytes. The amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

**Performance consideration**
You can improve performance with the IOHEAP64 runtime option by specifying values that minimize the number of times the operating system allocates storage. See “RPTSTG” on page 63 for information about how to generate a report you can use to determine the optimum values for the IOHEAP64 runtime option.
LIBHEAP64 (AMODE 64 only)

The LIBHEAP64 runtime option controls the allocation of heap storage that is used by Language Environment for AMODE 64 applications. Storage that is unrestricted can be located anywhere in 64-bit addressable storage.

The default value for AMODE 64 applications is LIBHEAP64(1M,1M,FREE,16K,8K,FREE,8K,4K,FREE).

init64
Determines the initial allocation of library heap storage that is obtained above the 2G bar. Specify this value as nM bytes of storage. If a value of 0 or less is specified, the default is used.

incr64
Determines the minimum size of any subsequent increment to the library heap storage obtained above the 2G bar. Specify this value as nM bytes of storage. If a value less than 0 is specified, the default is used.

KEEP
Specifies that an increment to library heap storage is not released when the last of the storage within that increment is freed.

FREE
Specifies that an increment to library heap storage is released when the last of the storage within that increment is freed.

init31
Determines the minimum initial size of library heap storage that is obtained above the 16M line and below the 2G bar. This value can be specified as n, nK, or nM number of bytes. If 0 is specified, the initial storage is obtained on the first use and is based on the increment size. The amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

incr31
Determines the minimum size of any subsequent increment to library heap storage that is obtained above the 16M line and below the 2G bar. This value can be specified as n, nK, or nM number of bytes. The amount of allocated storage is rounded up to the nearest multiple of 8 bytes.
init24
Determines the minimum initial size of library heap storage that is obtained below the 16M line. This value can be specified as \( n \), \( n\text{K} \), or \( n\text{M} \) number of bytes. If 0 is specified, the initial storage is obtained on the first use and is based on the increment size. The amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

incr24
Determines the minimum size of any subsequent increment to library heap storage that is obtained below the 16M line. This value can be specified as \( n \), \( n\text{K} \), or \( n\text{M} \) number of bytes. The amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

Performance consideration
You can improve performance with the LIBHEAP64 runtime option by specifying values that minimize the number of times the operating system allocates storage. See “RPTSTG” on page 63 for information about how to generate a report you can use to determine the optimum values for the LIBHEAP64 runtime option.

For more information
- For more information about heap storage and heap storage tuning with storage report numbers, see z/OS Language Environment Programming Guide.

LIBSTACK

Derivation: LIBrary STACK storage
LIBSTACK controls the allocation of the thread's library stack storage. This stack is used by Language Environment routines that require save areas below the 16 M line.

The default value for non-CICS applications is LIBSTACK(4K,4K,FREE).

The default value for CICS applications is LIBSTACK(32,4080,FREE).

init_size
Determines the minimum size of the initial library stack storage. This value can be specified as \( n \), \( n\text{K} \), or \( n\text{M} \) bytes of storage. Language Environment allocates the storage rounded up to the nearest multiple of 8 bytes.

incr_size
Determines the minimum size of any subsequent increment to the library stack. This value can be specified as \( n \), \( n\text{K} \), or \( n\text{M} \) bytes of storage. The actual amount of allocated storage is the larger of 2 values—incr_size or the requested size—rounded up to the nearest multiple of 8 bytes. If you specify 0 as incr_size, Language Environment gets only the amount of storage that is needed at the time of the request, rounded up to the nearest multiple of 8 bytes.

FREE
Specifies that Language Environment releases storage allocated to LIBSTACK increments when the last of the storage in the library stack is freed. The initial library stack segment is not released until the thread ends.

FREE is the default.
KEEP
Specifies that Language Environment does not release storage allocated to LIBSTACK increments when the last of the storage is freed.

CICS considerations
The default increment size under CICS is 4080 bytes, rather than 4096 bytes, to accommodate the 16-byte CICS storage check zone. Without this accommodation, an extra page of storage is allocated.

z/OS UNIX considerations
The LIBSTACK option sets the library stack characteristics on each thread.

Usage notes
Language Environment does not acquire the initial library stack segment until the first program that requires LIBSTACK runs.

Performance considerations
You can improve performance with the LIBSTACK runtime option by specifying values that minimize the number of times the operating system allocates storage. See “RPTSTG” on page 63 for information about how to generate a report you can use to determine the optimum values for the LIBSTACK runtime option.

For more information
• See “RPTSTG” on page 63 for more information about the RPTSTG runtime option.
• For more information about using the storage reports generated by the RPTSTG runtime option to tune the stacks, see z/OS Language Environment Programming Guide.

MSGFILE

Derivation: MeSaGe FILE
MSGFILE specifies the ddbname and attributes of the data set (message file) where Language Environment directs the following output:
• All Language Environment messages
• Reports that are generated by the RPTOPTS and RPTSTG runtime options
• Output that is produced by the CEEMSG and CEEMOUT callable services
The default value for non-CICS applications is MSGFILE(SYSOUT,FBA,121,0,NOENQ). MSGFILE is ignored under CICS.

ddname
The ddbname of the message file where Language Environment directs the information that was previously listed.
**recfm**
The record format (RECFM) for the message file. *recfm* is used when this information is not available either in a data set definition or in the label of an existing data set. The following record formats are acceptable: F, FA, FB, FBA, FBS, FBSA, U, UA, V, VA, VB, and VBA.

**lrecl**
The record length (LRECL) for the message file. *lrecl* is used when this information is not available either in a data set definition or in the label of an existing data set. *lrecl* is expressed as bytes of storage. The *lrecl* cannot exceed *blksize*. For variable-length record formats, the *lrecl* is limited to *blksize* minus 4.

**blksize**
The block size (BLKSIZE) for the message file. *blksize* is used when this information is not available either in a data set definition or in the label of an existing data set. *blksize* is expressed as bytes of storage and cannot exceed 32760.

**NOENQ**
Specifies that no serialization is performed on *ddname*.

NOENQ is the default.

**ENQ**
Specifies that serialization is performed on the *ddname* specified in case multiple Language Environment environments are running in the same address space and sharing the message file.

**CICS consideration**
- MSGFILE output under CICS is directed to a transient data queue named CESE.

**z/OS UNIX considerations**
- When multiple threads write to the message file, the output is interwoven by line. To group lines of output, the application must serialize its own output.
- If the message file is allocated (whether POSIX or z/OS), Language Environment directs the output to this file. If the current message file is not allocated, and the application calls fork()/exec(), spawn(), or spawnp(), Language Environment checks if file descriptor 2 (fd2) exists.
  - If fd2 exists, Language Environment uses it.
  - If fd2 does not exist, Language Environment dynamically allocates the message file to the POSIX file system and attempts to open the file SYSOUT in the current working directory. If there is no current directory, SYSOUT is opened in the directory /tmp.

**Usage notes**
1. Under most circumstances, the NOENQ suboption is sufficient and provides better performance. The ENQ suboption is only needed when multiple Language Environment environments are running in the same address space and share the message file.

An instance when ENQ might be needed is a batch job that uses ATTACH to create subtasks. Each of the subtasks is potentially a distinct Language Environment environment, all running with the same default MSGFILE parameters. In this example, each of these environments shares message file.

To avoid conflicts while writing to the shared message file, use the ENQ suboption. Using a different *ddname* for each environment can remove the need to use the ENQ suboption.

There are cases where concurrent initialization of multiple Language Environment environments can cause dynamic allocation or unallocation problems, resulting in unexpected program behaviors like abnormal termination or *ddname* remaining allocated after program termination. To resolve this situation, you can choose to preallocate the *ddname* before starting up any of the environments, or you can choose to use a different *ddname* for each environment.
2. Compiler options, such as the COBOL OUTDD compiler option, can affect if your runtime output goes to MSGFILE ddname.

3. If there is no blksize in the MSGFILE runtime option, in a data set definition, or in the label of an existing data set, the block size is determined as follows:
   • If recfm specifies unblocked fixed-length format records (F or FA) or undefined-format records (U or UA), blksize is the same as lrecl.
   • If recfm specifies unblocked variable-length format records (V or VA), blksize is lrecl plus 4.
   • If recfm specifies blocked records (FB, FBA, FBS, FBSA, VB, or VBA) for a DASD device on z/OS, Language Environment uses a blksize of 0 so the system can determine the optimum blksize.
   • If recfm specifies blocked fixed-length format records (FB, FBA, FBS, or FBSA) for a terminal, blksize is the same as lrecl.
   • If recfm specifies blocked variable-length format records (VB or VBA) for a terminal, blksize is lrecl plus 4.
   • For all other cases, blksize is calculated to provide the largest number of records per block, up to 100 records per block, that does not exceed the maximum block size of 32760.

4. Language Environment does not diagnose combinations of recfm, lrecl, and blksize that are not valid but the system can detect an error condition on the first attempt to write to the message file.

5. Language Environment does not check the validity of the MSGFILE ddname. A ddname that is not valid generates an error condition on the first attempt to write to the message file.

6. C/C++ consideration—C output directed to stderr and perror() messages go to the MSGFILE destination.

7. PL/I consideration—Runtime messages in PL/I programs are directed to the message file instead of to the PL/I SYSPRINT STREAM PRINT file.
   User-specified output is directed to the PL/I SYSPRINT STREAM PRINT file. To direct this output to the message file, specify MSGFILE(SYSPRINT).
   Use of MSGFILE(SYSPRINT) restricts the LINESIZE for PL/I programs to a maximum of 255.

8. Fortran consideration—to get the same message file function as with VS Fortran, specify MSGFILE(FTnnF001,UA,133) where nn is the unit number of the error unit. For more information, see Language Environment for MVS & VM Fortran Run-Time Migration Guide.

9. Language Environment supports the use of a MSGFILE DDNAME dynamically allocated with the XTIOT, UCB nocapture, or DSAB-above-the-line options specified in the SVC99 parameters (S99TIOEX, S99ACUCB, S99DSABA flags).

For more information:
• For more information about the RPTOPTS and RPTSTG runtime options, see “RPTOPTS” on page 62 and “RPTSTG” on page 63.
• For more information about the CEEMSG and CEEMOUT callable services, see “CEEMSG—Get, format, and dispatch a message” on page 328 and “CEEMOUT—Dispatch a message” on page 312.
• For details on how HLL compiler options affect messages, see information about HLL I/O statements and message handling in z/OS Language Environment Programming Guide.
• For examples of getting and formatting messages, including HLL runtime output, see “CEEMSG—Get, format, and dispatch a message” on page 328.
• For more information about perror() and stderr see the C message output information in z/OS Language Environment Programming Guide.
• For more information about the CESE transient data queue, see z/OS Language Environment Programming Guide.
**MSGQ**

**Derivation:** Message Queue

MSGQ specifies the number of instance specific information (ISI) blocks that Language Environment allocates on a per thread basis for use by the application. The ISI block contains information for Language Environment to use when identifying and reacting to conditions, providing access to q_data tokens, and assigning space for message inserts used with user-created messages. When an insufficient number of ISI blocks are available, Language Environment uses the least recently used ISI block.

The default value for non-CICS applications is MSGQ(15).

MSGQ is ignored under CICS.

```
MSGQ (number)
```

*number*

An integer that specifies the number of ISI blocks to maintain on a per thread basis.

**Usage notes**

- PL/I MTF consideration—In a PL/I MTF application, MSGQ sets the number of message queues allowed for each task.
- The CEECMIB callable service allocates storage for ISI blocks if necessary. For information about using the CEECMIB callable service, see “CEECMI—Store and load message insert data” on page 193.

**For more information**

- For more information about the ISI blocks, see z/OS Language Environment Programming Guide.

---

**NATLANG**

**Derivation:** National Language

NATLANG specifies the initial national language that Language Environment uses for the runtime environment, including error messages, month names, and day of the week names. Message translations are provided for Japanese and for uppercase and mixed-case US English. NATLANG also determines how the message facility formats messages.

The default value for non-CICS applications is NATLANG(ENU).

The default value for CICS applications is NATLANG(ENU).

The default value for AMODE 64 applications is applications is NATLANG(ENU).

```
NATLANG (ENU UEN JPN)
```

*ENU*

A 3-character ID that specifies mixed-case U.S. English. Message text consists of SBCS characters and includes both uppercase and lowercase letters.
**UEN**
A 3-character ID specifying uppercase U.S. English. Message text consists of SBCS characters and includes only uppercase letters.

**JPN**
A 3-character ID specifying Japanese. Message text can contain a mixture of SBCS and DBCS characters.

**Usage notes**
- CEE3LNG and CEESETL are not available to AMODE 64 applications.
- You can use the CEE3LNG callable service to set the national language.
- If you specify a national language that is not available on your system, Language Environment uses the IBM-supplied default ENU (mixed-case US English).
- Language Environment is sensitive to the national language when it writes storage reports, option reports, and dump output.
  
  When the national language is uppercase US English or Japanese, the environment variable _CEE_UPPERCASE_DATA can be used to determine if variable data in storage reports, options reports and dump output is in uppercase.
  
  When this environment variable is set to YES, variable data (entry point names, program unit names, variable names, Trace Entry in EBCDIC data, hexadecimal/EBCDIC displays of storage) will be in uppercase.
  
  When this environment variable is not set or set to a value other than YES, variable data will not be in uppercase. Variable data is never in uppercase when the national language is mixed-case US English.
- Language Environment provides locales used in C/C++ to establish default formats for the locale-sensitive functions and locale callable services, such as date and time formatting, sorting, and currency symbols. To change the locale, you can use the setlocale() library function or the CEESETL callable service.
  
  The settings of CEESETL or setlocale() do not affect the setting of the NATLANG runtime option. NATLANG affects the Language Environment NLS and date and time services. setlocale() and CEESETL affect only C/C++ locale-sensitive functions and Language Environment locale callable services.
  
  To ensure that all settings are correct for your country, use NATLANG and either CEESETL or setlocale().
- PL/I MTF consideration—NATLANG affects every task in the application. The SET function of CEE3LNG is supported for the relinked OS PL/I or PL/I for MVS & VM MTF applications only.

**For more information**
- For more information about the CEE3LNG callable service, see “CEE3LNG—Set national language” on page 155.
- For more information about the CEESETL callable service, see “CEESETL—Set locale operating environment” on page 362.
- For more information about setlocale(), see z/OS XL C/C++ Programming Guide.

**OCSTATUS (Fortran only)**

**Derivation:** Open Close STATUS

OCSTATUS controls the verification of file existence and if a file is actually deleted based on the STATUS specifier on the OPEN and CLOSE statement, respectively.

The default value for non-CICS applications is OCSTATUS.
OCSTATUS is ignored under CICS.

**OCSTATUS**

Specifies that file existence is checked with each OPEN statement to verify that the status of the file is consistent with STATUS='OLD' and STATUS='NEW'. It also specifies that file deletion occurs with each CLOSE statement with STATUS='DELETE' for those devices that support file deletion. Preconnected files are included in these verifications. OCSTATUS consistency checking applies to DASD files, PDS members, VSAM files, MVS labeled tape files, and dummy files only. For dummy files, the consistency checking occurs only if the file was previously opened successfully in the current program.

In addition, when a preconnected file is disconnected by a CLOSE statement, an OPEN statement is required to reconnect the file under OCSTATUS. Following the CLOSE statement, the INQUIRE statement parameter OPENED indicates that the unit is disconnected.

OCSTATUS is the default.

**NOOCSTATUS**

Bypasses file existence checking with each OPEN statement and bypasses file deletion with each CLOSE statement.

If STATUS='NEW', a new file is created; if STATUS='OLD', the existing file is connected. If STATUS='UNKNOWN' or 'SCRATCH', and the file exists, it is connected; if the file does not exist, a new file is created.

In addition, when a preconnected file is disconnected by a CLOSE statement, an OPEN statement is not required to reestablish the connection under NOOCSTATUS. A sequential READ, WRITE, BACKSPACE, REWIND, or ENDFILE will reconnect the file to a unit. Before the file is reconnected, the INQUIRE statement parameter OPENED will indicate that the unit is disconnected; after the connection is reestablished, the INQUIRE statement parameter OPENED will indicate that the unit is connected.

**PAGEFRAMESIZE**

**Derivation:** PAGE FRAME SIZE

PAGEFRAMESIZE specifies the preferred page frame size in virtual storage for HEAP, ANYHEAP, and STACK storage that is obtained during application initialization and runtime.

The default value for non-CICS applications is PAGEFRAMESIZE(4K,4K,4K).

PAGEFRAMESIZE is ignored under CICS.

**heap_frame_size**

Specifies the preferred page frame size in virtual storage for initial heap storage allocation and any subsequent heap increments. The page frame size can be specified as one of the following values:
PAGEFRAMESIZE

4K
Requests the default value of 4-KB pages.
4K is the default.

1M
Requests that 1-MB large pages be used, if available.

*anyheap_frame_size*
Specifies the preferred page frame size in virtual storage for initial anywhere heap storage allocation and any subsequent anywhere heap increments. The page frame size can be specified as one of the following values:

4K
Requests the default value of 4-KB pages.
4K is the default.

1M
Requests that 1-MB large pages be used, if available.

*stack_frame_size*
Specifies the preferred page frame size in virtual storage for initial stack storage allocation and any subsequent stack increments. The page frame size can be specified as one of the following values:

4K
Requests the default value of 4-KB pages.
4K is the default.

1M
Requests that 1-MB large pages be used, if available.

Usage notes

- You cannot set PAGEFRAMESIZE at the system level or region level.
- You cannot specify PAGEFRAMESIZE with the CEEBXITA assembler user exit interface.
- In an XPLINK environment, the *stack_frame_size* suboption only applies to the upward-growing stack.
- If 1-MB page frames are not available, the default 4-KB page frame size will be used. No message is issued to indicate this behavior.
- Page frame sizes larger than 4 KB are not allowed below the 16-MB line. If a PAGEFRAMESIZE parameter specifies 1 MB but that storage type is allocated below the 16-MB line, then the default 4-KB page frames is used. No message is issued to indicate this behavior; however, the runtime options report will show the value that was specified.
- If any PAGEFRAMESIZE parameter specifies 1M, then all of the storage preallocated to the enclave will request 1-MB page frames. The previous two usage notes apply as well.
- By default, THREADSTACK storage comes from the library heap storage that is allocated with the ANYHEAP runtime option. To use 1-MB page frames for the THREADSTACK, ensure the *anyheap_frame_size* suboption specifies 1M.
- When running in a preinitialized environment with an @GETSTORE service routine, a flag is passed to indicate that storage was requested to be backed by 1-MB page frames. For more information about using 1-MB page frames with an @GETSTORE service routine, see z/OS Language Environment Programming Guide.

Performance considerations

Large pages are a special-purpose feature to improve performance; therefore, using large pages is not recommended for all types of workloads. For more information about large pages, see the following publications:

- z/OS MVS Programming: Assembler Services Reference IAR-XCT
PAGEFRAMESIZE64

**Derivation:** PAGE FRAME SIZE for AMODE64

PAGEFRAMESIZE64 specifies the preferred page frame size in virtual storage for HEAP64, LIBHEAP64, IOHEAP64, and STACK64 storage that is obtained during application initialization and runtime.

The default value for AMODE 64 applications is PAGEFRAMESIZE64=(4K,4K,4K,4K,4K,4K,4K)

---

**heap64_frame_size64**
Specifies the preferred page frame size in virtual storage for initial heap storage allocation and any subsequent heap increments above the 2 GB bar. The page frame size can be specified as one of the following values:

- **4K**
  Requests the default 4 KB pages.

- **1M**
  Requests that 1 MB large pages be used, if available.

**heap64_frame_size31**
Specifies the preferred page frame size in virtual storage for initial heap storage allocation and any subsequent heap increments above the 16 MB line and below the 2 GB bar. The page frame size can be specified as one of the following values:

- **4K**
  Requests the default 4 KB pages.

- **4K** is the default.

- **1M**
  Requests that 1 MB large pages be used, if available.

**libheap64_frame_size64**
Specifies the preferred page frame size in virtual storage for initial library heap storage allocation and any subsequent library heap increments above the 2 GB bar. The page frame size can be specified as one of the following values:

- **4K**
  Requests the default 4 KB pages.
4K is the default.

1M
Requests that 1 MB large pages be used, if available.

**libheap64_frame_size31**
Specifies the preferred page frame size in virtual storage for initial library heap storage allocation and any subsequent library heap increments above the 16 MB line and below the 2 GB bar. The page frame size can be specified as one of the following values:

4K
Requests the default 4 KB pages.
4K is the default.

1M
Requests that 1 MB large pages be used, if available.

**ioheap64_frame_size64**
Specifies the preferred page frame size in virtual storage for initial I/O heap storage allocation and any subsequent I/O heap increments above the 2 GB bar. The page frame size can be specified as one of the following values:

4K
Requests the default of 4 KB pages.
4K is the default.

1M
Requests that 1 MB large pages be used, if available.

**ioheap64_frame_size31**
Specifies the preferred page frame size in virtual storage for initial I/O heap storage allocation and any subsequent I/O heap increments above the 16 MB line and below the 2 GB bar. The page frame size can be specified as one of the following values:

4K
Requests the default 4 KB pages.
4K is the default.

1M
Requests that 1 MB large pages be used, if available.

**stack64_frame_size**
Specifies the preferred page frame size in virtual storage for initial stack storage allocation above the 2 GB bar. The page frame size can be specified as one of the following values:

4K
Requests the default KB pages.
4K is the default.

1M
Requests that 1 MB large pages be used, if available.

**Usage notes**
- You cannot set PAGEFRAMESIZE64 at the system level or region level.
- You cannot specify PAGEFRAMESIZE64 with the CEEBXITA assembler user exit interface.
- If 1 MB page frames are not available, the default 4 KB page frame size is used. No message is issued to indicate this behavior.
- Page frame sizes larger than 4 KB are not allowed below the 16 MB line. If a PAGEFRAMESIZE parameter specifies 1 MB but that storage type is allocated below the 16 MB line, then the default 4 KB page frames is used. No message is issued to indicate this behavior, and the runtime options report shows the value that was specified.
• If the `heap64_frame_size64` or `hlibheap64_frame_size64` option is specified as 1M, then the initial storage allocation for both requests 1 MB page frames. The previous two usage notes apply as well.
• For THREADSTACK64 storage, the default 4 KB page frame size is used.
• When running in a preinitialized AMODE 64 (CELOPIPI) environment with an `@GETSTORE` service routine, a flag is passed to indicate that storage was requested to be backed by 1 MB page frames. For more information about using 1 MB page frames with an `@GETSTORE` service routine, see `z/OS Language Environment Programming Guide for 64-bit Virtual Addressing Mode`.

**Performance considerations**

Large pages are a special-purpose feature to improve performance; therefore, using large pages is not recommended for all types of workloads. For more information about large pages, see the following publications:

- `z/OS MVS Programming: Assembler Services Reference IAR-XCT`
- `z/OS MVS Programming: Authorized Assembler Services Guide`
- `z/OS MVS Programming: Assembler Services Guide`

**PC (Fortran only)**

**Derivation:** Private Common blocks

PC controls if Fortran status common blocks are shared among load modules.

The default value for non-CICS applications is NOPC.

PC is ignored under CICS.

**NOPC**

Specifies that Fortran static common blocks with the same name but in different load modules all refer to the same storage. NOPC applies only to static common blocks referenced by compiled code produced by any of the following compilers and that were not compiled with the PC compiler option:

- VS FORTRAN Version 2 Release 5
- VS FORTRAN Version 2 Release 6

NOPC is the default.

**PC**

Specifies that Fortran static common blocks with the same name but in different load modules do not refer to the same storage.

**PLIST**

**Derivation:** Parameter LIST

PLIST specifies the format of the invocation parameters your C application receives when you invoke it. Although the CICS, CMS, IMS, MVS, and TSO suboptions of PLIST are supported for compatibility, you should use the HOST or OS suboptions of PLIST. Before using this runtime option, you should review the following restrictions:

- This option does not apply to non-C languages and can be specified only with the C `#pragma runopts` directive.
• You cannot set this option at the system level, region level, or in the CEEBXITA assembler user exit interface.

The default value for non-CICS applications is PLIST(HOST).

PLIST is ignored in CICS.

**HOST**
The parameter list is a character string. The string is located differently under various systems, as follows:

**CMS**
If invoked by OSRUN, use the string presented in an MVS-like format located by the pointer held in R1. If not invoked by OSRUN, use the CMS extended parameter list.

**TSO**
If a command processor parameter list (CPPL) is detected, get the string from the command buffer. If a CPPL is not detected, assume a halfword-prefixed string in the MVS format.

**MVS**
Use the halfword-prefixed string.

HOST is the default.

**CICS**
The parameter list received by your C application is assumed to be in a CICS format.

**CMS**
The parameter list received by your C application is assumed to be in a CMS extended parameter list format.

**IMS**
The parameter list received by your C application is assumed to be in an IMS format.

**MVS**
The parameter list received by your C application is assumed to be in an MVS format.

**OS**
The parameter list received by your C application is assumed to be in an OS style.

**TSO**
The parameter list received by your C application is assumed to be in a CPPL format.

**Usage notes**
• The behavior of C applications with PLIST(HOST) in effect is the same for C++.
• When using the pre-Language Environment-conforming C interface for preinitialization, it is necessary to specify PLIST(MVS) in order to flag preinitialized routines.
• IMS considerations—If your C application runs under IMS, the suboption of PLIST that you specify depends on the version of the C compiler you used. Note that PLIST(IMS) is obsolete and should only be used with ADCycle C compiler Version 2.1 or earlier. For z/OS XL C/C++ compilers, you should specify the compiler options PLIST(OS) and TARGET(IMS) instead of runtime option PLIST(IMS).
• z/OS UNIX consideration—The PLIST option applies only to the main routine of the initial thread.

**PLITASKCOUNT (PL/I only)**

**Derivation:** `PL/I TASK COUNTer`

PLITASKCOUNT controls the maximum number of tasks that can be active at one time while you are running PL/I MTF applications. PLITASKCOUNT(20) provides behavior compatible with the PL/I ISASIZE(,,20) option.

The default value for non-CICS applications is PLITASKCOUNT(20).

PLITASKCOUNT is ignored in CICS.

```
PLITaskcount (tasks)
```

**tasks**

A decimal integer that is the maximum number of tasks allowed in a PL/I MTF application at any one time during execution. The total tasks include the main task and subtasks created directly or indirectly from the main task.

**Usage notes**

• A value of zero (0) assumes the IBM-supplied default of 20.
• If tasks or the IBM-supplied default of 20 exceeds the z/OS UNIX installation default of the maximum number of threads, Language Environment assumes the z/OS UNIX installation default.
• If a request to create a task would put the number of currently active tasks over the allowable limit, condition IBM0566S is signaled and the task is not created.

**POSIX**

**Derivation:** Portable Operating System Interface - X

POSIX specifies if the enclave can run with the POSIX semantics. POSIX is an application characteristic that is maintained at the enclave level. After you have established the characteristic during enclave initialization, you cannot change it.

The default value for non-CICS applications is POSIX(OFF).

POSIX is ignored in CICS.

The default value for AMODE 64 is POSIX(OFF).

```
POSix (OFF ON)
```

**OFF**

Indicates that the application is not POSIX-enabled.
OFF is the default.

**ON**
Indicates that the application is POSIX-enabled.

**Usage notes**
- When you set POSIX to ON, you can use functions that are unique to POSIX, such as `pthread_create()`.
- POSIX(ON) applies to z/OS but explicitly excludes CICS. If you set POSIX to ON while an application is running under CICS, you receive a warning message, POSIX is set OFF, and the application continues to run. You can specify POSIX(ON) for both Db2® and IMS applications.
- When you set POSIX to ON while an application is running under CICS, you receive a warning message, POSIX is set OFF, and the application continues to run.
- One of the effects of POSIX(ON) is the enablement of POSIX signal handling semantics, which interact closely with the Language Environment condition handling semantics.
- ANSI C programs can access the z/OS UNIX file system independent of the POSIX setting. Where ambiguities exist between ANSI and POSIX semantics, the POSIX runtime option setting indicates the POSIX semantics to follow.
- Within nested enclaves, only one enclave can have the POSIX option set to ON. All other nested enclaves must have the POSIX option set to OFF. When a second nested enclave tries to specify the runtime option POSIX(ON) within one Language Environment process, Language Environment ends with abend U4093, reason code 172.

**For more information**
For more information about POSIX functions that have a kernel dependency or a POSIX ON dependency, see *z/OS XL C/C++ Runtime Library Reference.*

**PROFILE**

PROFILE controls the use of an optional PROFILER to collect performance data for the running application.

An application cannot run with both the TEST and PROFILE options in effect. If both are specified, an informational message is generated and Language Environment forces the PROFILE option OFF.

The default value for non-CICS applications is PROFILE(OFF,"").

The default value for CICS applications is PROFILE(OFF,"").

The default value for AMODE 64 applications is PROFILE(OFF,"").

**OFF**
Indicates that the profile facility is inactive.

**ON**
Indicates that the profile facility is active.
**string**
Profile options that Language Environment passes to the profiler installed. You can enclose the string in either single or double quotation marks. The maximum length of the string is 250 bytes when specified on program invocation or from a compiler directive.

**For more information**
For details on the Performance Analyzer, see *Getting Started with C/C++ Productivity Tools for OS/390*, GC09-2918-00.

---

**PRTUNIT (Fortran only)**

**Derivation:** PRinT UNIT

PRTUNIT identifies the unit number used for PRINT and WRITE statements that do not specify a unit number.

The default value for non-CICS applications is PRTUNIT(6).

PRTUNIT is ignored on CICS.

**number**
A valid unit number in the range 0-99.

---

**PUNUNIT (Fortran only)**

**Derivation:** PUNch UNIT

PUNUNIT identifies the unit number used for PUNCH statements that do not specify a unit number.

The default value for non-CICS applications is PUNUNIT(7).

PUNUNIT is ignored on CICS.

**number**
A valid unit number in the range 0-99.

---

**RDRUNIT (Fortran only)**

**Derivation:** ReaDeR UNIT

RDRUNIT identifies the unit number used for READ statements that do not specify a unit number.

The default value for non-CICS applications is RDRUNIT(5).

RDRUNIT is ignored on CICS.
**number**
A valid unit number in the range 0-99.

---

**RECPAD (Fortran only)**

**Derivation:** RE Cord PAD ding

RECPAD specifies if a formatted input record is padded with blanks.
The default value for non-CICS applications is NORECpad.
RECPAD is ignored on CICS.

![Diagram](image)

**Usage notes**
- The PAD specifier of the OPEN statement can be used to indicate padding for individual files.

---

**REDIR | NOREDIR**

**Derivation:** REDIR ection

REDIR specifies if you can redirect stdin, stdout, and stderr.

**Restriction:** This option can only be specified with the `#pragma runopts` directive or the REDIR and NOREDIR compiler options.
The default value for non-CICS applications is REDIR.
REDIR is ignored in CICS.
The default value for AMODE 64 applications is REDIR.

![Diagram](image)

**REDIR**
Specifies that you can redirect stdin, stdout, and stderr from the command line. REDIR applies only if ARGPARSE is also specified or defaulted.
REDIR is the default.

**NOREDIR**
Specifies that you cannot redirect stdin, stdout, and stderr from the command line.

**For more information**
See “ARGPARSE | NOARGPARSE ” on page 14 for a description of ARGPARSE.

---

**RPTOPTS**

**Derivation:** Re PorT OPT ionS

RPTOPTS generates, after an application has run, a report of the runtime options in effect while the application was running. RPTOPTS(ON) lists the declared runtime options in alphabetical order. The
report lists the option names and shows where each option obtained its current setting. Language Environment writes options reports only in mixed-case U.S. English.

For an example and complete description of the options report, see z/OS Language Environment Debugging Guide.

The default value for non-CICS applications is RPTOPTS(OFF).

The default value for CICS applications is RPTOPTS(OFF).

The default value for AMODE 64 applications is RPTOPTS(OFF).

**Default Value**

**Non-CICS**

RPTOPTS(OFF)

**AMODE 64**

RPTOPTS(OFF)

**OFF**

Does not generate a report of the runtime options in effect while the application was running.

OFF is the default.

**ON**

Generates a report of the runtime options in effect while the application was running.

**Usage notes**

- For AMODE 64 applications, Language Environment writes the options report to stderr.
- In some cases, RPTOPTS will not generate the options report if your application ends abnormally.
- In a non-CICS environment, Language Environment directs the report to the *ddname* specified in the MSGFILE runtime option. Under CICS, with RPTOPTS(ON), Language Environment writes the options report to the CESE queue when the transaction ends successfully.
- If the RPTSTG runtime option is specified while using HEAPPOOLS, extra storage is obtained from the ANYHEAP and is used to complete the storage report on heap pools. This extra storage is only allocated when both HEAPPOOLS and RPTSTG are used.

**Performance consideration**

This option increases the time it takes for the application to run. Therefore, use it only as an aid to application development.

**For more information**

- See “MSGFILE” on page 48 for more information about the MSGFILE runtime option.
- For an example and complete description of the options report, see z/OS Language Environment Debugging Guide.

**RPTSTG**

**Derivation:** Report Storage
RPTSTG generates, after an application has run, a report of the storage the application used. Language Environment writes storage reports only in mixed-case US English.

You can use the storage report information to help you set the ANYHEAP, BELOWHEAP, HEAP, HEAP64, HEAPPOLLS, HEAPPOLLS64, IOHEAP64, LIBHEAP64, LIBSTACK, STACK, STACK64, THREADHEAP, THREADSTACK, and THREADSTACK64 runtime options for the best storage tuning. For an example and complete description of the storage report, see z/OS Language Environment Debugging Guide.

The default value for non-CICS applications is RPTSTG(OFF).

The default value for CICS applications is RPTSTG(OFF).

The default value for AMODE 64 applications is RPTSTG(OFF).

OFF

Does not generate a report of the storage used while the application was running.

OFF is the default.

ON

Generates a report of the storage used while the application was running.

CICS consideration

• The phrases "Number of segments allocated" and "Number of segments freed" represent, on CICS, the number of EXEC CICS GETMAIN and EXEC CICS FREEMAIN requests, respectively.

z/OS UNIX considerations

• The RPTSTG option applies to storage utilization for the enclave, including thread-level information about stack utilization, and heap storage used by multiple threads.

Usage notes

• For AMODE 64 applications, Language Environment writes the storage report to stderr.

• When a vendor heap manager (VHM) is active, the Language Environment Storage Report will have a text line indicating that the user heap for C/C++ part of the enclave is managed separately. The VHM is expected to write its own storage report to the stderr stream.

• In some cases, RPTSTG will not generate the storage report if your application ends abnormally.

• RPTSTG includes PL/I task-level information about stack and heap usage.

• The phrases "Number of segments allocated" and "Number of segments freed" represent the number of GETMAIN and FREEMAIN requests, respectively.

Performance consideration

• This option increases the time it takes for an application to run. Therefore, use it only as an aid to application development.

• The storage report generated by RPTSTG(ON) shows the number of system-level calls to obtain storage that were required while the application was running. To improve performance, use the storage report numbers generated by the RPTSTG option as an aid in setting the initial and increment size for stack and heap. This reduces the number of times that the Language Environment storage manager makes requests to acquire storage. For example, you can use the storage report numbers to set appropriate values in the HEAP init_size and incr_size fields for allocating storage.
For more information

- For more information about tuning your application with storage numbers, see z/OS Language Environment Programming Guide.
- For more information about the MSGFILE runtime option, see “MSGFILE” on page 48.
- For an example and complete description of the storage report, see z/OS Language Environment Debugging Guide.

RTEREUS (COBOL only)

Derivation: Run Time Environment REUSE

RTEREUS implicitly initializes the runtime environment to be reusable when the main program for the thread is a COBOL program. This option is valid only when specified at the system level, region level, in a CEEUOPT, or in the CEEBXITA assembler user exit.

The default value for non-CICS applications is NORTEREUS.

RTEREUS is ignored on CICS.

NORTEREUS

- Does not initialize the runtime environment to be reusable when the first COBOL program is invoked.
- NORTEREUS is the default.

RTEREUS

- Initializes the runtime environment to be reusable when the first COBOL program is invoked.

Usage notes

- Enterprise COBOL programs compiled with the THREAD compiler option do not run with RTEREUS(ON).
- Avoid using RTEREUS(ON) as a system-level or region-level default. If you do use RTEREUS, use it for specific applications only.
- Under Language Environment, RTEREUS(ON) is only supported in a single enclave environment unless you modify the behavior using the IGZERREO CSECT. With the IBM supplied default setting for COBOL's reusable environment, applications that create multiple enclaves will terminate with error message IGZ0168S. Multiple enclaves can be created by applications that use SVC LINK or CMSCALL to invoke application programs. One example is when an SVC LINK is used to invoke an application program under ISPF that is using ISPF services (such as CALL 'ISPLINK' and ISPF SELECT).
- If a Language Environment reusable environment is established (using RTEREUS), any attempts to run a C or PL/I main program under Language Environment will fail. For example, when running on ISPF with RTEREUS(ON):
  - The first program invoked by ISPF is a COBOL program. A Language Environment reusable environment is established.
  - At some other point, ISPF invokes a PL/I or C program. The initialization of the PL/I or C program fails.
- If a large number of COBOL programs run (using RTEREUS) under the same MVS task, you can encounter out-of-region abends. This is because all storage acquired by Language Environment to run COBOL programs is kept in storage until the MVS task ends or the Language Environment environment is terminated.
• Language Environment storage and runtime options reports are not produced by Language Environment (using RTEREUS) unless a STOP RUN is issued to end the enclave.
• IMS consideration—RTEREUS is not recommended for use under IMS.
• The IGZERREO CSECT affects the handling of program checks in the non-Language Environment-enabled driver that repeatedly invokes COBOL programs. It also affects the behavior of running COBOL programs in a nested enclave when a reusable environment is active.

Performance consideration

• You must change STOP RUN statements to GOBACK statements to gain the benefits of RTEREUS. STOP RUN terminates the reusable environment. If you specify RTEREUS and use STOP RUN, Language Environment recreates the reusable environment on the next invocation of COBOL. Doing this repeatedly degrades performance, because a reusable environment takes longer to create than does a normal environment.
• The IGZERREO CSECT affects the performance of running with RTEREUS.
• Language Environment also offers preinitialization support in addition to RTEREUS.

For more information

• For information about specifying this option at the system or region level, z/OS Language Environment Customization.
• For information about specifying this option in a CEEUOPT, see z/OS Language Environment Programming Guide.
• For more information about IGZERREO, see z/OS Language Environment Customization.
• See z/OS Language Environment Programming Guide for more information about preinitialization.

SIMVRD (COBOL only)

Derivation: SIMulate Variable length Relative organization Data sets

SIMVRD specifies if your COBOL programs use a VSAM KSDS to simulate variable-length relative organization data sets.

The default value for non-CICS applications is NOSIMVRD.

SIMVRD is ignored on CICS.

NOSIMVRD

Do not use a VSAM KSDS to simulate variable-length relative organization.

NOSIMVRD is the default.

SIMVRD

Use a VSAM KSDS to simulate variable-length relative organization.

For more information

See the appropriate version of the COBOL programming guide in the COBOL library at Enterprise COBOL for z/OS library (www.ibm.com/support/docview.wss?uid=swg27036733).
STACK controls the allocation of the thread's stack storage for both the upward and downward-growing stacks. Typical items residing in the upward-growing stack are C or PL/I automatic variables, COBOL LOCAL-STORAGE data items, and work areas for runtime library routines. The downward-growing stack is allocated only in an XPLINK environment.

The default value for non-CICS applications is STACK(128K,128K,ANYWHERE,KEEP,512K,128K).

The default value for CICS applications is STACK(4K,4080,ANYWHERE,KEEP,4K,4080).

\( \text{STACK} \) \( (\text{usinit}\_\text{size}, \text{usincr}\_\text{size}, \text{ANYWHERE}, \text{KEEP}, \text{dsinit}\_\text{size}, \text{dsincr}\_\text{size}) \)

**usinit\_size**

Determines the initial allocation of the upward-growing stack storage. This value can be specified as \( n, nK, \) or \( nM \) bytes of storage. The actual amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

\( \text{usinit}\_\text{size} \) can be preceded by a minus sign. In environments other than CICS, if you specify a negative number Language Environment uses all available storage minus the amount specified for the initial stack storage.

A size of "0" or "-0" requests half of the largest block of contiguous storage in the region below the 16-MB line.

**usincr\_size**

Determines the minimum size of any subsequent increment to the upward-growing stack storage. This value can be specified as \( n, nK, \) or \( nM \) bytes of storage. The actual amount of allocated storage is the larger of two values— \( \text{usincr}\_\text{size} \) or the requested size—rounded up to the nearest multiple of 8 bytes.

If you specify \( \text{usincr}\_\text{size} \) as 0, only the amount of the storage needed at the time of the request, rounded up to the nearest multiple of 8 bytes, is obtained.

The requested size is the amount of storage a routine needs for a stack frame.

In the following example:

- \( \text{usinc}\_\text{rsize} \) is specified as 8K
- The requested size is 9000 bytes
- The currently allocated stack storage has less than 9000 bytes available

As a result, Language Environment allocates enough storage to hold the 9000 byte request.

If the requested size is smaller than 8K, Language Environment allocates 8K of stack storage.

**ANYWHERE|ANY**

Specifies that stack storage can be allocated anywhere in storage. If there is no available storage above the line, storage is acquired below the 16 MB line.

ANYWHEREHERE is the default.
**BELOW**
Specifies that stack storage is allocated below the 16M line in storage.

**KEEP**
Specifies that an increment to stack storage is not released when the last of the storage within that increment is freed.

KEEP is the default.

**FREE**
Specifies that an increment to stack storage is released when the last of the storage within that increment is freed.

**dsinit_size**
Determines the initial allocation of the downward-growing stack storage. This value can be specified as \( n \), \( nK \), or \( nM \) bytes of storage. The actual amount of allocated storage is rounded up to the nearest multiple of 16 bytes.

**dsincr_size**
Determines the minimum size of any subsequent increment to the downward-growing stack storage. This value can be specified as \( n \), \( nK \), or \( nM \) bytes of storage. The actual amount of allocated storage is the larger of two values—dsincr_size or the requested size—rounded up to the nearest multiple of 16 bytes.

**CICS consideration**
- dsinit_size and dsincr_size suboptions are ignored under CICS.
- The maximum initial and increment size for CICS above 16 MB is 1 gigabyte (1024 MB).
- The minimum for the initial size is 4K.
- STACK(0), STACK (-0), and STACK (-n) are all interpreted as STACK(4K) under CICS.
- The default increment size under CICS is 4080 bytes, rather than 4096 bytes, to accommodate the 16-byte CICS storage check zone. Without this accommodation, an extra page of storage is allocated when the storage allocation is below the 16-MB line.

**z/OS UNIX considerations**
- The STACK option specifies the characteristics of the user stack for the initial thread. In particular, it gets the initial size of the user stack for the initial thread. The characteristics that indicate incr_size, ANYWHERE, and KEEP | FREE apply to any thread created using pthread_create. Language Environment gets the initial stack size from the threads attribute object specified in the pthread_create function. The default size to be set in the thread's attribute object is obtained from the initial size of the STACK runtime option.
- The default setting for STACK under z/OS UNIX is STACK=(12K,12K,ANYWHERE,KEEP,512K,128K).

**Usage notes**
- Applications running with ALL31(OFF) must specify STACK(,,BELOW,,,) to ensure that stack storage is addressable by the application.
- When an application is running in an XPLINK environment, the STACK runtime option is forced to STACK(,,ANY,,,). Only the third suboption of the STACK runtime option is changed by this action, to indicate that stack storage can be allocated anywhere in storage. No message is issued to indicate this action. In this case, if a Language Environment runtime options report is generated using the RPTOPTS runtime option, the STACK option will be reported as "Override" under the LAST WHERE SET column.
- If the initial routine of the Language Environment application is AMODE 24, the STACK runtime option is forced to STACK(,,BELOW). Only the third suboption of the STACK runtime option is changed by this action. No message is issued to indicate this action. However, if a Language Environment runtime options report is generated using the RPTOPTS runtime option, the STACK option is reported as "Override" under the LAST WHERE SET column.
• The \textit{dsinit\_size} and \textit{dsincr\_size} values are not the actual amounts of storage obtained. The actual size of the storage obtained is 4K larger (8K if a 4K page alignment cannot be guaranteed) to accommodate the guard page.

• PL/I consideration—PL/I automatic storage above the 16-MB line is supported under control of the Language Environment STACK option. When the Language Environment stack is above, PL/I temporaries (dummy arguments) and parameter lists (for reentrant/recursive blocks) also reside above.

The stack frame size for an individual block is constrained to 16 MB. Stack frame extensions are also constrained to 16 MB. Therefore, the size of an automatic aggregate, temporary variable, or dummy argument cannot exceed 16 MB. Violation of this constraint might have unpredictable results.

If an OS PL/I application does not contain any edited stream I/O and if it is running with AMODE 31, you can relink it with Language Environment to use STACK(,,ANY,,). Doing so is particularly useful under CICS to help relieve below-the-line storage constraints.

• PL/I MTF consideration—The STACK option allocates and manages stack storage for the PL/I main task only.

Performance consideration

You can improve performance with the STACK runtime option by specifying values that minimize the number of times the operating system allocates storage. See “RPTSTG” on page 63 for information about how to generate a report you can use to determine the optimum values for the STACK runtime option.

For more information

• See “ALL31” on page 11 for more information about the ALL31 runtime option.

• See “RPTSTG” on page 63 for more information about the RPTSTG runtime option.

• For more information about using the storage reports generated by the RPTSTG runtime option to tune the stacks, see \textit{z/OS Language Environment Debugging Guide}.

• See “XPLINK” on page 91 for more information about the XPLINK runtime option.

\textbf{STACK64 (AMODE 64 only)}

STACK64 controls the allocation of the thread's stack storage for AMODE 64 applications. Storage required for the common anchor area (CAA) and other control blocks is allocated separately from, and prior to, the allocation of the initial stack segment and the initial heap.

The default value for AMODE 64 applications is STACK64(1M,1M,128M).

\begin{center}
\begin{tikzpicture}[>={Stealth[round]}, auto, node distance=2cm, thick, main node/.style={rectangle, rounded corners, minimum width=3cm, minimum height=1cm, text centered, draw=black}]
  \node (A) [main node] {STACK64};
  \node (B) [main node, below of=A] {564};
  \node (C) [main node, below of=B] {initial};
  \node (D) [main node, below of=C] {increment};
  \node (E) [main node, below of=D] {maximum};
  \node (F) [main node, below of=E, xshift=-1cm] {0};
  \node (G) [main node, below of=F] {0};
  \node (H) [main node, below of=G, xshift=1cm] {0};
  \node (I) [main node, below of=H, xshift=1cm] {0};

  \draw [->] (A) -- (B);
  \draw [->] (B) -- (C);
  \draw [->] (C) -- (D);
  \draw [->] (D) -- (E);
  \draw [->] (E) -- (F);
  \draw [->] (F) -- (G);
  \draw [->] (G) -- (H);
  \draw [->] (H) -- (I);
\end{tikzpicture}
\end{center}

\textit{initial}  
Determines the size of the initial stack segment. The storage is contiguous. This value is specified as \textit{nM} bytes of storage.

\textit{increment}  
Determines the minimum size of any subsequent increment to the downward-growing stack area. This value is specified as \textit{nM} bytes of storage. The actual amount of allocated storage is the larger of two values—\textit{increment} or the requested size—rounded up to the nearest 1MB. If you specify \textit{increment} as 0, only the amount of the storage needed at the time of the request, rounded up to the nearest multiple of 1MB, is obtained. The requested size is the amount of storage a routine needs for a stack frame.
maximum
Specifies the maximum stack size. This value is specified as nM bytes of storage. When the maximum size is less than the initial size, initial is used as the maximum stack size.

Usage notes
• The 1MB guard page is not included in any of the sizes.
• The maximum stack segment is the maximum of STACK64 initial and maximum sizes.
• The default value of 128MB for the maximum stack size of the STACK64 and THREADSTACK64 runtime options can cause excessive use of system resources (such as real storage) when running a multithreaded application that creates many pthreads. For such applications, it is recommended to use the Language Environment Storage Report (RPTSTG runtime option) to determine your application's actual pthread stack storage usage, and then use the THREADSTACK64 runtime option to set the maximum stack size to a value closer to the actual usage.

Performance consideration
You can improve performance with the STACK64 runtime option by specifying values that minimize the number of times the operating system allocates storage. See “RPTSTG” on page 63 for information about how to generate a report you can use to determine the optimum values for the STACK64 runtime option.

For more information
• See “RPTSTG” on page 63 for more information about the RPTSTG runtime option.
• For more information about heap storage and heap storage tuning with storage report numbers, see z/OS Language Environment Programming Guide.
• For more information about using the storage reports generated by the RPTSTG runtime option to tune the stacks, see z/OS Language Environment Debugging Guide.
**heap_alloc_value**

The initialized value of any heap storage that is allocated by the storage manager. You can specify `heap_alloc_value` as:

- A single character that is enclosed in quotation marks. If you specify a single character, every byte of heap storage that is allocated by the storage manager is initialized to that character's EBCDIC equivalent. For example, if you specify `a` as the `heap_alloc_value`, heap storage is initialized to `X'818181...81'` or `aaa...a`.
- Two hex digits without quotation marks. If you specify two hex digits, every byte of the allocated heap storage is initialized to that value. For example, if you specify `FE` as the `heap_alloc_value`, heap storage is initialized to `X'FEFEFE...FE'`. A `heap_alloc_value` of `00` initializes heap storage to `X'0000...00'`.
- `NONE`. If you specify `NONE`, the allocated heap storage is not initialized. `NONE` is the default.

**heap_free_value**

The value of any heap storage that is freed by the storage manager is overwritten. You can specify `heap_free_value` as:

- A single character that is enclosed in quotation marks. For example, a `heap_free_value` of `'f'` overwrites freed heap storage to `X'868686...86'`; `'B'` overwrites freed heap storage to `X'C2C2C2...C2'`.
- Two hex digits without quotation marks. A `heap_free_value` of `FE` overwrites freed heap storage with `X'FEFEFE...FE'`.
- `NONE`. If you specify `NONE`, the freed heap storage is not initialized. `NONE` is the default.

**dsa_alloc_value**

The initialized value of stack frames from the Language Environment stack. A stack frame is storage that was acquired dynamically and is composed of a standard register save area and the area available for automatic storage. The `dsa_alloc_value` has no effect on the XPLINK or AMODE 64 downwards growing stack.

If specified, all Language Environment stack storage, including automatic variable storage, is initialized to `dsa_alloc_value`. Stack frames that are allocated outside the Language Environment stack are never initialized.

You can specify `dsa_alloc_value` as:

- A single character that is enclosed in quotation marks. If you specify a single character, any dynamically acquired stack storage that is allocated by the storage manager is initialized to that character's EBCDIC equivalent. For example, if you specify `'A'` as the `dsa_alloc_value`, stack storage is initialized to `X'C1C1C1...C1'`. A `dsa_alloc_value` of `'F'` initializes stack storage to `X'C6C6C6...C6'`; `'d'` to `X'848484...84'`.
- Two hex digits without quotations. If you specify two hex digits, any dynamically-acquired stack storage is initialized to that value. For example, if you specify `FE` as the `dsa_alloc_value`, stack storage is initialized to `X'FEFEFE...FE'`. A `dsa_alloc_value` of `00` initializes stack storage to `X'0000...00'`, FF to `X'FFFFFF...FF'`.
- `[CLEAR]`. If you specify CLEAR, any unused portion of the initial upward growing stack segment is initialized to binary zeros, just before the main procedure gains control. This value has no effect on any stack increments or on the XPLINK or AMODE 64 downward growing stack.
- `NONE`. If you specify `NONE`, the stack storage is not initialized. `NONE` is the default.

**reserve_size**

The amount of storage for the Language Environment storage manager to reserve in the event of an out-of-storage condition. You can specify the `reserve_size` value as `n`, `nK`, or `nM` bytes of storage. The amount of storage is rounded to the nearest multiple of 8 bytes.

This option is ignored in a 64–bit environment.
If you specify `reserve_size` as 0, no reserve segment is allocated. The default `reserve_size` is 0, so no reserve segment is allocated. If you do not specify a reserve segment and your application exhausts storage, the application terminates with abend 4088 and a reason code of 1024.

If you specify a `reserve_size` that is greater than 0 on a non-CICS system, Language Environment does not immediately abend when your application runs out of storage. Instead, when the stack overflows, Language Environment uses the reserve stack as the new segment and signals a CEEOPD out of storage condition. This allows a user-written condition handler to gain control for this signal and release storage. If the reserve stack segment overflows while this is happening, Language Environment terminates with abend 4088 and reason code of 1004. The reserve stack segment is not freed until thread termination. It is acquired from 31-bit storage if the STACK(,,ANY,,,) runtime option is set or 24-bit storage when STACK(,,BELOW,,,) is requested. If a determination is made to activate the reserve stack, the reserve size should be set to a minimum of 32 K to support Language Environment condition handling and messaging internal routines as well as the user condition handler. If you are using the reserve stack in a multithreaded environment, it is recommended that the ALL31(ON) and STACK(,,ANY,,,) options also be in effect.

To avoid such an overflow, increase the size of the reserve stack segment with the STORAGE(,,reserve_size) runtime option. The reserve stack segment is not freed until thread termination.

**CICS consideration**
The out-of-storage condition is not raised under CICS.

**z/OS UNIX considerations**
A reserve stack of the size that is specified by the `reserve_size` suboption of STORAGE is allocated for each thread.

**Usage notes**
- The `heap_alloc_value`, `heap_free_value`, and `dsa_alloc_value` can all be enclosed in quotation marks. To initialize heap storage to the EBCDIC equivalent of a single quotation mark, double it within the string that is delimited by single quotation marks or surround it with a pair of double quotation marks. Both of the following are correct ways to specify a single quotation mark:

  ```
  STORAGE('''')
  STORAGE('"')
  ```

  Similarly, double quotation marks must be doubled within a string that is delimited by double quotation marks, or surrounded by a pair of single quotation marks. The following are correct ways to specify a double quotation mark:

  ```
  STORAGE("""")
  STORAGE('"')
  ```

- CLEAR is not a valid option for AMODE 64 applications.
- COBOL consideration—If using WSCLEAR in VS COBOL II, STORAGE(00,NONE,NONE,8K) is recommended.

**Performance considerations**
The use of the STORAGE runtime option to set values within heap and stack storage can have a negative impact on the performance of a Language Environment application.
• For applications that use the STORAGE heap_alloc_value to initialize large areas of heap storage, if there are pages of storage that would otherwise have not been referenced, then unnecessary first reference page faults will cause additional overhead.

• A similar problem can occur with applications that use the STORAGE heap_free_value to set free storage to a given value, since Language Environment will initialize newly-obtained heap segments to this value. This could also cause unnecessary first reference page faults.

• Performance can also be negatively impacted for applications that use the STORAGE dsa_alloc_value to initialize stack frames, since this requires the runtime to assist on every call to a routine.

IBM strongly recommends that you use STORAGE(NONE,NONE,NONE,0K) when you are not debugging, especially with any performance-critical applications. Do not set the STORAGE runtime option to values other than NONE at the system or region level if at all possible, because settings at those levels affect many more programs than might otherwise need it. Instead, use language mechanisms to ensure that automatic variables and data structures, including those contained within COBOL LOCAL-STORAGE and WORKING-STORAGE, are properly initialized.

**TERMTHDACT**

**Derivation:** TERMinating THreaD ACTions

TERMTHDACT sets the level of information that is produced when Language Environment percolates a condition of severity 2 or greater beyond the first routine’s stack frame. The Language Environment service CEE3DMP is called for the TRACE, UATRACE, DUMP, and UADUMP suboptions of TERMTHDACT.

The TRACE and UATRACE suboptions suppress the dumping of user storage and Language Environment control blocks.

The DUMP and UADUMP suboptions include the dumping of user storage and Language Environment control blocks.

If a message is printed, based upon the TERMTHDACT(MSG) runtime option, the message is for the active condition immediately prior to the termination imminent step. In addition, if that active condition is a promoted condition (was not the original condition), the original condition’s message is printed.

If the TRACE runtime option is specified with the DUMP suboption, a dump containing the trace table, at a minimum, is produced. The contents of the dump depend on the values set in the TERMTHDACT runtime option.

The default value for non-CICS applications is TERMTHDACT(TRACE,CESE,96).

The default value for CICS applications is TERMTHDACT(TRACE,CESE,96).

The default value for AMODE 64 applications is TERMTHDACT(TRACE,,96).
TRACE
Specifies that when a thread terminates due to an unhandled condition of severity 2 or greater, Language Environment generates a message indicating the cause of the termination and a trace of the active routines on the activation stack.

QUIET
Specifies that Language Environment does not generate a message when a thread terminates due to an unhandled condition of severity 2 or greater.

MSG
Specifies that when a thread terminates due to an unhandled condition of severity 2 or greater, Language Environment generates a message indicating the cause of the termination.

DUMP
Specifies that when a thread terminates due to an unhandled condition of severity 2 or greater, Language Environment generates a message indicating the cause of the termination, a trace of the active routines on the activation stack, and a Language Environment dump.

UATRACE
Specifies that when a thread terminates due to an unhandled condition of severity 2 or greater, Language Environment generates a message indicating the cause of the termination, a trace of the active routines on the activation stack, and a U4039 system dump of the user address space. Under CICS, you will get a CICS transaction dump. Under non-CICS, if the appropriate DD statement is used, you will get a system dump of your user address space.

UADUMP
Specifies that when a thread terminates due to an unhandled condition of severity 2 or greater, Language Environment generates a message indicating the cause of the termination, a trace of the active routines on the activation stack, a Language Environment dump, and a U4039 system dump of the user address space. Under non-CICS, if the appropriate DD statement is used, you will get a system dump of your user address space. Under CICS, you will get a CICS transaction dump.

UAONLY
Specifies that when a thread terminates due to an unhandled condition of severity 2 or greater, Language Environment generates a U4039 system dump of the user address space. Under non-CICS, if the appropriate DD statement is used, you will get a system dump of your user address space. Under CICS, you will get a CICS transaction dump.

UAIMM
Specifies to Language Environment that prior to condition management processing, for abends and program interrupts that are conditions of severity 2 or higher, Language Environment will immediately request the operating system to generate a system dump of the original abend/program interrupt of the user address space. Due to an unhandled condition of severity 2 or greater, Language Environment generates a U4039 system dump of the user address space. Under non-CICS, if the appropriate DD statement is used, you will get a system dump of your user address space. After the dump is taken by the operating system, Language Environment condition manager can continue processing. If the thread terminates due to an unhandled condition of Severity 2 or higher, then Language Environment will terminate as if TERMTHDACT(QUIET) was specified.

Note: For software-raised conditions or signals, UAIMM behaves the same as UAONLY.

CESE
Specifies that Language Environment dump output are written to the CESE QUEUE as it has always been. This option is ignored in a 64–bit environment.

CESE is the default.

CICSDDS
Specifies that Language Environment dump output are written to the new CICS transaction dump that contains both CICS and CEEDUMP data. This option is ignored in a 64–bit environment.

reg_stor_amount
Controls the amount of storage to be dumped around registers. This amount can be in the range from 0 to 256 bytes. The amount specified will be rounded up to the nearest multiple of 32. The default amount is 96 bytes.
CICS consideration

All TERMTHDACT output is written to the data queue based on the setting of CESE or CICSDDS. See Table 5 on page 75 for a summary of the results of the different options that are available.

<table>
<thead>
<tr>
<th>Options</th>
<th>TERMTHDACT(option,CESE,)</th>
<th>TERMTHDACT(option,CICSDDS,)</th>
</tr>
</thead>
<tbody>
<tr>
<td>QUIET</td>
<td>• No output.</td>
<td>• No output.</td>
</tr>
<tr>
<td></td>
<td>• ASRA or user ABEND issued.</td>
<td>• ASRA or user ABEND issued.</td>
</tr>
<tr>
<td>MSG</td>
<td>• Message written to CESE queue or MSGFILE.</td>
<td>• Message written to CESE queue or MSGFILE.</td>
</tr>
<tr>
<td></td>
<td>• ASRA or user ABEND issued.</td>
<td>• ASRA or user ABEND issued.</td>
</tr>
<tr>
<td>TRACE</td>
<td>• Message written to CESE queue.</td>
<td>• Message written to CESE or MSGFILE.</td>
</tr>
<tr>
<td></td>
<td>• Traceback written to CESE queue.</td>
<td>• Traceback included in CICS transaction dump for this ABEND.</td>
</tr>
<tr>
<td></td>
<td>• ASRA or user ABEND issued.</td>
<td>• ASRA or user ABEND issued.</td>
</tr>
<tr>
<td>DUMP</td>
<td>• Message written to CESE queue.</td>
<td>• Invalid suboption combination. Not supported.</td>
</tr>
<tr>
<td></td>
<td>• Traceback written to CESE queue.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• CEEDUMP to CESE queue.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• ASRA or user ABEND issued.</td>
<td></td>
</tr>
<tr>
<td>UATRACE</td>
<td>• Message written to CESE queue.</td>
<td>• Message written to CESE queue.</td>
</tr>
<tr>
<td></td>
<td>• Traceback written to CESE queue.</td>
<td>• Traceback included in CICS transaction dump for this ABEND.</td>
</tr>
<tr>
<td></td>
<td>• U4039 transaction dump in CICS dump data set.</td>
<td>• U4039 transaction dump in CICS dump data set.</td>
</tr>
<tr>
<td></td>
<td>• ASRA or user ABEND issued.</td>
<td>• ASRA or user ABEND issued.</td>
</tr>
<tr>
<td>UADUMP</td>
<td>• Message written to CESE queue.</td>
<td>• Invalid suboption combination. Not supported.</td>
</tr>
<tr>
<td></td>
<td>• Traceback written to CESE queue.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• CEEDUMP written to CESE queue.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• U4039 transaction dump in CICS dump data set.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• ASRA or user ABEND issued.</td>
<td></td>
</tr>
<tr>
<td>UAONLY</td>
<td>• U4039 transaction dump in CICS dump data set.</td>
<td>• No changes in behavior for CICSDDS.</td>
</tr>
<tr>
<td>UAIMM</td>
<td>• U4039 transaction dump in CICS dump data set.</td>
<td>• No changes in behavior for CICSDDS.</td>
</tr>
</tbody>
</table>

**Note:** Program checks end in ASRx (most commonly ASRA) CICS abend with a CICS dump in the dump data set. Abends end with the abend code provided on the EXEC CICS ABEND command with a CICS dump in the dump data set if the NODUMP option was NOT specified.

<table>
<thead>
<tr>
<th>Options</th>
<th>TERMTHDACT(option,CESE,)</th>
<th>TERMTHDACT(option,CICSDDS,)</th>
</tr>
</thead>
<tbody>
<tr>
<td>QUIET</td>
<td>• No output.</td>
<td>• No output.</td>
</tr>
<tr>
<td></td>
<td>• U4038 abend issued with CANCEL and NODUMP options.</td>
<td>• U4038 abend issued with CANCEL and NODUMP options.</td>
</tr>
</tbody>
</table>
## Table 6: Handling of software-raised conditions (continued)

<table>
<thead>
<tr>
<th>Options</th>
<th>TERMTHDACT(option,CESE,)</th>
<th>TERMTHDACT(option,CICSDDS,)</th>
</tr>
</thead>
</table>
| MSG     | • Message written to CESE queue or MSGFILE.  
|         | • U4038 abend issued. |   
|         | • Message written to CESE queue or MSGFILE.  
|         | • U4038 abend issued. |   |
| TRACE   | • Message written to CESE queue or MSGFILE.  
|         | • Traceback written to CESE queue.  
|         | • U4038 abend issued. |   
|         | • Message written to CESE queue or MSGFILE.  
|         | • Traceback written to CESE queue.  
|         | • U4038 abend issued. |   |
| DUMP    | • Message written to CESE queue or MSGFILE.  
|         | • Traceback written to CESE queue.  
|         | • CEEDUMP written to CESE queue.  
|         | • U4038 abend issued. |   
|         | • Message written to CESE queue or MSGFILE.  
|         | • Traceback written to CESE queue.  
|         | • U4038 abend issued. |   |
| UATRACE | • Message written to CESE queue or MSGFILE.  
|         | • Traceback written to CESE queue.  
|         | • U4039 transaction dump in CICS dump data set.  
|         | • U4038 abend issued. |   
|         | • Message written to CESE queue or MSGFILE.  
|         | • Traceback written to CESE queue.  
|         | • U4039 transaction dump in CICS dump data set.  
|         | • U4038 abend issued. |   |
| UADUMP  | • Message written to CESE queue or MSGFILE.  
|         | • Traceback written to CESE queue.  
|         | • CEEDUMP written to CESE queue.  
|         | • U4039 transaction dump in CICS dump data set.  
|         | • U4038 abend issued. |   
|         | • Message written to CESE queue or MSGFILE.  
|         | • Traceback written to CESE queue.  
|         | • U4039 transaction dump in CICS dump data set.  
|         | • U4038 abend issued. |   |
| UAONLY  | • U4039 transaction dump in CICS dump data set.  
|         | • U4038 abend issued. |   
|         | • No changes in behavior for CICSDDS. |   |
| UAIMM   | • U4039 transaction dump in CICS dump data set.  
|         | • U4038 abend issued. |   
|         | • Incorrect suboption combination. Not supported. |   |

### Notes:

1. CICS is told about software-raised error conditions for DUMP and TRACE.
2. When assembling a CEEROPT or CEEUOPT, the CICSDDS option cannot be issued with DUMP or UADUMP. This results in a RC=8, CEEXOPT issues an MNOTE, and the setting is forced to TRACE:
3. Language Environment requests a CICS transaction dump via the U4039 abend.
4. See z/OS Language Environment Runtime Messages for more complete details regarding the U4039 abend.

### z/OS UNIX considerations

The TERMTHDACT option applies when a thread terminates abnormally. Abnormal termination of a single thread causes termination of the entire enclave. If an unhandled condition of severity 2 or higher percolates beyond the first routine's stack frame, the enclave terminates abnormally.

If an enclave terminates due to a POSIX default signal action, TERMTHDACT applies only to conditions that result from program checks or abends.

If running under a z/OS UNIX shell and Language Environment generates a system dump, a core dump is generated to a file based on the kernel environment variable, _BPXKDUMP.
Usage notes

• A runtime options report is generated and placed at the end of the enclave information whenever the TRACE, UATRACE, DUMP and UADUMP options are invoked.

• PL/I considerations—After a normal return from a PL/I ERROR ON-unit or from a PL/I FINISH ON-unit, Language Environment considers the condition unhandled. If a GOTO is not performed and the resume cursor is not moved, the thread terminates. The TERMTHDACT setting guides the amount of information that is produced. The message is not presented twice.

• PL/I MTF considerations—
  – TERMTHDACT applies to a task when the task terminates abnormally due to an unhandled condition of severity 2 or higher that is percolated beyond the initial routine's stack frame.
  – When a task ends with a normal return from an ERROR ON-unit and other tasks are still active, a dump is not produced even when the TERMTHDACT option DUMP, UADUMP, UAONLY, or UAIMM is specified.
  – All active subtasks created from the incurring task also terminate abnormally, but the enclave can continue to run.

• The environment variable _CEE_DMPTARG allows a sysout class for a dynamically allocated CEEDUMP. You can set the _CEE_DMPTARG value string from a z/OS UNIX shell by:
  – Using the export command
  – Using the C functions setenv() or putenv()
  – Using the ENVAR runtime option

_CEE_DMPTARG has the following format, _CEE_DMPTARG=value. The value is a null-terminated character string, SYSOUT(x), that defines a sysout class that Language Environment will set dynamically allocating the CEEDUMP. For example, you can specify: _CEE_DMPTARG=SYSOUT(A)

To set the _CEE_DMPTARG value from a z/OS UNIX shell, you could issue the export command and specify the following run-options, for example:

```export _CEE_DMPTARG=SYSOUT(A).```

WHEN _CEE_DMPTARG is not set, then the sysout class will default to SYSOUT(*) for the dynamically allocated CEEDUMP. If the dynamic allocation for the specified SYSOUT class specified by _CEE_DMPTARG should fail, the default, SYSOUT(*) will be used.

• Language Environment will suppress CEEDUMP information that is generated based on the TERMTHDACT runtime option settings TRACE, DUMP, UATRACE, or UADUMP for authorized applications under the following conditions:
  – A user is running a Language Environment application as a RACF-controlled program on a system where the IEAABD.DMPAUTH resource has been defined, but the user has not been permitted access to this resource.
  – A user is running an authorized key Language Environment application in a non-started task address space but the user has not been permitted access to the IEAABD.DMPAKEY resource.
  – A user is running a Language Environment application in a non-started task address space that has the JSCBPASS indicator on, including applications whose PPT entry specifies bypassing security protection.

After Language Environment suppresses a dump, message CEE3880I is written to the application's programmer log. For more information, refer to the documentation for message CEE3880I in z/OS Language Environment Runtime Messages. Also refer to z/OS Security Server RACF Security Administrator's Guide.

For more information

• See “TRACE” on page 84, for more information about the TRACE runtime option.
TEST | NOTEST

TEST specifies the conditions under which a debug tool (such as the IBM z/OS Debugger) assumes control when the user application is being initialized. Parameters of the TEST and NOTEST runtime options are merged as one set of parameters.

The default value for non-CICS applications is NOTEST(ALL,*PROMPT,INSPPREF).

The default value for CICS applications is NOTEST(ALL,*PROMPT,INSPPREF).

The default value for AMODE 64 applications is NOTEST(ALL,*PROMPT,INSPPREF).

ALL

Specifies that any of the following causes the debug tool to gain control even without a defined AT OCCURRENCE for a particular condition or AT TERMINATION:

- The ATTENTION function
- Any Language Environment condition of severity 1 or above
- Application termination

ALL is the default.

ERROR

Specifies that only one of the following causes the debug tool to gain control without a defined AT OCCURRENCE for a particular condition or AT TERMINATION:

- The ATTENTION function
- Any Language Environment-defined error condition of severity 2 or higher
- Application termination

NONE

Specifies that no condition causes the debug tool to gain control without a defined AT OCCURRENCE for a particular condition or AT TERMINATION.

commands_file

A valid ddname, data set name (MVS), or file name (CMS), specifying the primary commands file for this run. If you do not specify this parameter all requests for commands go to the user terminal.
You can enclose `commands_file` in single or double quotation marks to distinguish it from the rest of the TEST | NOTEST suboption list. It can have a maximum length of 80 characters. If the data set name provided can be interpreted as a ddname, it must be preceded by a slash (/). The slash and data set name must be enclosed in quotation marks.

A primary commands file is required when running in a batch environment.

* (asterisk—in place of `commands_file`)  
Specifies that no `commands_file` is supplied. The terminal, if available, is used as the source of the debug tool commands.

**PROMPT**  
Specifies that the debug tool is invoked at Language Environment initialization.  

**PROMPT** is the default.

**NOPROMPT**  
Specifies that the debug tool is not invoked at Language Environment initialization.

* (asterisk—in place of **PROMPT/NOPROMPT**)  
Specifies that the debug tool is not invoked at Language Environment initialization; equivalent to **NOPROMPT**.

; (semicolon—in place of **PROMPT/NOPROMPT**)  
Specifies that the debug tool is invoked at Language Environment initialization; equivalent to **PROMPT**.

A character string that specifies a valid debug tool command. The command list can be enclosed in single or double quotation marks to distinguish it from the rest of the TEST parameter list; it cannot contain DBCS characters. Quotation marks are needed whenever the command list contains embedded blanks, commas, semicolons, or parentheses. The list can have a maximum of 250 characters.

**INSPPREF**  
Specifies the default setting for `preference_file`.

**INSPPREF** is the default.

**preference_file**  
A valid ddname, data set name (MVS), or file name (CMS), specifying the preference file to be used. A preference file is a type of commands file that you can use to specify settings for your debugging environment. It is analogous to creating a profile for a text editor, or initializing a terminal session.

You can enclose `preference_file` in single or double quotation marks to distinguish it from the rest of the TEST parameter list. It can have a maximum of 80 characters.

If a specified data set name could be interpreted as a ddname, it must be preceded by a slash (/). The slash and data set name must be enclosed in quotation marks.

* (asterisk—in place of `preference_file`)  
Specifies that no `preference_file` is supplied.

**z/OS UNIX considerations**

Language Environment honors the initial command string before the main routine runs on the initial thread.

The test level (ALL, ERROR, NONE) applies to the enclave.

Language Environment honors the preference file when the debug tool is initialized, regardless of which thread first requests the debug tool services.

**Usage notes**

* You can specify parameters on the NOTEST option. If NOTEST is in effect when the application gains control, it is interpreted as TEST(NONE,,*). If z/OS Debugger is initialized using a CALL CEETEST or
equivalent, the initial test level, the initial commands_file, and the initial preference_file are taken from the NOTEST runtime option setting.

Performance consideration
To improve performance, use this option only while debugging.

For more information
See z/OS Debugger publications for details and examples of the TEST runtime option as it relates to z/OS Debugger.

THREADHEAP

Derivation: THREAD level HEAP storage

THREADHEAP controls the allocation and management of thread-level heap storage. Separate heap segments are allocated and freed for each thread based on the THREADHEAP specification.

For PL/I MTF applications, controlled and based variables declared in a subtask are allocated from heap storage specified by THREADHEAP. Variables in the main task are allocated from heap storage specified by HEAP.

Library use of heap storage in a substack is allocated from the enclave-level heap storage specified by the ANYHEAP and BELOWHEAP options.

The default value for non-CICS applications is THREADHEAP(4K,4K,ANY,KEEP).

THREADHEAP is ignored on CICS.

init_size
The minimum initial size of thread heap storage, and is specified in n, nK, or nM. Storage is acquired in multiples of 8 bytes. A value of zero (0) causes an allocation of 4K.

incr_size
The minimum size of any subsequent increment to the noninitial heap storage is specified in n, nK, or nM. The actual amount of allocated storage is the larger of two values, incr_size or the requested size, rounded up to the nearest multiple of 8 bytes. If you specify incr_size as 0, only the amount of the storage needed at the time of the request (rounded up to the nearest 8 bytes) is obtained.

ANYWHERE
Specifies that the heap storage can be allocated anywhere in storage. If there is no available storage above the line, storage is acquired below the 16-MB line. The only valid abbreviation of ANYWHERE is ANY.

ANYWHERE is the default.

BELOW
Specifies that the heap storage must be allocated below the 16M line.
**KEEP**

Specifies that storage allocated to THREADHEAP increments is not released when the last of the storage in the thread heap increment is freed.

KEEP is the default.

**FREE**

Specifies that storage allocated to THREADHEAP increments is released when the last of the storage in the thread heap increment is freed.

**CICS consideration**

Even though this option is ignored under CICS, the default increment size under CICS has changed from 4K (4096 bytes) to 4080 bytes, to accommodate the 16 bytes CICS storage check zone.

**Usage notes**

- If the requesting routine is running in 24-bit addressing mode and THREADHEAP(,,ANY,) is in effect, THREADHEAP storage is allocated below the 16M line based upon the HEAP(,,,initsz24,incrsz24) settings.
- PL/I MTF considerations—The thread-level heap is allocated only in applications that use the PL/I MTF. For PL/I MTF applications, controlled and based variables specified in subtasks are located in the thread-level heap.
  
  If the main program is running in 24-bit addressing mode and THREADHEAP(,,ANY,) is in effect, heap storage is allocated below the 16M line. The only case in which storage is allocated above the line is when all of the following conditions exist:
  
  - The user routine requesting the storage is running in 31-bit addressing mode.
  - HEAP(,,ANY,) is in effect.
  - The main routine is running in 31-bit addressing mode.
- When running PL/I with POSIX(ON) in effect, THREADHEAP is used for allocating heap storage for PL/I base variables declared in non-IPTs. Storage allocated to all THREADHEAP segments is freed when the thread terminates.
- THREADHEAP(4K,4K,ANYWHERE,KEEP) provides behavior compatible with the PL/I TASKHEAP option.
- The initial thread heap segment is never released until the thread terminates.
- THREADHEAP has no effect on C/C++ or Fortran for z/OS MTF applications.

**THREADSTACK**

**Derivation:** THREAD level STACK storage

THREADSTACK controls the allocation of the thread's stack storage for both the upward and downward-growing stacks, except the initial thread in a multithreaded application. If the thread attribute object does not provide an explicit stack size, then the allocation values can be inherited from the STACK option or specified explicitly on the THREADSTACK option.

The default values for non-CICS applications is THREADSTACK(OFF,4K,4K,ANYWHERE,KEEP,128K,128K). THREADSTACK is ignored on CICS.
**OFF**
Indicates that the allocation suboptions of the STACK runtime option are used for thread stack allocation. Any other suboption specified with THREADSTACK is ignored.

**ON**
Controls the stack allocation for each thread, except the initial thread, in a multithreaded environment.

**usinit_size**
Determines the size of the initial upward-growing stack segment. The storage is contiguous. You specify the `usinit_size` value as `n`, `nK`, or `nM` bytes of storage. The actual amount of allocated storage is rounded up to the nearest multiple of 8 bytes.

The `usinit_size` value can be preceded by a minus sign. In environments other than CICS, if you specify a negative number Language Environment uses all available storage minus the amount specified for the initial stack segment.

A size of "0" or "-0" requests half of the largest block of contiguous storage in the region below the 16-MB line.

**usincr_size**
Determines the minimum size of any subsequent increment to the upward-growing stack area. You can specify this value as `n`, `nK`, or `nM` bytes of storage. The actual amount of allocated storage is the larger of two values—`usincr_size` or the requested size—rounded up to the nearest multiple of 8 bytes.

If you specify `usincr_size` as 0, only the amount of the storage needed at the time of the request, rounded up to the nearest multiple of 8 bytes, is obtained.

The requested size is the amount of storage a routine needs for a stack frame. For example, if the requested size is 9000 bytes, `usincr_size` is specified as 8K, and the initial stack segment is full, Language Environment gets a 9000 byte stack increment from the operating system to satisfy the request. If the requested size is smaller than 8K, Language Environment gets an 8K stack increment from the operating system.

**ANYWHERE | ANY**
Specifies that stack storage can be allocated anywhere in storage. On systems that support bimodal addressing, storage can be allocated either above or below the 16M line. If there is no storage available above the line, Language Environment acquires storage below the line. On systems that do not support bimodal addressing (for example, when VM/ESA is initial program loaded in 370 mode) Language Environment ignores this option and places the stack storage below 16M.

**BELOW**
Specifies that the stack storage must be allocated below the 16M line in storage that is accessible to 24–bit addressing.

**KEEP**
Specifies that storage allocated to stack increments is not released when the last of the storage in the stack increment is freed.
FREE
 specifies that storage allocated to stack increments is released when the last of the storage in the stack is freed. The initial stack segment is never released until the enclave terminates.

dsinit_size
 determines the size of the initial downward-growing stack segment. The storage is contiguous. You specify the init_size value as n, nK, or nM bytes of storage. The actual amount of allocated storage is rounded up to the nearest multiple of 16 bytes.

dsincr_size
 determines the minimum size of any subsequent increment to the downward-growing stack area. You can specify this value as n, nK, or nM bytes of storage. The actual amount of allocated storage is the larger of two values-- incr_size or the requested size--rounded up to the nearest multiple of 16 bytes.

Usage notes

- The dsinit_size and dsincr_size values are the amounts of storage that can be used for downward-growing stack frames (plus the stack header, approximately 20 bytes). The actual size of the storage getmained will be 4K (8K if a 4K page alignment cannot be guaranteed) larger to accommodate the guard page.
- The downward-growing stack is only initialized in a XPLINK supported environment, that is, batch, TSO, z/OS UNIX, and only when a XPLINK application is active in the enclave. Otherwise the suboptions for the downward-growing stack are ignored.
- All storage allocated to THREADSTACK segments are freed when the thread terminates.
- The initial stack segment of the thread is never released until the thread terminates, regardless of the KEEP/FREE state.
- You can specify suboptions with THREADSTACK(OFF,...), but they are ignored. If you override the THREADSTACK(OFF,...) suboption with THREADSTACK(ON) and you omit suboptions, then the suboptions you specified with THREADSTACK(OFF,...) remain in effect. If you respecify THREADSTACK(OFF,...) with different suboptions, they override the defaults.
- PL/I MTF consideration—THREADSTACK(ON,4K, 4K, BELOW, KEEP,,) provides PL/I compatibility for stack storage allocation and management for each subtask in the application.
- PL/I considerations—For multitasking or multithreaded environments, the stack size for a subtask or non-Initial Process Thread (non-IPT) is taken from the THREADSTACK option unless THREADSTACK(OFF) is specified. THREADSTACK(OFF) specifies that the values in the STACK option be used.
- In the multithreaded environment, you can explicitly specify the stack size in the thread attribute object; it will be used instead of the value specified with THREADSTACK or STACK.
- The THREADSTACK option replaces the NONIPTSTACK and NONONIPTSTACK options.

**THREADSTACK64 (AMODE 64 only)**

**Derivation:** THREAD level STACK storage for AMODE 64

THREADSTACK64 controls the allocation of the thread's stack storage for AMODE 64 applications, except for the initial thread in a multithreaded environment.

The default value for AMODE 64 applications is THREADSTACK64(OFF,1M,1M,128M).
**OFF**
Indicates that the allocation suboptions of the STACK64 runtime option are used for thread stack allocation. Any other suboption specified with THREADSTACK64 is ignored.
OFF is the default.

**ON**
Controls the stack allocation for each thread, except the initial thread, in a multithreaded environment.

*initial*
Determines the size of the initial stack segment. The storage is contiguous. This value is specified as \( nM \) bytes of storage.

*increment*
Determines the minimum size of any subsequent increment to the stack area. This value is specified as \( nM \) bytes of storage. The actual amount of allocated storage is the larger of two values—increment or the requested size—rounded up to the nearest multiple of 1MB.

If you specify increment as 0, only the amount of the storage needed at the time of the request, rounded up to the nearest multiple of 1MB, is obtained.

The requested size is the amount of storage a routine needs for a stack frame.

*maximum*
Specifies the maximum stack size. This value is specified as \( nM \) bytes of storage. When the maximum size is less than the initial size, initial is used as the maximum stack size.

**Usage notes**
- The 1 MB guard page is not included in any of the sizes.
- The maximum thread stack segment is the maximum of THREADSTACK64 initial and maximum sizes.
- The default value of 128 MB for the maximum stack size of the STACK64 and THREADSTACK64 runtime options can cause excessive use of system resources (such as real storage) when running a multithreaded application that creates many pthreads. For such applications, it is recommended to use the Language Environment Storage Report (RPTSTG runtime option) to determine your application's actual pthread stack storage usage, and then use the THREADSTACK64 runtime option to set the maximum stack size to a value closer to the actual usage.

**For more information**
For more information about heap storage and heap storage tuning with storage report numbers, see *z/OS Language Environment Programming Guide*.

---

**TRACE**

TRACE controls runtime library tracing activity, the size of the in-storage trace table, the type of trace events to record, and it determines whether a dump containing, at a minimum, the trace table should be unconditionally taken when the application terminates. When you specify TRACE(ON), user-requested trace entries are intermixed with Language Environment trace entries in the trace table.

Under normal termination conditions, if TRACE is active and you specify DUMP, only the trace table is written to the dump report, independent of the TERMTHDACT setting. Only one dump is taken for each termination. Under abnormal termination conditions, the type of dump taken (if one is taken) depends on the value of the TERMTHDACT runtime option and if TRACE is active and the DUMP suboption is specified.

The default value for non-CICS applications is TRACE(OFF,4K,DUMP,LE=0).

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84 *z/OS: Language Environment Programming Reference*
The default value for CICS applications is TRACE(OFF,4K,DUMP,LE=0).
The default value for AMODE 64 applications is TRACE(OFF,4K,DUMP,LE=0).

**OFF**
Indicates that the tracing facility is inactive.
OFF is the default.

**ON**
Indicates that the tracing facility is active.

**table_size**
Determines the size of the tracing table as specified in bytes (nK or nM). The upper limit is 16M - 1 (1666777215 bytes). This option is ignored in a 64–bit environment and the size is set to 1M.

**DUMP**
Requests that a Language Environment-formatted dump (containing the trace table) be taken at program termination regardless of the setting of the TERMTHDACT runtime option.
DUMP is the default.

**NODUMP**
Requests that a Language Environment-formatted dump not be taken at program termination.

**LE=0**
Specifies that no trace events be recorded.
LE=0 is the default.

**LE=1**
Specifies that entry to and exit from Language Environment member libraries be recorded (such as, in the case of C, entry and exit of the printf() library function).

**LE=2**
Specifies that mutex init/destroy and locks/unlocks from Language Environment member libraries be recorded.

**LE=3**
Activates both the entry/exit trace and the mutex trace.

**LE=20**
Specifies that XPLINK/non-XPLINK transition should be recorded.

**Usage notes**
- PL/I MTF consideration—The TRACE(ON,,LE=2) setting provides the following trace table entries for PL/I MTF support:
  - Trace entry 100 occurs when a task is created.
  - Trace entry 101 occurs when a task that contains the tasking CALL statements is terminated.
Trace entry 102 occurs when a task that does not contain the tasking CALL statements is terminated.

- When running PL/I with POSIX(ON) in effect, no PL/I-specific trace information is provided.
- When you specify LE=20:
  - AMODE 64 applications have no transitions.
  - Transitions across OS_UPSTACK linkage are not recorded.
- When TRACE(OFF) is specified, Language Environment activates tracing when a pthread_create() is done and a debugger is being used.
- COBOL does not provide any Trace Table Entries.

For more information

- For more information about the dump contents, see “TERMTHD ACT” on page 73.
- For more information about using the tracing facility, see z/OS Language Environment Debugging Guide.

**TRAP**

TRAP specifies how Language Environment programs handle abends and program interrupts (see Table 7 on page 86). CEESGL is unaffected by this option.

TRAP(ON) must be in effect for the ABTERMENC runtime option to have effect. This option is similar to options that were offered by earlier versions of COBOL, C, and PL/I runtime libraries:

- STAE | NOSTAE runtime option of earlier COBOL, C, and PL/I
- SPIE | NOSPIE option that is offered by earlier C and PL/I

<table>
<thead>
<tr>
<th>Table 7: TRAP runtime option settings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>If ...</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>One option is specified in input.</td>
</tr>
<tr>
<td>Both options are specified in input.</td>
</tr>
<tr>
<td>STAE is specified in one #pragma runopts statement, and NOSPIE in another statement.</td>
</tr>
<tr>
<td>Multiple instances of STAE</td>
</tr>
<tr>
<td>Multiple instances of SPIE</td>
</tr>
<tr>
<td>An options string has TRAP(ON) or TRAP(OFF) together with SPIE</td>
</tr>
</tbody>
</table>

The default value for non-CICS applications is TRAP(ON,SPIE).
The default value for CICS applications is TRAP(ON,SPIE).
The default value for AMODE 64 applications is TRAP(ON,SPIE).
ON

Fully enables the Language Environment condition handler.

OFF

Prevents language condition handlers or handlers registered by CEEHDLR from being notified of abends or program checks. POSIX signal handling semantics for abends and program checks are not applied.

SPIE

SPIE specifies that Language Environment issue an ESPIE macro to handle program interrupts. The SPIE suboption is ignored when specified with the OFF suboption.

SPIE is the default.

NOSPIE

NOSPIE specifies that Language Environment will not issue the ESPIE macro. When you specify the ON, NOSPIE suboption, Language Environment will handle program interrupts and abends via an ESTAE. The NOSPIE suboption is ignored when specified with the OFF suboption.

Due to the restrictions and side-effects when running TRAP(OFF) stated in the Usage notes, IBM highly recommends running TRAP(ON,SPIE) in all environments.

CICS consideration

Since Language Environment never sets a SPIE or STAE, the SPIE|NOSPIE suboption is ignored on CICS.

z/OS UNIX considerations

The TRAP option applies to the entire enclave and all threads within.

Usage notes

• Use TRAP(OFF) only when you need to analyze a program exception before Language Environment handles it.

• When you specify TRAP(OFF) in a non-CICS environment, an ESPIE is not issued, but an ESTAE is issued. Language Environment does not handle conditions raised by program interrupts or abends initiated by SVC 13 as Language Environment conditions, and does not print messages for such conditions.

• Language Environment requires TRAP(ON) because it uses condition handling internally. As a result, running with TRAP(OFF) for exception diagnosis purposes can cause many side effects. If you run with TRAP(OFF), you can get side effects even if you do not encounter a software-raised condition, program check, or abend. If you do encounter a program check or an abend with TRAP(OFF) in effect, the following side effects can occur:
  – The ABTERMENC runtime option has no effect.
  – The ABPERC runtime option has no effect.
  – Resources that are acquired by Language Environment are not freed.
  – Files opened by HLLs are not closed by Language Environment, so records might be lost.
  – The abnormal termination exit is not driven for enclave termination.
  – The assembler user exit is not driven for enclave termination.
– User condition handlers are not enabled.
– The debugger is not notified of the error.
– No storage report or runtime options report is generated.
– No Language Environment messages or Language Environment dump output is generated.
– In z/OS UNIX, POSIX signal handling semantics are not enabled for the abend.
– The enclave terminates abnormally if such conditions are raised.
– The COBOL ON SIZE ERROR clause may be disabled for arithmetic statements.

• TRAP(ON) must be in effect when you use the CEEBXITA assembler user exit for enclave initialization to specify a list of abend codes that Language Environment percolates.
• C++ consideration—TRAP(ON) must be in effect in order for the z/OS XL C++ try, throw, and catch condition handling mechanisms to work.
• When TRAP(ON) is in effect, and the abend code is in the CEEAUE_A_AB_CODES list in CEEBXITA, Language Environment percolates the abend. Normal Language Environment condition handling is never invoked to handle these abends. This feature is useful when you do not want Language Environment condition handling to intervene for certain abends or when you want to prevent invocation of the abnormal termination exit for certain abends, such as when IMS issues a user abend code 777.
• When TRAP(ON,NOSPIE) is specified in a non-CICS environment, Language Environment will handle program interrupts and abends via an ESTAE. This feature is useful when you do not want Language Environment to issue an ESPIE macro.

When TRAP(OFF), (TRAP(OFF,SPIE) or TRAP(OFF,NOSPIE) is specified and there is a program interrupt, the user exit for termination is not driven.

For more information
• See “ABTERMENC” on page 10 for more information about the ABTERMENC runtime option.
• See “CEESGL—Signal a condition” on page 365 for more information about the CEESGL callable service.
• For more information about the CEEHDLR callable service, see “CEEHDLR—Register user-written condition handler” on page 281.
• See z/OS Language Environment Programming Guide, for more information about the CEEBXITA assembler user exit.

UPSI (COBOL only)

Derivation: User Programmable Status Indicator

UPSI sets the eight UPSI switches on or off for applications that use COBOL programs.

The default for non-CICS applications is UPSI(00000000).

The default for CICS applications is UPSI(00000000).

```
    UPSI 0
    nnnnnnnn
```

`n` represents one UPSI switch between 0 and 7, the leftmost `n` representing the first switch. Each `n` can either be 0 (off) or 1 (on).

For more information
• For more information about how COBOL programs access the UPSI switches, see the appropriate version of the COBOL programming guide in the COBOL library at Enterprise COBOL for z/OS library (www.ibm.com/support/docview.wss?uid=swg27036733).
**USRHDLR | NOUSRHDLR**

**Derivation:** USeR condition HanDLeR

USRHDLR registers a user condition handler at stack frame 0, allowing you to register a user condition handler without having to include a call to CEEHDLR in your application and then recompile the application.

The default value for non-CICS applications is NOUSRHDLR.

The default value for CICS applications is NOUSRHDLR().

**NOUSRHDLR**

Does not register a user condition handler without recompiling an application to include a call to CEEHDLR.

NOUSRHDLR is the default.

**USRHDLR**

Registers a user condition handler without recompiling an application to include a call to CEEHDLR.

**lmname**

The name of a load module (or an alias name of a load module) that contains the user condition handler that is to be registered at stack frame 0. This parameter is optional.

**lmname2**

The name of a load module (or an alias name of a load module) that contains the user condition handler that is to be registered to get control after the enablement phase and before any other user condition handler. This parameter is optional.

**CICS consideration**

When specifying USRHDLR under CICS, *lmname* and *lmname2* must be defined in the CICS system definition data set (CSD) for your CICS region, rather than using program autoinstall. This includes the sample user-written condition handler CEEWUCHA.

**Usage notes**

- The user condition handler specified by the USRHDLR runtime option must be in a separate load module rather than be link-edited with the rest of the application.
- The user condition handler *lmname* is invoked for conditions that are still unhandled after being presented to condition handlers for the main program.
- The user condition handler *lmname2* is invoked for each condition after the condition completes the enablement phase but before any other registered user condition handlers are given control.
- You can use a user condition handler registered with the USRHDLR runtime option to return any of the result codes allowed for a user condition handler registered with the CEEHDLR callable service.
- A condition that is percolated or promoted by a user condition handler registered to handle conditions at stack frame 0 using the USRHDLR run time option is not presented to any other user condition handler.
- The loading of the user condition handlers *lmname* and *lmname2* occurs only when that user condition handler needs to be invoked the first time.
- If the load of either *lmname* or *lmname2* fails, an error message is issued.
To turn off one of the suboptions previously specified by USRHDLR (lmname or lmname2), specify the option with either empty single quotes or empty double quotation marks. For example, to turn off the lmname2 suboption after it had been previously specified, use either USRHDLR(lmname, '' ) or USRHDLR(lmname, " ").

In SCEESAMP, IBM supplies a sample user-written condition handler, called CEEWUCHA. Under CICS, this handler will give you similar abend codes that existed in certain pre-Language Environment environments. The CEEWUCHA load module needs to be built using CEEWWCHA, which is also provided in SCEESAMP. This handler has support for both COBOL and PL/I; however, it is shipped with the PL/I-specific behavior commented out. If you want this PL/I behavior, modify the source before using CEEWWCHA.

For more information
For information about registering a user condition handler and its interfaces, see “CEEHDLR—Register user-written condition handler” on page 281.

VCTRSAVE

**Derivation: VeCToR environment to be SAVEd**

VCTRSAVE specifies if any language in the application uses the vector facility when user-written condition handlers are called.

The default values for non-CICS applications is VCTRSAVE(OFF).

VCTRSAVE is ignored on CICS.

**OFF**

No language in the application uses the vector facility when user-provided condition handlers are called.

OFF is the default.

**ON**

A language in the application uses the vector facility when user-provided condition handlers are called.

**CICS consideration**

VCTRSAVE is ignored under CICS.

**z/OS UNIX considerations**

The VCTRSAVE option applies to the entire enclave and all threads within the enclave.

**Performance consideration**

When a condition handler plans to use the vector facility (that is, run any vector instructions), the entire vector environment must be saved on every condition and restored on return to the application code. You can avoid this extra work by specifying VCTRSAVE(OFF) when you are not running an application under vector hardware.
The XPLINK runtime option controls the initialization of the XPLINK environment. XPLINK resources such as the downward-growing stack and the XL C/C++ runtime library are committed only when it is known that an XPLINK program will receive control. If the initial program in the enclave contains at least one function that was compiled using XPLINK conventions, then XPLINK resources will be committed during Language Environment initialization as if XPLINK(ON) had been specified. If the initial program is purely non-XPLINK, then no XPLINK resources will be committed. If it is known that an XPLINK function will be called at some point during the execution of the application, (for example, by calling a DLL function that has been compiled XPLINK), then XPLINK(ON) must be specified so the necessary XPLINK resources are available.

You cannot set this option at the system level, region level, or in the CEEBXITA assembler user exit interface. You can only specify XPLINK on application invocation (command-line interface or _CEE_RUNOPTS environment variable), or as an application default (CEEUOPT, C/C++ #pragma runopts, or PLIXOPT).

The default value for non-CICS applications is XPLINK(OFF). XPLINK is ignored on CICS.

### Off
Specifies that no programs containing XPLINK-compiled functions will be run. XPLINK resources will not be committed.

OFF is the default.

### On
Specifies that at some time during the execution of an application, an XPLINK-compiled function may be called. XPLINK resources will be committed so that when this occurs, the XPLINK function can properly execute.

### Usage notes
The XPLINK(ON) runtime option is provided for application compatibility. It should be specified only for applications that:

- Have a non-XPLINK main(),
- Use XPLINK resources during their execution (for example, calls to an XPLINK function in a DLL), and have been tested to run in an XPLINK environment (that is, they do not use any resources or subsystems that are restricted in an XPLINK environment) Blindly running a non-XPLINK application in an XPLINK environment by specifying the XPLINK(ON) runtime option could result in performance degradation or application abends.

For these reasons, the XPLINK(ON) application should only be specified for individual applications that require it. That is why you cannot set XPLINK(ON) as a system-level or region-level default.

- If the XPLINK runtime option is not specified and the initial program contains at least one XPLINK-compiled part, then the XPLINK runtime option will be forced to (ON). No message will be issued to indicate this action.
- When an application is running in an XPLINK environment (that is, either the XPLINK(ON) runtime option was specified, or the initial program contained at least one XPLINK compiled part), the ALL31 runtime option will be forced to ON. No AMODE 24 routines are allowed in an enclave that uses XPLINK.
No message will be issued to indicate this action. If a Language Environment runtime options report is generated using the RPTOPTS runtime option, the ALL31 option will be reported as "Override" under the LAST WHERE SET column.

- When an application is running in an XPLINK environment (that is, either the XPLINK(ON) runtime option was specified, or the initial program contained at least one XPLINK compiled part), the STACK runtime option will be forced to STACK(,,ANY). Only the third suboption is changed by this action to indicate that STACK storage can be allocated anywhere in storage. No message will be issued to indicate this action. If a Language Environment runtime options report is generated using the RPTOPTS runtime option, the STACK option will be reported as "Override" under the LAST WHERE SET column.

**Performance considerations**

- When XPLINK(ON) is in effect, resources required for the execution of an XPLINK-compiled function are committed. This includes, for example, allocation of a downward-growing stack segment. If no XPLINK functions are invoked, then these are resources that are not available to an XPLINK function.

- If the application contains C or C++ and XPLINK(ON) is specified, then the XPLINK-compiled version of the C Runtime Library is loaded, which will run on the downward-growing stack. When non-XPLINK functions call C RTL functions in this environment, a swap from the upward-growing stack to the downward-growing stack will occur. This results in additional overhead that could cause performance degradation. Applications that make heavy use of the C RTL from non-XPLINK callers should be aware of this, and if necessary for performance reasons, either run in a pure non-XPLINK environment with XPLINK(OFF), or convert as much of the application to XPLINK as possible and run with XPLINK(ON).

- Applications that consist only of non-XPLINK functions (for example, COBOL or PL/I) should not specify the XPLINK(ON) runtime option, as just turning this on in these applications will result in a performance degradation.

**XUFLOW**

**Derivation:** eXponent Under FLOW

XUFLOW specifies if an exponent underflow causes a program interrupt. An exponent underflow occurs when a floating point number becomes too small to be represented. The underflow setting is determined at enclave initialization and is updated when new languages are introduced into the application (via fetch or dynamic call, for example). Otherwise, it does not vary while the application is running.

Language Environment preserves the language semantics for C/C++ and COBOL regardless of the XUFLOW setting. Language Environment preserves the language semantics for PL/I only when XUFLOW is set to AUTO or ON. Language Environment does not preserve the language semantics for PL/I when XUFLOW is set to OFF.

An exponent underflow caused by a C/C++ or COBOL program does not cause a condition to be raised. The default value for non-CICS applications is XUFLOW(AUTO).

The default value for CICS applications is XUFLOW(AUTO).

**AUTO**

An exponent underflow causes or does not cause a program interrupt dynamically, based on the HLLs that make up the application. Enablement is determined without user intervention. XUFLOW(AUTO) causes condition management to process underflows only in those applications where the semantics...
of the application languages require it. Normally, XUFLOW(AUTO) provides the best efficiency while meeting language semantics.

AUTO is the default.

**ON**

An exponent underflow causes a program interrupt. XUFLOW(ON) causes condition management to process underflows regardless of the mix of languages; therefore, this setting might be less efficient in applications that consist of languages not requiring underflows to be processed by condition management.

**OFF**

An exponent underflow does not cause a program interrupt; the hardware takes care of the underflow. When you set XUFLOW to OFF, the hardware processes exponent underflows. This is more efficient than condition handling to process the underflow.

**Usage notes**

- **PL/I consideration**—When setting XUFLOW to OFF, be aware that the semantics of PL/I require the underflow to be signaled.
- **z/OS UNIX consideration**—The XUFLOW option applies to the entire enclave and all threads within.

### Language runtime option mapping

Language Environment provides one set of runtime options for applications. These options are processed at the enclave level and allow you to control many aspects of the Language Environment environment.

Most options are applicable to all Language Environment-conforming languages. In addition, although Language Environment assists migration by mapping current HLL options to the options of Language Environment, the runtime options of a particular HLL product might change in the Language Environment-enabled version. However, Language Environment has attempted to maintain runtime options consistently across language products while minimizing required changes within each product.

Tables of pre-Language Environment, HLL-specific options and their Language Environment equivalents are provided in the [z/OS Language Environment Runtime Application Migration Guide](#). The mapping is performed automatically by Language Environment, except where noted.
Part 2. Language Environment callable services

The following sections contain detailed information about how to use the Language Environment callable services.
Chapter 3. Quick reference tables for Language Environment services

The following tables are a quick reference of the Language Environment callable services and math services.

**Note:** Language Environment callable services are not supported for AMODE 64 applications.

## Bit manipulation routines

### Table 8: Bit manipulation routines

<table>
<thead>
<tr>
<th>Callable service</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEESICLR</td>
<td>Bit clear. See “CEESICLR—Bit clear” on page 379.</td>
</tr>
<tr>
<td>CEESISHF</td>
<td>Bit shift. See “CEESISHF—Bit shift” on page 380.</td>
</tr>
<tr>
<td>CEESITST</td>
<td>Bit test. See “CEESITST—Bit test” on page 381.</td>
</tr>
</tbody>
</table>

## Condition-handling callable services

### Table 9: Condition-handling callable services

<table>
<thead>
<tr>
<th>Callable service</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE3CIB</td>
<td>Returns a pointer to a condition information block (CIB) associated with a given condition token. See “CEE3CIB—Return pointer to condition information block” on page 119.</td>
</tr>
<tr>
<td>CEE3GRN</td>
<td>Gets the name of the most current Language Environment-conforming routine in which a condition occurred. See “CEE3GRN—Get name of routine that incurred condition” on page 143.</td>
</tr>
<tr>
<td>CEE3GRO</td>
<td>Returns the offset within a failing routine of the most recent condition. See “CEE3GRO—Get offset of condition” on page 147.</td>
</tr>
<tr>
<td>CEE3SPM</td>
<td>Queries and modifies the enablement of Language Environment hardware conditions. See “CEE3SPM—Query and modify Language Environment hardware condition enablement” on page 180.</td>
</tr>
<tr>
<td>CEE3SRP</td>
<td>Sets the resume point at the next instruction in the calling routine to be used by CEEMRCE. See “CEE3SRP—Set resume point” on page 185.</td>
</tr>
<tr>
<td>CEECOD</td>
<td>Decodes an existing condition token. See “CEECOD—Decompose a condition token” on page 220.</td>
</tr>
<tr>
<td>CEEENV</td>
<td>Processes environment variables based on the function codes that were passed as input. See “CEEENV—Process environmental variables” on page 234.</td>
</tr>
<tr>
<td>CEEGQDT</td>
<td>Provides a mechanism by which application code can retrieve the q_data_token from the instance-specific information (ISI). See “CEEQDT—Retrieve q_data_token” on page 268.</td>
</tr>
<tr>
<td>CEEHDLR</td>
<td>Registers a user condition handler for the current stack frame. See “CEEHDLR—Register user-written condition handler” on page 281.</td>
</tr>
<tr>
<td>CEEHDLU</td>
<td>Unregisters a user-written condition handler for the current stack frame. See “CEEHDLU—Unregister user-written condition handler” on page 287.</td>
</tr>
</tbody>
</table>
### Table 9: Condition-handling callable services (continued)

<table>
<thead>
<tr>
<th>Callable service</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEEITOK</td>
<td>Computes the initial condition token for the current condition information block. See “Condition-handling callable services” on page 97.</td>
</tr>
<tr>
<td>CEEMRCE</td>
<td>Resumes execution of a user routine at the location that was established by CEE3SRP. See “CEEMRCE—Move resume cursor explicit” on page 314.</td>
</tr>
<tr>
<td>CEMRCCR</td>
<td>Moves the resume cursor to a position relative to the current position of the handle cursor. See “CEEMRCCR—Move resume cursor” on page 319.</td>
</tr>
<tr>
<td>CEENCOD</td>
<td>Dynamically constructs a condition token. See “CEENCOD—Construct a condition token” on page 331.</td>
</tr>
<tr>
<td>CEERCDM</td>
<td>Records information for the active condition so that the information can be retrieved from the CIB later. See “CEERCDM—Record information for an active condition” on page 346.</td>
</tr>
<tr>
<td>CEESGL</td>
<td>Raises, or signals, a condition to the condition manager. See “CEESGL—Signal a condition” on page 365.</td>
</tr>
</tbody>
</table>

### Date and time callable services

### Table 10: Date and time callable services

<table>
<thead>
<tr>
<th>Callable service</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEECBLDY</td>
<td>Converts a string representing a date to a COBOL integer format. See “CEECBLDY—Convert date to COBOL Integer format” on page 190.</td>
</tr>
<tr>
<td>CEEDATE</td>
<td>Converts a number representing a Lilian date to a date written in character format. See “CEEDATE—Convert Lilian date to character format” on page 205.</td>
</tr>
<tr>
<td>CEEDATM</td>
<td>Converts a number representing the number of seconds since 00:00:00 14 October 1582 to character format. See “CEEDATM—Convert seconds to character timestamp” on page 210.</td>
</tr>
<tr>
<td>CEEDAYS</td>
<td>Converts a string representing a date to a Lilian format. See “CEEDAYS—Convert date to Lilian format” on page 215.</td>
</tr>
<tr>
<td>CEEDYWK</td>
<td>Calculates the day of the week on which a Lilian date falls. See “CEEDYWK—Calculate day of week from Lilian date” on page 231.</td>
</tr>
<tr>
<td>CEEGMT</td>
<td>Computes the current Greenwich Mean Time (GMT) as both a Lilian date and as the number of seconds since 00:00:00 14 October 1582. See “CEEGMT—Get current Greenwich Mean Time” on page 259.</td>
</tr>
<tr>
<td>CEEGMTO</td>
<td>Computes values to the calling routine that represent the difference between the local system time and Greenwich Mean Time. See “CEEGMT—Get offset from Greenwich Mean Time to local time” on page 262.</td>
</tr>
<tr>
<td>CEEISSEC</td>
<td>Converts separate binary integers representing year, month, day, hour, minute, second, and millisecond to a number representing the number of seconds since 00:00:00 14 October 1582. See “CEEISSEC—Convert integers to seconds” on page 291.</td>
</tr>
<tr>
<td>CEELOCT</td>
<td>Gets the current local time in three formats. See “CEELOCT—Get current local date or time” on page 304.</td>
</tr>
<tr>
<td>CEEQCEN</td>
<td>Queries the century within which Language Environment assumes two-digit year values lie. See “CEEQCEN—Query the century window” on page 336.</td>
</tr>
<tr>
<td>CEESCEN</td>
<td>Sets the century in which Language Environment assumes two-digit year values lie. See “CEESCEN—Set the century window” on page 348.</td>
</tr>
</tbody>
</table>
| CEESECII         | Converts a number representing the number of seconds since 00:00:00 14 October 1582 to seven separate binary integers representing year, month, day, hour, minute, second, and millisecond. See “CEESECII—Convert seconds to integers” on page 353.
## Table 10: Date and time callable services (continued)

<table>
<thead>
<tr>
<th>Callable service</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEESECS</td>
<td>Converts a string representing a timestamp into a number representing the number of seconds since 00:00:00 14 October 1582. See “CEESECS—Convert timestamp to seconds” on page 357.</td>
</tr>
</tbody>
</table>

## Dynamic storage callable services

### Table 11: Dynamic storage callable services

<table>
<thead>
<tr>
<th>Callable service</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE3RPH</td>
<td>Sets the heading displayed at the top of the storage or options reports that are generated when you specify the RPTSTG(ON) or RPTOPTS(ON) runtime options. See “CEE3RPH—Set report heading” on page 177.</td>
</tr>
<tr>
<td>CEECRHP</td>
<td>Creates additional heaps. See “CEECRHP—Create new additional heap” on page 197.</td>
</tr>
<tr>
<td>CEECZST</td>
<td>Changes the size of a previously allocated storage element, while preserving its contents. See “CEECZST—Reallocate (change size of) storage” on page 201.</td>
</tr>
<tr>
<td>CEEDSHP</td>
<td>Discards an entire heap that you created previously with a call to CEECRHP. See “CEEDSHP—Discard heap” on page 228.</td>
</tr>
<tr>
<td>CEEFRST</td>
<td>Frees storage previously allocated by CEEGTST. See “CEEFRST—Free heap storage” on page 250.</td>
</tr>
<tr>
<td>CEEGTST</td>
<td>Allocates storage from a heap whose ID you specify. See “CEEGTST—Get heap storage” on page 276.</td>
</tr>
</tbody>
</table>

## General callable services

### Table 12: General callable services

<table>
<thead>
<tr>
<th>Callable service</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE3DLY</td>
<td>Suspends processing of an active enclave for a specified number of seconds. See “CEE3DLY—Suspend processing of the active enclave in seconds” on page 126.</td>
</tr>
<tr>
<td>CEE3DMP</td>
<td>Generates a Language Environment formatted dump of the runtime environment and member language libraries. See “CEE3DMP—Generate the dump” on page 129.</td>
</tr>
<tr>
<td>CEE3INF</td>
<td>Returns to the calling routine information about the system, subsystem, environment, member languages, and version of Language Environment associated with the enclave. See “CEE3INF—Query enclave information” on page 151.</td>
</tr>
<tr>
<td>CEE3PRM</td>
<td>Returns to the calling routine the argument string that was specified at program invocation. See “CEE3PRM—Query parameter string” on page 172.</td>
</tr>
<tr>
<td>CEE3PR2</td>
<td>Returns to the calling routine the argument string and its associated length that was specified at program invocation. See “CEE3PR2—Query parameter string” on page 172.</td>
</tr>
<tr>
<td>CEE3USR</td>
<td>Sets or queries one of two 4-byte fields known as the user area fields. See “CEE3USR—Set or query user area fields” on page 186.</td>
</tr>
<tr>
<td>CEEDLYM</td>
<td>Suspends processing of an active enclave for a specified number of milliseconds. See “CEEDLYM—Suspend processing of the active enclave in milliseconds” on page 225.</td>
</tr>
<tr>
<td>CEEGPID</td>
<td>Retrieves the version of Language Environment that is currently in use. See “CEEGPID—Retrieve the Language Environment version and platform ID” on page 265.</td>
</tr>
</tbody>
</table>
### General callable services (continued)

<table>
<thead>
<tr>
<th>Callable service</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEEGTJS</td>
<td>Retrieves the value of an exported JCL symbol. See “CEEGTJS—Retrieves the value of an exported JCL symbol” on page 275.</td>
</tr>
<tr>
<td>CEERAN0</td>
<td>Generates a sequence of uniform pseudorandom numbers between 0.0 and 1.0 using the multiplicative congruential method with a user-specified seed. See “CEERAN0—Calculate uniform random numbers” on page 343.</td>
</tr>
<tr>
<td>CEETEST</td>
<td>Invokes a tool for debugging. See “CEETEST—Invoke the debug tool” on page 375.</td>
</tr>
</tbody>
</table>

### Initialization and termination services

<table>
<thead>
<tr>
<th>Callable service</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE3ABD</td>
<td>Stops the enclave with an abend. The abend can be issued either with or without cleanup. See “CEE3ABD—Terminate enclave with an abend” on page 113.</td>
</tr>
<tr>
<td>CEE3AB2</td>
<td>Stops the enclave with an abend and a reason code. The abend can be issued either with or without cleanup. See “CEE3AB2—Terminate enclave with an abend and reason code” on page 116.</td>
</tr>
<tr>
<td>CEE3GRC</td>
<td>Gets the enclave return code. See “CEE3GRC—Get the enclave return code” on page 136.</td>
</tr>
<tr>
<td>CEE3SRC</td>
<td>Sets the enclave return code. See “CEE3SRC—Set the enclave return code” on page 185.</td>
</tr>
</tbody>
</table>

### Locale callable services

<table>
<thead>
<tr>
<th>Callable service</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEEFMON</td>
<td>Formats monetary strings. See “CEEFMON—Format monetary string” on page 243.</td>
</tr>
<tr>
<td>CEEFTDS</td>
<td>Formats time and date into a character string. See “CEEFTDS—Format time and date into character string” on page 254.</td>
</tr>
<tr>
<td>CEELCNV</td>
<td>Queries locale numeric conventions. See “CEELCNV—Query locale numeric conventions” on page 299.</td>
</tr>
<tr>
<td>CEEQDTC</td>
<td>Queries locale date and time conventions and returns the specified format information. See “CEEQDTC—Query locale date and time conventions” on page 338.</td>
</tr>
<tr>
<td>CEEQRYL</td>
<td>Queries the active locale environment. See “CEEQRYL—Query active locale environment” on page 342.</td>
</tr>
<tr>
<td>CEESCOL</td>
<td>Compares the collation weights of two strings. See “CEESCOL—Compare collation weight of two strings” on page 350.</td>
</tr>
<tr>
<td>CEESETL</td>
<td>Sets the locale operating environment. “CEESETL—Set locale operating environment” on page 362.</td>
</tr>
<tr>
<td>CEESTXF</td>
<td>Transforms string characters into collation weights. See “CEESTXF—Transform string characters into collation weights” on page 369.</td>
</tr>
</tbody>
</table>
## Math services

<table>
<thead>
<tr>
<th>Math service</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEEsxABS</td>
<td>Absolute value. See “CEESxABS—Absolute value” on page 385.</td>
</tr>
<tr>
<td>CEEsxACS</td>
<td>Arccosine. See “CEESxACS—Arccosine” on page 386.</td>
</tr>
<tr>
<td>CEEsxASN</td>
<td>Arcsine. See “CEESxASN—Arcsine” on page 387.</td>
</tr>
<tr>
<td>CEEsxATH</td>
<td>Hyperbolic arctangent. See “CEESxATH—Hyperbolic arctangent” on page 387.</td>
</tr>
<tr>
<td>CEEsxATN</td>
<td>Arctangent. See “CEESxATN—Arctangent” on page 388.</td>
</tr>
<tr>
<td>CEEsxAT2</td>
<td>Arctangent of two arguments. See “CEESxAT2—Arctangent2” on page 389.</td>
</tr>
<tr>
<td>CEEsxCJG</td>
<td>Conjugate complex. See “CEESxCJG—Conjugate of complex” on page 390.</td>
</tr>
<tr>
<td>CEEsxCOS</td>
<td>Cosine. See “CEESxCOS—Cosine” on page 391.</td>
</tr>
<tr>
<td>CEEsxCSH</td>
<td>Hyperbolic cosine. See “CEESxCSH—Hyperbolic cosine” on page 392.</td>
</tr>
<tr>
<td>CEEsxCTN</td>
<td>Cotangent. See “CEESxCTN—Cotangent” on page 393.</td>
</tr>
<tr>
<td>CEEsxDIM</td>
<td>Positive difference. See “CEESxDIM—Positive difference” on page 394.</td>
</tr>
<tr>
<td>CEEsxDVD</td>
<td>Division. See “CEESxDVD—Floating-point complex divide” on page 395.</td>
</tr>
<tr>
<td>CEEsxERC</td>
<td>Error function complement. See “CEESxERC—Error function complement” on page 396.</td>
</tr>
<tr>
<td>CEEsxERF</td>
<td>Error function. See “CEESxERF—Error function” on page 396.</td>
</tr>
<tr>
<td>CEEsxEXP</td>
<td>Exponential (base e). See “CEESxEXP—Exponential base e” on page 397.</td>
</tr>
<tr>
<td>CEEsxGMA</td>
<td>Gamma function. See “CEESxGMA—Gamma function” on page 398.</td>
</tr>
<tr>
<td>CEEsxIMG</td>
<td>Imaginary part of complex. See “CEESxIMG—Imaginary part of complex” on page 399.</td>
</tr>
<tr>
<td>CEEsxINT</td>
<td>Truncation. See “CEESxINT—Truncation” on page 400.</td>
</tr>
<tr>
<td>CEEsxLGM</td>
<td>Log gamma function. See “CEESxLGM—Log gamma” on page 401.</td>
</tr>
<tr>
<td>CEEsxLG1</td>
<td>Logarithm base 10. See “CEESxLG1—Logarithm base 10” on page 401.</td>
</tr>
<tr>
<td>CEEsxLG2</td>
<td>Logarithm base 2. See “CEESxLG2—Logarithm base 2” on page 402.</td>
</tr>
<tr>
<td>CEEsxLOG</td>
<td>Logarithm base e. See “CEESxLOG—Logarithm base e” on page 403.</td>
</tr>
<tr>
<td>CEEsxMLT</td>
<td>Floating-point complex multiplication. See “CEESxMLT—Floating-point complex multiply” on page 404.</td>
</tr>
<tr>
<td>CEEsxMOD</td>
<td>Modular arithmetic. See “CEESxMOD—Modular arithmetic” on page 404.</td>
</tr>
<tr>
<td>CEEsxNIN</td>
<td>Nearest integer. See “CEESxNIN—Nearest integer” on page 405.</td>
</tr>
<tr>
<td>CEEsxNWN</td>
<td>Nearest whole number. See “CEESxNWN—Nearest whole number” on page 406.</td>
</tr>
<tr>
<td>CEEsxSGN</td>
<td>Transfer of sign. See “CEESxSGN—Transfer of sign” on page 407.</td>
</tr>
<tr>
<td>CEEsxSIN</td>
<td>Sine. See “CEESxSIN—Sine” on page 408.</td>
</tr>
<tr>
<td>CEEsxSNH</td>
<td>Hyperbolic sine. See “CEESxSNH—Hyperbolic sine” on page 409.</td>
</tr>
<tr>
<td>CEEsxSQT</td>
<td>Square root. See “CEESxSQT—Square root” on page 410.</td>
</tr>
<tr>
<td>CEEsxTAN</td>
<td>Tangent. See “CEESxTAN—Tangent” on page 411.</td>
</tr>
<tr>
<td>CEEsxTNH</td>
<td>Hyperbolic tangent. See “CEESxTNH—Hyperbolic tangent” on page 412.</td>
</tr>
<tr>
<td>CEEsxXPx</td>
<td>Exponential (**). See “CEESxXPx—Exponentiation” on page 413.</td>
</tr>
</tbody>
</table>
### Message handling callable services

**Table 16: Message handling callable services**

<table>
<thead>
<tr>
<th>Callable service</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEECMI</td>
<td>Stores message insert data. See “CEECMI—Store and load message insert data” on page 193.</td>
</tr>
<tr>
<td>CEEMGET</td>
<td>Retrieves a message corresponding to a condition token returned from a callable service. See “CEEMGET—Get a message” on page 307.</td>
</tr>
<tr>
<td>CEEMOUT</td>
<td>Writes a specified message to the message string file. See “CEEMOUT—Dispatch a message” on page 312.</td>
</tr>
<tr>
<td>CEEMSG</td>
<td>Retrieves a message corresponding to a condition token received and writes it to the message file. See “CEEMSG—Get, format, and dispatch a message” on page 328.</td>
</tr>
</tbody>
</table>

### National Language Support callable services

**Table 17: National Language Support and National Language Architecture callable services**

<table>
<thead>
<tr>
<th>Callable service</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE3CTY</td>
<td>Changes or queries the current national country setting. See “CEE3CTY—Set the default country” on page 122.</td>
</tr>
<tr>
<td>CEE3LNG</td>
<td>Changes or queries the current national language. See “CEE3LNG—Set national language” on page 155.</td>
</tr>
<tr>
<td>CEE3MCS</td>
<td>Gets the default currency symbol for a country specified in country_code. See “CEE3MCS—Get default currency symbol” on page 161.</td>
</tr>
<tr>
<td>CEE3MC2</td>
<td>Gets the default currency symbol and the international currency symbol for a country specified in country_code. See “CEE3MC2—Get default and international currency symbols” on page 164.</td>
</tr>
<tr>
<td>CEE3MDS</td>
<td>Gets the default decimal separator for the country specified in country_code. See “CEE3MDS—Get default decimal separator” on page 167.</td>
</tr>
<tr>
<td>CEE3MTS</td>
<td>Gets the default thousands separator for the country that you specify in country_code. See “CEE3MTS—Get default thousands separator” on page 169.</td>
</tr>
<tr>
<td>CEEFMDA</td>
<td>Gets the default date picture string for a country specified in country_code. See “CEEFMDA—Get default date format” on page 238.</td>
</tr>
<tr>
<td>CEEFMDT</td>
<td>Gets the default date and time picture strings for the country specified in country_code. See “CEEFMDT—Get default date and time format” on page 241.</td>
</tr>
<tr>
<td>CEEFMTM</td>
<td>Gets the default time picture string for the country specified in country_code. See “CEEFMTM—Get default time format” on page 247.</td>
</tr>
</tbody>
</table>
Chapter 4. Using Language Environment callable services

**Restriction:** Language Environment services are not supported for AMODE 64 applications.

This topic provides syntax and examples of Language Environment callable services, which you can invoke from applications generated with the following IBM compiler products:

- IBM z/OS XL C/C++
- C/C++ for MVS/ESA
- IBM SAA AD/Cycle C/370
- Enterprise COBOL for z/OS
- Enterprise PL/I for z/OS
- IBM COBOL for OS/390 & VM
- IBM COBOL for MVS & VM
- IBM PL/I for MVS & VM

You can invoke Language Environment callable services from assembler programs using the CEEENTRY and associated macros. While you cannot call these services directly from Fortran programs, you can use the Fortran routines AFHCEEN and AFHCEEF to invoke most of these services. (See *Language Environment for MVS & VM Fortran Run-Time Migration Guide* You can use the other languages to perform these services on behalf of a Fortran program.

**Note:**

1. Customers using this information may not have pre-Language Environment runtime libraries.
2. You can use DYNAMIC calls from VS COBOL II programs to Language Environment Date/Time callable services. You can not use DYNAMIC calls from VS COBOL II programs to other Language Environment callable services. You can not use STATIC calls from VS COBOL II programs to any Language Environment callable services.
3. A Language Environment callable service used by application programmers can also be called an application writer interface (AWI).

Language Environment callable services provide functions that pre-Language Environment runtime libraries might not provide. You can use these services alone or with Language Environment runtime options, which customize your runtime environment. For guidelines about writing your own callable services, see *z/OS Language Environment Programming Guide*.

**Locating callable service information**

The following sections help you use the Language Environment callable services. For a summary of Language Environment callable services, see Chapter 1, “Summary of Language Environment runtime options,” on page 3.

- “General usage notes for callable services” on page 104
- “Invoking callable services” on page 104
- “Data type definitions” on page 108
- Chapter 5, “Callable services,” on page 113
General usage notes for callable services

- You can invoke callable services from any Language Environment-conforming HLL except where otherwise noted.
- You might receive feedback codes from services other than the one you are invoking because the callable services invoke other callable services that might return a feedback code.
- Callable services that are intended to be available on any platform that Language Environment supports are prefixed with CEE. Callable services that are defined only for S/370 are prefixed with CEE3.
- Routines that invoke callable services do not need to be in 31-bit addressing mode. 31-bit addressing mode switching is performed implicitly without any action that is required by the calling routine, if you specify the ALL31(OFF) runtime option (see “ALL31” on page 11).

However, if AMODE switching occurs and your program makes many calls to Language Environment callable services, the switching time can slow down your application. Run with AMODE(31), if possible, to avoid unnecessary mode switching.

- In Language Environment, all parameters are indirectly passed by reference. The code in the following COBOL call that omits the fc parameter might cause unpredictable results.

```cobol
CALL CEEDATE USING X,Y,Z. **Invalid**
```

The following invalid PL/I call that omits the fc parameter might also cause unpredictable results.

```pli
DCL CEEDATE ENTRY OPTIONS(ASM);
CALL CEEDATE(x,y,z); /* invalid */
```

The following example shows valid COBOL calls that use the optional fc parameter

```cobol
CALL CEEDATE USING X,Y,Z,OMITTED.
CALL CEEDATE USING X,Y,Z,FC.
```

The following example shows valid PL/I calls that use the optional fc parameter.

```pli
DCL CEEDATE ENTRY(*,*,* OPTIONAL) OPTIONS(ASM);
CALL CEEDATE(x,y,z,*) ; /* valid */
CALL CEEDATE(x,y,z,fc) ; /* valid */
```

The COBOL examples are valid only for COBOL for MVS & VM Release 2 or later.

Invoking callable services

You can invoke Language Environment callable services from assembler routines, HLL-generated object code, HLL library routines, other Language Environment library routines, and user-written HLL calls. When you want to access Language Environment library routines, you can use the same type of user-written HLL calls and functions you currently use for your HLL applications.

This topic provides syntax and examples to help you request callable services from C/C++, COBOL, and PL/I.

Header, copy, or include files

Many of the programming examples in this section imbed header, copy, or include files. (Whether you call the files header files, copy files, or include files depends on the language you are using.) These files can save you time by providing declarations for symbolic feedback codes and Language Environment callable services that you would otherwise need to code in your program. They can also help you reduce errors by verifying correct usage of Language Environment callable services at compile time.

Table 18 on page 105 summarizes the names and descriptions of the files imbedded in the callable service examples in this section.
### Table 18: Files used in C/C++, COBOL, and PL/I examples

<table>
<thead>
<tr>
<th>File name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ceeedctct.h</td>
<td>C declarations for Language Environment symbolic feedback codes</td>
</tr>
<tr>
<td>leawi.h</td>
<td>Declarations of Language Environment callable services and OMIT_FC, which is used to explicitly omit the fc parm, for routines written in C/C++</td>
</tr>
<tr>
<td>CEEIGZCI</td>
<td>Declarations for condition information block</td>
</tr>
<tr>
<td>CEEIGZCT</td>
<td>Declarations for Language Environment symbolic feedback codes</td>
</tr>
<tr>
<td>CEEIGZLC</td>
<td>Locale category constants LC-ALL, LC-COLLATE, LC-CTYPE, LC-MESSAGES, LC-MONETARY, LC-NUMERIC, LC-TIME, and version_info structure.</td>
</tr>
<tr>
<td>CEEIGZTD</td>
<td>TD-STRUCT structure needed for CEEFTDS calls</td>
</tr>
<tr>
<td>CEEIGZNM</td>
<td>NM-STRUCT structure needed for CEELCNV calls</td>
</tr>
<tr>
<td>CEEIGZN2</td>
<td>NM-STRUCT structure needed for ISO/IEC 9899:1999 (C99) support of CEELCNV calls</td>
</tr>
<tr>
<td>CEEIGZDT</td>
<td>DTCONV structure needed for CEEQDTC calls</td>
</tr>
<tr>
<td>CEEIGZD2</td>
<td>DTCONV structure needed for C99 support of CEEQDTC calls</td>
</tr>
<tr>
<td>CEEIBMAW</td>
<td>Language Environment callable service declarations for routines written in PL/I</td>
</tr>
<tr>
<td>CEEIBMCI</td>
<td>Declarations for condition information block</td>
</tr>
<tr>
<td>CEEIBMCT</td>
<td>Declarations for Language Environment symbolic feedback codes</td>
</tr>
<tr>
<td>CEEIBMTC</td>
<td>Locale category constants LC-ALL, LC-COLLATE, LC-CTYPE, LC-MESSAGES, LC-MONETARY, LC-NUMERIC, LC-TIME, and version_info structure.</td>
</tr>
<tr>
<td>CEEIBMTD</td>
<td>TD-STRUCT structure needed for CEEFTDS calls</td>
</tr>
<tr>
<td>CEEIBMNM</td>
<td>NM-STRUCT structure needed for CEELCNV calls</td>
</tr>
<tr>
<td>CEEIBMNM2</td>
<td>NM-STRUCT structure needed for C99 support of CEELCNV calls</td>
</tr>
<tr>
<td>CEEIBMDT</td>
<td>DTCONV structure needed for CEEQDTC calls</td>
</tr>
<tr>
<td>CEEIBMD2</td>
<td>DTCONV structure needed for C99 support of CEEQDTC calls</td>
</tr>
<tr>
<td>CEEFORCT</td>
<td>Fortran declarations for Language Environment symbolic feedback codes</td>
</tr>
</tbody>
</table>

**Note:**

1. A symbolic feedback code is a symbolic representation of a condition token.
2. PL/I routines that imbed CEEIBMAW require the MACRO compiler option.
3. COBOL does not require declarations of external programs; therefore, you do not need declarations of Language Environment callable services for programs written in COBOL.
4. CEEIBMxx parts support PL/I applications.
5. CEEIGZxx parts support COBOL applications.

On z/OS, these files are contained in the Language Environment SCEESAMP partitioned data set, except for leawi.h, which is contained in the SCEEH.H partitioned data set. You can imbed these files using the statement appropriate for the language your routine is written in, as shown in Table 19 on page 105. Examples of these statements are shown in the following topics on syntax.

### Table 19: Imbedding files in your routines

<table>
<thead>
<tr>
<th>To imbed a file in a...</th>
<th>Use statement...</th>
</tr>
</thead>
<tbody>
<tr>
<td>C/C++ routine</td>
<td>#include</td>
</tr>
</tbody>
</table>
Table 19: Imbedding files in your routines (continued)

<table>
<thead>
<tr>
<th>To imbed a file in a...</th>
<th>Use statement...</th>
</tr>
</thead>
<tbody>
<tr>
<td>COBOL program</td>
<td>COPY</td>
</tr>
<tr>
<td>PL/I routine</td>
<td>%include</td>
</tr>
</tbody>
</table>

Sample programs

Sample C/C++, COBOL, and PL/I programs are provided for most of the callable services. Sample
FORTRAN programs are not provided because you cannot invoke Language Environment callable services
from Fortran programs. However, you can use other languages to perform these services on behalf of a
Fortran program. These sample programs are also provided online with the Language Environment
product for your convenience. On MVS, the sample routines are located in the SCEESAMP partitioned data
set.

C/C++ syntax

In C or C++, use the following syntax to invoke a Language Environment callable service with a feedback
code in effect:

```
ceexxxx(par1, par2, ..., parmn, fc);
```

Note: "..." is "and so on," not the C ellipsis operator.

Use the following syntax to invoke callable services with an omitted feedback code parameter:

```
CEExxxx(par1, par2, ..., parmn, NULL);
```

See “Parameter list for invoking callable services” on page 107 for a description of this syntax.

Language Environment callable services always have a return type of void and should be prototyped as
such.

Input strings for callable services are not NULL terminated in C/C++.

You can use the SCEEH file leawi.h to declare Language Environment callable services, in conjunction
with a C/C++ call to a Language Environment callable service, as shown in the following sample callable
services invocation syntax for C/C++.

```c
#include <leawi.h>
int main(void)
{
  CEExxxx(par1, par2, ... parmn, fc);
}
```

To help in checking the success of your applications, Language Environment provides FB_CHECK in the
cceecdcct.h file. FB_CHECK compares a feedback code against a condition token you supply to determine
whether you receive the feedback code you should.

COBOL syntax

In COBOL, use the following syntax to invoke Language Environment callable services:

```
CALL "CEExxxx" USING par1, par2, ..., parmn, fc
```

You can call Language Environment services either statically or dynamically from COBOL applications.
The Language Environment callable services are architected as low maintenance stubs that branch to the actual runtime routine that performs the service. Static CALL to these stubs is the preferred choice for best performance. This avoids the overhead of a COBOL dynamic call without the usual maintainability disadvantage of a more robust statically link-edited routine.

See “Parameter list for invoking callable services” on page 107 for a description of this syntax.

You can use the SCEESAMP file CEEIGZCT to declare symbolic Language Environment feedback codes, in conjunction with a COBOL call to a Language Environment callable service to return a feedback code, as shown in the following example:

```
COPY CEEIGZCT.
CALL "CEExxxx" USING parm1, parm2, ... parmn, fc
```

COBOL for MVS & VM Release 2 or later also allows you to omit arguments. In place of the argument, use the OMITTED parameter, as shown in the following example:

```
CALL "CEExxxx" USING parm1, parm2, ... parmn, OMITTED
```

PL/I syntax

In PL/I, use the following syntax to invoke a Language Environment callable service with a feedback code in effect:

```
CALL CEExxxx (parm1, parm2, ... parmn, fc);
```

PL/I also allows you to omit arguments. In place of the argument, code an asterisk (*), as shown in the following example:

```
CALL CEExxxx (*, *, ..., );
```

You cannot invoke callable services as function references.

See “Parameter list for invoking callable services” on page 107 for a description of this syntax.

The value of register 15 upon return from any Language Environment callable service is undefined. Use of OPTIONS(RETCODE) is not recommended, because a subsequent use of the PLIRETV built-in function returns an undefined value.

If you code your own declarations for the Language Environment callable services, be sure to specify all required arguments in the CALL statement. “General usage notes for callable services” on page 104 illustrates a call in which the feedback code to CEEDATE was incorrectly omitted.

You can use the SCEESAMP file CEEIBMAW to declare Language Environment callable services with a PL/I call to a Language Environment callable service, as the following example shows.

```
%INCLUDE CEEIBMAW;
CALL CEExxxx(parm1, parm2, ... parmn, fc);
```

Parameter list for invoking callable services

This section describes the syntax and parameters you need to invoke Language Environment callable services.

**CEExxxx**

The name of the callable service. By including a reference to a header file in your code, you can avoid declaring each callable service as an external entry. See “Header, copy, or include files” on page 104 for these file names.
**parm1 parm2 ... parm**n
Optional or required parameters passed to or returned from the called service. Some callable service parameters are optional in C/C++ and PL/I only. If you do not want to pass the parm or you do not want the return value, you can omit the parm, using the appropriate syntax to indicate that the parm is omitted.

**fc**
A feedback code that indicates the result of the service. *fc* can be omitted when you use C/C++, PL/I, and COBOL (COBOL for MVS & VM Release 2 or later).

If you specify *fc* as an argument, feedback information in the form of a condition token is returned to the calling routine. The condition token indicates whether the service completed successfully or whether a condition was encountered while the service was running. In Language Environment you can decode the condition token so that it can be acted on.

If you omit *fc* as an argument, using the appropriate syntax to indicate *fc* is omitted, the condition is signaled if the service was not successful.

Because callable services call other services, these other services might generate feedback codes.

### Data type definitions
Parameters in Language Environment are defined as specific data types, such as:
- Fullword binary integer
- Short floating-point hexadecimal
- Long floating-point hexadecimal
- Fixed-length character string with a predefined length
- Entry variable
- Character string with a halfword prefix indicating its current length

Table 20 on page 108, Table 21 on page 109, and Table 22 on page 110 contain data type definitions and their descriptions for C/C++, COBOL, and PL/I, respectively.

### C/C++ data type definitions
Table 20 on page 108 includes data type definitions and their descriptions for C/C++.

<table>
<thead>
<tr>
<th>Data type</th>
<th>Description</th>
<th>C/C++</th>
</tr>
</thead>
<tbody>
<tr>
<td>INT2</td>
<td>A 2-byte signed integer</td>
<td>signed short</td>
</tr>
<tr>
<td>INT4</td>
<td>A 4-byte signed integer</td>
<td>signed int</td>
</tr>
<tr>
<td>FLOAT4</td>
<td>A 4-byte single-precision floating-point number</td>
<td>float</td>
</tr>
<tr>
<td>FLOAT8</td>
<td>An 8-byte double-precision floating-point number</td>
<td>double</td>
</tr>
<tr>
<td>FLOAT16</td>
<td>A 16-byte extended-precision floating-point number</td>
<td>long double</td>
</tr>
<tr>
<td>COMPLEX8</td>
<td>Short floating-point complex hex number: an 8-byte complex number, whose real and imaginary parts are each 4-byte single-precision floating-point numbers</td>
<td>Not available</td>
</tr>
</tbody>
</table>
### Table 20: Data type definitions for C/C++ (continued)

<table>
<thead>
<tr>
<th>Data type</th>
<th>Description</th>
<th>C/C++</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMPLEX16</td>
<td>Long floating-point complex hex number: a 16-byte complex number, whose real and imaginary parts are each 8-byte double-precision floating-point numbers</td>
<td>Not available</td>
</tr>
<tr>
<td>COMPLEX32</td>
<td>Extended floating-point hex number: a 32-byte complex number, whose real and imaginary parts are each 16-byte extended-precision floating-point numbers</td>
<td>Not available</td>
</tr>
<tr>
<td>POINTER</td>
<td>A platform-dependent address pointer</td>
<td>void *</td>
</tr>
<tr>
<td>CHARn</td>
<td>A string (character array) of length n</td>
<td>char[n]</td>
</tr>
</tbody>
</table>
| VSTRING     | A halfword length-prefixed character string (for input); fixed-length 80-character string (for output) | struct _VSTRING(
  _INT2 short length;
  char string[1];
  char string-in;
  char string_out[80];
} |
| FEED_BACK   | A mapping of the condition token (fc)                                        | Case 1:
  typedef struct {
    short tok_sev ;
    short tok_msgno ;
    int  tok_case :2,
    tok_sever:3,
    tok_ctrl :3 ;
    char  tok_facid[3];
    int    tok_isi     ;
  } _FEEDBACK ;

  Case 2:
  typedef struct {
    short tok_sev ;
    short tok_msgno ;
    int  tok_class_code :2,
    tok_cause_code:3,
    tok_ctrl :3 ;
    char  tok_facid[3];
    int    tok_isi     ;
  } _FEEDBACK ; |

| CEE_ENTRY   | An HLL-dependent entry constant                                              | FUNCTION POINTER |

### COBOL data type definitions

Table 21 on page 109 includes data type definitions and their descriptions for COBOL.

### Table 21: Data type definitions for COBOL

<table>
<thead>
<tr>
<th>Data type</th>
<th>Description</th>
<th>COBOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>INT2</td>
<td>A 2-byte signed integer</td>
<td>PIC S9(4) USAGE IS BINARY</td>
</tr>
<tr>
<td>INT4</td>
<td>A 4-byte signed integer</td>
<td>PIC S9(9) USAGE IS BINARY</td>
</tr>
<tr>
<td>FLOAT4</td>
<td>A 4-byte single-precision floating-point number</td>
<td>COMP-1</td>
</tr>
<tr>
<td>FLOAT8</td>
<td>An 8-byte double-precision floating-point number</td>
<td>COMP-2</td>
</tr>
</tbody>
</table>
Table 21: Data type definitions for COBOL (continued)

<table>
<thead>
<tr>
<th>Data type</th>
<th>Description</th>
<th>COBOL</th>
</tr>
</thead>
<tbody>
<tr>
<td>FLOAT16</td>
<td>A 16-byte extended-precision floating-point number</td>
<td>Not available</td>
</tr>
<tr>
<td>COMPLEX8</td>
<td>Short floating-point complex hex number: an 8-byte complex number, whose real and imaginary parts are each 4-byte single-precision floating-point numbers</td>
<td>Not available</td>
</tr>
<tr>
<td>COMPLEX16</td>
<td>Long floating-point complex hex number: a 16-byte complex number, whose real and imaginary parts are each 8-byte double-precision floating-point numbers</td>
<td>Not available</td>
</tr>
<tr>
<td>COMPLEX32</td>
<td>Extended floating-point complex hex number: a 32-byte complex number, whose real and imaginary parts are each 16-byte extended-precision floating-point numbers</td>
<td>Not available</td>
</tr>
<tr>
<td>POINTER</td>
<td>A platform-dependent address pointer</td>
<td>USAGE IS POINTER</td>
</tr>
<tr>
<td>CHARn</td>
<td>A string (character array) of length n</td>
<td>PIC X(n)</td>
</tr>
<tr>
<td>VSTRING</td>
<td>A halfword length-prefixed character string (for input); fixed-length 80-character string (for output)</td>
<td>01 STRING-IN.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>02 LEN</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PIC S9(4) USAGE IS BINARY.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>02 TXT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PIC X(N).</td>
</tr>
<tr>
<td></td>
<td></td>
<td>01 STRING-OUT PIC X(80).</td>
</tr>
<tr>
<td>FEED_BACK</td>
<td>A mapping of the condition token (fc)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Case 1:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>01 FC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>02 SEV PIC S9(4) USAGE IS BINARY.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>02 MSGNO PIC S9(4) USAGE IS BINARY.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>02 FLGS PIC X(1).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>02 FACID PIC X(3).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>02 ISI PIC X(4).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Case 2:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>01 FC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>02 CLASS-CODE PIC 9(4) USAGE IS BINARY.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>02 CAUSE-CODE PIC 9(4) USAGE IS BINARY.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>02 FLGS PIC X(1).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>02 FACID PIC X(3).</td>
<td></td>
</tr>
<tr>
<td></td>
<td>02 ISI PIC X(4).</td>
<td></td>
</tr>
<tr>
<td>CEE_ENTRY</td>
<td>An HLL-dependent entry constant</td>
<td>USAGE IS PROCEDURE-POINTER</td>
</tr>
</tbody>
</table>

PL/I data type definitions

Table 22 on page 110 includes data type definitions and their descriptions for PL/I.

Table 22: Data type definitions for PL/I

<table>
<thead>
<tr>
<th>Data type</th>
<th>Description</th>
<th>PL/I</th>
</tr>
</thead>
<tbody>
<tr>
<td>INT2</td>
<td>A 2-byte signed integer</td>
<td>REAL FIXED BINARY (15,0)</td>
</tr>
<tr>
<td>INT4</td>
<td>A 4-byte signed integer</td>
<td>REAL FIXED BINARY (31,0)</td>
</tr>
<tr>
<td>Data type</td>
<td>Description</td>
<td>PL/I</td>
</tr>
<tr>
<td>-------------</td>
<td>-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>FLOAT4</td>
<td>A 4-byte single-precision floating-point number</td>
<td>REAL FLOAT BINARY (21) or REAL FLOAT DECIMAL (6)</td>
</tr>
<tr>
<td>FLOAT8</td>
<td>An 8-byte double-precision floating-point number</td>
<td>REAL FLOAT BINARY (53) or REAL FLOAT DECIMAL (16)</td>
</tr>
<tr>
<td>FLOAT16</td>
<td>A 16-byte extended-precision floating-point number</td>
<td>REAL FLOAT DECIMAL (33) or REAL FLOAT BINARY (109)</td>
</tr>
<tr>
<td>COMPLEX8</td>
<td>Short floating-point complex hex number: an 8-byte complex number, whose real and imaginary parts are each 4-byte single-precision floating-point numbers</td>
<td>COMPLEX FLOAT DECIMAL (6)</td>
</tr>
<tr>
<td>COMPLEX16</td>
<td>Long floating-point complex hex number: a 16-byte complex number, whose real and imaginary parts are each 8-byte double-precision floating-point numbers</td>
<td>COMPLEX FLOAT DECIMAL (16)</td>
</tr>
<tr>
<td>COMPLEX32</td>
<td>Extended floating-point hex number: a 32-byte complex number, whose real and imaginary parts are each 16-byte extended-precision floating-point numbers</td>
<td>COMPLEX FLOAT DECIMAL (33)</td>
</tr>
<tr>
<td>POINTER</td>
<td>A platform-dependent address pointer</td>
<td>POINTER</td>
</tr>
<tr>
<td>CHARn</td>
<td>A string (character array) of length n</td>
<td>CHAR(n)</td>
</tr>
<tr>
<td>VSTRING</td>
<td>A halfword length-prefixed character string (for input); fixed-length 80-character string (for output)</td>
<td>DCL string_in CHAR(n) VARYING; DCL string_out CHAR(80);</td>
</tr>
<tr>
<td>FEED_BACK</td>
<td>A mapping of the condition token (fc)</td>
<td>Case 1:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Case 2:</td>
</tr>
<tr>
<td></td>
<td></td>
<td>DCL 1 FEEDBACK BASED,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 SEVERITY FIXED BINARY (15),</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 MSGNO FIXED BINARY (15),</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 FLAGS,</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 CASE BIT (2),</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 SEVERITY BIT (3),</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5 CONTROL BIT (3),</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 FACID CHAR (3),</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 ISI FIXED BINARY (31);</td>
</tr>
<tr>
<td>CEE_ENTRY</td>
<td>An HLL-dependent entry constant</td>
<td>ENTRY</td>
</tr>
</tbody>
</table>
Chapter 5. Callable services

This section lists the Language Environment callable services and shows examples of how to use them in C/C++, COBOL, and PL/I.

CEE3ABD—Terminate enclave with an abend

CEE3ABD requests that Language Environment terminate the enclave with an abend. The issuing of the abend can be either with or without clean-up. There is no return from this service, nor is there any condition associated with it.

CEE3ABD

(\texttt{abcode}, \texttt{clean-up})

\texttt{abcode} (input)

A fullword integer, no greater than 4095, specifying the abend code that is issued. Under CICS, this fullword integer is converted to EBCDIC.

\texttt{clean-up} (input)

Indicates if the abend should result in clean-up of the enclave's resources. The acceptable values for \texttt{clean-up} are as follows:

0

Issue the abend without clean-up.

1

Issue the abend with normal enclave termination processing.

2

Issue the abend with enclave termination processing honoring the TERMTHDACT runtime option for taking a system dump of the user address space but suppressing the CEEDUMP.

3

Issue the abend with enclave termination processing suppressing both the CEEDUMP and system dump if requested by the TERMTHDACT runtime option.

4

Issue the abend with enclave termination processing honoring the TERMTHDACT runtime option for taking a CEEDUMP but suppressing the system dump.

5

Issue the abend with enclave termination processing forcing a system dump of the user address space and suppressing the CEEDUMP.

If an illegal value for \texttt{clean-up} is passed, the abend is issued without clean-up.

If \texttt{clean-up} is 0, no Language Environment dump is generated. A system dump, however, is requested when issuing the abend. Under CICS, a transaction dump is taken. To get a dump under CMS, specify FILEDEF SYSABEND PRINTER or FILEDEF SYSUDUMP PRINTER.

If \texttt{clean-up} is 0, Language Environment condition handling is disabled for the current enclave and termination activities are not performed. Event handlers are not driven; the debug tool is not invoked; user exits are not invoked; and user-written condition handlers are not invoked.

When \texttt{clean-up} is 1, the abend is processed in the same manner as if it were a non-Language Environment abend. Its processing is affected by the ABPERC and TRAP options, the filedef abends percolated in the assembler user exit, and other elements of the environment related to abend processing. In particular, the condition handler can intercept the abend and give the application a chance to handle the abend. If the condition remains unhandled, normal termination activities are performed: information such as a Language Environment dump is produced, depending on the setting...
of the TERMTHDACT option; event handlers are driven; z/OS Debugger is invoked; and user exits are invoked. Assembler user exit settings control if the application actually terminates with an abend.

When clean-up is 2, it follows the abend processing as when clean-up is 1 except the CEEDUMP is suppressed.

When clean-up is 3, it follows the abend processing as when clean-up is 1, however CEEDUMP and system dumps are both suppressed.

When clean-up is 4, it follows the abend processing as when clean-up is 1, however only the system dumps are suppressed.

When clean-up is 5, it follows the abend processing as when clean-up is 1, however forcing a system dump to be taken and suppressing the CEEDUMP.

z/OS UNIX considerations

- In a multithreaded environment, CEE3ABD applies to the enclave.
- When ALL31(ON) is in effect, Language Environment allocates thread-specific control blocks from the anywhere heap.

Usage notes

1. Language Environment abend codes are usually in the range of 4000 (X'FA0') to 4095 (X'FFF'). Use the range of 0 to 3999 to avoid confusion with Language Environment abend codes. The value specified for the abend code is passed directly to the ABEND macro without further verification.
2. When TRAP(OFF) is specified, CEE3ABD behaves in a similar manner to clean-up 0.
3. In a non-CICS environment, a system dump of the user address space is taken only if a SYSMDUMP, SYSUDUMP, or SYSABEND DD card is present.
4. Users can look at CEE3AB2 to include user reason codes separately from abend codes.

For more information

- For more information about the ABPERC runtime option, see “ABPERC” on page 9.
- For more information about the TRAP runtime option, see “TRAP” on page 86.
- For more information about the TERMTHDACT runtime option, see “TERMTHDACT” on page 73.
- For more information about the CEE3AB2 callable service, see “CEE3AB2—Terminate enclave with an abend and reason code” on page 116.

Examples

1. An example of CEE3ABD called by C/C++.

```c
#include <leawi.h>

int main(void) {
    _INT4 code, timing;
    code = 1234; /* Abend code to issue */
    timing = 0;
    CEE3ABD
}
```

114 z/OS: Language Environment Programming Reference
2. An example of CEE3ABD called by COBOL.

```cobol
CBL LIB,QUOTE
******************************************************************************
*Module/File Name: IGZT3ABD
******************************************************************************
** CBL3ABD - Call CEE3ABD to terminate the **
** enclave with an abend **
******************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBL3ABD.

DATA DIVISION.
WORKING-STORAGE SECTION.
  01 ABDCODE PIC S9(9) BINARY.
  01 TIMING  PIC S9(9) BINARY.
PROCEDURE DIVISION.
  PARA-CBLMGET.

******************************************************************************
** 3415 is the abend code to be issued, **
** a timing of zero requests an abend without clean-up **
******************************************************************************
MOVE 3415 TO ABDCODE.
MOVE 0 TO TIMING.
CALL "CEE3ABD" USING ABDCODE , TIMING.
GOBACK.
```

3. An example of CEE3ABD called by PL/I.

```pli
*PROCESS MACRO;
/******************************************************************************/
/*Licensed Materials - Property of IBM */
/* 5688-198 (C) Copyright IBM Corp. 1993, 1995 */
/* All rights reserved */
/* US Government Users Restricted Rights - Use, */
/* duplication or disclosure restricted by GSA */
/* ADP Schedule Contract with IBM Corp. */
/******************************************************************************/
/*Module/File Name: IBM3ABD
******************************************************************************/
```
** Function: CEE3ABD - terminate enclave with an abend

** In this example, CEE3ABD is called with a timing value of 1. This requests an abend that
is deferred until clean-up takes place.

```plaintext
PLI3ABD: PROC OPTIONS(MAIN);

INCLUDE CEEIBMAW;
INCLUDE CEEIBMCT;
DCL ABDCODE REAL FIXED BINARY(31,0);
DCL TIMING  REAL FIXED BINARY(31,0);

ABDCODE = 3333; /* Choose code to abend with     */
TIMING = 1;     /* Specify 1, for an abend with     */
/* clean-up                   */
/* Call CEE3ABD to request an abend 3333 with */
/* clean-up                   */
CALL CEE3ABD ( ABDCODE, TIMING );
END PLI3ABD;
```

** CEE3AB2—Terminate enclave with an abend and reason code **

CEE3AB2 requests that Language Environment terminate the enclave with an abend and user-defined reason code. The issuing of the abend can be either with or without clean-up, with the type of dumps the user requires. There is no return from this service, nor is there any condition that is associated with it.

```plaintext
CEE3AB2(abcode, reasoncode, clean-up)
```

** abcode (input) **

A fullword integer, no greater than 4095, specifying the abend code that is issued. Under CICS, this fullword integer is converted to EBCDIC.

** reasoncode (input) **

A fullword integer, specifying the reason code that is issued by the user. If no reason code is specified, the reason code is 0.

** clean-up (input) **

Indicates if the abend should result in clean-up of the enclave’s resources. The acceptable values for clean-up are as follows:

0  
Issue the abend without clean-up

1  
Issue the abend with normal enclave termination processing

2  
Issue the abend with enclave termination processing honoring the TERMTHDAct runtime option for taking a system dump of the user address space but suppressing the CEEDUMP

3  
Issue the abend with enclave termination processing suppressing both the CEEDUMP and system dump if requested by the TERMTHDAct runtime option

4  
Issue the abend with enclave termination processing honoring the TERMTHDAct runtime option for taking a CEEDUMP but suppressing the system dump

5  
Issue the abend with enclave termination processing forcing a system dump of the user address space and suppressing the CEEDUMP
If an illegal value for clean-up is passed, the abend is issued without clean-up.

If clean-up is 0, no Language Environment dump is generated. A system dump, however, is requested when issuing the abend. Under CICS, a transaction dump is taken. To get a dump under CMS, specify FILEDEF SYSABEND PRINTER or FILEDEF SYSUDUMP PRINTER.

If clean-up is 0, Language Environment condition handling is disabled for the current enclave and termination activities are not performed. Event handlers are not driven; Debug Tool is not invoked; user exits are not invoked; and user-written condition handlers are not invoked.

When clean-up is 1, the abend is processed in the same manner as if it were a non-Language Environment abend. Its processing is affected by the ABPERC and TRAP options, the filedef abends percolated in the assembler user exit, and other elements of the environment related to abend processing. In particular, the condition handler can intercept the abend and give the application a chance to handle the abend. If the condition remains unhandled, normal termination activities are performed: information such as a Language Environment dump is produced, depending on the setting of the TERMTHDACT option; event handlers are driven; z/OS Debugger is invoked; and user exits are invoked. Assembler user exit settings control if the application actually terminates with an abend.

When clean-up is 2, it follows the abend processing as when clean-up is 1 except the CEEDUMP is suppressed.

When clean-up is 3, it follows the abend processing as when clean-up is 1, however CEEDUMP and system dumps are both suppressed.

When clean-up is 4, it follows the abend processing as when clean-up is 1, however only the system dumps are suppressed.

When clean-up is 5, it follows the abend processing as when clean-up is 1, however forcing a system dump to be taken and suppressing the CEEDUMP.

**z/OS UNIX consideration**
- In a multithreaded environment, CEE3AB2 applies to the enclave.

**Usage notes**
1. Language Environment abend codes are usually in the range of 4000 (X'FA0') to 4095 (X'FFF'). Use the range of 0 to 3999 to avoid confusion with Language Environment abend codes. The value that is specified for the abend code is passed directly to the ABEND macro without further verification.
2. When TRAP(OFF) is specified, CEE3AB2 behaves in a similar manner to clean-up 0.
3. In a non-CICS environment, a system dump of the user address space is taken only if a SYSMDUMP, SYSUDUMP, or SYSABEND DD card is present.

**For more information**
- For more information about the ABPERC runtime option, see “ABPERC” on page 9.
- For more information about the TRAP runtime option, see “TRAP” on page 86.
- For more information about the TERMTHDACT runtime option, see “TERMTHDACT” on page 73.
- For more information about the ABEND macro, see *z/OS MVS Programming: Authorized Assembler Services Reference* *SET-WTO*.
- For more information about the CEE3ABD callable service, see “CEE3ABD—Terminate enclave with an abend” on page 113.

**Examples**
1. Following is an example of CEE3AB2 called by C/C++.

```c
/*Module/File Name: EDC3AB2 */
/****************************************************************************/
/*                                                                            */
```
#include <leawi.h>

int main(void) {
    _INT4 code, reason, cleanup;
    code = 1234; /* Abend code to issue */
    reason = 9; /* User defined reason code */
    cleanup = 3; /* Specify 3, for an ABEND with cleanup & with no dumps*/
    CEE3AB2(&code, &reason, &cleanup);
}

2. Following is an example of CEE3AB2 called by COBOL.

CBL LIB,QUOTE
**********************************************
*Module/File Name: IGZTAB2
**********************************************
** Function: CEE3AB2 - Terminate enclave **
**           with an abend and user defined **
**           reason code                    **
**                                          **
** In this example, CEE3AB2 is called to **
** terminate the enclave with an abend and **
** a user defined reason code along with **
** Language Environment cleanup **
**********************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBL3AB2.
DATA DIVISION.
WORKING-STORAGE SECTION.
01 ABDCODE PIC S9(9) BINARY.
01 RESCODE PIC S9(9) BINARY.
01 TIMING  PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBLMGET.

**********************************************
** 1234 is the abend code to be issued, **
** 9 is the reason code for the abend.   **
** A timing of four requests an abend    **
** with clean-up.                        **
**********************************************
MOVE 1234 TO ABDCODE.
MOVE 9 TO RESCODE.
MOVE 4 TO TIMING.
CALL "CEE3AB2" USING ABDCODE, RESCODE, TIMING.
GOBACK.

3. Following is an example of CEE3AB2 called by PL/I.

*PROCESS MACRO;

*******************************************************************************/
/*Module/File Name: IBM3AB2                                                   */
*******************************************************************************/
/**                                                                              */
/** Function: CEE3AB2 - Terminate enclave with abend and user                  */
/** verified reason code                                                       */
/**                                                                              */
/** In this example, CEE3AB2 is called to terminate the enclave                */
/** with an abend and user defined reason code along with                     */
/** Language Environment cleanup                                               */
/**                                                                              */
*******************************************************************************/
PLI3AB2: PROCEDURE OPTIONS (MAIN) REORDER;

%INCLUDE  CEEIBMAW;
%INCLUDE  CEEIBMCT;

DCL ABDCODE REAL FIXED BINARY(31,0);
DCL RESCODE REAL FIXED BINARY(31,0);
DCL TIMING REAL FIXED BINARY(31,0);
**CEE3CIB—Return pointer to condition information block**

CEE3CIB returns a pointer to a condition information block (CIB) associated with a given condition token. Use this service only during condition handling.

For PL/I and COBOL applications, Language Environment provides called header, COPY, or include files (in SCEEESAMP) that map the CIB. For C/C++ applications, the macros are in the header file leawi.h (in SCEEH).H).

The CIB contains detailed information about the condition and provides input to your application's condition handlers, which can then respond more effectively to a given condition.

```
CEE3CIB
```

**cond_token**
The condition token passed to a user-written condition handler. If you do not specify this parameter, Language Environment returns the address of the most recently-raised condition.

**cib_ptr**
The address of the CIB associated with the condition token.

**fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE35S</td>
<td>1</td>
<td>3260</td>
<td>No condition was active when a call to a condition management routine was made.</td>
</tr>
<tr>
<td>CEE35U</td>
<td>1</td>
<td>3262</td>
<td>An invalid condition token was passed. The condition token did not represent an active condition.</td>
</tr>
</tbody>
</table>

**Usage notes**

- Because the CIB is used only for synchronous signals, do not use CEE3CIB in signal catchers that are driven for asynchronous signals.
- After the condition handling functions return control to your application, cib_ptr is no longer valid.
- z/OS UNIX consideration—In multithread applications, CEE3CIB returns the CIB associated with the current token on only the current thread.
For more information

- For more information about the CEE3CIB callable service, see z/OS Language Environment Programming Guide.

Examples

1. Following is example of CEE3CIB called by C/C++.

```c
/*Module/File Name: EDC3CIB */
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <string.h>
#include <ceeedcct.h>
#ifdef __cplusplus
extern "C" {
#endif
void handler(_FEEDBACK *, _INT4 *, _INT4 *, _FEEDBACK *);
#ifdef __cplusplus
}
#endif
int main(void) {
  _FEEDBACK fc;
  _ENTRY routine;
  _INT4 token;
  int x, y, z;

  /* set the routine structure to point to the handler */
  /* and use CEEHDLR to register the user handler */
  token = 99;
  routine.address = (_POINTER)&handler;
  routine.nesting = NULL;
  CEEHDLR(&routine, &token, &fc);
  /* verify that CEEHDLR was successful */
  if (_FBCHECK(fc, CEE000) != 0) {
    printf("CEEHDLR failed with message number %d\n", fc.tok_msgno);
    exit(2999);
  }
  x = 5;
  y = 0;
  z = x / y;
}

/****************************/
/* handler is a user condition handler */
/****************************/
void handler(_FEEDBACK *fc, _INT4 *token, _INT4 *result, _FEEDBACK *newfc) {
  _CEECIB *cib_ptr;
  _FEEDBACK cibfc;
  CEE3CIB(fc, &cib_ptr, &cibfc);
  /* verify that CEE3CIB was successful */
  if (_FBCHECK(cibfc, CEE000) != 0) {
    printf("CEE3CIB failed with message number %d\n", cibfc.tok_msgno);
    exit(2999);
  }
  printf("%s\n", (*cib_ptr).cib_eye);
  printf("%d\n", cib_ptr->cib_cond.tok_msgno);
  printf("%s\n", cib_ptr->cib_cond.tok_facid);
  *result = 10;
}
```
2. Following is an example of CEE3CIB called by COBOL.

```cobol
CBL LIB,QUOTE
*Module/File Name: IGZT3CIB
**************************************************
** CBL3CIB - Register a condition handler **
** that will call CEE3CIB to get **
** a Condition Information Block **
** (CIB) for the condition. **
**
**************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBL3CIB.
DATA DIVISION.
WORKING-STORAGE SECTION.
01  ROUTINE  PROCEDURE-POINTER.
01  TOKEN                   PIC S9(9) BINARY.
01  FC                      PIC X(12).
PROCEDURE DIVISION.
PARA-CBL3CIB.
  SET ROUTINE TO ENTRY "HANDLER".
  CALL "CEEHDLR" USING ROUTINE, TOKEN, FC.
GOBACK.
END PROGRAM CBL3CIB.

IDENTIFICATION DIVISION.
PROGRAM-ID. HANDLER.
DATA DIVISION.
WORKING-STORAGE SECTION.
01  CIB-PTR POINTER.
01  FC                      PIC S9(9) BINARY.
LINKAGE SECTION.
*************************************************
** Include the mapping of the CIB **
*************************************************
COPY CEEIGZCI.
01  CURCOND                 PIC X(12).
01  TOKEN                   PIC S9(9) BINARY.
01  RESULT                  PIC S9(9) BINARY.
01  NEWCOND                 PIC X(12).
PROCEDURE DIVISION USING CURCOND, TOKEN, RESULT, NEWCOND.
PARA-HANDLER.
  CALL "CEE3CIB" USING CURCOND, CIB-PTR, FC.
  SET ADDRESS OF CEECIB TO CIB-PTR.
  DISPLAY "In Handler".
  DISPLAY CIB-EYE.
  DISPLAY CIB-TOK-MSGNO.
  DISPLAY CIB-TOK-FACID.
GOBACK.
END PROGRAM HANDLER.

3. Following is an example of CEE3CIB called by PL/I.

```pli
*PROCESS OPT(0), MACRO;
/* Module/File Name: IBM3CIB */
******************************************************************************
** Function: CEE3CIB - example of CEE3CIB **
** invoked from PL/I ON-unit **
******************************************************************************
IBM3CIB:  PROCEDURE OPTIONS(MAIN);
  %INCLUDE CEEBMAM;
  %INCLUDE CEEBMCT;
  %INCLUDE CEEBMCI;
  DECLARE
    CIB_PTR     POINTER,
    01 FC,       /* Feedback token */
    03 MsgSev   REAL FIXED BINARY(15,0),
    03 MsgNo    REAL FIXED BINARY(15,0),
    03 Flags,    /* */
CEE3CTY—Set the default country

CEE3CTY sets the default country. A calling routine can change or query the current national country setting. The country setting affects the date format, the time format, the currency symbol, the decimal separator, and the thousands separator.

The current national country setting also affects the format of the date and time in the reports generated by the RPTOPTS and RPTSTG runtime options.

CEE3CTY also affects the default symbols for the NLS and date and time callable services.

CEE3CTY affects only the Language Environment NLS and date and time services, not the Language Environment locale callable services or C locale-sensitive functions.

The current default country setting, as well as previous default settings that have not been discarded, are stored on the stack on a LIFO (last in, first out) basis. The current default country setting is always on the top of the stack.

There are two methods of changing the default country setting with CEE3CTY:

• Specify the new default country setting and place it on top of the stack using a function value of 1 (SET). This discards the previous default setting.
• Specify the new default country setting and place it on top of the stack using a function value of 3 (PUSH). This pushes the previous default setting down on the stack so that you can later retrieve it by discarding the current setting.

To illustrate the second method, suppose you live in the United States and the code for the United States is specified as the default at installation. If you want to use the French defaults for a certain application, you can use CEE3CTY to PUSH France as the default country setting; then when you want the defaults for the United States, you can POP France from the top of the stack, making the United States the default setting.

CEE3CTY

```plaintext
CEE3CTY(function, country_code, fc)
```

**function (input)**

A fullword binary integer specifying the service to be performed. The possible values for function are:

1—SET

Establishes the country_code parameter as the current country. The top of the stack is, in effect, replaced with country_code.
2—QUERY
Returns the current country code on the top of the stack to the calling routine. The current code is returned in the country_code parameter.

3—PUSH
Pushes the country_code parameter onto the top of the country code stack, making it the current country code. Previous country codes on the stack are retained on a LIFO basis, which makes it possible to return to a prior country code at a later time.

4—POP
Pops the current country code. The last country code that was affected by a PUSH now becomes the current country_code. On return to the calling routine, the country_code parameter contains the discarded country code. If the stack contains only one country code, the code cannot be popped because the stack would be empty after the call. Therefore, no action is taken and a feedback code indicating such is returned to the calling routine.

country_code (input/output)
A 2-character fixed-length string. country_code is not case-sensitive. Table 33 on page 419 contains a list of valid country codes. It is used in the following ways for the different functions:

<table>
<thead>
<tr>
<th>If function is:</th>
<th>then country_code:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 or 3</td>
<td>Contains the desired 2-character country code. In this case, it is an input parameter. Table 33 on page 419 contains a list of valid country codes.</td>
</tr>
<tr>
<td>2</td>
<td>Returns the current 2-character country code on top of the stack. In this case, it is an output parameter.</td>
</tr>
<tr>
<td>4</td>
<td>Returns the discarded 2-character country code. In this case, it is an output parameter.</td>
</tr>
</tbody>
</table>

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE3BV</td>
<td>2</td>
<td>3455</td>
<td>Only one country code was on the stack when a POP request was made to CEE3CTY. The current country code was returned in the</td>
</tr>
<tr>
<td>CEE3C0</td>
<td>3</td>
<td>3456</td>
<td>The country code country-code for the PUSH or SET function for CEE3CTY was invalid. No operation was performed.</td>
</tr>
<tr>
<td>CEE3C1</td>
<td>3</td>
<td>3457</td>
<td>The function function specified for CEE3CTY was not recognized. No operation was performed.</td>
</tr>
</tbody>
</table>

Usage notes
• The default setting for country_code is already on the stack when you start a program. You do not have to PUSH it there.
• The bytes X’0E’ and X’0F’ representing shift-out and shift-in codes are not affected by any country_code setting.
• C/C++ consideration—Language Environment provides locales used in C and C++ to establish default formats for the locale-sensitive functions and locale callable services, such as date and time formatting, sorting, and currency symbols. To change the locale, you can use the setlocale() library function or the CEESETL callable service.

The settings of CEESETL or setlocale() do not affect the setting of the CEE3CTY callable service. CEE3CTY affects only Language Environment NLS and date and time services. setlocale() and CEESETL affect only C/C++ locale-sensitive functions and Language Environment locale callable services.
To ensure that all settings are correct for your country, use CEE3CTY and either CEESETL or setlocale().

- z/OS UNIX consideration—CEE3CTY applies to the enclave. Every thread in the enclave has the same country setting.

**For more information**

- For more information about the RPTOPTS and RPTSTG runtime options, see “RPTOPTS” on page 62 and “RPTSTG” on page 63.
- For a list of the default settings for a specified country, see Table 33 on page 419.
- For more information about the COUNTRY runtime option, see “COUNTRY” on page 20.
- For more information about setlocale(), see *z/OS XL C/C++ Programming Guide*.

**Examples**

1. Following is an example of CEE3CTY called by C/C++.

```c
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {
  _FEEDBACK fc;
  _INT4 function;
  _CHAR2 country;
  /* query the current country setting */
  function = 2; /* function 2 is query */
  CEE3CTY(&function,country,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
    printf("CEE3CTY failed with message number %d\n", fc.tok_msgno);
    exit(2999);
  }
  /* if the current country is not Canada then set */
  /* it to Canada */
  if (memcmp(country,"CA",2) != 0) {
    memcpy(country,"CA",2);
    function = 1; /* function 1 is set */
    CEE3CTY(&function,country,&fc);
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEE3CTY failed with message number %d\n", fc.tok_msgno);
      exit(2999);
    }
  }
}
```

2. Following is an example of CEE3CTY called by COBOL.

```cobol
IDENTIFICATION DIVISION.
PROGRAM-ID. CBL3CTY.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01  FUNCTN                  PIC S9(9) BINARY.
  01  COUNTRY                 PIC X(2).
  01  FC.
  02  Condition-Token-Value.
```

---

124 z/OS: Language Environment Programming Reference
COPY CEEIGZCT.
03 Case-1-Condition-ID.
  04 Severity PIC S9(4) BINARY.
  04 Msg-No PIC S9(4) BINARY.
03 Case-2-Condition-ID REDEFINES Case-1-Condition-ID.
  04 Class-Code PIC S9(4) BINARY.
  04 Cause-Code PIC S9(4) BINARY.
03 Case-Sev-Ctl PIC X.
  03 Facility-ID PIC XXX.
02 I-S-Info PIC S9(9) BINARY.

PROCEDURE DIVISION.
PARA-3CTYQRY.
************************************************
** Call CEE3CTY with the QUERY function,
** and display current country code.
************************************************
MOVE 2 TO FUNCTN.
CALL "CEE3CTY" USING FUNCTN, COUNTRY, FC.
IF CEE000 of FC THEN
  DISPLAY "THE CURRENT COUNTRY CODE IS "
  COUNTRY
ELSE
  DISPLAY "CEE3CTY(query) failed with msg "
  Msg-No of FC UPON CONSOLE
STOP RUN
END-IF.
PARA-3CTYSET.
************************************************
** If the current country code is not the US,
** call CEE3CTY with the SET function to make
** it the US. Display result.
************************************************
IF ( COUNTRY IS NOT = "US" ) THEN
  MOVE 1 TO FUNCTN
  MOVE "US" TO COUNTRY
  CALL "CEE3CTY" USING FUNCTN,
  COUNTRY, FC
  IF CEE000 of FC THEN
    DISPLAY "THE NEW COUNTRY CODE IS ",
    COUNTRY
  ELSE
    DISPLAY "CEE3CTY(set) failed with msg "
    Msg-No of FC UPON CONSOLE
  END-IF.
END-IF.
GOBACK.

3. Following is an example of CEE3CTY called by PL/I.

*PROCESS MACRO;
/* Module/File Name: IBM3CTY
/*************************************************************************
/** Function: CEE3CTY - set current country
/** In this example, a call is made to the query
/** function of CEE3CTY to return the current
/** default country setting. This is then
/** printed out. If the current country code is
/** not 'US', then it is set to 'US' and printed.
/***************************************************************************/
PLI3CTY: PROC OPTIONS(MAIN);
%INCLUDE CEEIBMAW;
%INCLUDE CEEIBMCT;
DCL FUNCTN REAL FIXED BINARY(31,0);
DCL COUNTRY CHARACTER ( 2 ); /* Feedback token */
DCL 01 FC, /* Feedback token */
  03 MsgSev REAL FIXED BINARY(15,0),
  03 MsgNo REAL FIXED BINARY(15,0),
  03 Flags,
  05 Case BIT(2),
  05 Severity BIT(3),
  05 Control BIT(3),
CEE3DLY—Suspend processing of the active enclave in seconds

CEE3DLY provides a service for Language Environment-conforming applications that suspends the processing of the active enclave for a specified number of seconds. The maximum is 1 hour.

CEE3DLY

\[
\text{CEE3DLY} \rightarrow \text{input\_seconds} \rightarrow \text{fc} \rightarrow \text{CEF} \rightarrow \text{END}
\]

**input\_seconds**

A fullword binary value in the range of 0 to 3600 that specifies the total number of seconds during which the enclave should be suspended.

**fc (output)**

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE3QQ</td>
<td>1</td>
<td>CEE3930W</td>
<td>The input value input_value in a call to the callable service callable_service_name was not within the valid range.</td>
</tr>
<tr>
<td>CEE3QS</td>
<td>1</td>
<td>CEE3932W</td>
<td>The system service system_service failed with return code return_code and reason code reason_code.</td>
</tr>
</tbody>
</table>
Usage notes

• CICS consideration—CEE3DLY is available under CICS.
• z/OS UNIX consideration—CEE3DLY is handled by the z/OS UNIX System Services when POSIX is set to ON.
• This service is not intended for timing requests. Delays up to the nearest second might occur in some circumstances.
• In a multi-threaded application, only the calling thread is suspended.

Examples

1. An example of CEE3DLY called by C/C++:

```c
/*Module/File Name: EDC3DLY   */
/*********************************************************************/
/*                                                                   */
/* THIS EXAMPLE CALLS CEE3DLY TO SUSPEND PROCESSING OF THE ACTIVE    */
/* ENCLAVE FOR SPECIFIED NUMBER OF SECONDS.                          */
/*                                                                   */
/*********************************************************************/
#include <time.h>
#include <stdio.h>
#include <leawi.h>
#include <ceeedcct.h>
int main(void)
{
    _INT4 seconds;
    _FEEDBACK fc;
    time_t ltime;
    /* Get the time in seconds */
    time(&ltime);
    printf("CEE3DLY Start time : %s", ctime(&ltime));
    seconds = 10;
    CEE3DLY(&seconds,&fc);
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEE3DLY failed with message number %d\n",fc.tok_msgno);
        exit(999);
    }
    time(&ltime);
    printf("CEE3DLY Finish time : %s", ctime(&ltime));
}
```

2. A example of CEE3DLY called by COBOL:

```cobol
CBL LIB,QUOTE
*****************************************************************
*MODULE/FILE NAME: IGZT3DLY
*****************************************************************
**                                                             **
** FUNCTION: CEE3DLY - SUSPEND ENCLAVE EXECUTION IN SECONDS      **
**                                                             **
** THIS EXAMPLE CALLS CEE3DLY TO SUSPEND PROCESSING OF THE       **
** ACTIVE ENCLAVE FOR SPECIFIED NUMBER OF SECONDS.              **
**                                                             **
*****************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBL3DLY.
DATA DIVISION. WORKING-STORAGE SECTION.
  01 DATE-TIME PIC X(21).
  01 CUR-DATE-FIELDS.
     03 CURRENT-DATE PIC X(8).
     03 FILLER REDEFINES CURRENT-DATE.
     05 CUR-MM PIC XX.
     05 CUR-DD PIC XX.
     05 CUR-YY PIC XX.
  01 SECONDS PIC S9(9) BINARY.
  01 FC.
```
02 CONDITION-TOKEN-VALUE.
COPY CEEIGZCT.
03 CASE-1-CONDITION-ID.
  04 SEVERITY PIC S9(4) BINARY.
  04 MSG-NO PIC S9(4) BINARY.
03 CASE-2-CONDITION-ID
REDEFINES CASE-1-CONDITION-ID.
  04 CLASS-CODE PIC S9(4) BINARY.
  04 CAUSE-CODE PIC S9(4) BINARY.
  03 CASE-SEV-CTL PIC X.
  03 FACILITY-ID PIC XXX.
02 I-S-INFO            PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBL3DLY.
MOVE FUNCTION CURRENT-DATE TO DATE-TIME.
STRING DATE-TIME (5:2) "/
DATE-TIME (7:2) "/
DATE-TIME (3:2)
DELIMITED BY SIZE
INTO CURRENT-DATE.
STRING DATE-TIME (9:2) ":
DATE-TIME (11:2) ":
DATE-TIME (13:2)
DELIMITED BY SIZE
INTO TIME-OF-DAY.
DISPLAY "CEE3DLY - BEGINS"
DISPLAY "DATE    : " CURRENT-DATE
DISPLAY "TIME    : " TIME-OF-DAY
MOVE 10 TO SECONDS.
CALL "CEE3DLY" USING SECONDS, FC.
IF NOT CEE000 OF FC THEN
  DISPLAY "CEE3DLY FAILED WITH MSG 
  MSG-NO OF FC
  STOP RUN
END-IF.
MOVE FUNCTION CURRENT-DATE TO DATE-TIME.
STRING DATE-TIME (5:2) "/
DATE-TIME (7:2) "/
DATE-TIME (3:2)
DELIMITED BY SIZE
INTO CURRENT-DATE.
STRING DATE-TIME (9:2) ":
DATE-TIME (11:2) ":
DATE-TIME (13:2)
DELIMITED BY SIZE
INTO TIME-OF-DAY.
DISPLAY "CEE3DLY - COMPLETED"
DISPLAY "DATE    : " CURRENT-DATE
DISPLAY "TIME    : " TIME-OF-DAY
GOBACK.

3. An example of CEE3DLY called by PL/I:

*PROCESS MACRO; 00001000
/***************************************************************************/ 00013000
/*MODULE/FILE NAME: IBM3DLY */ 00014000
/***************************************************************************/ 00015000
/**                                                               **/ 00016000
/** FUNCTION: CEE3DLY - SUSPENDS ENCLAVE EXECUTION IN SECONDS     **/ 00017000
/**                                                               /**/ 00018000
/***************************************************************************/ 00019000
PLI3DLY: PROCEDURE OPTIONS (MAIN) REORDER; 00023000
/INCLUDE CEEIBMAW; 00024000
/INCLUDE CEEIBMCT; 00025000
DECLARE DLYSECS REAL FIXED BINARY(31,0); 00026000
DECLARE LILIAN REAL FIXED BINARY(31,0); 00027000
DECLARE SECONDS REAL FLOAT DECIMAL(16); 00028000
DECLARE GREGORN CHARACTER (17); 00029000
DECLARE 01 FC1,             /* FEEDBACK TOKEN FOR CEELOCT */ 00030000
  03 MSGSEV       REAL FIXED BINARY(15,0), 00031000
  03 MSGNO       REAL FIXED BINARY(15,0), 00032000
  03 FLAGS,                                                00033000
     05 CASE BIT(2), 00034000
     05 SEVERITY BIT(3), 00035000
     05 CONTROL BIT(3), 00036000
PLI3DLY: PROCEDURE OPTIONS (MAIN) REORDER; 00023000
/INCLUDE CEEIBMAW; 00024000
/INCLUDE CEEIBMCT; 00025000
DECLARE DLYSECS REAL FIXED BINARY(31,0); 00026000
DECLARE LILIAN REAL FIXED BINARY(31,0); 00027000
DECLARE SECONDS REAL FLOAT DECIMAL(16); 00028000
DECLARE GREGORN CHARACTER (17); 00029000
DECLARE 01 FC1,             /* FEEDBACK TOKEN FOR CEELOCT */ 00030000
  03 MSGSEV       REAL FIXED BINARY(15,0), 00031000
  03 MSGNO       REAL FIXED BINARY(15,0), 00032000
  03 FLAGS,                                                00033000
     05 CASE BIT(2), 00034000
     05 SEVERITY BIT(3), 00035000
     05 CONTROL BIT(3), 00036000
CxEE3DMP—Generate the dump

CEE3DMP generates a dump of Language Environment and the member language libraries. Sections of the dump are selectively included, depending on options specified with the options parameter. When an error occurs that would cause a CEEDUMP to be taken, and this is a POSIX application, Language Environment writes this dump to the current directory. Output from CEE3DMP is written to one of the following (in top-down order):

- The directory found in _CEE_DMPTARG, if found.
- The current working directory, if this is not the root (/), and if the directory is writable, and if the dump path name (made up of the cwd path name plus the dump file name) does not exceed 1024 characters.
- The directory found in environment variable TMPDIR (if the temporary directory is not /tmp.
- /tmp.

(See the Fname suboption of CEE3DMP in “Fname” on page 133 for more information about the dump output filename.)

If it is longer than 60 characters, the dump title is truncated to 60 characters in order to match the record size of the dump file. Only nested enclaves within a single process are supported.

CEE3DMP establishes a condition handler that captures all conditions that occur during dump processing. It terminates the section of the dump in progress when a condition occurs and inserts the following line into the dump (nnnnnnnnn is the instruction address at the time of the exception). After this line is inserted in the report, dump processing continues for other member languages until CEE3DMP is complete.

Exception occurred during dump processing at nnnnnnnnn
If an abend occurs, or if any other condition occurs or is raised, the condition manager attempts to handle it. If the condition remains unhandled, and it is of sufficient severity, the condition manager might, based on if the TERMTHDACT TRACE or DUMP suboption is specified, invoke dump services and then terminate the program. You do not have to call CEE3DMP to use the dump services. Any routine can use them. To support this case, dump services are invoked as follows:

- The title is Condition processing resulted in the unhandled condition to indicate why the dump was produced.
- The dump options are 'TRACE COND THR(ALL) BLOCKS STOR NOENTRY' for dump output and 'TRACE COND THR(ALL) NOBLOCK NOSTOR NOENTRY' for trace output.

Reprinting of section title and control block name at the beginning of each page is suppressed. Only the main title CEE3DMP: ... is reprinted.

![CEE3DMP](image)

**title (input)**

An 80-byte fixed-length character string containing a title printed at the beginning of each page of the dump.

**options**

Options are declared as a string of keywords that are separated by blanks or commas. Some options have suboptions that follow the option keyword and are contained in parentheses. The options can be specified in any order, but the last option declaration is honored if there is a conflict between it and any preceding options. The following options are recognized by Language Environment:

- **ENCLave**(ALL | CURRENT | n)
  Dumps the current enclave, a fixed number of enclaves, or all enclaves associated with the current process; n is an integer ranging from 1 to $2^{31}-1$, inclusive, that indicates the maximum number of enclaves that should be dumped. ENCLAVE(CURRENT) and ENCLAVE(1) are equivalent. ALL is the default.

- **THRead**(ALL | CURRENT)
  Dumps the current thread (the thread that invoked this service) or all threads associated with the current enclave. When you specify THREAD(ALL) and more than one thread is running, the library quiesces all threads before writing the dump. Therefore, the state of the library changes from the time the dump is requested to the time the dump is written.
  The default is CURRENT.

- **TRACEBACK**
  Includes a traceback of all routines on the call chain. The traceback shows transfers of control from either calls or exceptions. The traceback extends backwards to the main program of the current thread. PL/I transfers of control into BEGIN-END blocks or ON-units are considered calls.
  TRACEBACK is the default.

- **NOTRACEback**
  Does not include a traceback.

- **FILES**
  Includes attributes of all open files and the buffer contents that are used by the files. The particular attributes displayed are defined by the member languages. File buffers are dumped when FILE and STORAGE are specified. File control blocks are dumped when FILE and BLOCKS are specified.
  FILES is the default.

- **NOFILEs**
  Does not include file attributes of open files.

- **VARiables**
  Includes a symbolic dump of all variables, arguments, and registers. Variables include arrays and structures. Register values are those saved in the stack frame at the time of call. There is no way
to print a subset of this information. Variables and arguments are printed only if the symbol tables are available. A symbol table is generated when a program is compiled with the options in the following table for each HLL, except for PL/I, which does not support the VARIABLE option.

<table>
<thead>
<tr>
<th>Table 23: Symbol table</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Language</strong></td>
</tr>
<tr>
<td>C</td>
</tr>
<tr>
<td>C++</td>
</tr>
<tr>
<td>COBOL</td>
</tr>
</tbody>
</table>

The variables, arguments, and registers are dumped, beginning with the routine that called CEE3DMP. The dump proceeds up the chain for the number of routines that are specified by the STACKFRAME option.

**NOVARIABLES**

Does not include a dump of variables, arguments, and registers.

**BLOCKS**

Dumps the control blocks used in Language Environment and member language libraries. Global control blocks, as well as control blocks associated with routines on the call chain, are printed. Control blocks are printed for the routine that called CEE3DMP. The dump proceeds up the call chain for the number of routines specified by the STACKFRAME option. Control blocks for files are also dumped if the FILES option was specified. See the FILES option above for more information. If the TRACE runtime option is set to ON, the trace table is dumped when BLOCKS is specified. If the heap storage diagnostics report is requested through the HEAPCHK runtime option, the report is displayed when BLOCKS is specified.

**NOBLOCKS**

Suppresses the dump of control blocks. NOBLOCKS is the default.

**STORAGE**

Dumps the storage used by the program. The storage is displayed in hexadecimal and character format. Global storage, as well as storage associated with each routine on the call chain, is printed. Storage is dumped for the routine that called CEE3DMP, which proceeds up the call chain for the number of routines specified by the STACKFRAME option. Storage for all file buffers is also dumped if the FILES option was specified (see above).

**NOSTORAGE**

Suppresses storage dumps. NOSTORAGE is the default.

**REGSTOR**

Controls the amount of storage (reg_stor_amount) that is dumped around registers. reg_stor_amount indicates storage in bytes to be dumped around each register and must be in the range of 0 to 256. The number is rounded up to the nearest multiple of 32. The default is REGSTOR(96).

You must specify REGSTOR(0) as a CEE3DMP option if a dump storage around registers is not required.

**StackFrame(n|ALL)**

Specifies the number of stack frames dumped from the call chain. If STACKFRAME(ALL) is specified, all stack frames are dumped. No stack frame storage is dumped if STACKFRAME(0) is specified. The particular information dumped for each stack frame depends on the VARIABLE, BLOCK, and STORAGE option declarations specified for CEE3DMP. The first stack frame dumped is the one associated with the routine that called CEE3DMP, followed by its caller, and proceeding backwards up the call chain.
**PAGEsize(n)**
Specifies the number of lines on each page of the dump. This value must be greater than 9. A value of 0 indicates that there should be no page breaks in the dump. The default setting is PAGEsize(60). Refer to the CEEDUMP runtime option for an optional method of setting the number of lines on each page of the dump.

**FNAME(ddname)**
Specifies the ddname of the file to which the dump report is written. The ddname supplied in this option must be a valid ddname for the system on which the application is running. CEE3DMP does not check the ddname for validity, nor does CEE3DMP translate or modify the ddname. Supplying an invalid ddname can result in unpredictable behavior. The default ddname CEEDUMP is used if this option is not specified.

**CONDITION**
Specifies that for each active condition on the call chain, the following information is dumped from the CIB:
- The address of the CIB.
- The message that is associated with the current condition token.
- The message that is associated with the original condition token, if different from the current one.
- The location of the error.
- The machine state at the time the condition manager was invoked, if an abend or hardware condition occurred.
- The abend code and reason code, if the condition occurred as a result of an abend.
- Language-specific error information.

The information supplied by Language Environment-conforming languages differs. PL/I supplies DATAFIELD, ONCHAR, ONCOUNT, ONFILE, ONKEY, and ONSOURCE built-in function (BIF) values, which are shown in the context of the condition raised.

CONDITION is the default.

This option does not apply to asynchronous signals.

**NOCONDITION**
Does not dump condition information for active conditions on the call chain.

**ENTRY**
Includes in the dump a description of the routine that called CEE3DMP and the contents of the registers on entry to CEE3DMP.

ENTRY is the default.

**NOENTRY**
Does not include in the dump a description of the routine that called CEE3DMP and the contents of the registers on entry to CEE3DMP.

**GENOpts**
Includes in the dump a runtime options report like that generated by the use of the RPTOPTS runtime option.

**NOGENOpts**
Does not include in the dump a runtime options report like that generated by the use of the RPTOPTS runtime option.

**fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted. If specified as an argument, feedback information, in the form of a condition token, is returned to the calling routine. If not specified, and the requested operation was not successfully completed, the condition is signaled to the condition manager.
The following feedback codes can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE317</td>
<td>1</td>
<td>3111</td>
<td>CEEDUMP was defined as a dummy data set. No Language Environment dump processing was performed.</td>
</tr>
<tr>
<td>CEE30U</td>
<td>2</td>
<td>3102</td>
<td>Invalid CEE3DMP options or suboptions were found and ignored.</td>
</tr>
<tr>
<td>CEE30V</td>
<td>3</td>
<td>3103</td>
<td>An error occurred in writing messages to the dump file.</td>
</tr>
</tbody>
</table>

**Usage notes**

- Language Environment is sensitive to the national language when it writes dump output.
  - When the national language is upper case U.S. English or Japanese, the environment variable `_CEE_UPPERCASE_DATA` can be used to determine if variable data in the dump output is in uppercase.
  - When this environment variable is set to YES, variable data (entry point names, program unit names, variable names, Trace Entry in EBCDIC data, hexadecimal/EBCDIC displays of storage) will be in uppercase.
  - When this environment variable is not set or set to a value other than YES, variable data will not be in uppercase. Variable data is never in uppercase when the national language is mixed-case U.S. English.
- CICS consideration—Only ENCLAVE(CURRENT) and ENCLAVE(1) are supported on CICS.
- MVS consideration—On MVS, all values for the ENCLAVE option are supported.
- z/OS UNIX consideration—CEE3DMP applies to the enclave.

When you call CEE3DMP in a multithread environment, the current thread or all threads might be dumped. Enclave- and process-related storage (along with storage related to threads other than the current thread) might have changed in value from the time the dump request was issued.

If the CEEDUMP DD has a PATH= parameter, the dump is directed to the specified file system.

If your application is running under z/OS UNIX System Services and is either running in an address space that is created by using the `fork()` function or is invoked by one of the exec family of functions, the dump is written to the file system. Language Environment writes the dump to a file in your current working directory, unless that directory is the root directory, in which case the dump is written to a file in the directory `/tmp`.

The name of this file changes with each dump and uses the following format:

```
/path/Fname.Date.Time.Pid
```

- **path**
  - The current working directory

- **Fname**
  - The name specified in the FNAME parameter on the call to CEE3DMP (default is CEEDUMP)

- **Date**
  - The date the dump is taken, appearing in the format YYYYMMDD (such as 19940325 for March 25, 1994)

- **Time**
  - The time the dump is taken, appearing in the format HHMMSS (such as 175501 for 05:55:01 PM)

- **Pid**
  - The process ID the application is running in when the dump is taken

- When nested CEEPIPI main-DP environments are present, the traceback section includes all nested environments. The first environment contains all the usual sections as determined by the CEE3DMP...
options. For the chained parent main-DP environments, the dump output omits all sections other than the traceback.

The ENCLAVE option controls how many enclaves appear in the output for each CEEPIPI main-DP environment. The STACKFRAME option controls how many stack frames are dumped for each CEEPIPI main-DP environment.

- When multiple CEEPIPI main-DP environments are present, and the chained parent Main-DP environments contain Language Environment member languages that are not present in the current active Main-DP environment (the one that caused the dump), the information dumped out might be incomplete.
- If the assembler CEEPIPI driver program does not follow standard z/OS linkage conventions, the dumped traceback information might be incomplete or incorrect.

For more information
- See “TERMTHDACT” on page 73 for more information about the TERMTHDACT runtime option.
- For more information about generating dumps, see z/OS Language Environment Debugging Guide.

Examples
1. Following is an example of CEE3DMP called by C/C++.

```c
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <string.h>
#include <ceeedcct.h>

#define OPT_STR "THREAD(CURRENT) TRACEBACK FILES"

int main(void) {
    _CHAR80 title = "This is the title of the dump report";
    _CHAR255 options;
    FILE *f;
    _FEEDBACK fc;
    memset(options,' ',sizeof(options));
    memcpy(options,OPT_STR,sizeof(OPT_STR)-1);
    f = fopen("my.file","wb");
    fprintf(f,"my file record 1 \n");
    CEE3DMP(title,options,&fc);
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEE3DMP failed with msgno %d\n", fc.tok_msgno);
        exit(2999);
    }
}
```

2. Following is an example of CEE3DMP called by COBOL.

```cobol
IDENTIFICATION DIVISION.
PROGRAM-ID. CBL3DMP.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01 DMPTITL        PIC X(80).
```


01 OPTIONS          PIC X(255).
01 FC.
  02 Condition-Token-Value.
COPY CEEIOZCT.
  03 Case-1-Condition-ID.
    04 Severity    PIC S9(4) BINARY.
    04 Msg-No      PIC S9(4) BINARY.
  03 Case-2-Condition-ID
    REDEFINES Case-1-Condition-ID.
    04 Class-Code  PIC S9(4) BINARY.
    04 Cause-Code  PIC S9(4) BINARY.
  03 Case-Sev-Ctl    PIC X.
  03 Facility-ID     PIC XXX.
  02 I-S-Info            PIC S9(9) BINARY.
PROCEDURE DIVISION.
*************************************************
** Specify title to appear on each page of the**
** dump report.  **
** Specify options that will request that a**
** traceback be provided, but no variables,**
** stack frames, condition information, or**
** registers be dumped.                              **
*************************************************
PARA-CBL3DMP.
  MOVE "This is the dump report title."  
    TO DMPTITL.
  MOVE "TRACE NOVAR SF(0) NOCOND NOENTRY" 
    TO OPTIONS.
  CALL "CEE3DMP" USING DMPTITL, OPTIONS, FC.
  IF NOT CEE000 of FC  THEN
    DISPLAY "CEE3DMP failed with msg 
      Msg-No of FC UPON CONSOLE
    STOP RUN
  END-IF.
  GOBACK.

3. Following is an example of CEE3DMP called by PL/I.

*PROCESS MACRO;  /* Module/File Name: IBM3DMP */
** Function: CEE3DMP - generate dump **
** In this example, a call to CEE3DMP is made to **
** request a dump of the runtime environment. **
** Several options are specified, to customize **
** the dump. **
PLI3DMP: PROC OPTIONS(MAIN);
  %INCLUDE  CEEIBMAW;
  %INCLUDE  CEEIBMCT;
  DCL DMPTITL  CHAR(80);
  DCL OPTIONS  CHARACTER ( 255 );/* Feedback token */
  DCL 01 FC,  /* Feedback token */
      03 MsgSev   REAL FIXED BINARY(15,0),
      03 MsgNo    REAL FIXED BINARY(15,0),
      03 Flags,  /* Feedback token */
      05 Case    BIT(2),
      05 Severity BIT(3),
      05 Control BIT(3),
      03 FacID   CHAR(3),  /* Facility ID */
      03 ISI     /* Instance-Specific Information */
        REAL FIXED BINARY(31,0);
    /* Specify a string to be printed at the top of */
    /* each page of dump */
    DMPTITL = 'This is the title for the dump report.';
    /* Request that a traceback be provided, but */
    /* no variables, stack frames, condition */
    /* information, or registers be dumped */
    OPTIONS = 'TRACE NOVAR SF(0) NOCOND NOENTRY';
    /* Call CEE3DMP with options to customize dump */
    CALL CEE3DMP ( DMPTITL, OPTIONS, FC );
    IF FBCHECK( FC, CEE000 ) THEN DO;
CEE3GRC—Get the enclave return code

CEE3GRC retrieves the current value of the user enclave return code. Use CEE3GRC in conjunction with CEE3SRC to get and then set user enclave return codes.

```
return_code (output)
The enclave return code.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
</tbody>
</table>
```

Usage notes

- z/OS UNIX consideration—CEE3GRC is not supported in multithread applications.
- PL/I MTF consideration—CEE3GRC is not supported in PL/I MTF applications.
- PL/I consideration—When running PL/I with POSIX(ON), CEE3GRC is not supported.

For more information

- See “CEE3SRC—Set the enclave return code” on page 185 for more information about the CEE3SRC callable service.
- See z/OS Language Environment Programming Guide for more information about the CEE3GRC and CEE3SRC callable services.

Examples

1. Following is an example of a C/C++ main() routine that calls CEEHDLR and CEE3GRC.
2. Following is an example of a C/C++ user-written condition handler that sets a user enclave return code.

```c
#include <stdio.h>
#include <string.h>
#include <leawi.h>
#include <ceeedcct.h>
#define RESUME 10
#define PERCOLATE 20
```
#ifndef __cplusplus
extern "C" void CESETRC (_FEEDBACK *, _INT4 *,
_INT4 *, _FEEDBACK *);
#endif

void CESETRC (_FEEDBACK *cond, _INT4 *input_token,
_INT4 *result, _FEEDBACK *new_cond)
{
_INT4 enclave_RC;
_FEEDBACK feedback;
if ( _FBCHECK ( *cond, CEE349 ) == 0 )
{
enclave_RC = 999998;
CEE3SRC(&enclave_RC, &feedback);
*result = RESUME;
}
else
{
*result = PERCOLATE;
}

3. Following is an example of a C/C++ subroutine that generates the divide-by-zero condition.

#include <stdio.h>
#include <string.h>

void CERCDIV (int Integer)
{
int num;
num = 1/Integer;
}

4. Following is an example of a COBOL main routine that calls CEEHDLR and CEE3GRC.

IDENTIFICATION DIVISION.
PROGRAM-ID.    CBL3GRC.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01  TOKEN           PIC X(4).
  01  IDIVISOR        PIC S9(9)
    BINARY VALUE ZERO.
  01  ENCLAVE-RC      PIC S9(9) BINARY.
**  Declares for condition handling
**  01  PGMPTR          USAGE IS PROCEDURE-POINTER.
  01  FBCODE.
    02  Condition-Token-Value.
    COPY CEEIGZCT.
    03  Case-1-Condition-ID.
5. Following is an example of a COBOL condition handler that sets a user enclave return code and resumes when a divide-by-zero condition occurs.

```
CBL C,RENT,OPTIMIZE,NODYNAM,LIB,QUOTE
*Module/File Name: IGZT3SRC
******************************************************************************
** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** ** **
IDENTIFICATION DIVISION.
PROGRAM-ID. DRV3SRC.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01 ROUTINE         PROCEDURE-POINTER.
  01 DENOMINATOR     PIC S9(9) BINARY.
  01 NUMERATOR       PIC S9(9) BINARY.
  01 RATIO           PIC S9(9) BINARY.
  01 TOKEN           PIC S9(9) BINARY VALUE 0.
  01 FC.             PIC S9(9) BINARY.
  02 Condition-Token-Value.
COPY CEEIGZCT.
  03 Case-1-Condition-ID.
    04 Severity    PIC S9(4) BINARY.
    04 Msg-No      PIC S9(4) BINARY.
  03 Case-2-Condition-ID
    REDEFINES Case-1-Condition-ID.
```
PROCEDURE DIVISION.
REGISTER-HANDLER.
******************************************************************************
** Register handler
******************************************************************************
** Set routine to entry "CBL3SRC".
CALL "CEEHDLR" USING ROUTINE, TOKEN, FC.
IF NOT CEE000 of FC THEN
  DISPLAY "CEEHDLR failed with msg 
    Msg-No of FC UPON CONSOLE
STOP RUN
END-IF. RAISE-CONDITION.
******************************************************************************
** Cause a zero-divide condition.
******************************************************************************
MOVE 0 TO DENOMINATOR.
MOVE 1 TO NUMERATOR.
DIVIDE NUMERATOR BY DENOMINATOR GIVING RATIO.

UNREGISTER-HANDLER.
******************************************************************************
** UNregister handler
******************************************************************************
CALL "CEEHDLU" USING ROUTINE, TOKEN, FC.
IF NOT CEE000 of FC THEN
  DISPLAY "CEEHDLU failed with msg 
    Msg-No of FC UPON CONSOLE
END-IF.
STOP RUN.
END PROGRAM DRV3SRC.
******************************************************************************
** CBL3SRC - Call CEE3SRC to set the enclave return code
** This is an example of a user-written condition handler that sets a user enclave return code and resumes when a divide-by-zero condition occurs.
******************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBL3SRC.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01  ENCLAVE-RC             PIC S9(9) BINARY.
  01  FEEDBACK.
      02  Condition-Token-Value.
      COPY CEEIGZCT.
      03  Case-1-Condition-ID.
          04  Severity    PIC S9(4) BINARY.
          04  Msg-No      PIC S9(4) BINARY.
      03  Case-2-Condition-ID
          REDEFINES Case-1-Condition-ID.
          04  Class-Code  PIC S9(4) BINARY.
          04  Cause-Code  PIC S9(4) BINARY.
          03  Case-Sev-Ctl PIC X.
          03  Facility-ID  PIC XXX.
      02  I-S-Info     PIC S9(9) BINARY.
  01  TOKEN                   PIC X(4).
  01  RESULT-CODE             PIC S9(9) BINARY.
      88 RESUME               VALUE +10.
      88 PERCOLATE            VALUE +20.
  01  CURRENT-CONDITION.
      02  Condition-Token-Value.
      COPY CEEIGZCT.
      03  Case-1-Condition-ID.
          04  Severity    PIC S9(4) BINARY.
          04  Msg-No      PIC S9(4) BINARY.
      03  Case-2-Condition-ID
6. Following is an example of a COBOL subroutine that generates a divide-by-zero condition.

```cobol
IDENTIFICATION DIVISION.
PROGRAM-ID. CERCDIV.
DATA DIVISION.
WORKING-STORAGE SECTION.
01 TO-DIVIDE PIC S9(9) BINARY VALUE 1.
LINKAGE SECTION.
01 IDIVISOR PIC S9(9) BINARY.

PROCEDURE DIVISION USING IDIVISOR.

**********
**Function:
**
** A divide by zero is attempted. This  **
** induces the invocation of user condition **
** handler CESETRC registered in program  **
** CEGETRC.  **
**
**********
IDENTIFICATION DIVISION.
PROGRAM-ID. CERCDIV.

Data DIVISION.
WORKING-STORAGE SECTION.
01 TO-DIVIDE PIC S9(9) BINARY VALUE 1.
LINKAGE SECTION.
01 IDIVISOR PIC S9(9) BINARY.

PROCEDURE DIVISION USING IDIVISOR.

DIVIDE IDIVISOR INTO TO-DIVIDE.
GOBACK.
End program CERCDIV.
```
Following is an example in PL/I that sets and retrieves the user enclave return code when a divide-by-zero is generated.

```
*Process lc(101),opt(0),s,map,list,stmt,a(f),ag,macro ;
/*Module/File Name: IBMIV */
/*****************************/
/**
** Function: CEE3SRC - Set the enclave return code *
** : CEE3GRC - Get the enclave return code *
** *
** 1. A user ZERODIVIDE ON-unit is established by *
** CEESETRC.
** 2. A sub-program, sdivide, is called and causes *
** a ZERODIVIDE condition to occur.
** 3. The ON-unit for ZERODIVIDE is entered.
** The ON-unit calls CEE3GRC to get the current *
** enclave return code. It increments the return *
** code by 4444, and sets the enclave return *
** code to this new value.
** 4. On completion, the program prints the enclave *
** return code.
*/
/******************************/
CESETRC: Proc Options(Main) ;
%INCLUDE CEEIBMAW;
%INCLUDE CEEIBMCT;
REAL FIXED BINARY(31,0);
DCL Enclave_RC REAL FIXED BINARY(31,0);
DCL 01 FC, /* Feedback token */
  03 MsgSev REAL FIXED BINARY(15,0),
  03 MsgNo REAL FIXED BINARY(15,0),
  03 Flags, 
  05 Case BIT(2),
  05 Severity BIT(3),
  05 Control BIT(3),
  03 FacID CHAR(3),    /* Facility ID */
  03 ISI /* Instance-Specific Information */
/******************************/
/* A ZERODIVIDE ON-unit is established */
/******************************/
on zerodivide begin;
call CEE3GRC (Enclave_RC, fc);
IF FBCHECK( FC, CEE000) THEN DO;
  PUT SKIP LIST( 'Original Enclave RC was ' || Enclave_RC );
END;
ELSE DO;
  DISPLAY( 'CEE3GRC failed with msg ' || FC.MsgNo );
  STOP;
END;
Enclave_RC = Enclave_RC + 4444;
call CEE3SRC (Enclave_RC, fc);
IF FBCHECK( FC, CEE000) THEN DO;
  PUT SKIP LIST( 'New Enclave RC is ' || Enclave_RC );
END;
ELSE DO;
  DISPLAY( 'CEE3SRC failed with msg ' || FC.MsgNo );
  STOP;
END;
goto resume;
end;
/******************************/
/* Call sdivide to cause a ZERODIVIDE condition. */
/******************************/
call sdivide;
resume:
put skip edit('Enclave return code is ', Enclave_RC) (A, F(10));
/******************************/
/* The sdivide routine causes a ZERODIVIDE condition*/
/******************************/
sdivide: proc;
  dcl int fixed bin (15,0);
  dcl int_2 fixed bin (15,0) init(5);
  dcl int_3 fixed bin (15,0) init(8);
```
CEE3GRN—Get name of routine that incurred condition

CEE3GRN gets the name of the most current Language Environment-conforming routine where a condition occurred. If there are nested conditions, the most recently signaled condition is used.

CEE3GRN

(name, fc)

**name (output)**

A fixed-length 80-character string (VSTRING), that contains the name of the routine that was executing when the condition was raised. *name* is left-justified within the field and right-padded with blanks. If there are nested conditions, the most recently activated condition is used to determine *name*.

**fc (output)**

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE35S</td>
<td>1</td>
<td>3260</td>
<td>No condition was active when a call to a condition management routine was made.</td>
</tr>
</tbody>
</table>

**Usage notes**

- z/OS UNIX consideration—In multithread applications, CEE3GRN gets the name of the routine that incurred the condition on the current thread.

**Examples**

1. Following is an example of CEE3GRN called by C/C++.

```c
/*Module/File Name: EDC3GRN */
#include <stdio.h>
#include <string.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>
#ifdef __cplusplus
extern "C" {
#endif
void handler(_FEEDBACK *,_INT4 *,_INT4 *,_FEEDBACK *);
#ifdef __cplusplus
}
#endif
int main(void) {
    _FEEDBACK fc,condtok;
    _ENTRY routine;
    _INT4 token,qdata;
    _INT2 c_1,c_2,cond_case,sev,control;
    _CHAR3 facid;
    _INT4 isi;
    CEE3GRN(name,fc);
    /* More code */
}
```
/* register condition handler */
token = 99;
routine.address = (_POINTER)&handler;;
routine.nesting = NULL;
CEEHDLR(&routine,&token,&fc);
if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
    printf("CEEHDLR failed with message number %d\n", fc.tok_msgno);
    exit (2999);
}

/* set up any condition sev 2 or higher */
c_1 = 3;
c_2 = 99;
cond_case = 1;
sev = 3;
control = 0;
memcpy(facid,"ZZZ",3);
isi = 0;
CEENCOD(&c_1,&c_2,&cond_case,&sev,&control,;
     facid,&isi,&condtok,&fc);
if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
    printf("CEENCOD failed with message number %d\n", fc.tok_msgno);
    exit(2999);
}

/* signal condition */
CEESGL(&condtok,&qdata,&fc);
if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
    printf("CEESGL failed with message number %d\n", fc.tok_msgno);
    exit (2999);
}

} void handler(_FEEDBACK *fc, _INT4 *token, _INT4 *result, _FEEDBACK *newfc) {

    _CHAR80 name;
    _FEEDBACK grnfc;

    /* get name of the routine that signal the */
    /* condition */
    CEE3GRN(name,&grnfc);
    if ( _FBCHECK ( grnfc , CEE000 ) != 0 ) {
        printf("CEE3GRN failed with message number %d\n", grnfc.tok_msgno);
        exit (2999);
    }
    printf("the routine that called this condition");
    printf(" handler is:\n %.80s\n",name);
    *result = 10;
    return;
}

2. Following is an example of CEE3GRN called by COBOL.

CBL LIB,QUOTE,NOOPT
*Module/File Name: IGZT3GRN
******************************************************************************
** **
** DRV3GRN - Drive sample program for CEE3GRN. **
** **
******************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. DRV3GRN.

DATA DIVISION.
WORKING-STORAGE SECTION.
01 ROUTINE          PROCEDURE-POINTER.
01 DENOMINATOR      PIC S9(9) BINARY.
01 NUMERATOR        PIC S9(9) BINARY.
01 RATIO            PIC S9(9) BINARY.
01 TOKEN            PIC S9(9) BINARY VALUE 0.
01 FC.
IDENTIFICATION DIVISION.
PROGRAM-ID. CBL3GRN.
DATA DIVISION.
WORKING-STORAGE SECTION.
01 RNAMES PIC X(80).
01 FC.
 02 Condition-Token-Value.
COPY CEEIGZCT.
 03 Case-1-Condition-ID.
    04 Severity PIC S9(4) BINARY.
    04 Msg-No PIC S9(4) BINARY.
 03 Case-2-Condition-ID
    REDEFINES Case-1-Condition-ID.
    04 Class-Code PIC S9(4) BINARY.
    04 Cause-Code PIC S9(4) BINARY.
 03 Case-Sev-Ctl PIC X.
 03 Facility-ID PIC XXX.
02 I-S-Info PIC S9(9) BINARY.

PROCEDURE DIVISION.
REGISTER-HANDLER.
******************************************************************************
** Register handler
******************************************************************************
SET ROUTINE TO ENTRY "CBL3GRN".
CALL "CEEHDLR" USING ROUTINE, TOKEN, FC.
IF NOT CEE000 of FC THEN
  DISPLAY "CEEHDLR failed with msg "
  Msg-No of FC UPON CONSOLE
  /*
  STOP RUN.
END-IF.
RAISE-CONDITION.
******************************************************************************
** Cause a zero-divide condition.
******************************************************************************
MOVE 0 TO DENOMINATOR.
MOVE 1 TO NUMERATOR.
DIVIDE NUMERATOR BY DENOMINATOR
  GIVING RATIO.

UNREGISTER-HANDLER.
******************************************************************************
** UNRegister handler
******************************************************************************
CALL "CEEHDLU" USING ROUTINE, TOKEN, FC.
IF NOT CEE000 of FC THEN
  DISPLAY "CEEHDLU failed with msg "
  Msg-No of FC UPON CONSOLE
END-IF.
STOP RUN.
END PROGRAM DRV3GRN.******************************************************************************
** **
** ** CBL3GRN - Call CEE3GRN to get the name of **
** ** the routine that incurred **
** ** the condition. **
** **
******************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBL3GRN.
DATA DIVISION.
WORKING-STORAGE SECTION.
01 RNAMES PIC X(80).
01 FC.
 02 Condition-Token-Value.
COPY CEEIGZCT.
 03 Case-1-Condition-ID.
    04 Severity PIC S9(4) BINARY.
    04 Msg-No PIC S9(4) BINARY.
 03 Case-2-Condition-ID
    REDEFINES Case-1-Condition-ID.
    04 Class-Code PIC S9(4) BINARY.
    04 Cause-Code PIC S9(4) BINARY.
 03 Case-Sev-Ctl PIC X.
 03 Facility-ID PIC XXX.
02 I-S-Info PIC S9(9) BINARY.
LINKAGE SECTION.
01 TOKEN PIC S9(9) BINARY.
01 RESULT PIC S9(9) BINARY.
 88 RESUME VALUE 10.
01 CURCOND.
 02 Condition-Token-Value.
COPY CEEIGZCT.
 03 Case-1-Condition-ID.
    04 Severity PIC S9(4) BINARY.
    04 Msg-No PIC S9(4) BINARY.
 03 Case-2-Condition-ID

Callable services 145
3. Following is an example of CEE3GRN called by PL/I.

```pli
*PROCESS OPT(0), MACRO;
/* Module/File Name: IBM3GRN */
/****************************/ **
/** Function: CEE3GRN - example of CEE3GRN /**
/** invoked from PL/I ON-unit /**
/****************************/

IBM3GRN:  PROCEDURE OPTIONS(MAIN);

DECLARE
    RNAME       CHAR(80),  /* Feedback token */
    01 FC,          /* Feedback token */
        03 MsgSev   REAL FIXED BINARY(15,0),
        03 MsgNo    REAL FIXED BINARY(15,0),
        03 Flags,
        05 Case     BIT(2),
        05 Severity  BIT(3),
        05 Control   BIT(3),
        03 FacID    CHAR(3),  /* Facility ID */
        03 ISI      /* Instance-Specific Information */
            REAL FIXED BINARY(31),
    divisor    FIXED BINARY(31) INITIAL(0);

ON ZERODIVIDE BEGIN;
/* Call CEE3GRN to get the name of the routine */
/* that incurred the most recently signalled */
/* condition */
```
CALL CEE3GRN ( RNAME, FC );
IF FBCHECK ( FC, CEE000 ) THEN DO;
  PUT SKIP LIST( 'The most recently signalled ' || 'condition was incurred by ' || RNAME );
END;
ELSE DO;
  DISPLAY( 'CEE3GRN failed with msg ' || FC.MsgNo );
END;
END /* ON ZeroDivide */;

divisor = 15 / divisor /* signals ZERODIVIDE */;
END IBM3GRN;

CEE3GRO—Get offset of condition

The CEE3GRO service returns the offset within a failing routine of the most recent condition. If there are nested conditions, the most recently signaled condition is returned.

conditionally (output)

An INT4 data type that, upon completion of this service, contains the offset within a failing routine of the most recent condition.

fc (output, optional)

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE35S</td>
<td>1</td>
<td>3260</td>
<td>No condition was active when a call to a condition management routine was made.</td>
</tr>
</tbody>
</table>

Examples

1. Following is an example of CEE3GRO called by COBOL.

CBL LIB,QUOTE,NOOPT
*Module/File Name: IGZT3GRO
*************************
** ** DRV3GRO - Register a condition handler **
** that calls CEE3GRO to determine **
** the offset in the program that **
** incurred the condition. **
**
*************************
IDENTIFICATION DIVISION.
PROGRAM-ID. DRV3GRO.

DATA DIVISION.
WORKING-STORAGE SECTION.
01 ROUTINE PROCEDURE-POINTER.
01 DENOMINATOR PIC S9(9) BINARY.
01 NUMERATOR PIC S9(9) BINARY.
01 RATIO PIC S9(9) BINARY.
01 TOKEN PIC S9(9) BINARY VALUE 0.
01 FC.
IDENTIFICATION DIVISION.
PROGRAM-ID. CBL3GRO.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01 ROFFSET PIC S9(9) BINARY.
  01 FC.
    02 Condition-Token-Value.
    COPY CEEIGZCT.
    03 Case-1-Condition-ID.
    04 Severity PIC S9(4) BINARY.
    04 Msg-No PIC S9(4) BINARY.
    03 Case-2-Condition-ID
    REDEFINES Case-1-Condition-ID.
    04 Class-Code PIC S9(4) BINARY.
    04 Cause-Code PIC S9(4) BINARY.
    03 Case-Sev-Ctl PIC X.
    03 Facility-ID PIC XXX.
    02 I-S-Info PIC S9(9) BINARY.
LINKAGE SECTION.
  01 TOKEN PIC S9(9) BINARY.
  01 RESULT PIC S9(9) BINARY.
  08 RESUME VALUE 10.
  01 CURCOND.
    02 Condition-Token-Value.
    COPY CEEIGZCT.
    03 Case-1-Condition-ID.
    04 Severity PIC S9(4) BINARY.

PROCEDURE DIVISION. REGISTER-HANDLER.
******************************************************************************
** Register handler
******************************************************************************
SET ROUTINE TO ENTRY "CBL3GRO".
CALL "CEEHDLR" USING ROUTINE, TOKEN, FC.
IF NOT CEE000 of FC THEN
  DISPLAY "CEEHDLR failed with msg ",
  Msg-No of FC UPON CONSOLE
  STOP RUN
END-IF.
 RAISE-CONDITION.
******************************************************************************
** Unregister handler
******************************************************************************
CALL "CEEHDLU" USING ROUTINE, FC.
IF NOT CEE000 of FC THEN
  DISPLAY "CEEHDLU failed with msg ",
  Msg-No of FC UPON CONSOLE
  STOP RUN
END-IF.
 STOP RUN.
END PROGRAM DRV3GRO.
******************************************************************************
** CBL3GRO - Call CEE3GRO to get the offset in the routine that incurred the
** condition.
******************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBL3GRO.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01 ROFFSET PIC S9(9) BINARY.
  01 FC.
    02 Condition-Token-Value.
    COPY CEEIGZCT.
    03 Case-1-Condition-ID.
    04 Severity PIC S9(4) BINARY.
    04 Msg-No PIC S9(4) BINARY.
    03 Case-2-Condition-ID
    REDEFINES Case-1-Condition-ID.
    04 Class-Code PIC S9(4) BINARY.
    04 Cause-Code PIC S9(4) BINARY.
    03 Case-Sev-Ctl PIC X.
    03 Facility-ID PIC XXX.
    02 I-S-Info PIC S9(9) BINARY.
04  Msg-No      PIC S9(4) BINARY.
03  Case-2-Condition-ID
   REDEFINES Case-1-Condition-ID.
04  Class-Code  PIC S9(4) BINARY.
04  Cause-Code  PIC S9(4) BINARY.
03  Case-Sev-Ctl PIC X.
03  Facility-ID  PIC XXX.
02  I-S-Info    PIC S9(9) BINARY.
01  NEWCOND.
  02  Condition-Token-Value.
COPY CEEIGZCT.
03  Case-1-Condition-ID.
04  Severity    PIC S9(4) BINARY.
04  Msg-No      PIC S9(4) BINARY.
03  Case-2-Condition-ID
   REDEFINES Case-1-Condition-ID.
04  Class-Code  PIC S9(4) BINARY.
04  Cause-Code  PIC S9(4) BINARY.
03  Case-Sev-Ctl PIC X.
03  Facility-ID  PIC XXX.
02  I-S-Info    PIC S9(9) BINARY.

PROCEDURE DIVISION USING CURCOND, TOKEN,
   RESULT, NEWCOND.
PARA-CBL3GRO.
CALL "CEE3GRO" USING ROFFSET, FC.
IF CEE000 of FC THEN
   DISPLAY "Offset in routine which "
   "incurred the condition is:  "
   ROFFSET
ELSE
   DISPLAY "CEE3GRO failed with msg "
   Msg-No of FC UPON CONSOLE
END-IF.
PARA-HANDLER.
*************************************************
**  In user handler - resume execution
*************************************************
SET RESUME TO TRUE.
GOBACK.
END PROGRAM CBL3GRO.

2. Following is an example of CEE3GRO called by PL/I.

*Process lc(101),opt(0),s,map,list,stmt,a(f),ag;
*Process macro;
DRV3GRO: Proc Options(Main);

/*Module/File Name: IBM3GRO                      */
/******************************************************************************/
**DRV3GRO - Register a condition handler that   *
**  calls CEE3GRO to determine               *
**  the offset in the routine that           *
**  incurred the condition.                  *
*******************************************************************************/
%include CEEIBMCT;
%include CEEIBMAW;
declare 01 FBCODE feedback;
declare DENOMINATOR real fixed binary(31,0);
declare NUMERATOR real fixed binary(31,0);
declare RATIO real fixed binary(31,0);
declare PLI3GRO external entry;
declare U_PTR pointer;
declare 01 U_DATA,    
   03 U_CNTL fixed binary(31,0),
   03 U_TOK pointer;
U_PTR = addr(U_DATA);
U_CNTL = 0;

/* Set Resume Point */
Display('Setting resume point via CEE3SRP');
Call CEE3SRP(U_TOK,FBCODE);
Display('After call to CEE3SRP ... Resume point');
If U_CNTL = 0
Do;
    Display('First time through...');
/* Register User Handler */
    Display('Registering user handler');
    Call CEEHDLR(PLI3GRO, U_PTR, FBCODE);
    If FBCHECK(FBCODE, CEE000) then
        Do;
            /* Cause a zero-divide condition */
            DENOMINATOR = 0;
            NUMERATOR = 1;
            RATIO = NUMERATOR/DENOMINATOR;
        End;
    Else
        Do:
            Display('CEEHDLR failed with msg');
            Display(MsgNo);
        End;
    End;
Else
    Display('2nd time...User can do whatever');
/* Unregister handler */
    Call CEEHDLU(PLI3GRO, FBCODE);
    If FBCHECK(FBCODE, CEE000) Then
        Display('Main: unregistered PLI3GRO');
    Else
        Do;
            Display('CEEHDLU failed with msg ');
            Display(MsgNo);
        End;
    End;
End DRV3GRO;

*Process lc(101),opt(0),s,map,list,stmt,a(f),ag;
*Process macro;
PLI3GRO: Proc (PTR1,PTR2,PTR3,PTR4);
    /***************************************************
    **                                                
    ** PLI3GRO - Call CEE3GRO to get the offset in    
    **           the routine that incurred the        
    **           condition.                           
    **                                                
    ***************************************************/
    %include CEEIBMCT;
    %include CEEIBMAW;
    declare (PTR1,PTR2,PTR3,PTR4) pointer;
    declare 01 CURCOND based(PTR1) feedback;
    declare TOKEN      pointer based(PTR2);
    declare RESULT     fixed binary(31,0) based(PTR3);
    declare 01 NEWCOND based(PTR4) feedback;
    declare ROFFSET    real fixed binary(31,0);
    declare 01 FBCODE  feedback;
    declare 01 U_DATA  based(TOKEN),
        03 U_CNTL fixed binary(31,0),
        03 U_TOK  pointer;
    Call CEE3GRO(ROFFSET,FBCODE);
    If fbcheck (fbcode, cee000) Then
        Do;
            Display('Routine offset which incurred');
            Display('the condition is: ');
            Display(ROFFSET);
        End;
    Else
        Do;
            Display('CEE3GRO failed with msg ');
            Display(FBCODE.MsgNo);
        End;
    End;
    /***************************************************
    ** In user handler - resume execution             
    ***************************************************/
    RESULT = 10;
    Call CEEMRCE(U_TOK,FBCODE);
    U_CNTL = 1;
    Return;
End PLI3GRO;
CEE3INF—Query enclave information

CEE3INF queries and returns to the calling routine the information about the system/subsystem, the environment information, the member languages, and the version of Language Environment associated with this enclave.

\[
\begin{array}{c}
\text{CEE3INF} \rightarrow \text{sys/subsys} \rightarrow \text{env-info} \rightarrow \text{member-id} \rightarrow \text{gpid} \rightarrow \text{fc} \rightarrow \text{fc}
\end{array}
\]

**sys/subsys (input/output)**

As input, `sys/subsys` is considered to be an address to a fullword. As output, the fullword is a 32-bit map that represents the operating system or subsystem on which the enclave is currently running.

0  Currently executing in the CICS environment
1  Currently executing in a CICS_PIPI environment
2-3  Reserved for other specific CICS environments
4  Currently executing in a TSO environment
5  Currently executing in a Batch environment
6  Currently executing in a z/OS UNIX environment
7-28  Reserved for future use
29  Currently executing on z/VSE®
30  Currently executing on z/OS
31  Reserved.

**env-info (input/output)**

As input, `env-info` is considered to be an address to a fullword. As output, the fullword is a 32-bit map representing the environments that are active in that enclave.

0  Currently executing in a PIPI environment
1  Currently executing in a PIPI-Main environment
2  Currently executing in a PIPI-Sub environment
3  Currently executing in a PIPI-Subdp environment
4  Currently executing in a PICI (Pre-init compatibility interface) environment. For more information, see [z/OS XL C/C++ Programming Guide](https://www.ibm.com/docs/en/zos/2.6.0). 
5  Currently executing in a nested enclave
6  LRR is active in the current enclave
Runtime reuse is active in the current environment

XPLINK(ON) is in effect in the current enclave

POSIX(ON) RTO in effect in the current enclave

At least one pthread has been created in this enclave

Currently executing on the IPT

Multithreaded fork is in effect in the current enclave

AMODE Init

B'00'
  AMODE 24

B'10'
  AMODE 31

Currently executing in a PIPI-Maindp environment

Reserved for future use

**member-id (input/output)**

As input, *member-id* is considered to be an address to a fullword. As output, the fullword is a 32-bit map representing the member languages that are initialized in that enclave.

Reserved

Reserved

Reserved

C/C++

Reserved

COBOL

Reserved

Fortran

Reserved

Reserved

PL/I

Enterprise PL/I

Reserved
15
Reserved
16
Reserved
17-23
Reserved for future use
24-31
The current version number of CEE3INF. It is currently set to 0.

gpid (input/output)
A fullword integer representing the version of Language Environment that created this thread. This
fullword can be interpreted as a four-byte hex number as follows:

|PP|VV|RR|MM|

PP
product number
VV
version
RR
release
MM
modification

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you
choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate
syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
</tbody>
</table>

Usage notes
• z/OS UNIX considerations — CEE3INF is allowed only in the thread.
• If you are not interested in any one of the parameters being passed, a 0 must be placed in the slot of
those parameters. This indicates that no information is needed regarding that parameter.
• When the PIPI or nested enclave environment bit is on, a subsystem bit may not be set.

Examples
1. An example of CEE3INF called by C/C++:

```c
/*Module/File Name: EDC3INF */
/*****************************************************************************/
/* THIS EXAMPLE CALLS CEE3INF TO GET INFORMATION OF THE CURRENT */
/* ENCLAVE, LIKE THE SYSTEM/SUBSYSTEM, THE ENVIRONMENT INFORMATION, */
/* THE MEMBER LANGUAGES USED AND THE VERSION OF LANGUAGE ENVIRONMENT.*/
/*****************************************************************************/
#include <leawi.h>
#include <string.h>
#include <ceeedcct.h>

int main(void) {
    _INT4 sys_subsys, env_info, member_id, gpid;
    _FEEDBACK fc;
```
2. An example of CEE3INF called by COBOL:

```cobol
CBL LIB,QUOTE
*****************************************************************
**                                                             **
** Function: CEE3INF - Query enclave information               **
**                                                             **
** This example calls CEE3INF to gather data about the current **
** enclave like the system/subsystem, environment information, **
** member languages, and Language Environment version number. **
**                                                             **
*****************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBL3INF.
DATA DIVISION.
WORKING-STORAGE SECTION.
**********************************************************
**  Define space for a Language Environment feedback    **
**  code (12 total bytes).                              **
**  Include a copy of CEEIGZCT to get pre-defined       **
**  Language Environment condition tokens.              **
**********************************************************
01 FC.
   02 CONDITION-TOKEN-VALUE.
   COPY CEEIGZCT.
      03 CASE-1-CONDITION-ID.
      04 SEVERITY PIC S9(4) BINARY.
      04 MSG-NO PIC S9(4) BINARY.
      02 I-S-INFO PIC S9(9) BINARY.
**********************************************************
**  Define some storage to be used by the Language      **
**  Environment callable service.                       **
**********************************************************
01 SYS-SUBSYS PIC S9(9) BINARY.
01 ENV-INFO PIC S9(9) BINARY.
01 MEM-ID PIC S9(9) BINARY.
01 GPID PIC S9(9) BINARY.
PROCEDURE DIVISION.
MAIN-PROG.
*  *************************************************
*  ** Now call CEE3INF. It returns the results    **
*  ** of the query on the environment and the **
*  ** feedback code. **
*  ** Report error and stop if CEE3INF fails. **
*  *************************************************
CALL "CEE3INF" USING SYS-SUBSYS, ENV-INFO, MEM-ID, GPID, FC.
IF CEE000 OF FC THEN
   DISPLAY "SYS-SUBSYS: " SYS-SUBSYS
   DISPLAY "ENV-INFO : " ENV-INFO
   DISPLAY "MEM-ID : " MEM-ID
   DISPLAY "GPID : " GPID
ELSE
   DISPLAY "CEE3INF FAILED WITH MSG "
      MSG-NO OF FC UPON CONSOLE
END-IF.
GOBACK.
```
3. An example of CEE3INF called by PL/I:

```pli
*PROCESS MACRO;
/*****************************/
/*Module/File Name: IBM3INF */
/*****************************/
/**
** Function: CEE3INF - query enclave information
**
** This example calls CEE3INF to gather data about the current
** enclave like the system/subsystem, environment information, 
** member languages, and Language Environment version number.
**
******************************/

PLI3INF: PROCEDURE OPTIONS (MAIN) REORDER;

%INCLUDE CEEIBMAW;
%INCLUDE CEEIBMCT;

DCL SYSPRINT File Output Stream;

DCL SYS_SUB REAL FIXED BINARY(31,0),
ENV_INF REAL FIXED BINARY(31,0),
MEM_ID REAL FIXED BINARY(31,0),
GPID REAL FIXED BINARY(31,0);

/****************************/
/* Declare a Language Environment Feedback token. */
/* 12 Total bytes of storage. */
/****************************/
Declare 01 LE_Feedback_Code,
03 MsgSev REAL FIXED BINARY(15,0),
03 MsgNo REAL FIXED BINARY(15,0),
03 Flags,
  05 Case BIT(2),
  05 Severity BIT(3),
  05 Control BIT(3),
03 FacID CHAR(3),
03 ISI REAL FIXED BINARY(31,0);

/****************************/
/* Local declares needed for Messaging Callable Services*/
/****************************/
Declare  Msg_dest REAL FIXED BINARY(31,0);
Declare  Msg_String CHAR(255) VARYING;
Msg_dest = 2;

/*****************************/
/* Call CEE3INF to request info about the */
/* current enclave */
/*****************************/
CALL CEE3INF(SYS_SUB,ENV_INF,MEM_ID,GPID,LE_Feedback_Code);

/*****************************/
/* Output the result. */
/*****************************/
Msg_String = 'System-Subsystem  : ' || BIT(SYS_SUB);
Call CEEMOUT(Msg_String,Msg_Dest,LE_Feedback_Code);

Msg_String = 'Environment Information: ' || BIT(ENV_INF);
Call CEEMOUT(Msg_String,Msg_Dest,LE_Feedback_Code);

Msg_String = 'Member Languages    : ' || BIT(MEM_ID);
Call CEEMOUT(Msg_String,Msg_Dest,LE_Feedback_Code);
```

### CEE3LNG—Set national language

CEE3LNG sets the current national language. You can also use CEE3LNG to query the current national language. Changing the national language changes the languages in which error messages are displayed and printed, the names of the days of the week, and the names of the months. The current national language setting, as well as previous national language settings that have not been discarded, are recorded on the stack on a LIFO (last in, first out) basis. The current national language setting is always on the top of the stack.
There are two methods of changing the default national language setting with CEE3LNG:

- Specify the new national language setting and place it on top of the stack using a `function` value of 1 (SET). This discards the previous default setting.
- Specify the new national language setting and place it on top of the stack using a `function` value of 3 (PUSH). This pushes the previous national language setting down on the stack so that you can later retrieve it by discarding the current setting.

To illustrate the second method, suppose you live in the United States and the code for the United States is specified as a system-level default. If you want to use the French defaults for a certain application, you can use CEE3LNG to PUSH France as the national language setting; then when you want the defaults for the United States, you can POP France from the top of the stack, making the United States the national language setting.

If you specify a `desired_language` that is not available on your system, Language Environment uses the IBM-supplied default ENU (mixed-case U.S. English). If an unknown national language code is specified as a system-level, region-level or CEEUOPT default, a return code of 4 and a warning message is issued.

You can also use the NATLANG runtime option to set the national language.

CEE3LNG affects only the Language Environment NLS and date and time services, not the Language Environment locale callable services or C locale-sensitive functions.

---

**CEE3LNG**

```
CEE3LNG (function, desired_language, fc)
```

**function (input)**

A fullword binary integer that specifies the service to perform. The possible values for `function` are:

1—SET

Establishes the `desired_language` specified in the call to CEE3LNG as the current language. In effect, it replaces the current language on the top of the stack with the `desired_language` that you specify. When setting the national language, the `desired_language` is folded to uppercase. "enu" and "ENU", for example, are considered to be the same national language.

2—QUERY

Identifies the current language on the top of the stack to the calling routine by returning it in the `desired_language` parameter of CEE3LNG. The `desired_language` retained as the result of the QUERY function is in uppercase.

3—PUSH

Pushes the `desired_language` specified in the call to CEE3LNG on to the top of the language stack, making it the current language. Previous languages are retained on the stack on a LIFO basis, making it possible to return to a prior language at a later time.

4—POP

Pops the current language off the stack. The previous language that was pushed on to the stack now becomes the new current language. Upon return to the caller, the `desired_language` parameter contains the discarded language. If the stack contains only one language and would be empty after the call, no action is taken and a feedback code indicating such is returned.

**desired_language (input/output)**

A 3-character fixed-length string. The string is not case-sensitive and is used in the following ways for different `functions`:
If function is: Then desired_language:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 or 3</td>
<td>Contains the desired national language identification. In this case, it is an input parameter. Table 24 on page 160 contains a list of national language identifiers.</td>
</tr>
<tr>
<td>Note: Language Environment supports only these national languages:</td>
<td></td>
</tr>
<tr>
<td>ENU</td>
<td>Mixed-case U.S. English</td>
</tr>
<tr>
<td>UEN</td>
<td>Uppercase U.S. English</td>
</tr>
<tr>
<td>JPN</td>
<td>Japanese.</td>
</tr>
<tr>
<td>2</td>
<td>Returns the current language on top of the stack. In this case, it is an output parameter.</td>
</tr>
<tr>
<td>4</td>
<td>Returns the discarded national language. In this case, it is an output parameter.</td>
</tr>
</tbody>
</table>

fc (output)

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE3BQ</td>
<td>2</td>
<td>3450</td>
<td>Only one language was on the stack when a POP request was made to CEE3LNG. The current language was returned.</td>
</tr>
<tr>
<td>CEE3BR</td>
<td>3</td>
<td>3451</td>
<td>The desired language desired-language for the PUSH or SET function for CEE3LNG was invalid. No operation was performed.</td>
</tr>
<tr>
<td>CEE3BS</td>
<td>3</td>
<td>3452</td>
<td>The function function specified for CEE3LNG was not recognized. No operation was performed.</td>
</tr>
</tbody>
</table>

Usage notes

• PL/I MTF consideration—The CEE3LNG callable service is not supported in PL/I multitasking applications.
• PL/I consideration—When running PL/I with POSIX(ON), CEE3LNG is not supported.
• z/OS UNIX consideration
  – CEE3LNG applies to the enclave. Each enclave has a single current national language setting.
  – Language Environment provides z/OS UNIX-compliant locales as part of the C/C++ runtime library. The locales establish the cultural conventions for locale-sensitive functions in this runtime. The CEESETL callable service and other locale callable services depend on the loaded locale. To change the locale, you can use the setlocale() C/C++ library function or the CEESETL callable service. Locale values do not affect the settings used by the CEE3LNG callable service. For a complete list of locales, see z/OS Language Environment Programming Guide.
  – The CEE3LNG callable services, such as date and time formatting, sorting, and currency symbols are independent of the locale. CEE3LNG affects only Language Environment NLS and date and time services. Mixing CEE3LNG services and locale callable services might produce inconsistent results.

For more information

• See “NATLANG” on page 51 for more information about the NATLANG runtime option.
• For more information about the CEESETL callable service, see “CEESETL—Set locale operating environment” on page 362.
• For more information about setlocale(), see z/OS XL C/C++ Programming Guide.
Examples

1. Following is an example of CEE3LNG called by C/C++.

```c
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {
    _FEEDBACK fc;
    _INT4 function;
    _CHAR3 lang;

    /* Query the current language setting */
    function = 2; /* function 2 is query */
    CEE3LNG(&function,lang,&fc);
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEE3LNG failed with message number %d\n", fc.tok_msgno);
        exit(2999);
    }

    /* if the current language is not mixed-case */
    /* American English set the current language to */
    /* mixed-case American English */
    if (memcmp(lang,"ENU",3) != 0) {
        memcpy(lang,"ENU",3);
        function = 1; /* function 1 is set */
        CEE3LNG(&function,lang,&fc);
        if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
            printf("CEE3LNG failed with message number %d\n", fc.tok_msgno);
            exit(2999);
        }
    }
}

2. Following is an example of CEE3LNG called by COBOL.

```
** Specify 2 for QUERY function.  ** Specify 2 for QUERY function.  ** Call CEE3LNG to query the current  ** Call CEE3LNG to query the current  ** national language setting  ** national language setting  

```
MOVE 2 TO FUNCTN.
CALL "CEE3LNG" USING FUNCTN, LANG, FC.
IF CEE000 of FC THEN
  DISPLAY "Current National Language is: "
  LANG
ELSE
  DISPLAY "CEE3LNG(query) failed with msg "
  Msg-No of FC UPON CONSOLE
  STOP RUN
END-IF.
```

** If the current national language is not  ** If the current national language is not  ** mixed-case U.S. English, then call  ** mixed-case U.S. English, then call  ** CEE3LNG with the SET function (1) to  ** CEE3LNG with the SET function (1) to  ** change the national language to mixed-case  ** change the national language to mixed-case  ** U.S. English  ** U.S. English  

```
IF ( LANG IS NOT = "ENU" ) THEN
  MOVE 1 TO FUNCTN
  CALL "CEE3LNG" USING FUNCTN, LANG, FC
  IF NOT CEE000 of FC THEN
    DISPLAY "CEE3LNG(set) failed with msg "
    Msg-No of FC UPON CONSOLE
    STOP RUN
  END-IF
  DISPLAY "The national language has ",
  "been changed to mixed-case "
  "U.S. English (ENU)."
END-IF.
GOBACK.
```

3. Following is an example of CEE3LNG called by PL/I.

```
*PROCESS MACRO;
/* Module/File Name: IBM3LN
** Function: CEE3LNG - set national language */
** In this example, CEE3LNG is called to query the */
** current national language setting. If the */
** setting is not mixed case American English, */
** CEE3LNG is called to change the setting to that*/
** */
**/PLI3LNG: PROC OPTIONS(MAIN);
%INCLUDE CEEIBMAW;
%INCLUDE CEEIBMCT;
DCL FUNCTN REAL FIXED BINARY(31,0);
DCL LANG CHARACTER ( 3 );
DCL 01 FC, /* Feedback token */
  03 MsgSev REAL FIXED BINARY(15,0),
  03 MsgNo REAL FIXED BINARY(15,0),
  03 Flags,
    05 Case BIT(2),
    05 Severity BIT(3),
    05 Control BIT(3),
  03 FacID CHAR(3), /* Facility ID */
  03 ISI /* Instance-Specific Information */
    REAL FIXED BINARY(31,0);
FUNCTN = 2; /* Specify code to query current */
/* national language */
/* Call CEE3LNG with function code 2 to query */
/* national language */
CALL CEE3LNG ( FUNCTN, LANG, FC );
IF FBCHECK( FC, CEE000 ) THEN DO;
  PUT SKIP LIST('The current national language '
```
<table>
<thead>
<tr>
<th>ID</th>
<th>National Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>AFR</td>
<td>Afrikaans</td>
</tr>
<tr>
<td>ARA</td>
<td>Arab countries</td>
</tr>
<tr>
<td>BGR</td>
<td>Bulgarian</td>
</tr>
<tr>
<td>CAT</td>
<td>Catalan</td>
</tr>
<tr>
<td>CHT</td>
<td>Traditional Chinese</td>
</tr>
<tr>
<td>CHS</td>
<td>Simplified Chinese</td>
</tr>
<tr>
<td>CSY</td>
<td>Czech</td>
</tr>
<tr>
<td>DAN</td>
<td>Danish</td>
</tr>
<tr>
<td>DEU</td>
<td>German</td>
</tr>
<tr>
<td>DES</td>
<td>Swiss German</td>
</tr>
<tr>
<td>ELL</td>
<td>Greek</td>
</tr>
<tr>
<td>ENG</td>
<td>U.K. English</td>
</tr>
<tr>
<td>ENU</td>
<td>U.S. English</td>
</tr>
<tr>
<td>ESP</td>
<td>Spanish</td>
</tr>
<tr>
<td>FIN</td>
<td>Finnish</td>
</tr>
<tr>
<td>FRA</td>
<td>French</td>
</tr>
<tr>
<td>FRB</td>
<td>Belgian French</td>
</tr>
<tr>
<td>FRC</td>
<td>Canadian French</td>
</tr>
<tr>
<td>FRS</td>
<td>Swiss French</td>
</tr>
</tbody>
</table>

4. Table 24 on page 160 lists the supported national language codes.
### Table 24: National language codes (continued)

<table>
<thead>
<tr>
<th>ID</th>
<th>National Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEB</td>
<td>Hebrew</td>
</tr>
<tr>
<td>HUN</td>
<td>Hungarian</td>
</tr>
<tr>
<td>ISL</td>
<td>Icelandic</td>
</tr>
<tr>
<td>ITA</td>
<td>Italian</td>
</tr>
<tr>
<td>ITS</td>
<td>Swiss Italian</td>
</tr>
<tr>
<td>JPN</td>
<td>Japanese</td>
</tr>
<tr>
<td>KOR</td>
<td>Korean</td>
</tr>
<tr>
<td>NLD</td>
<td>Dutch</td>
</tr>
<tr>
<td>NLB</td>
<td>Belgian Dutch</td>
</tr>
<tr>
<td>NOR</td>
<td>Norwegian - Bokmal</td>
</tr>
<tr>
<td>NON</td>
<td>Norwegian - Nynorsk</td>
</tr>
<tr>
<td>PLK</td>
<td>Polish</td>
</tr>
<tr>
<td>PTG</td>
<td>Portuguese</td>
</tr>
<tr>
<td>PTB</td>
<td>Brazilian Portuguese</td>
</tr>
<tr>
<td>RMS</td>
<td>Rhaeto-Romanic</td>
</tr>
<tr>
<td>ROM</td>
<td>Romanian</td>
</tr>
<tr>
<td>RUS</td>
<td>Russian</td>
</tr>
<tr>
<td>SHC</td>
<td>Serbo-Croatian (Cyrillic)</td>
</tr>
<tr>
<td>SHL</td>
<td>Serbo-Croatian (Latin)</td>
</tr>
<tr>
<td>SKY</td>
<td>Slovakian</td>
</tr>
<tr>
<td>SQI</td>
<td>Albanian</td>
</tr>
<tr>
<td>SVE</td>
<td>Swedish</td>
</tr>
<tr>
<td>THA</td>
<td>Thai</td>
</tr>
<tr>
<td>TRK</td>
<td>Turkish</td>
</tr>
<tr>
<td>UEN</td>
<td>U.S. uppercase English</td>
</tr>
<tr>
<td>URD</td>
<td>Urdu</td>
</tr>
</tbody>
</table>

### CEE3MCS—Get default currency symbol

CEE3MCS returns the default currency symbol for the country you specify with *country_code*. For a list of the default settings for a specified country, see Table 33 on page 419.

```plaintext
CEE3MCS(country_code, currency_symbol)
```

**country_code** *(input)*

A 2-character fixed-length string representing one of the country codes found in Table 33 on page 419. *country_code* is not case-sensitive. If no value is specified, the default country code, as set by the COUNTRY runtime option or the CEE3CTY callable service, is used.
currency_symbol (output)
A 4-character fixed-length string returned to the calling routine. It contains the default currency symbol for the country specified. The currency symbol is left-justified and padded on the right with blanks, if necessary.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE3C7</td>
<td>2</td>
<td>3463</td>
<td>The country code country_code was not valid for CEE3MCS. The default currency symbol currency_symbol was returned.</td>
</tr>
</tbody>
</table>

Usage notes
• If you specify a country_code that is not valid, the default currency symbol is X'9F404040'. In the United States, it is shown as a '$' followed by three blanks.
• z/OS UNIX considerations—CEE3MCS applies to the enclave. Every enclave has a single current country setting that has a single currency symbol. Every thread in every enclave has the same default.
• Euro considerations—For countries in the European Union that have adopted the Euro as the legal tender, the currency symbol is represented as a hexadecimal string in the default country settings. The value is the code point for the Euro sign, taken from a typical code page for the given country. Of course, the actual graphical representation depends on the code page in use. See Table 33 on page 419 for a list of country settings.

Language Environment supports the Euro as the default currency symbol in the following countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain. As more countries pass the economic and monetary union convergence criteria and adopt the Euro as the legal currency, the default currency symbol will replace the national currency symbol with the Euro sign.

For more information
• See “COUNTRY” on page 20 for an explanation of the COUNTRY runtime option.
• See “CEE3CTY—Set the default country” on page 122 for an explanation of the CEE3CTY callable service.
• See “CEE3MC2—Get default and international currency symbols” on page 164 for an explanation of the CEE3MC2 callable service.

Examples
1. Following is an example of CEE3MCS called by C/C++.

```c
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {
    _FEEDBACK fc;
    _CHAR2 country;
    _CHAR4 currency;
    /* get the default currency symbol for Canada */
    strcpy(country, "CA");
    ```
2. Following is an example of CEE3MCS called by COBOL.

```cobol
CBL LIB,QUOTE
*Module/File Name: IGZT3MCS
*******************************************************************************
**                       **
** CBL3MCS - Call CEE3MCS to obtain the **
**           default currency symbol          **
**                       **
*******************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBL3MCS.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01  COUNTRY         PIC X(2).
  01  CURSYM          PIC X(4).
  01  FC.
     02  Condition-Token-Value.
     COPY  CEEIGZCT.
     03  Case-1-Condition-ID.
         04  Severity    PIC S9(4) BINARY.
         04  Msg-No      PIC S9(4) BINARY.
     03  Case-2-Condition-ID
         REDEFINES Case-1-Condition-ID.
         04  Class-Code  PIC S9(4) BINARY.
         04  Cause-Code  PIC S9(4) BINARY.
     03  Case-Sev-Ctl    PIC X.
     03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBL3MCS.
*******************************************************************************
** Specify country code for the US in the call **
** to CEE3MCS  
*******************************************************************************
MOVE "US" TO COUNTRY.
CALL "CEE3MCS" USING COUNTRY, CURSYM, FC.
*******************************************************************************
** If CEE3MCS runs successfully, display result. **
*******************************************************************************
IF CEE000 of FC  THEN
  DISPLAY "The default currency symbol ",
  " for the " COUNTRY " is: " CURSYM
ELSE
  DISPLAY "CEE3MCS failed with msg ",
  Msg-No of FC UPON CONSOLE
END-IF.
GOBACK.
```

3. Following is an example of CEE3MCS called by PL/I.

```pli
*PROCESS MACRO;
/* Module/File Name: IBM3MCS */
*******************************************************************************
/**                      **
/** Function: CEE3MCS - Obtain default currency symbol **
/**                      **
*******************************************************************************
PLI3MCS: PROC OPTIONS(MAIN);
%INCLUDE CEEIBMAW;
%INCLUDE CEEIBMCT;
DCL COUNTRY CHARACTER ( 2 );
DCL CURSYM CHARACTER ( 4 );
```
DCL 01 FC, /* Feedback token */
  03 MsgSev REAL FIXED BINARY(15,0),
  03 MsgNo  REAL FIXED BINARY(15,0),
  03 Flags,
    05 Case BIT(2),
    05 Severity BIT(3),
    05 Control  BIT(3),
  03 FacID   CHAR(3), /* Facility ID */
  03 ISI   /* Instance-Specific Information */
    REAL FIXED BINARY(31,0);

COUNTRY = 'US'; /* Specify country code for the */ /* United States */
  /* Call CEE3MCS to return currency symbol for */ /* the United States */
CALL CEE3MCS ( COUNTRY, CURSYM, FC );

  /* Print the default currency symbol for the US */
  IF  FBCHECK( FC, CEE000)  THEN  DO;
    PUT SKIP LIST( 'The default currency symbol for the '
                   || COUNTRY || ' is "' || CURSYM || '"');
  END;
  ELSE  DO;
    DISPLAY( 'CEE3MCS failed with msg '
             || FC.MsgNo );
    STOP;
  END;
END PLI3MCS;

CEE3MC2—Get default and international currency symbols

CEE3MC2 returns the default currency symbol and international currency symbol for the country you specify with country_code. For a list of the default settings for a specified country, see Table 33 on page 419.

```plaintext
CEE3MC2(country_code, currency_symbol, international_currency_symbol, fc)
```

**country_code (input)**
A 2-character fixed-length string representing one of the country codes found in Table 33 on page 419. country_code is not case-sensitive. If no value is specified, the default country code, as set by the COUNTRY runtime option or the CEE3CTY callable service, is used.

**currency_symbol (output)**
A 4-character fixed-length string returned to the calling routine. It contains the default currency symbol for the country specified. The currency symbol is left-justified and padded on the right with blanks, if necessary.

**international_currency_symbol (output)**
A 3-character alphabetic fixed-length string returned to the calling routine. It contains the international currency symbol for the country specified.

**fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
</tbody>
</table>
Usage notes

- If you specify a `country_code` that is not valid, the default currency symbol is X'9F404040'. In the United States, it is shown as a '$' followed by three blanks.
- z/OS UNIX considerations—CEE3MC2 applies to the enclave. Every enclave has a single current country setting that has a single currency symbol. Every thread in every enclave has the same default.
- Euro considerations—For countries in the European Union that have adopted the Euro as the legal tender, the currency symbol is represented as a hexadecimal string in the default country settings. The value is the code point for the Euro sign, taken from a typical code page for the given country. Of course, the actual graphical representation depends on the code page in use. See Table 33 on page 419 for a list of country settings.

Language Environment supports the Euro as the default currency symbol in the following countries: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, and Spain. As more countries pass the economic and monetary union convergence criteria and adopt the Euro as the legal currency, the default currency symbol will replace the national currency symbol with the Euro sign.

For more information

- See “COUNTRY” on page 20 for an explanation of the COUNTRY runtime option.
- See “CEE3CTY—Set the default country” on page 122 for an explanation of the CEE3CTY callable service.
- See “CEE3MCS—Get default currency symbol” on page 161 for an explanation of the CEE3MCS callable service.

Examples

1. Following is an example of CEE3MC2 called by C/C++.

```c
/*Module/File Name: EDC3MC2 */
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {
    _FEEDBACK fc;
    _CHAR2 country;
    _CHAR4 currency;
    _CHAR3 international_currency;
    /* get the default currency symbol for Canada */
    memcpy(country,"CA",2);
    CEE3MC2(country,currency,international_currency,&fc);
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEE3MC2 failed with message number %d\n",fc.tok_msgno);
        exit(2999);
    }
    printf("The default currency symbol for Canada is:" " %.2s\n",currency);
    printf("The international symbol for Canada is:" " %.3s\n",international_currency);
}```

Callable services 165
2. Following is an example of CEE3MC2 called by COBOL.

```cobol
CBL LIB,QUOTE
*Module/File Name: IGZT3MC2
******************************************************************************
** **
** CBL3MC2 - Call CEE3MC2 to obtain the **
** currency symbols **
**
******************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBL3MC2.
DATA DIVISION.
WORKING-STORAGE SECTION.
 01 COUNTRY     PIC X(2).
 01 CURSYM      PIC X(2).
 01 INTCURSYM   PIC X(3).
 01 FC.
    02 Condition-Token-Value.
    COPY CEEIGZCT.
      03 Case-1-Condition-ID.
        04 Severity    PIC S9(4) BINARY.
        04 Msg-No      PIC S9(4) BINARY.
      03 Case-2-Condition-ID
        REDEFINES Case-1-Condition-ID.
        04 Cause-Code  PIC S9(4) BINARY.
        04 Cause-Code  PIC S9(4) BINARY.
      03 Case-Sev-Ctl    PIC X.
      03 Facility-ID     PIC XXX.
    02 I-S-Info            PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBL3MC2.
******************************************************************************
** Specify country code for the US in the call **
** to CEE3MC2 **
******************************************************************************
  MOVE "US" TO COUNTRY.
  CALL "CEE3MC2" USING COUNTRY, CURSYM, INTCURSYM, FC.

******************************************************************************
** If CEE3MC2 runs successfully, display result. **
******************************************************************************
  IF CEE000 of FC THEN
    DISPLAY "The default currency symbol "
    "for the " COUNTRY " is: " CURSYM
    DISPLAY "The international currency symbol "
    "for the " COUNTRY " is: " INTCURSYM
  ELSE
    DISPLAY "CEE3MC2 failed with msg ",
    Msg-No of FC UPON CONSOLE
  END-IF.
GOBACK.
```

3. Following is an example of CEE3MC2 called by PL/I.

```pli
*PROCESS MACRO;
/*Module/File Name: IBM3MC2 */
******************************************************************************
** Function: CEE3MC2 - Obtain currency symbols **
******************************************************************************
PLI3MC2: PROC OPTIONS(MAIN);
%INCLUDE CEEIBMAW;
%INCLUDE CEEIBMCT;
DCL COUNTRY CHARACTER ( 2 );
DCL CURSYM CHARACTER ( 4 );
DCL INTCURSYM CHARACTER ( 3 );
DCL 01 FC, /* Feedback token */
  03 MsgSev   REAL FIXED BINARY(15,0),
  03 MsgNo    REAL FIXED BINARY(15,0),
  03 Flags,
    05 Case   BIT(2),
    05 Severity BIT(3),
    05 Control BIT(3),
```
CEE3MDS—Get default decimal separator

CEE3MDS returns the default decimal separator for the country specified by country_code. For a list of the default settings for a specified country, see Table 33 on page 419.

country_code (input)
A 2-character fixed-length string representing one of the country codes found in Table 33 on page 419. country_code is not case-sensitive. If no value is specified, the default country code, as set by the COUNTRY runtime option or the CEE3CTY callable service, is used.

decimal_separator (output)
A 2-character fixed-length string containing the default decimal separator for the country specified. The decimal separator is left-justified and padded on the right with a blank.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE3C4</td>
<td>2</td>
<td>3460</td>
<td>The decimal separator 'decimal_separator' was truncated and was not defined in CEE3MDS.</td>
</tr>
<tr>
<td>CEE3C5</td>
<td>2</td>
<td>3461</td>
<td>The country code country_code was invalid for CEE3MDS. The default decimal separator 'decimal_separator' was returned.</td>
</tr>
</tbody>
</table>

Usage notes
• If you specify a country_code that is not valid, the default decimal separator is a period (.).
• z/OS UNIX considerations—CEE3MDS applies to the enclave. Every enclave has a single current country setting that has a single decimal separator. Every thread in every enclave has the same default.
For more information

- See “COUNTRY” on page 20 for an explanation of the COUNTRY runtime option.
- See “CEE3CTY—Set the default country” on page 122 for an explanation of the CEE3CTY callable service.

Examples

1. Following is an example of CEE3MDS called by C/C++.

```c
/*Module/File Name: EDC3MDS   */
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {
    _FEEDBACK fc;
    _CHAR2 country,decimal;
    /* get the default decimal separator for Canada */
    memcpy(country,"CA",2);
    CEE3MDS(country,decimal,&fc);
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEE3MDS failed with message number %d\n", fc.tok_msgno);
        exit(2999);
    }
    /* print out the default decimal separator */
    printf("The default decimal separator for Canada is: %.2s\n",decimal);
}
```

2. Following is an example of CEE3MDS called by COBOL.

```cobol
CBL LIB,QUOTE

*Module/File Name: IGZT3MDS
******************************************************************************
**                                    **                                   **
** CBL3MDS - Call CEE3MDS to get the default decimal separator **
**                                    **                                   **
******************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBL3MDS.

DATA DIVISION.
WORKING-STORAGE SECTION.
01  COUNTRY            PIC X(2).
01  DECSEP             PIC X(2).
01  FC.
   02  Condition-Token-Value.
      COPY CEEIGZCT.
       03  Case-1-Condition-ID.
            04  Severity  PIC S9(4) BINARY.
            04  Msg-No    PIC S9(4) BINARY.
       03  Case-2-Condition-ID
            REDEFINED Case-1-Condition-ID.
            04  Class-Code  PIC S9(4) BINARY.
            04  Cause-Code  PIC S9(4) BINARY.
       03  Case-Sev-Ctl PIC X.
       03  Facility-ID  PIC XXX.
       02  I-S-Info     PIC S9(9) BINARY.

PROCEDURE DIVISION.
******************************************************************************
** Specify the country code for the US in the call to CEE3MDS. **
** If call was successful, print result. **
******************************************************************************
PARA-CBL3MDS.
MOVE "US" TO COUNTRY.
CALL "CEE3MDS" USING COUNTRY, DECSEP, FC.
```
IF CEE000 of FC THEN
  DISPLAY "The default Decimal Separator "
  "for " COUNTRY " is " DECSEP "
ELSE
  DISPLAY "CEE3MDS failed with msg "
  Msg-No of FC UPON CONSOLE
  STOP RUN
END-IF.
GOBACK.

3. Following is an example of CEE3MDS called by PL/I.

*PROCESS MACRO;
/* Module/File Name: IBM3MDS */
/***************************************************/
/**                                                **/
/** Function: CEE3MDS - get default decimal      **/
/**   separator                                **/
/***************************************************/
PLI3MDS: PROC OPTIONS(MAIN);
  %INCLUDE  CEEIBMAW;
  %INCLUDE  CEEIBMCT;
  DCL COUNTRY  CHARACTER ( 2 );
  DCL DECSEP   CHARACTER ( 2 );
  DCL 01 FC,                     /* Feedback token */
  03 MsgSev    REAL FIXED BINARY(15,0),
  03 MsgNo     REAL FIXED BINARY(15,0),
  03 Flags,
    05 Case      BIT(2),
    05 Severity  BIT(3),
    05 Control   BIT(3),
  03 FacID     CHAR(3),      /* Facility ID */
  03 ISI   /* Instance-Specific Information */
          REAL FIXED BINARY(31,0);
  COUNTRY = 'US';     /* Specify country code for  */
    /* the United States         */
  CALL CEE3MDS ( COUNTRY, DECSEP, FC );
  /* Call CEE3MDS to get default decimal     */
  /*   separator for the US                */
  /* CALL CEE3MDS ( COUNTRY, DECSEP, FC ); */
  /* Print the default decimal separator for */
  /*   US        */
  IF FBCHECK( FC, CEE000) THEN DO;
    PUT SKIP LIST(
      'The default decimal separator for the '
      || COUNTRY || ' is "'|| DECSEP || '"');
  END;
  ELSE DO;
    DISPLAY( 'CEE3MDS failed with msg ')
      || FC.MsgNo );
    STOP;
  END;
END PLI3MDS;

### CEE3MTS—Get default thousands separator

CEE3MTS returns the default thousands separator for the specified country with `country_code`.

```
country_code (input)
A 2-character fixed-length string representing one of the country codes found in Table 33 on page 419. `country_code` is not case-sensitive. If no value is specified, the default country code, as set by the COUNTRY runtime option or the CEE3CTY callable service, is used.

thousands_separator (output)
A 2-character fixed-length string representing the default thousands separator for the country specified. The thousands separator is left-justified and padded on the right with a blank.
```
**fc (output)**

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE3C8</td>
<td>2</td>
<td>3464</td>
<td>The thousands separator 'thousands-separator' was truncated and was not defined in CEE3MTS.</td>
</tr>
<tr>
<td>CEE3C9</td>
<td>2</td>
<td>3465</td>
<td>The country code country-code was invalid for CEE3MTS. The default thousands separator 'thousands-separator' was returned.</td>
</tr>
</tbody>
</table>

**Usage notes**

- If you specify a *country_code* that is not valid, the default thousands separator is a comma (,).
- z/OS UNIX considerations—CEE3MTS applies to the enclave. Every enclave has a single current country setting that has a single thousands separator. Every thread in every enclave has the same default.

**For more information**

- For a list of the default settings for a specified country, see Table 33 on page 419.
- See “COUNTRY” on page 20 for an explanation of the COUNTRY runtime option.
- See “CEE3CTY—Set the default country” on page 122 for an explanation of the CEE3CTY callable service.

**Examples**

1. Following is an example of CEE3MTS called by C/C++.

```c
/*Module/File Name: EDC3MTS */
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>
int main(void) {
    _FEEDBACK fc;
    _CHAR2 country,thousand;
    /* get the default thousands separator for Canada */
    memcpy(country,"CA",2);
    CEE3MTS(country,thousand,&fc);
    if ( !_FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEE3MTS failed with message number %d\n", fc.tok_msgno);
        exit(2999);
    }
    /* print out the default thousands separator */
    printf("The default thousands separator for Canada is:  %.2s\n",thousand);
}
```

2. Following is an example of CEE3MTS called by COBOL.

```
CBL LIB,QUOTE
  *Module/File Name: IGZT3MTS
  *************************************************
  **                                             **
  ** CBL3MTS - Call CEE3MTS to obtain the        **
  ** default thousands separator                **
  **                                             **
  *************************************************
```
IDENTIFICATION DIVISION.
PROGRAM-ID. CBL3MTS.

DATA DIVISION.
WORKING-STORAGE SECTION.
01  COUNTRY          PIC X(2).
01  THOUSEP          PIC X(2).
01  FC.
   02  Condition-Token-Value.
      COPY  CEEIGZCT.
       03  Case-1-Condition-ID.
            04  Severity    PIC S9(4) BINARY.
            04  Msg-No      PIC S9(4) BINARY.
       03  Case-2-Condition-ID
           REDEFINES Case-1-Condition-ID.
            04  Class-Code  PIC S9(4) BINARY.
            04  Cause-Code  PIC S9(4) BINARY.
       03  Case-Sev-Ctl PIC X.
       03  Facility-ID  PIC XXX.
       02  I-S-Info            PIC S9(9) BINARY.

PROCEDURE DIVISION.
PARA-CBL3MTS.

** Specify the country code for the US in the **
** call to CEE3MTS. **
** MOVE "US" TO COUNTRY. **
** CALL "CEE3MTS" USING COUNTRY, THOUSEP, FC. **
**
** If CEE3MTS runs successfully, display result **
** IF CEE000 of FC THEN **
** DISPLAY "The default Thousands Separator" **
** " for " COUNTRY " is " THOUSEP " **
** ELSE **
** DISPLAY "CEE3MDS failed with msg " **
** Msg-No of FC UPON CONSOLE **
** STOP RUN **
** END-IF. **

GOBACK.

3. Following is an example of CEE3MTS called by PL/I.

*PROCESS MACRO;
/* Module/File Name: IBM3MTS */
/****************************************************************************/
/**                      **/ /* Function: CEE3MTS - obtain default thousands separator */
/**                      **/ /* CALL */
/**                      **/ /****************************************************************************/
PLI3MTS: PROC OPTIONS(MAIN);

%INCLUDE  CEEIBMMAW;
%INCLUDE  CEEIBMCT;

DCL COUNTRY  CHARACTER ( 2 );
DCL THOUSEP  CHARACTER ( 2 );
DCL 01 FC, /* Feedback token */
   03 MsgSev  REAL FIXED BINARY(15,0),
   03 MsgNo   REAL FIXED BINARY(15,0),
   03 Flags,
      05 Case   BIT(2),
      05 Severity BIT(3),
      05 Control BIT(3),
   03 FacID   CHAR(3), /* Facility ID */
   03 ISI    /* Instance-Specific Information */
      REAL FIXED BINARY(31,0);

COUNTRY = 'US'; /* Specify US as the country */
/* code for the United States */

/* Call CEE3MTS to return default thousands */
/* separator for the US */
CALL CEE3MTS ( COUNTRY, THOUSEP, FC );
CEE3PRM—Query parameter string

CEE3PRM queries and returns to the calling routine the parameter string specified at invocation of the program. The returned parameter string contains only program arguments. If no program arguments are available, a blank string is returned.

char_parm_string (output)
An 80-byte fixed-length string passed by CEE3PRM. On return from this service, the char_parm_string contains the parameter string specified at invocation of the program. If this parameter string is longer than 80 characters, it is truncated. If the parameter string is shorter than 80 characters, the returned string is padded with blanks. If the program argument passed to the service is absent, or is not a character string, char_parm_string is blank.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE311</td>
<td>1</td>
<td>3649</td>
<td>The parameter string returned from CEE3PRM exceeded the maximum length of 80 bytes and was truncated.</td>
</tr>
</tbody>
</table>

Usage notes

- C/C++ consideration—C/C++ users can use the _osplist to return a program argument longer than 80 characters.
- z/OS UNIX considerations—CEE3PRM is allowed only in the initial thread.
- You can use the CEE3PR2 callable service to return a program string that is longer than 80 characters.

For more information

- For more information about the CEE3PR2 callable service, see “CEE3PR2—Query parameter string long” on page 174
Examples

1. Following is an example of CEE3PRM called by C/C++.

```c
/*Module/File Name: EDC3PRM   */
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <string.h>
#include <ceeedcct.h>

int main()
{
    _CHAR80 parm;
    _FEEDBACK fc;
    CEE3PRM(parm,&fc);
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEE3PRM failed with message number %d\n", fc.tok_msgno);
        exit(2999);
    } 
    printf("%.80s\n",parm);
}
```

2. Following is an example of CEE3PRM called by COBOL.

```
CBL LIB,QUOTE
*Module/File Name: IGZT3PRM
************************************************
**                                            **
** CBL3PRM - Call CEE3PRM to query the        **
**           parameter string                 **
**                                            **
** In this example, a call is made to        **
** CEE3PRM to return the parameter string     **
** that was specified at invocation of the    **
** program. The string is then displayed.     **
**                                            **
************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBL3PRM.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01 PARMSTR PIC X(80).
  01 FC.
    02 Condition-Token-Value.
    COPY CEEIGZCT.
      03 Case-1-Condition-ID.
        04 Severity PIC S9(4) BINARY.
        04 Msg-No PIC S9(4) BINARY.
      03 Case-2-Condition-ID
        REDEFINES Case-1-Condition-ID.
        04 Class-Code PIC S9(4) BINARY.
        04 Cause-Code PIC S9(4) BINARY.
      03 Case-Sev-Ctl PIC X.
      03 Facility-ID PIC XXX.
    02 I-S-Info PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBL3PRM.
  CALL "CEE3PRM" USING PARMSTR, FC.
  IF CEE000 THEN
    DISPLAY "Program arguments specified: "
    """ PARMSTR ""
  ELSE
    DISPLAY "CEE3PRM failed with msg "
    Msg-No of FC UPON CONSOLE
    STOP RUN
  END-IF.
GOBACK.
```
3. Following is an example of CEE3PRM called by PL/I.

```pli
*PROCESS MACRO:
/* Module/File Name: IBM3PRM */
/*****************************/
/**                        */
/** Function: CEE3PRM - Query Parameter String */
/**                        */
/*****************************/
PLI3PRM: PROC OPTIONS(MAIN);

   %INCLUDE  CEEIBMAW;
   %INCLUDE  CEEIBMCT;

   DCL PARMSTR CHAR(80);    /* Feedback token */
   DCL 01 FC,                    /* Feedback token */
       03 MsgSev    REAL FIXED BINARY(15,0),
       03 MsgNo     REAL FIXED BINARY(15,0),
       03 Flags,   
       05 Case      BIT(2),
       05 Severity  BIT(3),
       05 Control   BIT(3),
       03 FacID     CHAR(3),      /* Facility ID */
       03 ISI   /* Instance-Specific Information */
           REAL FIXED BINARY(31,0);

   /* Call CEE3PRM to return the program arguments */
   /* specified at invocation of the program */
   CALL CEE3PRM ( PARMSTR, FC );

   /* There are no non-zero feedback codes to */
   /* check, so print result */
   IF  FBCHECK( FC, CEE000)  THEN  DO;
      PUT SKIP LIST( 'These program arguments were specified:  "'
                        || PARMSTR || '"');
   END;
   ELSE  DO;
      DISPLAY( 'CEE3PRM failed with msg ' || FC.MsgNo );
      STOP;
   END;

END PLI3PRM;
```

**CEE3PR2—Query parameter string long**

CEE3PR2 queries and returns to the calling routine the parameter string and its associated length specified at invocation of the program. The returned parameter string contains only program arguments. If no program arguments are available, a blank string is returned.

- **int_parm_length (input/output)**
  
  A fullword integer that indicates the length of the parameter string.
  
  - For input: If the value is less than or equal to 0, `int_parm_length` is a request for the length of the parameter string passed during program invocation. If the value is greater than 0, it is the actual size of the `char_parm_string` buffer passed by the caller.
  
  - For output: CEE3PR2 returns the actual length of the parameter string passed during program invocation for any case, regardless of the input value in the `int_parm_length` field.

- **char_parm_string (input/output)**
  
  - For input: `char_parm_string` contains the address of a piece of storage that is obtained by the caller.

  **Note:** This storage is used as a varying string. It must be 2 bytes longer than the length of the parameter string passed during program invocation.
For output: The storage pointed to by this address contains a varying string that contains the parameter string passed during program invocation. The parameter string is truncated when the actual length of the parameter string passed during invocation exceeds \texttt{int\_parm\_length} minus 2.

\textbf{fc (output)}

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

\begin{center}
\begin{tabular}{llll}
\textbf{Code} & \textbf{Severity} & \textbf{Message number} & \textbf{Message text} \\
CEE000 & 0 & – & The service completed successfully. \\
CEE3K3 & 1 & 3715 & The parameter string returned from CEE3PR2 was truncated due to insufficient storage space for the string provided by the caller. \\
\end{tabular}
\end{center}

\textbf{Usage notes}

- C/C++ consideration—C/C++ users can use the \texttt{__osplist} return a program argument longer than 80 characters.
- z/OS UNIX consideration—CEE3PR2 is allowed only in the initial thread.
- CICS consideration—CEE3PR2 always returns a blank string.

\textbf{For more information}

- For more information about the CEE3PRM callable service, see “CEE3PRM—Query parameter string” on page 172.

\textbf{Examples}

1. Following an example of CEE3PR2 called by C/C++.

```c
/*Module/File Name: EDC3PR2 */
/*********************************************************************/
/*                                                                   */
/* THIS EXAMPLE CALLS CEE3PR2 TO RETRIEVE THE PARAMETER STRING THAT  */
/* WAS SPECIFIED AT THE INVOCATION OF THE PROGRAM AND ITS ASSOCIATED */
/* LENGTH. BOTH THESE VALUES ARE THEN PRINTED.                      */
/*                                                                   */
/*********************************************************************/
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <string.h>
#include <ceeedcct.h>

struct mystring{
    unsigned short int length;
    char           string[298];
};
type def struct mystring mystring;

int main() {
    int len;
    mystring parm;
    _FEEDBACK fc;

    /*Setting up the user defined space to store the retrieved string*/
    memset(&parm,0x00,sizeof(parm));
    len = sizeof(parm);

    /*Calling CEE3PR2 to retrieve the parameter string*/
    CEE3PR2(&len,&parm,&fc);

    if ( _FBCHECK ( fc , CEE000 ) != 0 ) { 
```
printf("CEE3PR2 failed with message number %d\n", fc.tok_msgno);
}
printf("Length field of the string : %d \n",len);
printf("Parameter String is: %s\n",parm.string);
return 0;
}

2. Following is an example of CEE3PR2 called by COBOL.

CBL LIB,QUOTE
*************************************************
*Module/File Name: IGZTPR2
*************************************************
**                                            **
** CBL3PR2 - Call CEE3PR2 to query the      **
** parameter string                          **
**                                            **
** In this example, a call is made to       **
** CEE3PR2 to return the parameter string    **
** that was specified at invocation of the   **
** program. The string is then displayed.    **
**                                            **
************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBL3PR2.
DATA DIVISION.
WORKING-STORAGE SECTION.
01 PARMLEN                 PIC S9(9) BINARY.
01 PARMSTR.
  02 STR1-LENGTH PIC S9(4) BINARY.
  02 STR1-STRING.
    03 STR1-CHAR PIC X
      OCCURS 0 TO 256 TIMES
      DEPENDING ON STR1-LENGTH.
01 FC.
  02 CONDITION-TOKEN-VALUE.
COPY CEEIGZCT.
    03 CASE-1-CONDITION-ID.
    04 SEVERITY      PIC S9(4) BINARY.
    04 MSG-NO        PIC S9(4) BINARY.
    03 CASE-SEV-CTL    PIC X.
    03 FACILITY-ID     PIC XXX.
  02 I-S-INFO           PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBL3PR2.
  MOVE 258 TO PARMLEN
  CALL "CEE3PR2" USING PARMLEN, PARMSTR, FC.
  IF CEE000 THEN
    DISPLAY "Program arguments specified: "
    STR1-STRING ""
  ELSE
    DISPLAY "CEE3PR2 FAILED WITH MSG "
    Msg-No of FC UPON CONSOLE
  STOP RUN
  END-IF.
GOBACK.

3. Following is an example of CEE3PR2 called by PL/I.

*PROCESS MACRO;
/***********************************************************/
/*Module/File Name: IBM3PR2                                */
/***********************************************************/
/** Function: CEE3PR2 - Query Parameter String            **
/** This example calls CEE3PR2 to retrieve the arguments passed **
/** during the invocation of the program.                 **
/*************************************************************/
PLI3PR2: PROCEDURE OPTIONS (MAIN) REORDER;
%INCLUDE CEEIBMFW;
%INCLUDE CEEIBMCT;
CEE3RPH—Set report heading

CEE3RPH sets the heading displayed at the top of the storage or options report generated when you specify the RPTSTG(ON) or RPTOPTS(ON) runtime options. For examples of these reports, see z/OS Language Environment Debugging Guide.

**(CEE3RPH)**

`CEE3RPH(report_heading, fc)`

**report_heading (input)**

An 80-character fixed-length string. `report_heading` sets the identifying character string displayed at the top of the storage or options report. Language Environment uses only the first 79 bytes of `report_heading`; the last byte is ignored. `report_heading` can contain DBCS characters surrounded by X'0E' (shift-out) and X'0F' (shift-in).

**fc (output)**

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:
### Usage notes

- **PL/I considerations**—CEE3RPH is designed to provide an equivalent function to the special PL/I variable PLIXHD.
- **z/OS UNIX considerations**—CEE3RPH applies to the enclave.

### For more information

- See “RPTSTG” on page 63 for more information about the RPTSTG runtime option.
- See “RPTOPTS” on page 62 for more information about the RPTOPTS runtime option.
- See *PL/I for MVS & VM Programming Guide* for further information about PLIXHD.

### Examples

1. Following is an example of CEE3RPH called by C/C++.

```c
/*Module/File Name: EDC3RPH */
#pragma runopts(RPTOPTS(ON))
#include <string.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {
  _CHAR80 heading;
  /* initialize heading to blanks and then set the */
  /* heading */
  memset(heading,' ',80);
  memcpy(heading,"User Defined Report Heading",27);
  /* set the report heading...do not need to check */
  /* feedback token because all return codes are */
  /* successful */
  CEE3RPH(heading,NULL);
  /* ...
   */
}
```

2. Following is an example of CEE3RPH called by COBOL.

```cobol
*Module/File Name: IGZT3RPH
**************************************************************************
**         **
** CBL3RPH - Call CEE3RPH to set report heading**
**         **
** In this example, a call is made to CEE3RPH **
** to set the report heading that appears at **
** the top of each page of the options report **
** (generated by RPTOPTS) and storage report **
** (generated by RPTSTG). **
**         **
**************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBL3RPH.

DATA DIVISION.
WORKING-STORAGE SECTION.
  01 RPTHEAD PIC X(80).
  01 FC.
  02 Condition-Token-Value.
```
3. Following is an example of CEE3RPH called by PL/I.

```plaintext
*PROCESS MACRO:
/* Module/File Name: IBM3RPH */
/**************************************************/
/** Function: CEE3RPH - set report heading **/
/** **************************************************/
PLI3RPH: PROC OPTIONS(MAIN);

%INCLUDE CEEIBMAW;
%INCLUDE CEEIBMCT;

DCL RPTHEAD CHAR(80);
DCL 01 FC, /* Feedback token */
  03 MsgSev REAL FIXED BINARY(15,0),
  03 MsgNo REAL FIXED BINARY(15,0),
  03 Flags,
  05 Case BIT(2),
  05 Severity BIT(3),
  05 Control BIT(3),
  03 FacID CHAR(3), /* Facility ID */
  03 ISI /* Instance-Specific Information */
    REAL FIXED BINARY(31,0);

/* Define report heading */
RPTHEAD = 'My storage report heading';

/* Set report heading in call to CEE3RPH */
CALL CEE3RPH ( RPTHEAD, FC );

IF FBCHECK( FC, CEE000) THEN DO;
  PUT SKIP LIST( 'Report heading now set to ' || RPTHEAD || '' );
END;
ELSE DO;
  DISPLAY( 'CEE3RPH failed with msg ' || FC.MsgNo );
  STOP;
END;

END PLI3RPH;
```
CEE3SPM—Query and modify Language Environment hardware condition enablement

CEE3SPM queries and modifies the enablement of Language Environment hardware conditions. You can use the CEE3SPM service to:

- Alter the settings of the Language Environment conditions, using an action value of 1 (SET), to those specified by the caller.
- Query the current settings of the Language Environment conditions and return the settings to the caller.
- Push the current settings of the Language Environment conditions on to the condition stack using an action value of 3 (PUSH). This pushes the current setting down on the stack for later retrieval, and, in effect, places a copy of the current setting on top of the stack. It does not alter the current condition settings.
- Pop the pushed settings of the Language Environment conditions from the condition stack using an action value of 4 (POP). This reinstates the previous condition settings as the current condition settings.
- Push the current settings of the Language Environment conditions on to the Language Environment - managed condition stack and alter the settings of the Language Environment conditions to those supplied by the caller.

The enabled or disabled Language Environment conditions are:

**fixed-overflow**
When enabled, raises the fixed-overflow condition when an overflow occurs during signed binary arithmetic or signed left-shift operations.

**decimal-overflow**
When enabled, raises the decimal-overflow condition when one or more nonzero digits are lost because the destination field in a decimal operation is too short to contain the results.

**underflow**
When enabled, raises the underflow condition when the result characteristic of a floating-point operation is less than zero and the result fraction is not zero. For an extended-format floating-point result, the condition is raised only when the high-order characteristic underflows.

**significance**
When enabled, raises the significance condition when the resulting fraction in floating-point addition or subtraction is zero.

When you use the CEE3SPM callable service, maintenance of the condition stack is required. For example, one user-written condition handler can disable a hardware condition while another enables it. Therefore, do not assume that the program mask is at a given setting. The program mask is set differently based on different HLL requirements. You can find out what the current setting is by using the QUERY function of CEE3SPM.

Language Environment initialization sets conditions based on the languages in the initial load module. Each language present adds to the conditions that are enabled.

Some S/370 hardware interrupt codes and their matching Language Environment feedback codes appear in Table 25 on page 182.

The action to be performed. action is specified as a fullword binary signed integer corresponding to one of the numbers in the following list:

1—SET
Alters the settings of the Language Environment conditions to those specified in the cond_string parameter.
2—QUERY
Queries the current settings of the Language Environment conditions and return the settings in the
cond_string parameter.

3—PUSH
Pushes the current settings of the Language Environment conditions on to the Language
Environment -managed condition stack.

4—POP
Pops the pushed settings of the Language Environment conditions from the condition stack,
discarding the current settings, and reinstating the previous condition settings as the current
condition settings.

5—PUSH, SET
Pushes the current settings of the Language Environment conditions on to the Language
Environment -managed condition stack and alters the settings of the Language Environment
conditions to those supplied by the caller in the cond_string parameter.

cond_string (input/output)
A fixed-length string of 80 bytes containing a sequence of identifiers representing the requested
settings for the Language Environment conditions that can be enabled and disabled. Following is a list
of conditions enabled and disabled and their associated identifiers:

fixed-overflow
  F (NOF for disablement)

decimal-overflow
  D (NOD for disablement)

underflow
  U (NOU for disablement)

significance
  S (NOS for disablement)

An identifier with the NO prefix is used to disable the condition it represents. An identifier without the
NO prefix is used to enable the condition that it represents. For example, the token 'F' is used to
enable the fixed-overflow condition. The identifier NOF is used to disable the fixed-overflow condition.
The rightmost option takes effect in the event of a conflict. Identifiers are separated by blanks or
commas.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you
choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate
syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE36V</td>
<td>4</td>
<td>3295</td>
<td>The condition string from CEE3SPM did not contain all of the settings, because the returned string was truncated.</td>
</tr>
<tr>
<td>CEE370</td>
<td>4</td>
<td>3296</td>
<td>Some of the data in the condition string from CEE3SPM could not be recognized.</td>
</tr>
<tr>
<td>CEE371</td>
<td>4</td>
<td>3297</td>
<td>The service completed successfully for recognized conditions, unsuccessfully for unrecognized (unsupported) conditions.</td>
</tr>
<tr>
<td>CEE372</td>
<td>4</td>
<td>3298</td>
<td>A call to CEE3SPM attempted to PUSH settings onto a full stack.</td>
</tr>
<tr>
<td>CEE373</td>
<td>4</td>
<td>3299</td>
<td>A call to CEE3SPM attempted to POP settings off an empty stack.</td>
</tr>
<tr>
<td>CEE374</td>
<td>4</td>
<td>3300</td>
<td>The action parameter in CEE3SPM was not one of the digits 1 to 5.</td>
</tr>
</tbody>
</table>
Usage notes

- PL/I MTF consideration—In PL/I MTF applications, CEE3SPM affects only the calling task.
- C/C++ consideration—C/C++ ignores the fixed-overflow, decimal-overflow, underflow, and significance interrupts, no matter what you specify in CEE3SPM.
- COBOL consideration—COBOL ignores the fixed-overflow and decimal-overflow interrupts, no matter what you specify in CEE3SPM.
- z/OS UNIX consideration—In multithread applications, CEE3SPM affects only the calling thread.
- You cannot use CEE3SPM to enable the fixed-overflow, decimal-overflow, underflow or significance interrupts. You can, however, query the settings of CEE3SPM.

<table>
<thead>
<tr>
<th>S/370 Interrupt Code</th>
<th>Description</th>
<th>Maskable</th>
<th>Symbolic Feedback Code</th>
<th>Message Number</th>
<th>Severity</th>
</tr>
</thead>
<tbody>
<tr>
<td>0001</td>
<td>Operation exception</td>
<td>No</td>
<td>CEE341</td>
<td>3201</td>
<td>3</td>
</tr>
<tr>
<td>0002</td>
<td>Privileged operation exception</td>
<td>No</td>
<td>CEE342</td>
<td>3202</td>
<td>3</td>
</tr>
<tr>
<td>0003</td>
<td>Execute exception</td>
<td>No</td>
<td>CEE343</td>
<td>3203</td>
<td>3</td>
</tr>
<tr>
<td>0004</td>
<td>Protection exception</td>
<td>No</td>
<td>CEE344</td>
<td>3204</td>
<td>3</td>
</tr>
<tr>
<td>0005</td>
<td>Addressing exception</td>
<td>No</td>
<td>CEE345</td>
<td>3205</td>
<td>3</td>
</tr>
<tr>
<td>0006</td>
<td>Specification exception</td>
<td>No</td>
<td>CEE346</td>
<td>3206</td>
<td>3</td>
</tr>
<tr>
<td>0007</td>
<td>Data exception</td>
<td>No</td>
<td>CEE347</td>
<td>3207</td>
<td>3</td>
</tr>
<tr>
<td>0008</td>
<td>Fixed-point overflow exception</td>
<td>Yes</td>
<td>CEE348</td>
<td>3208</td>
<td>3</td>
</tr>
<tr>
<td>0009</td>
<td>Fixed-point divide exception</td>
<td>No</td>
<td>CEE349</td>
<td>3209</td>
<td>3</td>
</tr>
<tr>
<td>000A</td>
<td>Decimal-overflow exception</td>
<td>Yes</td>
<td>CEE34A</td>
<td>3210</td>
<td>3</td>
</tr>
<tr>
<td>000B</td>
<td>Decimal divide exception</td>
<td>No</td>
<td>CEE34B</td>
<td>3211</td>
<td>3</td>
</tr>
<tr>
<td>000C</td>
<td>Exponent-overflow exception</td>
<td>No</td>
<td>CEE34C</td>
<td>3212</td>
<td>3</td>
</tr>
<tr>
<td>000D</td>
<td>Exponent-underflow exception</td>
<td>Yes</td>
<td>CEE34D</td>
<td>3213</td>
<td>3</td>
</tr>
<tr>
<td>000E</td>
<td>Significance exception</td>
<td>Yes</td>
<td>CEE34E</td>
<td>3214</td>
<td>3</td>
</tr>
<tr>
<td>nn0F</td>
<td>Floating-point divide exception</td>
<td>No</td>
<td>CEE34F</td>
<td>3215</td>
<td>3</td>
</tr>
</tbody>
</table>

Examples

1. Following is an example of CEE3SPM called by C/C++.

```c
#include <stdio.h>
#include <string.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main(void) {
    _FEEDBACK fc;
    _INT4 action;
    _CHAR80 cond_string;
    char *cond;

    /* query the current settings */
```
2. Following is an example of CEE3SPM called by COBOL.

CBL LIB,QUOTE
*Module/File Name: IGZT3SPM
*************************************************
**                                             **
** CBL3SPM - Call CEE3SPM to query and modify  **
**       Lang. Environ. hardware condition      **
**       enablement                           **
** In this example, a call is made to CEE3SPM **
** to check the setting of the program mask.   **
** See the parameter list of CEE3SPM to        **
** this example.                               **
**                                             **
*************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBL3SPM.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01  ACTION                  PIC S9(9) BINARY.
  01  CONDSTR                 PIC X(80).
  01  FC.
     02  Condition-Token-Value.
COPY  CEEIGZCT.
     03  Case-1-Condition-ID.
        04  Severity    PIC S9(4) BINARY.
        04  Msg-No      PIC S9(4) BINARY.
     03  Case-2-Condition-ID
        REDEFINES Case-1-Condition-ID.
        04  Class-Code  PIC S9(4) BINARY.
        04  Cause-Code  PIC S9(4) BINARY.
     03  Case-Sev-Ctl    PIC X.
     03  Facility-ID     PIC XXX.
     02  I-S-Info            PIC S9(9) BINARY.
PROCEDURE DIVISION.
*************************************************
** Specify 2 for the QUERY function.  **
** Pass ACTION in the call to CEE3SPM to return **
** the condition string DISPLAY results. **
*************************************************
PARA-CBL3SPM.
MOVE 2 TO ACTION.
CALL "CEE3SPM" USING ACTION, CONDSTR, FC.
IF CEE000 of FC THEN
  DISPLAY "The current setting of the ",
  "program mask is: " CONDSTR
ELSE
  DISPLAY "CEE3SPM failed with msg ",
  Msg-No of FC UPON CONSOLE
STOP RUN
END-IF.
GOBACK.

3. Following is an example of CEE3SPM called by PL/I.

*PROCESS MACRO;
 /* Module/File Name: IBM3SPM */
/*****************************/
/** Function: CEE3SPM - Query and Modify LE/370 */
/** Hardware Condition Enablement */
/** This example calls CEE3SPM to query the current */
/** setting of the program mask. See the parameter */
/** list of CEE3SPM to interpret what is returned */
** as CONDSTR in this example. */
/** */
/****************************************************/
PLI3SPM: PROC OPTIONS(MAIN);

%INCLUDE CEEIBMMAW;
%INCLUDE CEEIBMCT;

DCL ACTION   REAL FIXED BINARY(31,0);
DCL CONDSTR  CHAR(80);
DCL 01 FC,                     /* Feedback token */
     03 MsgSev    REAL FIXED BINARY(15,0),
     03 MsgNo     REAL FIXED BINARY(15,0),
     03 Flags,    05 Case      BIT(2),
     05 Severity  BIT(3),
     05 Control   BIT(3),
     03 FacID     CHAR(3),      /* Facility ID */
     03 ISI   /* Instance-Specific Information */
            REAL FIXED BINARY(31,0);

/* Call CEE3SPM to query the current setting of */
/* the program mask */
ACTION = 2; /* Specify action code 2 to query */
/* the program mask */
CALL CEE3SPM ( ACTION, CONDSTR, FC );
IF  FBCHECK( FC, CEE000)  THEN  DO;
   PUT SKIP LIST( 'The initial setting of the program mask is: ' || CONDSTR );
   END;
ELSE  DO;
   DISPLAY('CEE3SPM failed with msg ' || FC.MsgNo);
   STOP;
   END;

/* Call CEE3SPM to enable specification exceptions. */
/* Specify action code 1 to SET the program mask. */
ACTION = 1;
/* Specify a program mask that allows specification */
/* exceptions (all others are unchanged) */
CONDSTR = 'S'; CALL CEE3SPM ( ACTION, CONDSTR, FC );
IF  ¬ FBCHECK( FC, CEE000)  THEN  DO;
   DISPLAY('CEE3SPM failed with msg ' || FC.MsgNo);
   STOP;
   END;

CALL CEE3SPM (2, CONDSTR, FC); /* Query settings */
IF  ¬ FBCHECK( FC, CEE000)  THEN  DO;
   PUT SKIP LIST( 'The new setting of the program mask is: ' || CONDSTR );
   END;
ELSE  DO;
   DISPLAY('CEE3SPM failed with msg ' || FC.MsgNo);
   STOP;
   END;

END PLI3SPM; CALL CEE3SPM ( ACTION, CONDSTR, FC );
IF  ¬ FBCHECK( FC, CEE000)  THEN  DO;
   DISPLAY('CEE3SPM failed with msg ' || FC.MsgNo);
   STOP;
   END;

CALL CEE3SPM (2, CONDSTR, FC); /* Query settings */
IF  ¬ FBCHECK( FC, CEE000)  THEN  DO;
   PUT SKIP LIST( 'The new setting of the program mask is: ' || CONDSTR );
   END;
ELSE  DO;
   DISPLAY('CEE3SPM failed with msg ' || FC.MsgNo);
   STOP;
   END;

END PLI3SPM;
**CEE3SRC—Set the enclave return code**

CEE3SRC sets the user enclave return code. The value set is used in the calculation of the final enclave return code at enclave termination.

```
CEE3SRC (return_code, fc)
```

**return_code (input)**
An INT4 data type. The enclave return code to be set should be <= 999,999 and >= 0 to be in the Language Environment-preferred range. (The initial value is 0.)

**fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE0HA</td>
<td>1</td>
<td>0554</td>
<td>A value outside the preferred range of 0 through 999,999 was supplied. However, the value was still used as the enclave return code.</td>
</tr>
</tbody>
</table>

**Usage notes**

- z/OS UNIX consideration—CEE3SRC is not supported in multithread applications.
- PL/I MTF consideration—For PL/I multitasking applications, the user return code value set during invocation of CEE3SRC affects the current task only. If a PL/I program causes an enclave to terminate, the value set by CEE3SRC at the associated task level is reflected in the final return code at enclave termination.
- PL/I consideration—When running PL/I with POSIX(ON), CEE3SRC is not supported.

**For more information**

- See z/OS Language Environment Programming Guide, for more information about the CEE3SRC callable service.

**Examples**

CEE3SRC is used with CEE3GRC; see the examples for CEE3GRC show in “Examples” on page 136.

---

**CEE3SRP—Set resume point**

The CEE3SRP service sets the resume point at the next instruction in the calling routine. CEE3SRP works only in conjunction with the CEEMRCE service.

```
CEE3SRP (resume_token, fc)
```
**resume_token (output)**

An INT4 data type that, upon completion of this service, contains a token that represents a machine state block, which Language Environment allocates from heap storage. Language Environment automatically frees the heap storage for the machine state block when the routine associated with the stack frame to which it points returns to its caller.

**fc (output / optional)**

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE390</td>
<td>3</td>
<td>3360</td>
<td>The stack frame was not found on the call chain.</td>
</tr>
</tbody>
</table>

**Usage notes**

- An example for Service Label under COBOL follows:

  ```
  SET-RECOVERY-POINT-PARAGRAPH.
  CALL 'CEE3SRP' USING RECOVERY-POINT FC.
  SERVICE LABEL.
  ERROR-PARAGRAPH.
  * code to do post-error processing
  ```

- Use the CEE3SRP service only with the CEEMRCE service from within a user condition handler. The token returned by this service is used as input to the CEEMRCE service.

- Language Environment automatically frees the heap storage for the machine state block when the routine associated with the stack frame to which it points returns to its caller. Attempts to use the machine state block after it is freed result in unpredictable behavior.

- **COBOL considerations**
  - A Service Label compiler directive must be specified immediately after the call to CEE3SRP.
  - When a resume occurs and control resumes to the next instruction following the call to CEE3SRP, the COBOL RETURN-CODE special register contains an unpredictable value.

**Examples**

For examples of how to use CEE3SRP in combination with CEEMRCE and CEEHDLR, see “CEEMRCE—Move resume cursor explicit” on page 314.

---

**CEE3USR—Set or query user area fields**

CEE3USR sets or queries one of two 4-byte fields known as the user area fields. The user area fields are associated with an enclave and are maintained on an enclave basis. A user area field can be used by vendor or application programs to store a pointer to a global data area or to keep a recursion counter.

Be careful not to confuse the Language Environment user area fields with the PL/I user area. The PL/I user area is a 4-byte field in the PL/I TCA and can be accessed only through assembler language. The PL/I user area continues to be supported for compatibility.

Language Environment initializes both user area fields to X'00000000' during enclave initialization.

```
CEE3USR function_code field_number field_value fc
```
function_code (input)
A fullword binary integer representing the function performed:

1—SET
User area field according to the value specified in field_value.

2—QUERY
User area field; return current value in field_value.

field_number (input)
A fullword binary integer indicating the field to set or query. field_number must be specified as either 1 or 2.

field_value (input/output)
A fullword binary integer.

If function_code is specified as 1 (meaning SET user area field), field_value contains the value to be copied to the user area field.

If function_code is specified as 2 (meaning QUERY user area field), the value in the user area field is copied to field_value.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE3PS</td>
<td>3</td>
<td>3900</td>
<td>The function code passed to CEE3USR was not 1 or 2.</td>
</tr>
<tr>
<td>CEE3PT</td>
<td>3</td>
<td>3901</td>
<td>The field number passed to CEE3USR was not 1 or 2.</td>
</tr>
</tbody>
</table>

Usage notes
• z/OS UNIX consideration—CEE3USR applies to the enclave.

Examples

1. Following is an example of CEE3USR called by C/C++.

```c
/*Module/File Name: EDC3USR */
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <leawi.h>
#include <ceeedcct.h>

typedef struct {
  int value1,value2,value3;
  char slot1_80¨;
} info_struct;

int main (void) {
  _INT4 function_code, field_number, field_value;
  _FEEDBACK fc;
  info_struct *info;

  info = (info_struct *)malloc(sizeof(info_struct));
  /* */
  /* Set User field 1 to point to info_struct */
  function_code = 1;
  field_code = 1;
  field_value = 1;
  CEE3USR (function_code, field_number, field_value, &fc, info);
}```
2. Following is an example of CEE3USR called by COBOL.

```c
CEE3USR(&function_code,&field_number,&field_value,&fc);
if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
    printf("CEE3USR failed with message number %d\n", fc.tok_msgno);
    exit(2999);
}

/* . . . */
/* get the value of field 2 */
function_code = 2;
field_number = 1;
CEE3USR(&function_code,&field_number,&field_value,&fc);
if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
    printf("CEE3USR failed with message number %d\n", fc.tok_msgno);
    exit(2999);
}
/* . . . */
```
**Specify 2 for QUERY function.**  
**Specify field number 1 to query the value**  
**of field number 1.**  

---

**Para-3UsrQry.**

MOVE 2 TO Funcode.
MOVE 1 TO Fieldno.
CALL "CEE3USR" USING Funcode, Fieldno, Invalue, FC.

IF CEE000 of FC THEN
   DISPLAY "User Area field " Fieldno
   " is: " Invalue
ELSE
   DISPLAY "CEE3USR failed with msg "
   Msg-No of FC UPON CONSOLE
   STOP RUN
END-IF.
GOBACK.

---

3. Following is an example of CEE3USR called by PL/I.

*Process Macro;*  
/* Module/File Name: IBM3USR */  
/***************************************************/  
/**                                                ***/  
/** Function: CEE3USR - set/query user area fields ***/  
/**                                                ***/  
/** In this example, CEE3USR is called twice: once ***/  
/** to set the value of a user area, and once to ***/  
/** query it.                                       ***/  
/***************************************************/

PLI3USR: PROC OPTIONS(MAIN);

%INCLUDE  CEEIBMAW;
%INCLUDE  CEEIBMCT;

DCL Funcode   REAL FIXED BINARY(31,0);
DCL Fieldno   REAL FIXED BINARY(31,0);
DCL Outvalue  REAL FIXED BINARY(31,0);
DCL Invalue   REAL FIXED BINARY(31,0);
DCL 01 FC,                     /* Feedback token */
   03 MsgSev    REAL FIXED BINARY(15,0),
   03 MsgNo     REAL FIXED BINARY(15,0),
   03 Flags,
   05 Case      BIT(2),
   05 Severity  BIT(3),
   05 Control   BIT(3),
   03 FacID     CHAR(3),      /* Facility ID */
   03 ISI       CHAR(3),      /* Instance-Specific Information */
                  REAL FIXED BINARY(31,0);

Funcode = 1; /* Specify 1 for the set function */
Fieldno = 1; /* Specify field 1 of two */
Invalue = 5; /* Value to put in field 1 */

/* Call CEE3USR to set user field 1 to 5 */
CALL CEE3USR ( Funcode, Fieldno, Invalue, FC );
IF FBCheck( FC, CEE000) THEN DO;
   Put Skip List( 'LE/370 User field ' || Fieldno
                  ' has been set to ' || Invalue );
END;
ELSE DO;
   DISPLAY( 'CEE3USR failed with msg '
            ' || FC.MsgNo );
   STOP;
END;

/* Call CEE3USR to query the value of field 1 */

Funcode = 2; /* Specify 2 for query function */
Fieldno = 1; /* Specify field 1 of two */

CALL CEE3USR ( Funcode, Fieldno, Outvalue, FC );
IF FBCheck( FC, CEE000) THEN DO;
   Put Skip List( 'LE/370 User field ' || Fieldno
                  ' is currently set to ' || Outvalue );
END;
ELSE DO;
   DISPLAY( 'CEE3USR failed with msg '
            ' || FC.MsgNo );

---

Callable services 189
CEECBLDY—Convert date to COBOL Integer format

CEECBLDY converts a string representing a date into a COBOL Integer format, which is the number of days since 1 January 1601. This service is similar to CEEDAYS, except that it provides a string in COBOL Integer format, which is compatible with ANSI intrinsic functions. Use CEECBLDY to access the century window of Language Environment and to perform date calculations with COBOL intrinsic functions for programs compiled with the INTDATE(ANSI) compiler option.

Call CEECBLDY only from COBOL programs that use the returned value as input for COBOL intrinsic functions. You should not use the returned value with other Language Environment callable services, nor should you call CEECBLDY from any non-COBOL programs. Unlike CEEDAYS, there is no inverse function for CEECBLDY, because it is only for COBOL users who want to use the Language Environment century window service together with COBOL intrinsic functions for date calculations. The inverse function for CEECBLDY is provided by the DATE-OF-INTEGER and DAY-OF-INTEGER intrinsic functions.

To handle dates earlier than 1601, add 4000 to each year, convert to Integer, calculate, subtract 4000 from the result, and then convert back to character format. By default, 2-digit years lie within the 100-year range starting 80 years prior to the system date. Thus, in 1995, all 2-digit years represent dates between 1915 and 2014, inclusive. You can change this default range by using the CEESCEN callable service.

```
CEECBLDY

input_char_date (input)
A halfword length-prefixed character string (VSTRING) representing a date or timestamp, in a format conforming to that specified by picture_string. The character string must contain between 5 and 255 characters, inclusive. input_char_date can contain leading or trailing blanks. Parsing for a date begins with the first nonblank character (unless the picture string itself contains leading blanks, in which case CEECBLDY skips exactly that many positions before parsing begins). After parsing a valid date, as determined by the format of the date specified in picture_string, CEECBLDY ignores all remaining characters. Valid dates range between and include 01 January 1601 to 31 December 9999. See Table 34 on page 425 for a list of valid picture character terms that can be specified in input_char_date.

picture_string (input)
A halfword length-prefixed character string (VSTRING), indicating the format of the date specified in input_char_date. Each character in the picture_string corresponds to a character in input_char_date. For example, if you specify MMDDYY as the picture_string, CEECBLDY reads an input_char_date of 060288 as 02 June 1988. If delimiters such as the slash (/) appear in the picture string, leading zeros
can be omitted. For example, the following calls to CEECBLDY would each assign the same value, 148155 (02 June 1988), to COBINTDATE:

```
MOVE '6/2/88' TO DATEVAL.
MOVE 'MM/DD/YY' TO PICSTR.
CALL CEECBLDY USING DATEVAL, PICSTR, COBINTDATE, fc);
MOVE '06/02/88' TO DATEVAL.
MOVE 'MM/DD/YY' TO PICSTR.
CALL CEECBLDY USING DATEVAL, PICSTR, COBINTDATE, fc);
MOVE '060288' TO DATEVAL.
MOVE 'MMDDYY' TO PICSTR.
CALL CEECBLDY USING DATEVAL, PICSTR, COBINTDATE, fc);
MOVE '88154' TO DATEVAL.
MOVE 'YYDDD' TO PICSTR.
CALL CEECBLDY USING DATEVAL, PICSTR, COBINTDATE, fc);
```

Whenever characters such as colons or slashes are included in the picture_string (such as HH:MI:SS YY/MM/DD), they count as placeholders but are otherwise ignored. See Table 34 on page 425 for a list of valid picture character terms and Table 35 on page 426 for examples of valid picture strings.

If picture_string includes a Japanese Era symbol <JJJJ>, the YY position in input_char_date is replaced by the year number within the Japanese Era. For example, the year 1988 equals the Japanese year 63 in the Showa era. See Table 35 on page 426 for an additional example. See also Table 36 on page 426 for a list of Japanese Eras supported by CEEDATE.

If picture_string includes era symbol <CCCC> or <CCCCCCCC>, the YY position in input_char_date is replaced by the year number within the era. See Table 35 on page 426 for an additional example.

**output_Integer_date (output)**

A 32-bit binary integer representing the COBOL Integer date, the number of days since 31 December 1600. For example, 16 May 1988 is day number 141485. If input_char_date does not contain a valid date, output_Integer_date is set to 0 and CEECBLDY terminates with a non-CEE000 symbolic feedback code. Date calculations are performed easily on the output_Integer_date, because output_Integer_date is an integer. Leap year and end-of-year anomalies do not affect the calculations.

**fc (output)**

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can arise from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td></td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE2EB</td>
<td>3</td>
<td>2507</td>
<td>Insufficient data was passed to CEEDAYS or CEESecs. The Lilian value was not calculated.</td>
</tr>
<tr>
<td>CEE2EC</td>
<td>3</td>
<td>2508</td>
<td>The date value passed to CEEDAYS or CEESecs was invalid.</td>
</tr>
<tr>
<td>CEE2ED</td>
<td>3</td>
<td>2509</td>
<td>The era passed to CEEDAYS or CEESecs was not recognized.</td>
</tr>
<tr>
<td>CEE2EH</td>
<td>3</td>
<td>2513</td>
<td>The input date passed in a CEEISEC, CEEDAYS, or CEESecs call was not within the supported range.</td>
</tr>
<tr>
<td>CEE2EL</td>
<td>3</td>
<td>2517</td>
<td>The month value in a CEEISEC call was not recognized.</td>
</tr>
<tr>
<td>CEE2EM</td>
<td>3</td>
<td>2518</td>
<td>An invalid picture string was specified in a call to a date/time service.</td>
</tr>
<tr>
<td>CEE2EO</td>
<td>3</td>
<td>2520</td>
<td>CEEDAYS detected non-numeric data in a numeric field, or the date string did not match the picture string.</td>
</tr>
<tr>
<td>CEE2EP</td>
<td>3</td>
<td>2521</td>
<td>The (&lt;JJJJ&gt;) or (&lt;CCCC&gt;) year-within-era value passed to CEEDAYS or CEESecs was zero.</td>
</tr>
</tbody>
</table>
Usage notes

- The probable cause for receiving message number 2518 is a picture string that contains an invalid DBCS string. You should verify that the data in the picture string is correct.
- z/OS UNIX consideration—In multithread applications, CEECBLDY affects only the calling thread.

For more information

- See the INTDATE COBOL compiler installation option in the appropriate version of the COBOL programming guide in the COBOL library at Enterprise COBOL for z/OS library (www.ibm.com/support/docview.wss?uid=swg27036733) for information about how to get ANSI integer values from COBOL Intrinsic Functions that are compatible with the Language Environment callable services CEEDAYS and CEEDATE.
- See “CEESCEN—Set the century window” on page 348 for more information about the CEESCEN callable service.
- See Table 34 on page 425 for a list of valid picture character terms that can be specified in `input_char_date`.

Examples

1. Following is an example of CEECBLDY called by COBOL.

```cobol
CBL LIB,QUOTE
*Module/File Name: IGZTCBLD
*******************************************************************************
** Function: Invoke CEECBLDY callable service to convert date to COBOL Integer format. This service is used when using the Language Environment Century Window mixed with COBOL Intrinsic Functions. ***********************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLDY.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01  CHRDATE.
  02  Vstring-length PIC S9(4) BINARY.
  02  Vstring-text.
  03  Vstring-char PIC X OCCURS 0 TO 256 TIMES DEPENDING ON Vstring-length of CHRDATE.
  01  PICSTR.
  02  Vstring-length PIC S9(4) BINARY.
  02  Vstring-text.
  03  Vstring-char PIC X OCCURS 0 TO 256 TIMES DEPENDING ON Vstring-length of PICSTR.
  01  INTEGER PIC S9(9) BINARY.
  01  NEWDATE PIC 9(8).
  01  FC.
COPY CEEIGZCT.
  03  Case-1-Condition-ID.
  04  Severity PIC S9(4) BINARY.
  04  Msg-No PIC S9(4) BINARY.
  03  Case-2-Condition-ID
  REDIRECTS Case-1-Condition-ID.
  04  Class-Code PIC S9(4) BINARY.
  04  Cause-Code PIC S9(4) BINARY.
  03  Case-Sev-Ctl PIC X.
  03  Facility-ID PIC XXX.
  02  I-S-Info PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBLDAYS.
*******************************************************************************
** Specify input date and length ***********************************************************************
```
MOVE 25 TO Vstring-length of CHRDATE.
MOVE "1 January 00" to Vstring-text of CHRDATE.

**************************************************************************
** Specify a picture string that describes **
** input date, and set the string's length. **
**************************************************************************
MOVE 23 TO Vstring-length of PICSTR.
MOVE "ZD Mmmmmmmmmmmmmm YY" TO Vstring-text of PICSTR.

**************************************************************************
** Call CEECBLDY to convert input date to a **
** COBOL Integer date **
**************************************************************************
CALL "CEECBLDY" USING CHRDATE, PICSTR, INTEGER, FC.

**************************************************************************
** If CEECBLDY runs successfully, then compute **
** the date of the 90th day after the **
** input date using Intrinsic Functions **
**************************************************************************
IF CEE000 of FC THEN
    COMPUTE INTEGER = INTEGER + 90
    COMPUTE NEWDATE = FUNCTION
        DATE-OF-INTEGER (INTEGER)
    DISPLAY NEWDATE
        " is ANSI day: " INTEGER
ELSE
    DISPLAY "CEECBLDY failed with msg "
        Msg-No of FC UPON CONSOLE
    STOP RUN
ENDIF.

GOBACK.

CEECMI—Store and load message insert data

CEECMI copies message insert data and loads the address of that data into the Instance Specific
Information (ISI) associated with the condition being processed. CEECMI also allocates storage for the
ISI, if necessary. The number of ISIs per thread is determined by the MSGQ runtime option. ISIs are
released when the value specified in the MSGQ runtime option is exceeded. The least recently used ISI is
overwritten.

If you plan on using a routine that signals a new condition with a call to the CEESGL callable service, you
should first call CEECMI to copy any insert information into the ISI associated with the condition.

- **cond_rep** (input/output)
  A condition token that defines the condition for which the q_data_token is retrieved.

- **insert_seq_num** (input)
  A 4-byte integer that contains the insert sequence number (such as insert 1 insert 2). It corresponds
to an insert number specified with an ins tag in the message source file created by the CEEBLDTX
EXEC.

- **insert_data** (input)
  A halfword-prefixed length string that represents the insert data. The entire length described in the
halfword prefix is used without truncation. DBCS strings must be enclosed within shift-out (X'0E') and
shift-in (X'0F') characters. The maximum size for an individual insert data item is 254 bytes.
fc (output)

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can arise from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE0EB</td>
<td>3</td>
<td>0459</td>
<td>Not enough storage was available to create a new instance specific information block.</td>
</tr>
<tr>
<td>CEE0EC</td>
<td>1</td>
<td>0460</td>
<td>Multiple instances of the condition token with message number message-number and facility ID facility-id were detected.</td>
</tr>
<tr>
<td>CEE0ED</td>
<td>3</td>
<td>0461</td>
<td>The maximum number of unique message insert blocks was reached. This condition token had its 1_S_info field set to 1.</td>
</tr>
<tr>
<td>CEE0EE</td>
<td>3</td>
<td>0462</td>
<td>Instance specific information for the condition token with message number message-number and facility ID facility-id could not be found.</td>
</tr>
<tr>
<td>CEE0EF</td>
<td>3</td>
<td>0463</td>
<td>The maximum size for an insert data item was exceeded.</td>
</tr>
<tr>
<td>CEE0H9</td>
<td>3</td>
<td>0553</td>
<td>An internal error was detected in creating the inserts for a condition.</td>
</tr>
</tbody>
</table>

Usage notes

- z/OS UNIX consideration—In multithread applications, CEECMI applies to message insert data for only the calling thread.

For more information

- See “MSGQ” on page 51 for more information about the MSGQ runtime option.
- For more information about CEEBLDTX, see z/OS Language Environment Programming Guide.

Examples

1. Following is an example of CEECMI called by C/C++.

```c
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

void main ()
{
    _INT2 c_1,c_2,cond_case,sev,control;
    _CHAR3 facid;
```
2. Following is an example of CEECMI called by COBOL.

CBL LIB,QUOTE
*Module/File Name: IGZTCMI
******************************************************************************
** ** Function: CEECMI - Store and load message **
** ** : CEENCOD - Construct a condition **
** ** : CEEMSG - Dispatch a Message. **
** ** This example illustrates the invocation **
** ** of the Lang. Environ. message services to **
** ** store and load message insert data. **
** ** CEENCOD is called to construct a token **
** ** for a user defined message (message 10) **
** ** in a user message file. **
** ** CEECMI is called to insert text into **
** ** message 10. The resulting message and **
** ** insert is written to the MSGFILE. **
** ********************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLLCMI.
DATA DIVISION.
WORKING-STORAGE SECTION.
01 INSERTNO            PIC S9(9) BINARY.
01 CTOK                PIC X(12).
01 FBCODE.
02 Condition-Token-Value.
COPY CEEIGZCT.
03 Case-1-Condition-ID.
  04 Severity PIC S9(4) BINARY.
  04 Msg-No PIC S9(4) BINARY.
03 Case-2-Condition-ID
  REDEFINES Case-1-Condition-ID.
  04 Class-Code PIC S9(4) BINARY.
  04 Cause-Code PIC S9(4) BINARY.
03 Case-Sev-Ctl PIC X.
03 Facility-ID PIC XXX.
02 I-S-Info PIC S9(9) BINARY.
01 MSGDEST PIC S9(9) BINARY.
  01 SEV PIC S9(4) BINARY.
  01 MSGNO PIC S9(4) BINARY.
  01 CASE PIC S9(4) BINARY.
  01 CNTRL PIC S9(4) BINARY.
  01 FACID PIC X(3).
  01 ISINFO PIC S9(9) BINARY.
01 VSTRING.
  05 INSERT-TXTL PIC S9(4) BINARY.
  05 INSERT-TXT PIC X(80).
PROCEDURE DIVISION.
PARA-CEPGCMI.
************************************************
*   Set up token fields for creation of a      *
*   condition token for the user defined       *
*   message file and message number.           *
************************************************
MOVE 0 TO SEV.
MOVE 10 TO MSGNO.
MOVE 1 TO CASE.
MOVE 0 TO SEV2.
MOVE 0 TO CNTRL.
MOVE "XMP" TO FACID.
MOVE 0 TO ISINFO.
************************************************
*  Call CEENCOD to construct a condition token *
************************************************
CALL "CEENCOD" USING SEV, MSGNO, CASE,
  SEV2, CNTRL, FACID,
  ISINFO, CTOK, FBCODE.
IF NOT CEE000 of FBCODE THEN
  DISPLAY "CEENCOD failed with msg"
  Msg-No of FBCODE UPON CONSOLE
  STOP RUN
END-IF.
************************************************
*   Call CEECMI to store and load message     *
*   insert 1.                                 *
************************************************
MOVE "<CEPGCMI"s insert>" TO INSERT-TXT.
MOVE 19 TO INSERT-TXTL.
MOVE 1 TO INSERTNO.
CALL "CEECMI" USING CTOK, INSERTNO, VSTRING.
************************************************
*   Call CEEMSG to write message to MSGFILE   *
************************************************
MOVE 2 TO MSGDEST.
CALL "CEEMSG" USING CTOK, MSGDEST, FBCODE.
IF NOT CEE000 of FBCODE THEN
  DISPLAY "CEEMSG failed with msg"
  Msg-No of FBCODE UPON CONSOLE
  STOP RUN
END-IF.
GOBACK.

3. Following is an example of CEECMI called by PL/I.

*PROCESS MACRO;
IBMCMI: Proc Options(Main);

/ *Module/File Name: IBMCMI       */
/ *FUNCTION : CEECMI - store and load message    *
/ *   insert data        *
/ * : CEEMSG - retrieve, format, and dispatch a message to **

196 z/OS: Language Environment Programming Reference
This example illustrates the invocation of LE/370 message services to store and load message insert data. The resulting message and insert are written to the MSGFILE.

```
%INCLUDE  CEEIBMMAW;
%INCLUDE  CEEIBMCT;
DECLARE INSERT     CHAR(255) VARYING;
DCL 01 CTOK,                    /* Feedback token */
03 MsgSev    REAL FIXED BINARY(15,0),
03 MsgNo     REAL FIXED BINARY(15,0),
03 Flags,
05 Case      BIT(2),
05 Severity  BIT(3),
05 Control   BIT(3),
03 FacID     CHAR(3),    /* Facility ID */
03 ISI   /* Instance-Specific Information */
   REAL FIXED BINARY(31,0);
DCL 01 FBCODE,                 /* Feedback token */
03 MsgSev    REAL FIXED BINARY(15,0),
03 MsgNo     REAL FIXED BINARY(15,0),
03 Flags,
05 Case      BIT(2),
05 Severity  BIT(3),
05 Control   BIT(3),
03 FacID     CHAR(3),    /* Facility ID */
03 ISI   /* Instance-Specific Information */
   REAL FIXED BINARY(31,0);
DECLARE MSGFILE    REAL FIXED BINARY(31,0);
DECLARE INSERT_NO  REAL FIXED BINARY(31,0);
END IBMCMI;
```

**CEECRHP**—Create new additional heap

CEECRHP lets you define additional heaps. It returns a unique heap_id. The heaps defined by CEECRHP can be used just like the initial heap (heap_id=0), below heap, and anywhere heap. Unlike the heaps created by these heap services, all heap elements within an additional heap can be quickly freed by a single call to CEEDSHP (discard heap). The number of heaps supported by Language Environment is limited only by the amount of virtual storage available.

```c
CEECRHP
```
heap_id (output)
A fullword binary signed integer. heap_id is the heap identifier of the created heap. If a new heap cannot be created, the value of heap_id remains undefined. Storage obtained from heap_ids 79 and 80 is set to binary 0 independent of any initialization value specified by the STORAGE option.

initial_size (input)
A fullword binary signed integer. initial_size is the initial amount of storage, in bytes, allocated for the new heap. initial_size is rounded up to the nearest increment of 4096 bytes. If initial_size is specified as 0, then the init_size specified in the HEAP runtime option is used. If no HEAP runtime option was provided and initial_size is specified as 0, CEECRHP uses the system-level or region-level default.

increment (input)
A fullword binary signed integer. When it is necessary to enlarge the heap to satisfy an allocation request, increment represents the number of bytes by which the heap is extended. increment is rounded up to the nearest 4096 bytes. If increment is specified as 0, then the incr_size specified in the HEAP run time option is used. If no HEAP runtime option was provided and increment equals 0, CEECRHP uses the installation default.

options (input)
A fullword binary signed integer. options are specified with the decimal codes, as shown in Table 26 on page 198.

<table>
<thead>
<tr>
<th>Option setting</th>
<th>HEAP attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>00</td>
<td>Use same attributes as the initial heap (copy them from the HEAP runtime option)</td>
</tr>
<tr>
<td>01</td>
<td>HEAP(,,FREE) (location inherited from HEAP runtime option)</td>
</tr>
<tr>
<td>70</td>
<td>HEAP(,,KEEP) (location inherited from HEAP runtime option)</td>
</tr>
<tr>
<td>71</td>
<td>HEAP(,,ANYWHERE,KEEP)</td>
</tr>
<tr>
<td>72</td>
<td>HEAP(,,ANYWHERE,FREE)</td>
</tr>
<tr>
<td>73</td>
<td>HEAP(,,BELOW,KEEP)</td>
</tr>
<tr>
<td>74</td>
<td>HEAP(,,BELOW,FREE)</td>
</tr>
<tr>
<td>75</td>
<td>HEAP(,,ANYWHERE,) (disposition inherited from the HEAP runtime option)</td>
</tr>
<tr>
<td>76</td>
<td>HEAP(,,BELOW,) (disposition inherited from the HEAP runtime option)</td>
</tr>
<tr>
<td>77</td>
<td>HEAP(,,ANYWHERE,KEEP) (all heap storage obtained using this heap_id is allocated on a 4K boundary)</td>
</tr>
<tr>
<td>78</td>
<td>HEAP(,,ANYWHERE,FREE) (all heap storage obtained using this heap_id is allocated on a 4K boundary)</td>
</tr>
<tr>
<td>79</td>
<td>HEAP(,,ANYWHERE,KEEP) (all heap storage obtained using this heap_id is set to binary 0 when allocated using CEEGTST)</td>
</tr>
<tr>
<td>80</td>
<td>HEAP(,,ANYWHERE,FREE) (all heap storage obtained using this heap_id is set to binary 0 when allocated using CEEGTST)</td>
</tr>
</tbody>
</table>

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can arise from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE0P2</td>
<td>4</td>
<td>0802</td>
<td>Heap storage control information was damaged.</td>
</tr>
<tr>
<td>Code</td>
<td>Severity</td>
<td>Message number</td>
<td>Message text</td>
</tr>
<tr>
<td>--------</td>
<td>----------</td>
<td>----------------</td>
<td>-------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>CEE0P4</td>
<td>3</td>
<td>0804</td>
<td>The initial size value supplied in a create heap request was unsupported.</td>
</tr>
<tr>
<td>CEE0P5</td>
<td>3</td>
<td>0805</td>
<td>The increment size value supplied in a create heap request was unsupported.</td>
</tr>
<tr>
<td>CEE0P6</td>
<td>3</td>
<td>0806</td>
<td>The options value supplied in a create heap request was unrecognized.</td>
</tr>
<tr>
<td>CEE0Pd</td>
<td>3</td>
<td>0813</td>
<td>Insufficient storage was available to satisfy a get storage request.</td>
</tr>
</tbody>
</table>

**Usage notes**

- z/OS UNIX consideration—CEECRHP applies to the enclave.
- The heapid can only be used by the TCB on which the CEECRHP request was issued. Using the heapid on other TCBs is not supported and will generate unpredictable results.

**For more information**

- See “CEEDSHP—Discard heap” on page 228 for more information about the CEEDSHP callable service.
- See “HEAP” on page 32 for more information about the HEAP runtime option and IBM-supplied defaults.

**Examples**

1. Following is an example of CEECRHP called by C/C++.

```c
/*Module/File Name: EDCRHP */
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {

    _INT4 heapid, size, increment, options;
    _FEEDBACK fc;
    /* */
    // */ heapid = 0; /* heap identifier is set */
    // */ by CEECRHP */
    size = 4096; /* initial size of heap (in */
    // */ bytes) */
    increment = 4096; /* increment to extend heap by */
    options = 72; /* set up heap as */
    // */ (,,ANYWHERE,FREE) */

    /* create heap using CEECRHP */
    CEECRHP(&heapid,&size,&increment,&options,&fc);

    /* check the first 4 bytes of the feedback token */
    /* (0 if successful) */
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEECRHP failed with message number %d\n", fc.tok_msgno);
        exit(99);
    }
    /* */
    // */ discard the heap that was previously created */
    // */ using CEECRHP */
    CEEDSHP(&heapid,&fc);

    /* check the first 4 bytes of the feedback token */
    /* (0 if successful) */
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEEDSHP failed with message number %d\n", fc.tok_msgno);
    }
```
2. Following is an example of CEECRHP called by COBOL.

```cobol
CBL LIB,QUOTE
*Module/File Name: IGZTCRHP
**************************************************************************
** Function: CEECRHP - create new additional **
** heap **
**************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLCRHP.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01  HEAPID       PIC S9(9) BINARY.
  01  HPSIZE      PIC S9(9) BINARY.
  01  INCR        PIC S9(9) BINARY.
  01  OPTS        PIC S9(9) BINARY.
  01  FC.
    02  Condition-Token-Value.
    COPY  CEEIGZCT.
      03  Case-1-Condition-ID.
      04  Severity    PIC S9(4) BINARY.
      04  Msg-No      PIC S9(4) BINARY.
      03  Case-2-Condition-ID
      REDEFINES Case-1-Condition-ID.
      04  Class-Code  PIC S9(4) BINARY.
      04  Cause-Code  PIC S9(4) BINARY.
      03  Case-Sev-Ctl  PIC X.
      03  Facility-ID  PIC XXX.
      02  I-S-Info     PIC S9(9) BINARY.
PROCEDURE DIVISION.
**************************************************************************
** Specify 0 for HEAPID, and heap id will be **
**     set by CEECRHP.                         **
** Heap size and increment will each be **
**     4096 bytes.                             **
** Specify 00 for OPTS, and HEAP attributes **
**     will be inherited from the initial heap **
**     (copied from the HEAP runtime option). **
**************************************************************************
MOVE 0 TO HEAPID.
MOVE 4096 TO HPSIZE.
MOVE 4096 TO INCR.
MOVE 00 TO OPTS.
CALL "CEECRHP" USING HEAPID, HPSIZE,
      INCR, OPTS, FC.
IF CEE000 of FC THEN
  DISPLAY "Created heap number " HEAPID
  " which is " HPSIZE " bytes long"
ELSE
  DISPLAY "CEECRHP failed with msg 
   Msg-No of FC UPON CONSOLE
STOP RUN
END-IF.
GOBACK.
```

3. Following is an example of CEECRHP called by PL/I.

```pli
*PROCESS MACRO;
/*Module/File Name: IBMCRHP */

FLICTOKEN(msgno);
exit(99);
} */
}
```

200 z/OS: Language Environment Programming Reference
CEECZST—Reallocate (change size of) storage

CEECZST changes the size of a previously allocated heap element. The address parameter points to the beginning of the heap element. The new_size parameter gives the new size of the heap element, in bytes. The contents of the heap element are unchanged up to the shorter of the new and old sizes.

The CEECZST service returns a pointer to the reallocated heap element. It can move the storage location of the heap element. As a result, the address parameter passed to CEECZST is not necessarily the same as the value returned.

Because the new storage might be allocated at a different location from the existing allocation, any pointers (specifically any addresses) that referred to the old storage become invalid. Continued use of such dangling pointers gives unpredictable, and almost certainly incorrect, results.

The heap identifier is inferred from the address. The new storage block is allocated from the same heap that contained the old block.

The contents of the old storage are preserved in the following manner:

- If new_size is greater than the old size, the entire contents of the old storage block are copied to the new block. The remaining bytes in the new element are left uninitialized unless an initialization suboption value was specified for the heap in the STORAGE option.
- If new_size is less than the old size, the contents of the old block are truncated to the size of the new block.
If new_size is equal to the old size, no operations are performed; a successful feedback code is returned.

address (input/output)

A fullword address pointer. On input, this parameter contains an address returned by a previous CEEGTST call. On output, the address of the first byte of the newly allocated storage is returned in this parameter.

new_size (input)

A fullword binary signed integer. new_size is the number of bytes of storage to be allocated for the new heap element.

fc (output)

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE0P2</td>
<td>4</td>
<td>0802</td>
<td>Heap storage control information was damaged.</td>
</tr>
<tr>
<td>CEE0P8</td>
<td>3</td>
<td>0808</td>
<td>Storage size in a get storage request or a reallocate request was not a positive number.</td>
</tr>
<tr>
<td>CEE0PA</td>
<td>3</td>
<td>0810</td>
<td>The storage address in a free storage request was not recognized, or heap storage control information was damaged.</td>
</tr>
<tr>
<td>CEE0PD</td>
<td>3</td>
<td>0813</td>
<td>Insufficient storage was available to satisfy a get storage request.</td>
</tr>
</tbody>
</table>

Usage notes

- Storage that is reallocated maintains the same mark/release status as the old storage block. If the old storage block was marked, the new storage block carries the same mark and is released by a release operation that specifies that mark.
- z/OS UNIX consideration—CEECZST applies to the enclave.
- The _CEE_REALLOC_CONTROL environment variable provides additional levels of storage control, which can aid CEECZST to more efficiently use storage. For more information about _CEE_REALLOC_CONTROL, see z/OS XL C/C++ Programming Guide.

For more information

- See “STORAGE” on page 70 for more information about the STORAGE runtime option.
- For information about CEEGTST, see “CEEGTST—Get heap storage” on page 276.

Examples

1. Following is an example of CEECZST called by C/C++.

```c
/*Module/File Name: EDCCZST */
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>
int main(void) {
  _INT4 heapid, size;
  _POINTER address;
```
heapid = 0; /* get storage from initial heap */
size = 4000; /* number of bytes of heap storage */
/* obtain the storage using CEEGTST */
CEEGTST(&heapid,&size,&address,&fc);
/* check the first 4 bytes of the feedback token */
/* (0 if successful) */
if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
    printf("CEEGTST failed with message number %d\n", fc.tok_msgno);
    exit(99);
} /* . */
/* . */
size = 2000; /* new size of storage element */
/* change the size of the storage element */
CEECZST(&address,&size,&fc);
/* check the first 4 bytes of the feedback token */
/* (0 if successful) */
if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
    printf("CEECZST failed with message number %d\n", fc.tok_msgno);
    exit(99);
} /* . */
/* . */
/* free the storage that was previously obtained */
/* using CEEGTST */
CEEFRST(&address,&fc);
/* check the first 4 bytes of the feedback token */
/* (0 if successful) */
if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
    printf("CEEFRST failed with message number %d\n", fc.tok_msgno);
    exit(99);
} /* . */
/* . */
2. Following is an example of CEECZST called by COBOL.

CBL LIB,QUOTE
*Module/File Name: IGZTCZST
************************************************
**                                            **
** Function: CEECZST - reallocate storage     **
**                                            **
** In this example, CEEGTST is called to      **
** request storage from HEAPID = 0, and       **
** CEECZST is called to change the size of    **
** that storage request.                      **
**                                            **
**                                            **
** identification Division.                   **
** program-id.  CBLCZST.                     **
** data Division.                             **
** working-storage section.                   **
* 01 HEAPID       PIC S9(9) BINARY.   **
* 01 HPSIZE       PIC S9(9) BINARY.   **
* 01 ADDRSS       POINTER.            **
* 01 NEWSIZE      PIC S9(9) BINARY.   **
* 01 FC.                **
* 02 Condition-Token-Value. **
COPY CEEIGZCT.  **
* 03 Case-1-Condition-ID. **
* 04 Severity     PIC S9(4) BINARY.   **
* 04 Msg-No       PIC S9(4) BINARY.   **
* 03 Case-2-Condition-ID **
************************************************
REDEFINES Case-1-Condition-ID.
04 Class-Code PIC S9(4) BINARY.
04 Cause-Code PIC S9(4) BINARY.
03 Case-Sev-Ctl PIC X.
03 Facility-ID PIC XXX.
02 I-S-Info PIC S9(9) BINARY.

PROCEDURE DIVISION.
PARA-CBLGTST.

*************************************************
** Specify 0 to get storage from the initial   **
**     heap. Specify 4000 to get 4000 bytes of **
** storage.                                   **
*************************************************
MOVE 0 TO HEAPID.
MOVE 4000 TO HPSIZE.

*************************************************
** Call CEEGTST to obtain storage.            **
*************************************************
CALL "CEEGTST" USING HEAPID, HPSIZE,
ADDRSS, FC.

*************************************************
** If CEEGTST runs successfully, display result**
*************************************************
IF CEE000 OF FC THEN
   DISPLAY " " HPSIZE
   " bytes have been allocated."
ELSE
   DISPLAY "CEEGTST failed with msg ",
   Msg-No of FC UPON CONSOLE
   STOP RUN
END-IF.

*************************************************
** Specify a new size of 2000 bytes.           **
*************************************************
MOVE 2000 TO NEWSIZE.

*************************************************
** Call CEECZST to change the size of the      **
** storage allocated in the call to CEEGTST.    **
*************************************************
CALL "CEECZST" USING ADDRSS, NEWSIZE, FC.

*************************************************
** If CEECZST runs successfully, display result**
*************************************************
IF CEE000 OF FC THEN
   DISPLAY "The storage element now contains ",
   NEWSIZE " bytes."
ELSE
   DISPLAY "CEEGTST failed with msg ",
   Msg-No of FC UPON CONSOLE
   STOP RUN
END-IF.
GOBACK.

3. Following is an example of CEECZST called by PL/I.

*PROCESS MACRO;
/*Module/File Name: IBMZST                        */
/***************************************************/
/**                                               **/
/** Function: CEECZST - reallocate storage       **/
/**                                               **/
/** In this example, CEEGTST is called to request **/
/** storage from HEAPID = 0, and CEECZST is called**/
/** to change the size of that storage request.   **/
/**                                               **/
/***************************************************/
PLICZST: PROC OPTIONS(MAIN);

%INCLUDE  CEEIBMAW;
%INCLUDE  CEEIBMCT;

DCL HEAPID   REAL FIXED BINARY(31,0) ;
DCL STGSIZE  REAL FIXED BINARY(31,0) ;
DCL ADDRSS1  POINTER;

GOBACK.
CEEDATE—Convert Lilian date to character format

CEEDATE converts a number representing a Lilian date to a date written in character format. The output is a character string, such as 1993/09/09.

Do not use CEEDATE in combination with COBOL intrinsic functions.

The inverse of CEEDATE is CEEDAYS, which converts character dates to the Lilian format.

CEEDATE is affected only by the country code setting of the COUNTRY runtime option or CEE3CTY callable service, not the CEESETL callable service or the `setlocale()` function.
CEEDATE

**Input_Lilian_date (input)**
A 32-bit integer representing the Lilian date. The Lilian date is the number of days since 14 October 1582. For example, 16 May 1988 is Lilian day number 148138. The valid range of Lilian dates is 1 to 3,074,324 (15 October 1582 to 31 December 9999).

**Picture_string (input)**
A halfword length-prefixed character string (VSTRING), representing the desired format of output_char_date, for example MM/DD/YY. Each character in picture_string represents a character in output_char_date. If delimiters such as the slash (/) appear in the picture string, they are copied to output_char_date.

See Table 34 on page 425 for a list of valid picture characters, and Table 35 on page 426 for examples of valid picture strings.

If picture_string is null or blank, CEEDATE gets picture_string based on the current value of the COUNTRY runtime option. For example, if the current value of the COUNTRY runtime option is US (United States), the date format would be MM/DD/YY. If the current COUNTRY value is FR (France), the date format would be MM/DD/YY HH:MM:SS AM (or PM), for example: 09/09/93 4:56:29 PM. This default mechanism makes it easy for translation centers to specify the preferred date, and for applications and library routines to use this format automatically.

If picture_string includes a Japanese Era symbol <JJJJ>, the YY position in output_char_date is replaced by the year number within the Japanese Era. For example, the year 1988 equals the Japanese year 63 in the Showa era. See Table 35 on page 426 for an additional example. Also see Table 36 on page 426 for a list of Japanese Eras supported by CEEDATE.

If picture_string includes an era symbol <CCCC> or <CCCCCCCC>, the YY position in output_char_date is replaced by the year number within the era. See Table 35 on page 426 for an example.

**Output_char_date (output)**
A fixed-length 80-character string (VSTRING), is the result of converting input_Lilian_date to the format specified by picture_string. See Table 27 on page 210 for sample output dates. If input_Lilian_date is not valid, output_char_date is set to all blanks. CEEDATE terminates with a non-CEE000 symbolic feedback code.

**Fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>0</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE2EG</td>
<td>3</td>
<td>2512</td>
<td>The Lilian date value was not within the supported range.</td>
</tr>
<tr>
<td>CEE2EM</td>
<td>3</td>
<td>2518</td>
<td>An incorrect picture string was specified.</td>
</tr>
<tr>
<td>CEE2EQ</td>
<td>3</td>
<td>2522</td>
<td>&lt;JJJJ&gt;, &lt;CCCC&gt; or &lt;CCCCCCCC&gt; was used in a picture string passed to CEEDATE, but the Lilian date value was not within the supported range. The Era could not be determined.</td>
</tr>
<tr>
<td>CEE2EU</td>
<td>2</td>
<td>2526</td>
<td>The date string returned by CEEDATE was truncated.</td>
</tr>
</tbody>
</table>

**Usage notes**
- The probable cause for receiving message number 2518 is a picture string that contains a DBCS string that is not valid. You should verify that the data in the picture string is correct.
• To create a null VSTRING, set the length to zero; the content of the text portion does not matter. To create a blank VSTRING, any length greater than zero can be used; the content of the text portion must be spaces or blanks.
• z/OS UNIX consideration—In multithread applications, CEEDATE applies to the enclave.

For more information
• See the INTDATE COBOL compiler installation option in the appropriate version of the COBOL programming guide in the COBOL library at Enterprise COBOL for z/OS library (www.ibm.com/support/docview.wss?uid=swg27036733) for information about how to get Lilian integer values from COBOL intrinsic functions that are compatible with the Language Environment callable services CEEDAYS and CEEDATE.
• See “CEEDAYS—Convert date to Lilian format” on page 215 for more information about the CEEDAYS callable service.
• See “COUNTRY” on page 20 for more information about the COUNTRY runtime option.
• See “CEEFMDA—Get default date format” on page 238 for information about how to get the default format for a given country code.

Examples
1. Following is an example of CEEDATE called by C/C++.

```c
/**Module/File Name: EDCDATE*/
#include <leawi.h>
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <ceedcct.h>
int main(void) {
    _FEEDBACK fc;
    _INT4 lil_date = 139370; /* May 14, 1964 */
    _VSTRING date_pic,date;
    _CHAR80 date_out;
    strcpy(date_pic.string,
        "The date is Wwwwwwwmm, Mmmmmmmmm ZD, YYYY");
    date_pic.length = strlen(date_pic.string);
    CEEDATE(&lil_date,&date_pic,date_out,&fc);
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEEDATE failed with message number %d\n", fc.tok_msgno);
        exit(2999);
    }
    printf("%.80s\n",date_out);
}
```

2. Following is an example of CEEDATE called by COBOL.

```cobol
CBL_LIB,QUOTE
*Module/File Name: IGZTDATE
******************************************************************************
** Function: CEEDATE - convert Lilian date to **
** character format **
** In this example, a call is made to CEEDATE **
** to convert a Lilian date (the number of **
** days since 14 October 1582) to a character **
** format (such as 6/22/88). The result is **
** displayed. The Lilian date is obtained **
** via a call to CEEDAYS. **
******************************************************************************
IDENTIFICATION DIVISION.
```
PROGRAM-ID. CBLDATE.
DATA DIVISION.
WORKING-STORAGE SECTION.
01 LILIAN PIC S9(9) BINARY.
01 CHRDATE PIC X(80).
01 IN-DATE.
  02 Vstring-length PIC S9(4) BINARY.
  02 Vstring-text.
    03 Vstring-char PIC X
      OCCURS 0 TO 256 TIMES
      DEPENDING ON Vstring-length
      of IN-DATE.
01 PICSTR.
  02 Vstring-length PIC S9(4) BINARY.
  02 Vstring-text.
    03 Vstring-char PIC X
      OCCURS 0 TO 256 TIMES
      DEPENDING ON Vstring-length
      of PICSTR.
01 FC.
  02 Condition-Token-Value.
COPY CEEIZCT.
  03 Case-1-Condition-ID.
    04 Severity PIC S9(4) BINARY.
    04 Msg-No PIC S9(4) BINARY.
  03 Case-2-Condition-ID
    REDEFINES Case-1-Condition-ID.
    04 Class-Code PIC S9(4) BINARY.
    04 Cause-Code PIC S9(4) BINARY.
  03 Case-Sev-Ctl PIC X.
  03 Facility-ID PIC XXX.
  02 I-S-Info PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBLDAYS.
*************************************************
** Call CEEDAYS to convert date of 6/2/88 to   **
**     Lilian representation                   **
*************************************************
MOVE 6 TO Vstring-length of IN-DATE.
MOVE "6/2/88" TO Vstring-text of IN-DATE(1:6).
MOVE 8 TO Vstring-length of PICSTR.
MOVE "MM/DD/YY" TO Vstring-text of PICSTR(1:8).
CALL "CEEDAYS" USING IN-DATE, PICSTR,
       LILIAN, FC.

*************************************************
** If CEEDAYS runs successfully, display result**
*************************************************
IF CEE000 of FC THEN
  DISPLAY Vstring-text of IN-DATE
  " is Lilian day: " LILIAN
ELSE
  DISPLAY "CEEDAYS failed with msg "
       Msg-No of FC UPON CONSOLE
  STOP RUN
END-IF.

*************************************************
** Specify picture string that describes the   **
**   desired format of the output from CEEDATE, **
**   and the picture string's length.           **
*************************************************
MOVE 23 TO Vstring-length OF PICSTR.
MOVE "ZD Mmmmmmmmmmmmmmz YYYY" TO
      Vstring-text OF PICSTR(1:23).

*************************************************
** Call CEEDATE to convert the Lilian date     **
**     to a picture string.                     **
*************************************************
CALL "CEEDATE" USING LILIAN, PICSTR,
       CHRDATE, FC.

*************************************************
** If CEEDATE runs successfully, display result**
*************************************************
IF CEE000 of FC THEN
  DISPLAY "Input Lilian date of " LILIAN
       " corresponds to: " CHRDATE
ELSE
  DISPLAY "CEEDATE failed with msg "
       Msg-No of FC UPON CONSOLE

STOP RUN
END-IF.
GOBACK.

3. Following is an example of CEEDATE called by PL/I.

*PROCESS MACRO;
/*Module/File Name: IBMDATE */
/***********************************************/
/**                                            */
/** Function: CEEDATE - convert Lilian date to */
/**                     character format       */
/**                                            */
/** In this example, a call is made to CEEDATE */
/** to convert a date in the Lilian format */
/** (the number of days since 14 October 1582) */
/** to a date in character format. This date */
/** is then printed out. */
/**                                            */
/********************************************* */
PLIDATE: PROC OPTIONS(MAIN);

%INCLUDE  CEEIBMAW;
%INCLUDE  CEEIBMCT;

DCL LILIAN  REAL FIXED BINARY(31,0) ;
DCL PICSTR  CHAR(255) VARYING;
DCL CHRDATE CHAR(80) ;
DCL 01 FC,                     /* Feedback token */
    03 MsgSev    REAL FIXED BINARY(15,0),
    03 MsgNo     REAL FIXED BINARY(15,0),
    03 Flags,     
    05 Case      BIT(2),
    05 Severity  BIT(3),
    05 Control   BIT(3),
    03 FacID     CHAR(3),    /* Facility ID */
    03 ISI    * Instance-Specific Information */
    REAL FIXED BINARY(31,0);

LILIAN = 152385;  /* input date in Lilian format */
/* picture string that describes how converted */
/* date is to be formatted */
PICSTR = 'ZD Mmmmmmmmmmmmmmz YYYY';

/* Call CEE3DATE to convert input Lilian date to */
/* a date in the character format specified in */
/* PICSTR */
CALL CEEDATE ( LILIAN , PICSTR , CHRDATE , FC );

/* Print results if call to CEEDATE succeeds */
IF  FBCHECK( FC, CEE000)  THEN  DO;
   PUT SKIP LIST( 'Lilian day ' || LILIAN
                  || ' is equivalent to ' || CHRDATE );
END;
ELSE  DO;
   DISPLAY( 'CEEDATE failed with msg ' || FC.MsgNo );
   STOP;
END;

END PLIDATE;

Table 27 on page 210 shows the sample output from CEEDATE.
<table>
<thead>
<tr>
<th>input_Lilian_date</th>
<th>picture_string</th>
<th>output_char_date</th>
</tr>
</thead>
<tbody>
<tr>
<td>148138</td>
<td>YY</td>
<td>88</td>
</tr>
<tr>
<td></td>
<td>YYMM</td>
<td>8805</td>
</tr>
<tr>
<td></td>
<td>YY-MM</td>
<td>88-05</td>
</tr>
<tr>
<td></td>
<td>YYMMDD</td>
<td>880516</td>
</tr>
<tr>
<td></td>
<td>YYYY-MM-DD</td>
<td>19880516</td>
</tr>
<tr>
<td></td>
<td>YYYY-ZM-ZD</td>
<td>1988-05-16</td>
</tr>
<tr>
<td></td>
<td>JJJJ YYYY.MM.DD</td>
<td>1988-5-16</td>
</tr>
<tr>
<td></td>
<td>CCCC YYYY.MM.DD</td>
<td>Showa 63.05.16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(in a DBCS string)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Min Guo 77.05.16</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(in a DBCS string)</td>
</tr>
<tr>
<td>148139</td>
<td>MM</td>
<td>05</td>
</tr>
<tr>
<td></td>
<td>MMDD</td>
<td>0517</td>
</tr>
<tr>
<td></td>
<td>MM/DD</td>
<td>05/17</td>
</tr>
<tr>
<td></td>
<td>MM/DD/YYYY</td>
<td>05/17/1988</td>
</tr>
<tr>
<td></td>
<td>ZZ/MM/DD/YYYY</td>
<td>5/17/1988</td>
</tr>
<tr>
<td>148140</td>
<td>DD</td>
<td>18</td>
</tr>
<tr>
<td></td>
<td>DDMM</td>
<td>1805</td>
</tr>
<tr>
<td></td>
<td>DDMMYYYY</td>
<td>180588</td>
</tr>
<tr>
<td></td>
<td>DD.MM.YY</td>
<td>18.05.88</td>
</tr>
<tr>
<td></td>
<td>DD.MM.YYYY</td>
<td>18.05.1988</td>
</tr>
<tr>
<td></td>
<td>DD Mmm YYYY</td>
<td>18 May 1988</td>
</tr>
<tr>
<td>148141</td>
<td>DDD</td>
<td>140</td>
</tr>
<tr>
<td></td>
<td>YYDD</td>
<td>88148</td>
</tr>
<tr>
<td></td>
<td>YYYY.DDD</td>
<td>88.140</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1988.140</td>
</tr>
<tr>
<td>148142</td>
<td>YY/MM/DD HH:MI:SS.99</td>
<td>88/05/20</td>
</tr>
<tr>
<td></td>
<td>YYYY/MM/ZZ ZZ:MI AP</td>
<td>00:00:00.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1988/5/20 0:00 AM</td>
</tr>
<tr>
<td>148143</td>
<td><a href="http://WWW">WWW</a>., MMM DD, YYYY</td>
<td>SAT., MAY 21, 1988</td>
</tr>
<tr>
<td></td>
<td><a href="http://WWW">WWW</a>., Mmm DD, YYYY</td>
<td>Sat., May 21, 1988</td>
</tr>
<tr>
<td></td>
<td>WWWWWWWWWWW Mmmmmmmmm</td>
<td>Saturdaybb, Maybddd 21, 1988</td>
</tr>
<tr>
<td></td>
<td>DD, YYYY</td>
<td>Saturday, May 21, 1988</td>
</tr>
<tr>
<td></td>
<td>WWWWWWWWWWWZ, Mmmmmmmmmz DD, YYYY</td>
<td></td>
</tr>
</tbody>
</table>

**CEEDATM—Convert seconds to character timestamp**

CEEDATM converts a number representing the number of seconds since 00:00:00 14 October 1582 to a character string format. The format of the output is a character string timestamp, for example: 1988/07/26 20:37:00.

The inverse of CEEDATM is CEESECS, which converts a timestamp to number of seconds.

CEEDATM is affected only by the country code setting of the COUNTRY runtime option or CEE3CTY callable service, not the CEESETL callable service or the setlocale() function.
input_seconds (input)
A 64-bit double floating-point number representing the number of seconds since 00:00:00 on 14 October 1582, not counting leap seconds. For example, 00:00:01 on 15 October 1582 is second number 86,401 (24*60*60 + 01). The valid range of input_seconds is 86,400 to 265,621,679,999 (23:59:59.999 31 December 9999).

picture_string (input)
A halfword length-prefixed character string (VSTRING), representing the desired format of output_timestamp, for example, MM/DD/YY HH:MI AP.

Each character in the picture_string represents a character in output_timestamp. If delimiters such as a slash (/) appear in the picture string, they are copied as is to output_timestamp.

See Table 34 on page 425 for a list of valid picture character terms and Table 35 on page 426 for examples of valid picture strings.

If picture_string is null or blank, CEEDATM gets picture_string based on the current value of the COUNTRY runtime option. For example, if the current value of the COUNTRY runtime option is US (United States), the date-time format would be "MM/DD/YY HH:MI SS AP"; if the current COUNTRY value is FR (France), however, the date-time format would be "DD.MM.YYYY HH:MI:SS".

If picture_string includes the Japanese Era symbol <JJJJ>, the YY position in output_timestamp represents the year within Japanese Era. See Table 35 on page 426 for an example. See Table 36 on page 426 for a list of Japanese Eras supported by CEEDATM.

If picture_string includes era symbol <CCCC> or <CCCCCCCC>, the YY position in output_timestamp represents the year within the era. See Table 35 on page 426 for an example.

output_timestamp (output)
A fixed-length 80-character string (VSTRING), that is the result of converting input_seconds to the format specified by picture_string. If necessary, the output is truncated to the length of output_timestamp. See Table 28 on page 215 for sample output.

If input_seconds is not valid, output_timestamp is set to all blanks and CEEDATM terminates with a non-CEE000 symbolic feedback code.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE2E9</td>
<td>3</td>
<td>2505</td>
<td>The number-of-seconds value was not within the supported range.</td>
</tr>
<tr>
<td>CEE2EA</td>
<td>3</td>
<td>2506</td>
<td>&lt;JJJJ&gt;, &lt;CCCC&gt; or &lt;CCCCCCCC&gt; was used in a picture string passed to CEEDATM, but the input number-of-seconds value was not within the supported range. The Era could not be determined.</td>
</tr>
<tr>
<td>CEE2EM</td>
<td>3</td>
<td>2518</td>
<td>An invalid picture string was specified.</td>
</tr>
<tr>
<td>CEE2EV</td>
<td>2</td>
<td>2527</td>
<td>The timestamp string returned by CEEDATM was truncated.</td>
</tr>
<tr>
<td>CEE3CF</td>
<td>2</td>
<td>3471</td>
<td>The country code country-code was not valid for CEEFMDT. The default date and time picture string datetime-string was returned.</td>
</tr>
</tbody>
</table>
Usage notes

- The probable cause for receiving message number 2518 is a picture string that contains a DBCS string that is not valid. You should verify that the data in the picture string is correct.
- To create a null VSTRING, set the length to zero; the content of the text portion does not matter. To create a blank VSTRING, any length greater than zero can be used; the content of the text portion must be spaces or blanks.
- z/OS UNIX consideration—In multithread applications, CEEDATM applies to the enclave.

For more information

- See “CEESECS—Convert timestamp to seconds” on page 357 for more information about the CEESECS callable service.
- See “COUNTRY” on page 20 for more information about the COUNTRY runtime option.
- See “CEEFMDT—Get default date and time format” on page 241 for information about how to get a default timestamp for a given country code.

Examples

1. Following is an example of CEEDATM called by C/C++.

```c
#include <leawi.h>
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main(void) {

    /* September 13, 1991 at 11:23:23 PM */
    _FLOAT8 seconds = 12904183403.0;
    _VSTRING date,date_pic;
    _CHAR80 out_date;
    _FEEDBACK fc;
    strcpy(date_pic.string,
        "Mmmmmmmmmmm DD, YYYY at ZH:MI:.SS AP");
    date_pic.length = strlen(date_pic.string);

    CEEDATM(&seconds,&date_pic,out_date,&fc);
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEEDATM failed with message number %d
", fc.tok_msgno);
        exit(2999);
    }
    printf("%.80s
",out_date);
}
```

2. Following is an example of CEEDATM called by COBOL.

```assembler
CBL LIB,QUOTE

IDENTIFICATION DIVISION.
PROGRAM-ID. CBLDATM.

DATA DIVISION.
WORKING-STORAGE SECTION.```
PROCEDURE DIVISION.
PARA-CBLDATM.

*************************************************
** Call CEESECS to convert timestamp of 6/2/88 **
** at 10:23:45 AM to Lilian representation **
*************************************************
MOVE 20 TO Vstring-length of IN-DATE.
MOVE "06/02/88 10:23:45 AM" TO Vstring-text of IN-DATE.
MOVE 20 TO Vstring-length of PICSTR.
MOVE "MM/DD/YY HH:MI:SS AP" TO Vstring-text of PICSTR.
CALL "CEESECS" USING IN-DATE, PICSTR, SECONDS, FC.

*************************************************
** If CEESECS runs successfully, display result**
*************************************************
IF CEE000 of FC THEN
  DISPLAY Vstring-text of IN-DATE
  " is Lilian second: " SECONDS
ELSE
  DISPLAY "CEESECS failed with msg "
  Msg-No of FC UPON CONSOLE
  STOP RUN
ENDIF.

*************************************************
** Specify desired format of the output. **
*************************************************
MOVE 35 TO Vstring-length OF PICSTR.
MOVE "ZD MMMmmmYYYY at HH:MI:SS" TO Vstring-text OF PICSTR.

*************************************************
** Call CEEDATM to convert Lilian seconds to **
** a character timestamp **
*************************************************
CALL "CEEDATM" USING SECONDS, PICSTR, TIMESTP, FC.

*************************************************
** If CEEDATM runs successfully, display result**
*************************************************
IF CEE000 of FC THEN
  DISPLAY "Input seconds of " SECONDS
  " corresponds to: " TIMESTP
ELSE
  DISPLAY "CEEDATM failed with msg "
  Msg-No of FC UPON CONSOLE
  STOP RUN
3. Following is an example of CEEDATM called by PL/I.

```plaintext
*PROCESS MACRO;
/*Module/File Name: IBMDATM
****************************************************/
/**                                                **/
/** Function: CEEDATM - Convert seconds to         **/
/**                     character timestamp        **/
/**                                                **/
/** In this example, CEEDATM is called to convert **/
/** the number of seconds since 00:00:00 14        **/
/** October 1582 to the character format specified **/
/** in PICSTR.                                     **/
/**                                                **/
****************************************************/
PLIDATM: PROC OPTIONS(MAIN);

%INCLUDE  CEEIBMAW;
%INCLUDE  CEEIBMCT;
DCL SECONDS REAL FLOAT DECIMAL(16);
DCL PICSTR  CHAR(255) VARYING;
DCL TIMESTP CHAR(80);
DCL 01 FC,                     /* Feedback token */
    03 MsgSev    REAL FIXED BINARY(15,0),
    03 MsgNo     REAL FIXED BINARY(15,0),
    03 Flags,
    05 Case      BIT(2),
    05 Severity  BIT(3),
    05 Control   BIT(3),
    03 FacID     CHAR(3),    /* Facility ID */
    03 ISI       /* Instance-Specific Information */
        REAL FIXED BINARY(31,0);

SECONDS = 13166064060; /* Input is Lilian seconds*/
PICSTR = 'ZD Mmmmmmmmmmmmmmz YYYY';  /* Picture */
/* string describing desired output format */
/* Call CEEDATM to convert Lilian seconds to */
/* format specified in PICSTR */
CALL CEEDATM ( SECONDS , PICSTR , TIMESTP , FC );
/* If CEEDATM ran successfully, print result */
IF  FBCHECK( FC, CEE000)  THEN  DO;
   PUT SKIP LIST('Input Lilian seconds correspond to ' || TIMESTP);
   END;
ELSE  DO;
   DISPLAY( 'CEEDATM failed with msg ' || FC.MsgNo );
   STOP;
   END;
END PLIDATM;

Table 28 on page 215 shows the sample output of CEEDATM.
```
<table>
<thead>
<tr>
<th>Input_seconds</th>
<th>picture_string</th>
<th>output_timestamp</th>
</tr>
</thead>
<tbody>
<tr>
<td>12,799,191,601.000</td>
<td>YYMMDD</td>
<td>1988-05-16 19:01</td>
</tr>
<tr>
<td>12,799,191,661.986</td>
<td>DD Mmm YY</td>
<td>16 May 88</td>
</tr>
<tr>
<td>12,799,191,662.009</td>
<td>YYYY</td>
<td>1988</td>
</tr>
</tbody>
</table>

**CEEDAYS—Convert date to Lilian format**

CEEDAYS converts a string representing a date into a Lilian format, which represents a date as the number of days from the beginning of the Gregorian calendar. CEEDAYS converts the specified input character date to a number representing the number of days since day one in the Lilian format: Friday, 14 October, 1582. The inverse of CEEDAYS is CEEDATE, which converts output Lilian date to character format.

Do not use CEEDAYS in combination with COBOL intrinsic functions unless the programs are compiled with the INTDATE(LILIAN) compiler option. Use CEECBLDY for COBOL programs that use intrinsic functions and that are compiled with INTDATE(ANSI).

To handle dates earlier than 1601, it is possible to add 4000 to each year, convert to Lilian, calculate, subtract 4000 from the result, and then convert back to character format.
By default, 2-digit years lie within the 100-year range starting 80 years before the system date. Thus, in 1995, all 2-digit years represent dates between 1915 and 2014, inclusive. This default range is changed by using the callable service CEESCECN.

### CEEDAYS

**input_char_date (input)**

A halfword length-prefixed character string (VSTRING), representing a date or time stamp, in a format conforming to that specified by *picture_string*. The character string must contain between 5 and 255 characters, inclusive. *input_char_date* can contain leading or trailing blanks. Parsing for a date begins with the first nonblank character (unless the picture string itself contains leading blanks, in which case CEEDAYS skips exactly that many positions before parsing begins).

After parsing a valid date, as determined by the format of the date that is specified in *picture_string*, CEEDAYS ignores all remaining characters. Valid dates range between and include 15 October 1582 to 31 December 9999. See Table 34 on page 425 for a list of valid picture character terms that can be specified in *input_char_date*.

### picture_string (input)

A halfword length-prefixed character string (VSTRING), indicating the format of the date specified in *input_char_date*.

Each character in the *picture_string* corresponds to a character in *input_char_date*. For example, if you specify MMDDYY as the *picture_string*, CEEDAYS reads an *input_char_date* of 060288 as 02 June 1988.

If delimiters such as a slash (/) appear in the picture string, leading zeros can be omitted. For example, the following calls to CEEDAYS, would each assign the same value, 148155 (02 June 1988), to *lildate*.

```sql
CALL CEEDAYS('6/2/88' , 'MM/DD/YY', lildate, fc);
CALL CEEDAYS('06/02/88', 'MM/DD/YY', lildate, fc);
CALL CEEDAYS('060288' , 'MMDDYY'  , lildate, fc);
CALL CEEDAYS('88154'   , 'YYDDD'   , lildate, fc);
CALL CEEDAYS('1988154' , 'YYYYDDD' , lildate, fc);
```

Whenever characters such as colons or slashes are included in the *picture_string* (such as HH:MI:SS YY/MM/DD), they count as placeholders but are otherwise ignored. See Table 34 on page 425 for a list of valid picture character terms and Table 35 on page 426 for examples of valid picture strings.

If *picture_string* includes a Japanese Era symbol <JJJJ>, the YY position in *input_char_date* is replaced by the year number within the Japanese Era. For example, the year 1988 equals the Japanese year 63 in the Showa era. See Table 35 on page 426 for an additional example. See also Table 36 on page 426 for a list of Japanese Eras supported by CEEDATE.

If *picture_string* includes era symbol <CCCC> or <CCCCCCCC>, the YY position in *input_char_date* is replaced by the year number within the era. See Table 35 on page 426 for an additional example.

### output_Lilian_date (output)

A 32-bit binary integer representing the Lilian date, the number of days since 14 October 1582. For example, 16 May 1988 is day number 148138.

If *input_char_date* does not contain a valid date, *output_Lilian_date* is set to 0 and CEEDAYS terminates with a non-CEE000 symbolic feedback code.

Date calculations are performed easily on the *output_Lilian_date* because it is an integer. Leap year and end-of-year anomalies do not affect the calculations.
fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE2EB</td>
<td>3</td>
<td>2507</td>
<td>Insufficient data was passed to CEEDAYS or CEESECS. The Lilian value was not calculated.</td>
</tr>
<tr>
<td>CEE2EC</td>
<td>3</td>
<td>2508</td>
<td>The date value that was passed to CEEDAYS or CEESECS was not valid.</td>
</tr>
<tr>
<td>CEE2ED</td>
<td>3</td>
<td>2509</td>
<td>The era that was passed to CEEDAYS or CEESECS was not recognized.</td>
</tr>
<tr>
<td>CEE2EH</td>
<td>3</td>
<td>2513</td>
<td>The input date was not within the supported range.</td>
</tr>
<tr>
<td>CEE2EL</td>
<td>3</td>
<td>2517</td>
<td>The month value was not recognized.</td>
</tr>
<tr>
<td>CEE2EM</td>
<td>3</td>
<td>2518</td>
<td>An incorrect picture string was specified.</td>
</tr>
<tr>
<td>CEE2EO</td>
<td>3</td>
<td>2520</td>
<td>CEEDAYS detected non-numeric data in a numeric field, or the date string did not match the picture string.</td>
</tr>
<tr>
<td>CEE2EP</td>
<td>3</td>
<td>2521</td>
<td>The year-within-era value that was passed to CEEDAYS or CEESECS was zero.</td>
</tr>
</tbody>
</table>

Usage notes
- The probable cause for receiving message number 2518 is a picture string that contains a DBCS string that is not valid. You should verify that the data in the picture string is correct.
- z/OS UNIX consideration—In multithread applications, CEEDAYS applies to the enclave.

For more information
- See the INTDATE COBOL compiler installation option in the appropriate version of the COBOL programming guide in the COBOL library at Enterprise COBOL for z/OS library (www.ibm.com/support/docview.wss?uid=swg27036733) for information about how to get Lilian integer values from COBOL intrinsic functions that are compatible with the Language Environment callable services CEEDAYS and CEEDATE.
- See “CEEDATE—Convert Lilian date to character format” on page 205 for more information about the CEEDATE runtime option.
- See “CEESCECN—Set the century window” on page 348 for more information about the CEESCECN callable service.

Examples
1. Following is an example of CEEDAYS called by C/C++.

```c
/*Module/File Name: EDCDAYS */
#include <leawi.h>
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <ceedcct.h>

int main(void) {
  _FEEDBACK fc;
  _INT4 lil_date1,lil_date2;
```
2. Following is an example of CEEDAYS called by COBOL.

CBL LIB,QUOTE

*Module/File Name: IGZTDAYS
******************************************************************************
**                                                     **
** Function: CEEDAYS - convert date to **
**                      Lilian format **
******************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLDAYS.
DATA DIVISION.
WORKING-STORAGE SECTION.
01 CHRDATE.
  02 Vstring-length PIC S9(4) BINARY.
  02 Vstring-text.
    03 Vstring-char PIC X OCCURS 0 TO 256 TIMES DEPENDING ON Vstring-length
       of CHRDATE.

01 PICSTR.
  02 Vstring-length PIC S9(4) BINARY.
  02 Vstring-text.
    03 Vstring-char PIC X OCCURS 0 TO 256 TIMES DEPENDING ON Vstring-length
       of PICSTR.

01 LILIAN
  01 FC.
    02 Condition-Token-Value.
      COPY CEEIGZCT.
    03 Case-1-Condition-ID.
      04 Severity PIC S9(4) BINARY.
      04 Msg-No PIC S9(4) BINARY.
    03 Case-2-Condition-ID.
      REDEFINES Case-1-Condition-ID.
      04 Class-Code PIC S9(4) BINARY.
      04 Cause-Code PIC S9(4) BINARY.
      03 Case-Sev-Ctl PIC X.
      03 Facility-ID PIC XXX.
    02 I-S-Info PIC S9(9) BINARY.

PROCEDURE DIVISION.
PARA-CBLDAYS.
******************************************************************************
** Specify input date and length **
******************************************************************************
MOVE 16 TO Vstring-length of CHRDATE.
MOVE "1 January 2000"
TO Vstring-text of CHRDATE.
******************************************************************************
** Specify a picture string that describes **
** input date, and the picture string's length.**
******************************************************************************
MOVE 25 TO Vstring-length of PICSTR.
MOVE "ZD Mmmmmmzz YYYY"
TO Vstring-text of PICSTR.
******************************************************************************
** Call CEEDAYS to convert input date to a **
** Lilian date **
******************************************************************************
CALL "CEEDAYS" USING CHRDATE, PICSTR,
LILIAN, FC.
******************************************************************************
** If CEEDAYS runs successfully, display result**
******************************************************************************
IF  CEE000 of FC  THEN
  DISPLAY Vstring-text of CHRDATE
  " is Lilian day: " LILIAN
ELSE
  DISPLAY "CEEDAYS failed with msg "
  Msg-No of FC UPON CONSOLE
STOP RUN
END-IF.
GOBACK.

3. Following is an example of CEEDAYS called by PL/I.

*PROCESS MACRO;
/**Module/File Name: IBMDEAS */
/***************************************************************************/
/** Function     : CEEDAYS - Convert date to */
/** Lilian format */
/** This example converts two dates to the Lilian */
/** format in order to calculate the number of */
/** days between them. */
/***************************************************************************/
PLIDAYS: PROC OPTIONS(MAIN);
%INCLUDE  CEEIBMCT;
%INCLUDE  CEEIBMAW;
DCL CHRDATE  CHAR(255) VARYING;
DCL CHRD2    CHAR(255) VARYING;
DCL PICSTR   CHAR(255) VARYING;
DCL PICST2   CHAR(255) VARYING;
DCL LILIAN   REAL FIXED BINARY(31,0);
DCL LIL2     REAL FIXED BINARY(31,0);
DCL 01 FC,                     /* Feedback token */
   03 MsgSev    REAL FIXED BINARY(15,0),
   03 MsgNo     REAL FIXED BINARY(15,0),
   03 Flags,    05 Case     BIT(2),
   05 Severity  BIT(3),
   05 Control   BIT(3),
   03 FacID     CHAR(3),      /* Facility ID */
   03 ISI       /* Instance-Specific Information */
   REAL FIXED BINARY(31,0);

/* First date to be converted to Lilian format */
CHRDAT = '5/7/69';
/* Picture string of first input date */
PICSTR = 'ZM/ZD/YY';
/* Call CEEDAYS to convert input date to the */
/* Lilian format */
CALL CEEDAYS ( CHRDAT , PICSTR , LILIAN , FC );
IF FBCHECK( FC , CEE000 ) THEN DO;
PUT SKIP LIST( 'The Lilian date for ' || CHRDATE || ' is ' || LILIAN );
END;
ELSE  DO:
   DISPLAY( 'CEEDAYS failed with msg ' || FC.MsgNo );
   STOP;
END;

/* Second date to be converted to Lilian format */
CHRD2 = '1 January 2000';

/* Picture string of second input date */
PICST2 = 'ZD Mmmmmmmmmmmmmmmmmm YYYY';

/* Call CEEDAYS to convert input date to the */
/* Lilian format */
CALL CEEDAYS ( CHRD2, PICST2, LIL2, FC );
IF  FBCHECK( FC, CEE000)  THEN  DO;
   PUT SKIP LIST( 'The Lilian date for ' || CHRD2 || ' is ' || LIL2 );
   END;
ELSE  DO;
   DISPLAY( 'CEEDAYS failed with msg ' || FC.MsgNo );
   STOP;
END;

/* Subtract the two Lilian dates to find out */
/* the difference in days between the two */
/* input dates */
PUT SKIP LIST( 'The number of days between ' || CHRDATE || ' and ' || CHRD2 || ' is' || LIL2 - LILIAN || '.');
END PLIDAYS;

CEEDCOD

CEEDCOD alters an existing condition token. Language Environment-conforming HLLs can decompose or alter the condition token fields without using the CEEDCOD service. See the CEESGL HLL examples in “Examples” on page 367 for examples of how to alter the condition token field.

CEEDCOD
(cond_token)
(c_1)
(c_2)
(case)
(severity)
(control)

(cond_token) (input)
A 12-byte condition token that represents the current condition or feedback information.

c_1 (output)
A 2-byte binary integer that represents the value of the first 2 bytes of the condition_ID.

c_2 (output)
A 2-byte binary that represents the value of the second 2 bytes of the condition_ID. See “CEENCOD—Construct a condition token” on page 331 for a detailed explanation of the condition_ID.

case (output)
A 2-byte binary integer field that defines the format of the condition_ID portion of the token. A value of 1 identifies a case 1 condition. A value of 2 identifies a case 2 condition. The values 0 and 3 are reserved.

severity (output)
A 2-byte binary integer that represents the severity of the condition. severity specifies the following values:

0 Information only (or, if the entire token is zero, no information).
Warning—service completed, probably correctly.

Error detected—correction attempted; service completed, perhaps incorrectly.

Severe error—service not completed.

Critical error—service not completed; condition signaled. A critical error is a condition that jeopardizes the environment. If a critical error occurs during a Language Environment callable service, instead of returning synchronously to the caller, the condition manager is always signaled.

control (output)
A 2-byte binary integer that contains flags describing aspects of the state of the condition. Valid values for the control field are 1 and 0.

1 Indicates that the facility_ID is assigned by IBM.

0 indicates the facility_ID is assigned by the user.

facility_ID (output)
A 3-character field containing three alphanumeric characters identifying the product generating the condition or feedback information.

i_s_info
A fullword binary integer that identifies the ISI associated with the given instance of the condition that is represented by the condition token where it is contained. If an ISI is not associated with a given condition token, the i_s_info field contains a value of binary zero.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE036</td>
<td>3</td>
<td>0102</td>
<td>An unrecognized condition token was passed to routine and could not be used.</td>
</tr>
</tbody>
</table>

Usage notes

• C/C++ considerations—The structure of the condition token (type_FEEDBACK) is described in the leawi.h header file shipped with Language Environment. C users can assign values directly to the fields of the token in the header file without using the CEENCOD service. The layout of the type_FEEDBACK condition token in the header file is shown in Figure 5 on page 333.

• z/OS UNIX consideration—In multithread applications, CEEDCOD affects only the calling thread.

For more information

• See the CEESGL HLL examples starting in “Examples” on page 367 for examples of how to alter the condition token field.

• See “CEENCOD—Construct a condition token” on page 331 for a detailed explanation of the condition_ID.

• See CEENCOD “Usage notes” on page 333 for a discussion of case 1 and case 2 types.
• See the `facility_ID` parameter of “CEENCOD—Construct a condition token” on page 331 for more information.

• For more C user information about assigning values directly to the fields of the token in the header file without using the CEENCOD service, see the example for “CEESGL—Signal a condition” on page 365.

Examples

1. Following shows an example of CEEDCOD being called by C/C++.

```c
/*Module/File Name: EDCDCOD */
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

/****************************************************/
/* In C/C++ it is not necessary to use this service. */
/* The fields can be manipulated directly. See the */
/* condition token fields directly. */
/****************************************************/

int main(void) {
  _FEEDBACK fc,newfc;
  _INT2 c_1,c_2,cond_case,sev,control;
  _CHAR3 facid;
  _INT4 isi, heapid, size;
  _POINTER address;

  heapid = 0;
  size = 4000;

  CEEGTST(&heapid,&size,&address,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) { //
    printf("CEEGTST failed with msgno %d\n", fc.tok_msgno);
    exit(2999);
  }

  /* decompose the feedback token to check for errors */
  CEEDCOD(&fc,&c_1,&c_2,&cond_case,&sev,&control,facid,;
           &isi,&newfc);

  if ( _FBCHECK ( newfc , CEE000 ) != 0 ) { //
    printf("CEEDCOD failed with msgno %d\n", newfc.tok_msgno);
    exit(2889);
  }

  if (c_1 != 0 || c_2 != 0)
    printf("c_1 and c_2 returned from CEEDCOD should be 0\n");

  
}
```

2. Following an example of CEEDCOD being called by COBOL.

```cbl
CBL LIB QUIET
 Module/File Name: IGZTDCOD
 *******************************************************
 ** ** Function: CEEDCOD - Decompose a condition **
 ** ** token **
 ** **
 ** In this example, a call is made to **
 ** CEEGTST in order to obtain a condition **
 ** token to use in the call to CEEDCOD. **
 ** A call could also have been made to any **
 ** other Lang Env svc., or a condition token **
 ** could have been constructed using **
 ** CEEDCOD. **
 **
 ** *******************************************************
 IDENTIFICATION DIVISION.
```
PROGRAM-ID. CBLDCOD.
DATA DIVISION.
WORKING-STORAGE SECTION.
01 HEAPID PIC S9(9) BINARY.
01 HPSIZE PIC S9(9) BINARY.
01 ADDRSS USAGE POINTER.
01 SEV PIC S9(4) BINARY.
01 MSGNO PIC S9(4) BINARY.
01 CASE PIC S9(4) BINARY.
01 SEV2 PIC S9(4) BINARY.
01 CNTRL PIC S9(4) BINARY.
01 FACID PIC X(3).
01 ISINFO PIC S9(9) BINARY.
01 FC.
 02 Condition-Token-Value.
COPY CEEIZGC.
 03 Case-1-Condition-ID.
 04 Severity PIC S9(4) BINARY.
 04 Msg-No PIC S9(4) BINARY.
 03 Case-2-Condition-ID.
 03 Class-Code PIC S9(4) BINARY.
 03 Cause-Code PIC S9(4) BINARY.
 03 Case-Sev-Ctl PIC X.
 03 Facility-ID PIC XXX.
 02 I-S-Info PIC S9(9) BINARY.
01 FC2.
 02 Condition-Token-Value.
COPY CEEIZGC.
 03 Case-1-Condition-ID.
 04 Severity PIC S9(4) BINARY.
 04 Msg-No PIC S9(4) BINARY.
 03 Case-2-Condition-ID.
 03 Class-Code PIC S9(4) BINARY.
 03 Cause-Code PIC S9(4) BINARY.
 03 Case-Sev-Ctl PIC X.
 03 Facility-ID PIC XXX.
 02 I-S-Info PIC S9(9) BINARY.
PROCEDURE DIVISION.
*************************************************
** Call any Lang Env svc to receive a condition**
**     token to use as input to CEEDCOD.       **
*************************************************
PARA-CBLGTST.
************************************************
** Specify 0 to get storage from the initial  **
**     heap.                                  **
** Specify 4000 to get 4000 bytes of storage. **
** Call CEEGTST to obtain storage.             **
************************************************
MOVE 0 TO HEAPID.
MOVE 4000 TO HPSIZE.
CALL "CEEGTST" USING HEAPID, HPSIZE, ADDRSS, FC.
PARA-CBLDCOD.
*************************************************
** Use the FC returned from CEEGTST as an **
**     input condition token to CEEDCOD.      **
*************************************************
CALL "CEEDCOD" USING FC, SEV, MSGNO, CASE, SEV2, CNTRL, FACID, ISINFO, FC2.
IF CEE000 of FC2 THEN
  DISPLAY "CEEGTST completed with msg "
  MSGNO ", Severity " SEV ", Case "
  CASE ", Control " CNTRL ", and 
  "Instance-Specific Information of "
  ISINFO "."
ELSE
  DISPLAY "CEEDCOD failed with msg 
  Msg-No of FC2 UPON CONSOLE
END-IF.
GOBACK.
3. Following is an example of CEEDCOD called by PL/I.

```pli
*PROCESS MACRO;
/*Module/File Name: IBMDCOD */
/*******************************************************************/
/** Function: CEEDCOD - decompose a condition token **/
/** In this example, a call is made to CEEGTST to **/
/** receive a condition token to decompose. **/
/** A call could have been made to any LE/370 **/
/** service. The condition token returned by **/
/** CEEGTST is used as input to CEEDCOD. **/
/*******************************************************************/
PLIDCOD: PROC OPTIONS(MAIN);

%INCLUDE CEEIBMAW;
%INCLUDE CEEIBMCT;

DCL HEAPID  REAL FIXED BINARY(31,0);
DCL STGSIZE REAL FIXED BINARY(31,0);
DCL ADDRSS  POINTER;
DCL 01 FC,                  /* Feedback token */
03 MsgSev  REAL FIXED BINARY(15,0),
03 MsgNo   REAL FIXED BINARY(15,0),
03 Flags,  05 Case   BIT(2),
05 Severity BIT(3),
05 Control BIT(3),
03 FacID   CHAR(3),    /* Facility ID */
03 ISI     /* Instance-Specific Information */
       REAL FIXED BINARY(31,0);
DCL SEV    REAL FIXED BINARY(15,0);
DCL MSGNO  REAL FIXED BINARY(15,0);
DCL CASE   REAL FIXED BINARY(15,0);
DCL SEV2   REAL FIXED BINARY(15,0);
DCL CNTRL  REAL FIXED BINARY(15,0);
DCL FACID  CHARACTER ( 3 );
DCL ISINFO REAL FIXED BINARY(31,0);
DCL 01 FC2,                  /* Feedback token */
03 MsgSev  REAL FIXED BINARY(15,0),
03 MsgNo   REAL FIXED BINARY(15,0),
03 Flags,  05 Case   BIT(2),
05 Severity BIT(3),
05 Control BIT(3),
03 FacID   CHAR(3),    /* Facility ID */
03 ISI     /* Instance-Specific Information */
       REAL FIXED BINARY(31,0);

HEAPID = -1;    /* invalid heap ID */
STGSIZE = 4000; /* request 4000 bytes of storage */

/* Call any service (in this case, CEEGTST) to */
/* create a condition token to decompose */
CALL CEEGTST ( HEAPID , STGSIZE , ADDRSS , FC );
/* Call CEEDCOD with the condition token */
/* returned in FC from CEEGTST */
CALL CEEDCOD ( FC , SEV , MSGNO , CASE , SEV2 ,
               CNTRL , FACID , ISINFO , FC2 );

IF FBCHECK( FC2, CEE000) THEN DO;
  PUT SKIP LIST( 'Feedback token from CEEGTST has'
                  ' Severity of ' || SEV
                  ' Message number of ' || MSGNO
                  ' Case of ' || CASE
                  ' Control of ' || CNTRL
                  ' Facility ID of ' || FACID
                  ' and I-S-Info of ' || ISINFO
                 )
   END;
ELSE DO;
   DISPLAY( 'CEEDCOD failed with msg '
          FC2.MsgNo )
   STOP;
END;
END PLIDCOD;
```
CEEDLYM—Suspend processing of the active enclave in milliseconds

CEEDLYM provides a service for Language Environment-conforming applications that suspends the processing of the active enclave for a specified number of milliseconds. The maximum is 1 hour.

**CEEDLYM**

- **input_milliseconds**
  A full-word binary value in the range of 0 to 3,600,000 that specifies the total number of milliseconds during which the enclave should be suspended.

- **fc (output)**
  A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to "Invoking callable services" on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE3QQ</td>
<td>1</td>
<td>CEE3930W</td>
<td>The input value <code>input_value</code> in a call to the callable service <code>callable_service_name</code> was not within the valid range.</td>
</tr>
<tr>
<td>CEE3QR</td>
<td>1</td>
<td>CEE3931W</td>
<td>CEEDLYM was invoked in a CICS environment.</td>
</tr>
<tr>
<td>CEE3QS</td>
<td>1</td>
<td>CEE3932W</td>
<td>The system service <code>system_service</code> failed with return code <code>return_code</code> and reason code <code>reason_code</code>.</td>
</tr>
</tbody>
</table>

**Usage notes**

- CICS consideration—CEEDLYM is not available under CICS.
- z/OS UNIX consideration—CEEDLYM is handled by the z/OS UNIX System Services when POSIX is set to ON.
- This service is not intended for timing requests. Delays up to the nearest millisecond might occur in some circumstances.
- In a multi-threaded application, only the calling thread is suspended.

**Examples**

1. Following is an example of CEEDLYM called by C/C++.

```c
#include <string.h>
#include <time.h>
#include <stdio.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void)
{
  _INT4 millisecs, lil_date;
  _FLOAT8  local_date;
  _CHAR17  gregorian_date;
  _FEEDBACK fc1, fc2;

  /* Get current date and time */
  CEELOCT(&lil_date,&local_date,gregorian_date,&fc1);
  if (!_FBCHECK (fc1, CEE000) != 0 )
    printf("CEELOCT failed with message number %d\n",...
```
```c
CEEDLYM

fc1.tok_msgno);
exit(2999);
}
printf("CEEDLYM Start time : %.17s\n", gregorian_date);
millisecs = 5000;
CEEDLYM(&millisecs,&fc2);
if ( _FBCHECK ( fc2 , CEE000 ) != 0 ) {
    printf("CEEDLYM failed with message number %d\n",fc2.tok_msgno);
exit(999);
}
CEEDLOCT(&lil_date,&local_date,gregorian_date,&fc1);
if ( _FBCHECK ( fc1 , CEE000 ) != 0 ) {
    printf("CEEDLOCT failed with message number %d\n",
           fc1.tok_msgno);
exit(2999);
}
printf("CEEDLYM Finish time : %.17s\n",gregorian_date);
}
```

2. Following is an example of CEEDLYM called by COBOL.

```
CBL LIB,QUOTE
*************************************************
*MODULE/FILE NAME: IGZTDLYM
*****************************************************************
**                                                             **
** FUNCTION: CEEDLYM - SUSPEND ENCLAVE EXECUTION IN MILLISECS **
**                                                             **
** THIS EXAMPLE CALLS CEEDLYM TO SUSPEND PROCESSING OF THE     **
** ACTIVE ENCLAVE FOR SPECIFIED NUMBER OF MILLISECONDS.        **
**                                                             **
*****************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLDLYM.
DATA DIVISION.
WORKING-STORAGE SECTION.
01 LILIAN PIC S9(9) BINARY.
01 SECONDS COMP-2.
01 GREGORN PIC X(17).
01 MILLISECS PIC S9(9) BINARY.
01 FC1.
   02 CONDITION-TOKEN-VALUE.
COPY CEEIGZCT.
      03 CASE-1-CONDITION-ID.
         04 SEVERITY PIC S9(4) BINARY.
         04 MSG-NO PIC S9(4) BINARY.
      03 CASE-2-CONDITION-ID
         REDEFINES CASE-1-CONDITION-ID.
         04 CLASS-CODE PIC S9(4) BINARY.
         04 CAUSE-CODE PIC S9(4) BINARY.
      03 CASE-SEV-CTL PIC X.
      03 FACILITY-ID PIC XXX.
   02 I-S-INFO PIC S9(9) BINARY.
01 FC2.
   02 CONDITION-TOKEN-VALUE.
COPY CEEIGZCT.
      03 CASE-1-CONDITION-ID.
         04 SEVERITY PIC S9(4) BINARY.
         04 MSG-NO PIC S9(4) BINARY.
      03 CASE-2-CONDITION-ID
         REDEFINES CASE-1-CONDITION-ID.
         04 CLASS-CODE PIC S9(4) BINARY.
         04 CAUSE-CODE PIC S9(4) BINARY.
      03 CASE-SEV-CTL PIC X.
      03 FACILITY-ID PIC XXX.
   02 I-S-INFO PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBLDLYM.
   DISPLAY "CEEDLYM - BEGINS"
   CALL "CEEDLOCT" USING LILIAN, SECONDS, GREGORN, FC1.
   IF CEE000 OF FC1 THEN
       DISPLAY "START DATE & TIME: " GREGORN
   ELSE
       DISPLAY "CEEDLOCT FAILED WITH MSG ",
           MSG-NO OF FC1
   STOP RUN
   END-IF.
   MOVE 5000 TO MILLISECS.
```

226 z/OS: Language Environment Programming Reference
CALL "CEEDLYM" USING MILLISECS, FC2.
IF NOT CEE000 OF FC2 THEN
   DISPLAY "CEEDLYM FAILED WITH MSG "
   MSG-NO OF FC2
   STOP RUN
END-IF.
DISPLAY "CEEDLYM - COMPLETED"
CALL "CEELOCT" USING LILIAN, SECONDS,
   GREGORN, FC1.
IF CEE000 OF FC1 THEN
   DISPLAY "FINISH DATE & TIME: " GREGORN
ELSE
   DISPLAY "CEELOCT FAILED WITH MSG "
   MSG-NO OF FC1
   STOP RUN
END-IF.
GOBACK.

3. Following is an example of CEEDLYM called by PL/I.

```
*PROCESS MACRO;                          00001000
/*MODULE/FILE NAME: IBMDLYM               */ 00014000
/*******************************************************************/ 00015000
/**                                                               **/ 00016000
/** FUNCTION: CEEDLYM - SUSPENDS ENCLAVE EXECUTION IN MILLISECS   **/ 00017000
/**                                                               **/ 00018000
/** THIS EXAMPLE CALLS CEEDLYM TO SUSPEND PROCESSING OF THE       **/ 00019000
/** ACTIVE ENCLAVE FOR SPECIFIED NUMBER OF MILLISECS.             **/ 00020000
/**                                                               **/ 00021000
*******************************************************************/ 00022000
PLIDLYM: PROCEDURE OPTIONS (MAIN) REORDER; 00023000
00024000
%INCLUDE  CEEIBMAMW;                                                    00025000
%INCLUDE  CEEIBMCT;                                                    00026000
00027000
DECLARE MILLISECS REAL FIXED BINARY(31,0);                          00028000
DECLARE LILIAN    REAL FIXED BINARY(31,0);                          00029000
DECLARE SECONDS   REAL FLOAT DECIMAL(16);                           00030000
DECLARE GREGORN   CHARACTER (17);                                   00031000
00032000
DECLARE 01 FC1,               /* FEEDBACK TOKEN FOR CEELOCT */      00033000
03 MSGSEV       REAL FIXED BINARY(15,0),                            00034000
03 MSGNO        REAL FIXED BINARY(15,0),                            00035000
03 FLAGS,                                                00036000
05 CASE      BIT(2),                                    00037000
05 SEVERITY  BIT(3),                                    00038000
05 CONTROL   BIT(3),                                    00039000
03 FACID        CHAR(3),                                     00040000
03 ISI          REAL FIXED BINARY(31,0);                     00041000
00042000
DECLARE 01 FC2,             /* FEEDBACK TOKEN FOR CEEDLYM */        00043000
03 MSGSEV       REAL FIXED BINARY(15,0),                            00044000
03 MSGNO        REAL FIXED BINARY(15,0),                            00045000
03 FLAGS,                                                00046000
05 CASE      BIT(2),                                    00047000
05 SEVERITY  BIT(3),                                    00048000
05 CONTROL   BIT(3),                                    00049000
03 FACID        CHAR(3),                                     00050000
03 ISI          REAL FIXED BINARY(31,0);                     00051000
00052000
DECLARE 01 FC1,               /* FEEDBACK TOKEN FOR CEELOCT */      00053000
03 MSGSEV       REAL FIXED BINARY(15,0),                            00054000
03 MSGNO        REAL FIXED BINARY(15,0),                            00055000
03 FLAGS,                                                00056000
05 CASE      BIT(2),                                    00057000
05 SEVERITY  BIT(3),                                    00058000
05 CONTROL   BIT(3),                                    00059000
03 FACID        CHAR(3),                                     00060000
03 ISI          REAL FIXED BINARY(31,0);                     00061000
00062000
CALL CEELOCT ( LILIAN, SECONDS, GREGORN, FC1 );                    00063000
IF FBCHECK(FC1, CEE000)  THEN  DO;                                  00064000
   PUT LIST ( 'CEEDLYM FINISH DATE AND TIME: ' || GREGORN ); 00065000
   END;                                                                00066000
ELSE DO;                                                        00067000
   PUT ( 'CEELOCT FAILED WITH MSG ' || FC1.MSGNO );                 00068000
   STOP;                                                             00069000
END;                                                                00070000
00071000
MILLISECS = 6000;                                                   00072000
CALL CEEDLYM(MILLISECS, FC2);                                       00073000
IF FBCHECK(FC2, CEE000) THEN DO;                                    00074000
   CALL CEELOCT ( LILIAN, SECONDS, GREGORN, FC1 );                    00075000
   IF FBCHECK(FC1, CEE000) THEN DO;                                    00076000
      PUT LIST ( 'CEEDLYM FINISH DATE AND TIME: ' || GREGORN ); 00077000
      END;                                                                00078000
   ELSE DO;                                                        00079000
      PUT ( 'CEELOCT FAILED WITH MSG ' || FC1.MSGNO );                 00080000
      STOP;                                                             00081000
   END;                                                                00082000
   PUT SKIP LIST ( 'CEEDLYM IS SUCCESSFUL!' );                       00083000
```

.Callable services 227
CEEDSHP—Discard heap

CEEDSHP discards an entire heap created by CEECRHP or by CEEGTST. CEECRHP and CEEGTST return a unique heap_id to the caller; use this ID in the CEEDSHP call. A heap_id of 0 is not permitted with CEEDSHP.

Discarding a heap with CEEDSHP immediately returns all storage allocated to the heap to the operating system, even if the KEEP suboption has been specified with the HEAP runtime option.

CEEDSHP

heap_id (input)
A fullword binary signed integer. heap_id is a token specifying the discarded heap. A heap_id of 0 is not valid; the initial heap is logically created during enclave initialization and cannot be discarded.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE0P2</td>
<td>4</td>
<td>0802</td>
<td>Heap storage control information was damaged.</td>
</tr>
<tr>
<td>CEE0P3</td>
<td>3</td>
<td>0803</td>
<td>The heap identifier in a get storage request or a discard heap request was unrecognized.</td>
</tr>
<tr>
<td>CEE0PC</td>
<td>3</td>
<td>0812</td>
<td>An invalid attempt to discard the Initial Heap was made.</td>
</tr>
</tbody>
</table>

Usage notes
- After the call to CEEDSHP, any existing pointers to storage allocated from this heap are dangling pointers, that is, pointers to storage that is freed. Using these pointers can cause unpredictable results.
- z/OS UNIX considerations—CEEDSHP applies to the enclave. Language Environment frees all storage in the heap regardless of which thread allocated it.

For more information
- For more information about the CEEDSHP callable service, see “CEECRHP—Create new additional heap” on page 197.
- For more information about the CEEGTST callable service, and “CEEGTST—Get heap storage” on page 276.

Examples
1. Following is an example of CEEDSHP being called by C/C++.

   /*Module/File Name: EDCDSHP */
2. Following an example of CEEDSHP being called by COBOL.
04 Class-Code  PIC S9(4) BINARY.
04 Cause-Code  PIC S9(4) BINARY.
03 Case-Sev-Ctl  PIC X.
03 Facility-ID  PIC XXX.
02 I-S-Info  PIC S9(9) BINARY.

PROCEDURE DIVISION.
PARA-CBLRHP.

*************************************************
** Specify 0 for HEAPID, and heap id will      **
** be set by CEECRHP.                           **
** Heap size and increment will each be 4096   **
** bytes.                                      **
** Specify 00 for OPTS, and HEAP attributes    **
** will be inherited from the initial heap     **
** (copied from the HEAP runtime option).      **
*************************************************
MOVE 0 TO HEAPID.
MOVE 4096 TO HPSIZE.
MOVE 4096 TO INCR.
MOVE 00 TO OPTS.

CALL "CEECRHP" USING HEAPID, HPSIZE,
     INCR, OPTS, FC.

IF CEE000 of FC  THEN
  DISPLAY "Created heap number " HEAPID
  " which is " HPSIZE " bytes long"
ELSE
  DISPLAY "CEECRHP failed with msg "
  Msg-No of FC UPON CONSOLE
END-IF.

*************************************************
** To discard the heap, call CEEDSHP with the  **
** heap id returned from CEECRHP.              **
*************************************************

CALL "CEEDSHP" USING HEAPID, FC.

IF CEE000 of FC  THEN
  DISPLAY "Disposed of heap # " HEAPID
ELSE
  DISPLAY "CEEDSHP failed with msg "
  Msg-No of FC UPON CONSOLE
END-IF.

GOBACK.

3. Following is an example of CEEDSHP being called by PL/I.

*PROCESS MACRO;
/*Module/File Name: IBMDSHP*/
/*Function: CEEDSHP - discard heap */
/* In this example, calls are made to CEECRHP */
/* and CEEDSHP to create a heap of 4096 bytes */
/* and then discard it. */

PLIDSHP: PROC OPTIONS(MAIN);

DCL HEAPID REAL FIXED BINARY(31,0) ;
DCL HPSIZE REAL FIXED BINARY(31,0) ;
DCL INCR REAL FIXED BINARY(31,0) ;
DCL OPTS REAL FIXED BINARY(31,0) ;
DCL 01 FC,  /* Feedback token */
     03 MsgSev  REAL FIXED BINARY(15,0),
     03 MsgNo   REAL FIXED BINARY(15,0),
     03 Flags, 05 Case  BIT(2),
     05 Severity BIT(3),
     05 Control BIT(3),
     03 FacID  CHAR(3),  /* Facility ID */
     03 ISI   /* Instance-Specific Information */
     REAL FIXED BINARY(31,0);

DCL 01 FC2,  /* Feedback token */
     03 MsgSev  REAL FIXED BINARY(15,0),
     03 MsgNo   REAL FIXED BINARY(15,0),
CEEDYWK—Calculate day of week from Lilian date

CEEDYWK calculates the day of the week on which a Lilian date falls. The day of the week is returned to the calling routine as a number between 1 and 7. The number returned by CEEDYWK is useful for end-of-week calculations.

**input_Lilian_date (input)**
A 32-bit binary integer representing the Lilian date, the number of days since 14 October 1582. For example, 16 May 1988 is day number 148138. The valid range of input_Lilian_date is between 1 and 3,074,324 (15 October 1582 and 31 December 9999).

**output_day_no (output)**
A 32-bit binary integer representing input_Lilian_date’s day-of-week: 1 equals Sunday, 2 equals Monday, ..., 7 equals Saturday. If input_Lilian_date is invalid, output_day_no is set to 0 and CEEDYWK terminates with a non-CEE000 symbolic feedback code.

**fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.
The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE2EG</td>
<td>3</td>
<td>2512</td>
<td>The Lilian date value passed in a call to CEEDATE or CEEDYWK was not within the supported range.</td>
</tr>
</tbody>
</table>

Usage notes

- z/OS UNIX consideration—In multithread applications, CEEDYWK affects only the calling thread.
- COBOL consideration—The CEEDYWK callable service has different values than the COBOL ACCEPT statement with conceptual data item DAY-OF-WEEK. Use one or the other, not both.

Examples

1. Following is an example of CEEDYWK called by C/C++.

```c
/*Module/File Name: EDCDYWK */
#include <string.h>
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main (void) {
    _INT4 in_date, day;
    _FEEDBACK fc;
    in_date = 139370;  /* Thursday */
    CEEDYWK(&in_date,&day,&fc);
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEEDYWK failed with message number %d\n", fc.tok_msgno);
        exit(2999);
    }
    printf("Lilian date %d, occurs on a ",in_date);
    switch(day) {
    case 1: printf("Sunday.\n");
            break;
    case 2: printf("Monday.\n");
            break;
    case 3: printf("Tuesday.\n");
            break;
    case 4: printf("Wednesday.\n");
            break;
    case 5: printf("Thursday.\n");
            break;
    case 6: printf("Friday.\n");
            break;
    case 7: printf("Saturday.\n");
            break;
    default: printf(" ERROR! DAY RETURN BY CEEDYWK UNKNOWN\n");
            break;
    }
}
```

2. Following is an example of CEEDYWK called by COBOL.

```cbl
CBL LIB,QUOTE

*Module/File Name: IGZTDYWK
******************************************************************************
** CBLDYWK - Call CEEDYWK to calculate the **
** day of the week from Lilian date **
** In this example, a call is made to CEEDYWK **
** to return the day of the week on which a **
```
** Lilian date falls. (A Lilian date is the number of days since 14 October 1582) **
**
*****************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLDYWK.
DATA DIVISION.
WORKING-STORAGE SECTION.
01 LILIAN PIC S9(9) BINARY.
01 DAYNUM PIC S9(9) BINARY.
01 IN-DATE.
  02 Vstring-length PIC S9(4) BINARY.
  02 Vstring-text.
    03 Vstring-char PIC X,
       OCCURS 0 TO 256 TIMES
       DEPENDING ON Vstring-length
       of IN-DATE.
01 PICSTR.
  02 Vstring-length PIC S9(4) BINARY.
  02 Vstring-text.
    03 Vstring-char PIC X,
       OCCURS 0 TO 256 TIMES
       DEPENDING ON Vstring-length
       of PICSTR.
01 FC.
  02 Condition-Token-Value.
COPY CEEIGZCT.
  03 Case-1-Condition-ID.
    04 Severity PIC S9(4) BINARY.
    04 Msg-No PIC S9(4) BINARY.
  03 Case-2-Condition-ID
     REDEFINES Case-1-Condition-ID.
    04 Class-Code PIC S9(4) BINARY.
    04 Cause-Code PIC S9(4) BINARY.
  03 Case-Sev-Ctl PIC X.
  03 Facility-ID PIC XXX.
02 I-S-Info PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBLDAYS.
** Call CEEDAYS to convert date of 6/2/88 to **
** Lilian representation **
  MOVE 6 TO Vstring-length of IN-DATE.
  MOVE "6/2/88" TO Vstring-text of IN-DATE(1:6).
  MOVE 8 TO Vstring-length of PICSTR.
  MOVE "MM/DD/YY" TO Vstring-text of PICSTR(1:8).
  CALL "CEEDAYS" USING IN-DATE, PICSTR,
     LILIAN, FC.
** If CEEDAYS runs successfully, display result. **
  IF CEE000 of FC THEN
    DISPLAY Vstring-text of IN-DATE
    " is Lilian day: " LILIAN
  ELSE
    DISPLAY "CEEDAYS failed with msg ",
       Msg-No of FC UPON CONSOLE
    STOP RUN
  END-IF.
PARA-CBLDYWK.
** Call CEEDYWk to return the day of the week on **
** which the Lilian date falls **
  CALL "CEEDYWk" USING LILIAN, DAYNUM, FC.
** If CEEDYWk runs successfully, print results **
  IF CEE000 of FC THEN
    DISPLAY "Lilian day " LILIAN
    " falls on day " DAYNUM
    " of the week, which is a:"
  END-IF.
** Select DAYNUM to display the name of the day **
** of the week. **
  EVALUATE DAYNUM
    WHEN 1
      DISPLAY "Sunday."
    WHEN 2
      DISPLAY "Monday."
    WHEN 3
      DISPLAY "Tuesday"
    WHEN 4
      DISPLAY "Wednesday."
    WHEN 5
      DISPLAY "Thursday."
3. Following is an example of CEEDYWK called by PL/I.

### CEEENV—Process environmental variables

CEEENV processes environment variables depending on the function code passed in as input. Based on the input to this function, CEEENV can do the following:

- Obtain the value for an existing environment variable.
- Create a new environment variable with a value.
- Clear all environment variables.
- Delete an existing environment variable.
- Overwrite the value for an existing environment variable.

#### function_code (input)

A fullword binary integer containing the function code of one of the following values:

1. Searches the environment table for environment variables specified by name and if found returns a pointer to value.
2. Adds an environment variable to the environment table. It does not overwrite an existing environment variable.
3. Clears all environment variables from the environment table.
4. Deletes an environment variable from the environment table.
5. Overwrites an existing environment variable in the environment table and adds the environment variable if it does not exist.

#### name_length (input)

A fullword binary integer containing the length of the name for the environment variable. If the request is for function code 3, this argument is ignored.

#### name (input)

Specifies the name of an environment variable. If the request is for function code 3, this argument is ignored.
**value_length (input/output)**
A fullword binary integer containing the length of the value for the environment variable. This argument is input for setting or modifying an environment variable and is output for getting an environment variable value. If the request is for function code 3 or 4, this argument is ignored.

**value (input/output)**
A field that contains the address of a string that contains the value of the environment variable. This argument is input for setting or modifying an environment variable and is output for getting an environment variable value. If the request is for function code 3 or 4, this argument is ignored. For function code 1 (get), the value address is 0 (NULL) if the name is not found in the environment.

**fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE510</td>
<td>3</td>
<td>5176</td>
<td>Not enough memory available.</td>
</tr>
<tr>
<td>CEE51P</td>
<td>3</td>
<td>5177</td>
<td>Bad input character detected for name or value.</td>
</tr>
<tr>
<td>CEE51Q</td>
<td>3</td>
<td>5178</td>
<td>Bad address detected for the ENVAR anchor or environment variable array.</td>
</tr>
<tr>
<td>CEE51R</td>
<td>3</td>
<td>5179</td>
<td>A parameter to the environment variable processing routine contained a value that was not valid.</td>
</tr>
<tr>
<td>CEE51S</td>
<td>0</td>
<td>5180</td>
<td>The specified environment variable name already exists.</td>
</tr>
</tbody>
</table>

**Usage notes**
- The environment array is searched sequentially and the first occurrence of name is used.
- Because an application can manipulate the environment using the environ pointer, Language Environment cannot guarantee a single instance of any particular environment variable.
- For a function code 1 request, the storage returned for the value character string is supplied by Language Environment. There is one buffer per thread, making it the user's responsibility to use or save the value before the next call for a function code 1 on that thread.
- Specifying 0 for value_length with function code 2 or 5 results in the environment variable being removed from the environment.
- Applications should not define environment variables that begin with the characters "_BPXK_", "_EDC_", or "_CEE_" because there might be conflicts with variable names reserved for z/OS that begin with those characters.
- name and value are copied into storage owned by Language Environment.
- If a function code 1 request is made and the variable name is not found in the environment, value_length is set to 0 upon return.
- A NULL character in name is not valid and causes feedback code CEE51P to be returned.
- A NULL character in value is interpreted as a string terminator. If a NULL character is imbedded, CEEENV will truncate the value string at the last character preceding the NULL.

**Examples**
1. Following is an example of CEEENV called by C/C++.

```c
/*Module/FileName: EDCENV    */
/*****************************/
/*                        */
/* THIS EXAMPLE CALLS CEEENV TO CLEAR THE ENVIRONMENT VARIABLE */
/* ARRAY, SET AN ENVIRONMENT VARIABLE AND THEN GET THE VARIABLE */
/* FROM THE ARRAY.     */
/* */
```
```c
#include <stdio.h>
#include <stdlib.h>
#include <leawi.h>

int main(void) {
    _INT4 func_code;
    _INT4 name_len;
    _POINTER name = (_POINTER)malloc(255);
    _INT4 value_len;
    _POINTER value_ptr;
    _FEEDBACK fc;
    char value[255];

    /* Clearing all the environment variables */
    func_code = 3;
    CEEENV(func_code,name_len,name,value_len,value_ptr,fc);

    /* Setting a new environment variable */
    func_code = 2;
    strcpy(name,"ENVAR1");
    strcpy(value,"DEFAULT");
    name_len = strlen(name);
    value_len = strlen(value);
    value_ptr = value;
    CEEENV(func_code,name_len,name,value_len,value_ptr,fc);

    /* Getting the value of the new variable */
    func_code = 1;
    strcpy(name,"ENVAR1");
    strcpy(value,"");
    value_ptr = value;
    CEEENV(func_code,name_len,name,value_len,value_ptr,fc);
    if (value_len != 0)
        printf("$%s=%s\n",name,value_ptr);
    else
        printf("$%s not found\n",name);
}
```

2. Following is an example of CEEENV called by COBOL.

```cobol
CBL Lib,Quote
****************************************************************
*Module/File Name: IGZTENV
****************************************************************
** Function: CEEENV - Process environment variables     *
**                                                      *
** This example calls CEEENV to clear the environment     *
** variable array, set an environment variable and then get *
** the variable from the array.                          *
**                                                      *
****************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. IGZTENV.
DATA DIVISION.
WORKING-STORAGE SECTION.
    01  FUNCCODE  PIC 9(9) BINARY.
    01  NAMELEN   PIC 9(9) BINARY.
    01  VALUELEN  PIC 9(9) BINARY.
    01  NAME      PIC X(255).
    01  VALPTR    POINTER.
    01  FC.
        02  CONDITION-TOKEN-VALUE.
COPY CEEIGZCT.
        03  CASE-1-CONDITION-ID.
            04  SEVERITY   PIC S9(4) BINARY.
            04  MSG-NO     PIC S9(4) BINARY.
            03  CASE-SEV-CTL PIC X.
            03  FACILITY-ID PIC XXX.
        02  I-S-INFO   PIC S9(9) BINARY.
        01  VAL       PIC X(255).
LINKAGE SECTION.
    01  VAR  PIC X(5000).

PROCEDURE DIVISION.
```
MAIN-PROG.

************************************************************************************
** Clear environment array
*************************************************************************************
MOVE 3 TO FUNCCODE.
CALL "CEEENV" USING FUNCCODE, 
         NAMELEN, 
         NAME, 
         VALUELEN, 
         VALPTR, 
         FC.

*************************************************************************************
** Set an environment variable
*************************************************************************************
MOVE 2 TO FUNCCODE.
MOVE "ENVAR1" TO NAME.
MOVE "DEFAULT" TO VAL.
MOVE 6 TO NAMELEN.
MOVE 7 TO VALUELEN.
SET VALPTR TO ADDRESS OF VAL.
CALL "CEEENV" USING FUNCCODE, 
         NAMELEN, 
         NAME, 
         VALUELEN, 
         VALPTR, 
         FC.

*************************************************************************************
** Get the environment variable
*************************************************************************************
MOVE 1 TO FUNCCODE.
MOVE " " TO VAL.
MOVE 0 TO VALUELEN.
CALL "CEEENV" USING FUNCCODE, 
         NAMELEN, 
         NAME, 
         VALUELEN, 
         VALPTR, 
         FC.

IF VALUELEN NOT = 0 THEN
   SET ADDRESS OF VAR TO VALPTR 
   DISPLAY NAME(1:NAMELEN) ":" VAR(1:VALUELEN)
ELSE
   DISPLAY NAME " NOT FOUND"
END-IF.

GOBACK.

3. Following is an example of CEEENV called by PL/I.

*PROCESS MACRO;
/*********************************************/
/*Module/File Name: IBMENV*/
*********************************************/
/**
/** Function: CEEENV - process environment variables
/**
/** This example calls CEEENV to clear the environment variable, set an environment variable and then get the variable from the array.**/
/**
*********************************************/
PLIENV: PROCEDURE OPTIONS (MAIN) REORDER;

%INCLUDE  CEEIBMAW;
%INCLUDE  CEEIBMCT;

DECLARE FUNC_CODE       REAL FIXED BINARY(31,0);
DECLARE NAME_LEN        REAL FIXED BINARY(31,0);
DECLARE VALUE_LEN       REAL FIXED BINARY(31,0);
DECLARE NAME            CHAR(255) INIT('');
DECLARE VALUE            CHAR(255) INIT('');
DECLARE VALUE2           CHAR(255) BASED(VALUE_PTR);
DECLARE VALUE_PTR        POINTER;

DECLARE 01 LE_FEEDBACK_CODE,
   03 MSGSEV       REAL FIXED BINARY(15,0),
   03 MSGNO        REAL FIXED BINARY(15,0),
   03 FLAGS,
DECLARE MSG_STRING     CHAR(255) VARYING;
DECLARE MSG_DEST       REAL FIXED BINARY(31,0);
DECLARE SUBSTR BUILTIN;
DECLARE SYSPRINT FILE PRINT;

MSG_DEST = 2;

/***************************************/
/* Clear all the environment variables */
/***************************************/
FUNC_CODE = 3;
CALL CEEENV(FUNC_CODE,
            NAME_LEN,
            NAME,
            VALUE_LEN,
            VALUE_PTR,
            LE_FEEDBACK_CODE);

/***************************************/
/* Set an environment variable */
/***************************************/
FUNC_CODE = 2;
NAME = 'ENVAR1';
VALUE = 'DEFAULT';
VALUE_PTR = ADDR(VALUE);
NAME_LEN = 6;
VALUE_LEN = 7;
CALL CEEENV(FUNC_CODE,
            NAME_LEN,
            NAME,
            VALUE_LEN,
            VALUE_PTR,
            LE_FEEDBACK_CODE);

/***************************************/
/* Get the variable, to see if added */
/***************************************/
FUNC_CODE = 1;
NAME = 'ENVAR1';
VALUE = '';
NAME_LEN = 6;
VALUE_LEN = 0;
CALL CEEENV(FUNC_CODE,
            NAME_LEN,
            NAME,
            VALUE_LEN,
            VALUE_PTR,
            LE_FEEDBACK_CODE);

IF VALUE_LEN ^= 0 THEN DO;
    MSG_STRING = SUBSTR(NAME,1,NAME_LEN) ||
                 '=' || SUBSTR(VALUE2,1,VALUE_LEN);
    PUT SKIP LIST(MSG_STRING);
END;
ELSE DO;
    MSG_STRING = 'SET REQUEST UNSUCCESSFUL';
    PUT SKIP LIST(MSG_STRING);
END;
END PLIENV;

CEEFMDA—Get default date format

CEEFMDA returns to the calling routine the default date picture string for a specified country. CEEFMDA is affected only by the country code setting of the COUNTRY runtime option or CEE3CTY callable service, not the CEESETL callable service or the setlocale() function.

CEEFMDA(country_code, date_pic_str, fc)
**country_code (input)**
A 2-character fixed-length string representing one of the country codes found in Table 33 on page 419. The country_code is not case-sensitive. Also, if no value is specified, the default country code (as set by either the COUNTRY runtime option or the CEE3CTY callable service) is used. If you specify a country_code that is not valid, the default date format is 'YYYY-MM-DD'.

**date_pic_str (output)**
A fixed-length 80-character string (VSTRING), returned to the calling routine. It contains the default date picture string for the country specified. The picture string is left-justified and padded on the right with blanks if necessary.

**fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE3CB</td>
<td>2</td>
<td>3467</td>
<td>The country code country_code was invalid for CEEFMDA. The default date picture string date_pic_string was returned.</td>
</tr>
</tbody>
</table>

**Usage notes**
- z/OS UNIX considerations—CEEFMDA applies to the enclave. Every enclave has a single current country setting that has a single date format. Every thread in every enclave has the same default.

**For more information**
- For a list of the default settings for a specified country, see Table 33 on page 419.
- See “COUNTRY” on page 20 for an explanation of the COUNTRY runtime option.
- See “CEE3CTY—Set the default country” on page 122 for an explanation of the CEE3CTY callable service.

**Examples**
1. Following is an example of CEEFMDA called by C/C++.

   C/C++ example of CEEFMDA
   ```c
   /*Module/File Name: EDCFMDA */
   #include <stdio.h>
   #include <string.h>
   #include <stdlib.h>
   #include <leawi.h>
   #include <ceeedcct.h>
   int main(void) {
       _FEEDBACK fc;
       _CHAR2 country;
       _CHAR80 date_pic;

       /* get the default date format for Canada */
       memcpy(country,"CA",2);
       CEEFMDA(country,date_pic,&fc);
       if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
           printf("CEEFMDA failed with message number %d\n", fc.tok_msgno);
           exit(2999);
       }
       /* print out the default date format for Canada */
       printf("%.80s\n",date_pic);
   }
   ```
2. Following is an example of CEEFMDA called by COBOL.

```cobol
CBL LIB,QUOTE
*Module/File Name: IGZTFMDA
*******************************************************************************
**                          CBLFMDA - Call CEEFMDA to obtain the       **
**           default date format                                        **
*******************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLFMDA.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01 COUNTRY PIC X(2).
  01 PICSTR PIC X(80).
  01 FC.
    02 Condition-Token-Value.
      COPY CEEIGZCT.
        03 Case-1-Condition-ID.
          04 Severity PIC S9(4) BINARY.
          04 Msg-No PIC S9(4) BINARY.
        03 Case-2-Condition-ID
          REDEFINES Case-1-Condition-ID.
          04 Class-Code PIC S9(4) BINARY.
          04 Cause-Code PIC S9(4) BINARY.
        03 Case-Sev-Ctl PIC X.
        03 Facility-ID PIC XXX.
        02 I-S-Info PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBLFMDA.
  ** Specify country code for the US and call **
  ** CEEFMDA to return the default date format **
  ** for the US. **
  MOVE "US" TO COUNTRY.
  CALL "CEEFMDA" USING COUNTRY , PICSTR , FC.

  ** If CEEFMDA runs successfully, display result **
  IF CEE000 of FC THEN
    DISPLAY "The default date format for " PICSTR
    ELSE
      DISPLAY "CEEFMDA failed with msg "
      Msg-No of FC UPON CONSOLE
      STOP RUN
  END-IF.
GOBACK.
```

3. Following is an example of CEEFMDA called by PL/I.

```pli
*PROCESS MACRO;
/* Module/File Name: IBMFMDA */
/*****************************/
/** */
/** **
/** Function: CEEFMDA - obtain default date **
/** format **
/** */
/*****************************/
PLIFMDA: PROC OPTIONS(MAIN);
  %INCLUDE CEEIBMFW;
  %INCLUDE CEEIBMCT;
  DCL COUNTRY CHARACTER ( 2 );
  DCL PICSTR CHAR(80);
  DCL 01 FC, /* Feedback token */
    03 MsgSev REAL FIXED BINARY(15,0),
    03 MsgNo REAL FIXED BINARY(15,0),
    03 Flags,
      05 Case BIT(2),
      05 Severity BIT(3),
      05 Control BIT(3),
    03 FacID CHAR(3), /* Facility ID */
    03 ISI /* Instance-Specific Information */
      REAL FIXED BINARY(31,0);
  COUNTRY = 'US'; /* Specify country code for */
                /* the United States */
  /* Get the default date format for the US */
  CALL CEEFMDA ( COUNTRY , PICSTR , FC );
```
/* Print the default date format for the US     */
IF  FBCHECK( FC, CEE000)  THEN  DO;
   PUT SKIP LIST(
      'The default date format for the US is ' || PICSTR);
   END;
ELSE  DO:
   DISPLAY( 'CEEFMDA failed with msg ' || FC.MsgNo );
   STOP;
END;
END PLIFMDA;

CEEFMDT—Get default date and time format

CEEFMDT returns the default date and time picture strings for the country specified by country_code.
CEEFMDT is affected only by the country code setting of the COUNTRY runtime option or CEE3CTY callable service, not the CEESETL callable service or the setlocale() function.

<table>
<thead>
<tr>
<th>country_code (input)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 2-character fixed-length string representing one of the country codes found in Table 33 on page 419. The country_code is not case-sensitive. Also, if no value is specified, the default country code (as set by either the COUNTRY runtime option or by CEE3CTY) is used. If you specify a country_code that is not valid, the default date/time picture string is 'YYYY-MM-DD HH:MI:SS'.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>datetime_str (output)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A fixed-length 80-character string (VSTRING), returned to the calling routine. It contains the default date and time picture string for the country specified. The picture string is left-justified and padded on the right with blanks, if necessary.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>fc (output)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.</td>
</tr>
</tbody>
</table>

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE3CF</td>
<td>2</td>
<td>3471</td>
<td>The country code country_code was invalid for CEEFMDT. The default date and time picture string datetime_str was returned.</td>
</tr>
</tbody>
</table>

Usage notes

• z/OS UNIX considerations—CEEFMDT applies to the enclave. Every enclave has a single current country setting that has a single date and time format. Every thread in every enclave has the same default.

For more information

• For a list of the default settings for a specified country, see Table 33 on page 419.
• See “COUNTRY” on page 20 for an explanation of the COUNTRY runtime option.
• See “CEE3CTY—Set the default country” on page 122 for an explanation of CEE3CTY.
Examples

1. Following is an example of CEEFMDT called by C/C++.

```c
#include <stdio.h>
#include <string.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main(void) {
    _FEEDBACK fc;
    _CHAR2 country;
    _CHAR80 date_pic;

    /* get the default date and time format for Canada */
    memcpy(country,"CA",2);
    _FEEDBACK(country,date_pic,&fc);

    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEEFMDT failed with message number %d\n", 
                fc.tok_msgno);
        exit(2999);
    }

    printf("%.80s
",date_pic);
}
```

2. Following is an example of CEEFMDT called by COBOL.

```cobol
CBL LIB,QUOTE
*Module/File Name: IGZTFMDT
*************************************************
**                                             **
** CBLFMDT - Call CEEFMDT to obtain the        **
**           default date & time format        **
**                                             **
*************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLFMDT.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01 COUNTRY         PIC X(2).
  01 PICSTR          PIC X(80).
  01 FC.
COPY CEEIGZCT.
  03 Case-1-Condition-ID.
    04 Severity      PIC S9(4) BINARY.
    04 Msg-No        PIC S9(4) BINARY.
  03 Case-2-Condition-ID
    REDEFINES Case-1-Condition-ID.
    04 Class-Code    PIC S9(4) BINARY.
    04 Cause-Code    PIC S9(4) BINARY.
  03 Case-Sev-Ctl   PIC X.
  03 Facility-ID    PIC XXX.
  02 I-S-Info       PIC S9(9) BINARY.
PROCEDURE DIVISION.
  PARA-CBLFMDT.
** Specify country code for the US
  MOVE "US" TO COUNTRY.
** Call CEEFMDT to return the default date and
** time format for the US
  CALL "CEEFMDT" USING COUNTRY , PICSTR , FC.
** If CEEFMDT runs successfully, display result.
  IF CEE000 of FC THEN
    DISPLAY "The default date and time "
    "format for the US is: " PICSTR
  ELSE
    DISPLAY "CEEFMDT failed with msg "
    "Msg-No of FC UPON CONSOLE"
  STOP RUN
END-IF.
GOBACK.
```
3. Following is an example of CEEFMDT called by PL/I.

```pli
*PROCESS MACRO;
/* Module/File Name: IBMFMDT */
/* Function: CEEFMDT - obtain default date & time format */
/*                                                */
/* Specify country code for the United States */
*/ Call CEEFMDT to get default date format */
CALL CEEFMDT ( COUNTRY , PICSTR , FC );

COUNTRY = 'US';
/* Call CEEFMDT to get default date format */
/* for the US */
CALL CEEFMDT ( COUNTRY , PICSTR , FC );

IF FBCHECK( FC, CEE000 ) THEN DO;
   PUT SKIP LIST( 'The default date and time ' || PICSTR );
END;
ELSE DO;
   DISPLAY( 'CEEFMDT failed with msg ' || FC.MsgNo );
   STOP;
END;

END PLIFMDT;
```

**CEEFMON—Format monetary string**

CEEFMON, analogous to the C function `strfmon()`, converts numeric values to monetary strings according to the specifications passed to it. These specifications work in conjunction with the format conversions set in the current locale. The current locale's LC_MONETARY category affects the behavior of this service, including the monetary radix character, the thousands separator, the monetary grouping, the currency symbols (national and international), and formats.

CEEFMON is sensitive to the locales set by `setlocale()` or `CEESETL`, not to the Language Environment settings from COUNTRY or CEE3CTY.
omitted_parm
This parameter is reserved for future expansion and must be omitted. For information about how to code an omitted parm, see “Invoking callable services” on page 104.

stringin (input)
An 8-byte field that contains the value of a double-precision floating point number.

maxsize (input)
A 4-byte integer that specifies the maximum number of bytes (including the string terminator) that can be placed in stringout.

format (input)
A halfword length-prefixed character string (VSTRING) of 256 bytes that contains plain characters and a conversion specification. Plain characters are copied to the output stream. Conversion specification results in the fetching of the input stringin argument that is converted and formatted.

A conversion specification consists of a percent character (%), optional flags, optional field width, optional left precision, optional right precision, and a required conversion character that determines the conversion to be performed.

Flags (optional)
You can specify one or more of the following flags to control the conversion.

=f
An = followed by a single character f specifies that the character f should be used as the numeric fill character. The default numeric fill character is the space character. This option does not affect the other fill operations (such as field-width filling), which always use the space as the fill character.

^  
Do not format the currency amount with the grouping characters. The default is to insert the grouping characters if defined for the current locale.

+ or (  
Specifies the style of representing positive and negative currency amounts. You must specify either + or (. If + is specified, the locale's equivalent of + and - are used (for example, in USA: the empty (null) string if positive and - (minus sign) if negative). If ( is specified, the locale's equivalent of enclosing negative amounts within a parenthesis is used. If this option is not included, a default specified by the current locale is used.

!  
Suppresses the currency symbol from the output conversion.

Field Width (optional)
A decimal digit string w that specifies a minimum field width in which the result of the conversion is right-justified (or left-justified if -w is specified).

Left Precision (optional)
A # (pound sign) followed by the decimal digit string n, (specified as #n), indicates a maximum number of digits expected to be formatted to the left of the radix character. This option can be used to keep the formatted output from multiple calls to the CEEFMON service aligned in the same columns. It can also be used to fill unused positions with a special character as in $***123.45. This option causes an amount to be formatted as if it has the number of digits specified by n. If more digit positions are required than are specified, this conversion specification is ignored. Digit positions in excess of those actually required are filled with the numeric fill character. See the =f specification above.

If grouping is enabled, it is applied to the combined fill characters plus regular digits. However, if the fill character is not 0 (digit zero), grouping separators inserted after a fill character are replaced by the same fill character ($0,001,234.56 versus $****1,234.56).

Right Precision (optional)
A period (.) followed by the decimal digit string p, (specified as .p), indicates the number of digits after the radix character. If the value of the precision p is zero, no radix character appears. If this
option is not included, a default specified by the current locale is used. The amount being formatted is rounded to the specified number of digits prior to formatting.

**Conversion Characters (required)**

One of the following conversion characters must be specified.

- **i**
  
  The double argument is formatted according to the locale's international currency format (for example, in USA: USD 1,234.56).

- **n**
  
  The double argument is formatted according to the locale's national currency format (for example, in USA: $1,234.56).

- **%**
  
  No argument is converted; the conversion specification %%% is replaced by a single %.

**stringout (output)**

Contains the output of the CEEFMON service.

**result (output)**

Contains the number of characters placed in stringout, if successful. If unsuccessful, an error is reported.

**fc (output/optional)**

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE3T1</td>
<td>3</td>
<td>4001</td>
<td>General Failure: Service could not be completed.</td>
</tr>
<tr>
<td>CEE3VM</td>
<td>3</td>
<td>4086</td>
<td>Input Error: The number of characters to be formatted must be greater than zero.</td>
</tr>
</tbody>
</table>

**Usage notes**

- PL/I MTF consideration—CEEFMON is not supported in PL/I MTF applications.
- This callable service uses the C/C++ runtime library. The C/C++ library must be installed and accessible even when this service is called from a non-C program.

**For more information**

- For more information about the setlocale() function, see “COUNTRY” on page 20, “CEE3CTY—Set the default country” on page 122, and “CEE3LNG—Set national language” on page 155.
- For more information about the CEESETL callable service, see “CEESETL—Set locale operating environment” on page 362.

**Examples**

1. An example of CEEFMON called by COBOL:
IDENTIFICATION DIVISION.
PROGRAM-ID. COBFMON.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01 Monetary           COMP-2.
  01 Max-Size           PIC S9(9) BINARY.
  01 Format-Mon.
    02 FM-Length PIC S9(4) BINARY.
    02 FM-String PIC X(256).
  01 Output-Mon.
    02 OM-Length PIC S9(4) BINARY.
    02 OM-String PIC X(60).
  01 Length-Mon         PIC S9(9) BINARY.
  01 Locale-Name.
    02 LN-Length PIC S9(4) BINARY.
    02 LN-String PIC X(256).
**   Use Locale category constants
COPY CEEIGZLC.
  01 FC.
    02 Condition-Token-Value.
    COPY CEEIGZCT.
      03 Case-1-Condition-ID.
        04 Severity PIC S9(4) BINARY.
        04 Msg-No    PIC S9(4) BINARY.
      03 Case-2-Condition-ID
        REDEFINES Case-1-Condition-ID.
        04 Class-Code PIC S9(4) BINARY.
        04 Cause-Code PIC S9(4) BINARY.
      03 Case-SEv-Ctl PIC X.
      03 Facility-ID     PIC XXX.
    02 I-S-Info            PIC S9(9) BINARY.
**
PROCEDURE DIVISION.
** Set up locale name for United States
  MOVE 14 TO LN-Length.
  MOVE "En_US.IBM-1047"
    TO LN-String (1:LN-Length).
** Set all locale categories to United States.
** Use LC-ALL category constant from CEEIGZLC.
  CALL "CEESETL" USING Locale-Name, LC-ALL, FC.
** Check feedback code
  IF Severity > 0
    DISPLAY "Call to CEESETL failed. " Msg-No
  STOP RUN
END-IF. ** Set up numeric value
  MOVE 12345.62 TO Monetary.
  MOVE 60 TO Max-Size.
  MOVE 2 TO FM-Length.
  MOVE "%" TO FM-String (1:FM-Length).
** Call CEEFMON to convert numeric value
  CALL "CEEFMON" USING OMITTED, Monetary,
        Max-Size, Format-Mon
        Output-Mon, Length-Mon,
        FC.
** Check feedback code and display result
  IF Severity > 0
    DISPLAY "Call to CEEFMON failed. " Msg-No
  ELSE
    DISPLAY "International format is "
      OM-String(1:OM-Length)
  END-IF.
STOP RUN.
END PROGRAM COBFMON.

2. An example of CEEFMON called by PL/I:

*PROCESS MACRO;
/*Module/File Name: IBMFMON
/*****************************/
/* Example for callable service CEEFMON
/* Function: Convert a numeric value to a monetary */
/* string using specified format passed as parm */
/*****************************/
PLIFMON: PROC OPTIONS(MAIN);
  %INCLUDE CEEIBMAW; /* ENTRY defs, macro defs */
%INCLUDE CEEIBMCT; /* FBCHECK macro, FB constants */
%INCLUDE CEEIBMLC; /* Locale category constants */

/* CEESETL service call arguments */
DCL LOCALE_NAME CHAR(14) VARYING;

/* CEEFMON service call arguments */
DCL MONETARY REAL FLOAT DEC(16); /* input value */
DCL MAXSIZE_FMON BIN FIXED(31); /* output size */
DCL FORMAT_FMON CHAR(256) VARYING; /* format spec */
DCL RESULT_FMON BIN FIXED(31); /* result status */
DCL OUTPUT_FMON CHAR(60) VARYING; /* output string */
DCL 01 FC,                        /* Feedback token */
03 MsgSev    REAL FIXED BINARY(15,0),
03 MsgNo     REAL FIXED BINARY(15,0),
03 Flags,
05 Case      BIT(2),
05 Severity  BIT(3),
05 Control   BIT(3),
03 FacID     CHAR(3),       /* Facility ID */
03 ISI      /* Instance-Specific Information */
REAL FIXED BINARY(31,0);

/* init locale name to United States */
LOCALE_NAME = 'En_US.IBM-1047';

/* use LC_ALL category constant from CEEIBMLC */
CALL CEESETL (LOCALE_NAME, LC_ALL, FC);

/* FBCHECK macro used (defined in CEEIBMCT) */
IF FBCHECK (FC, CEE2KE) THEN
   DO;   /* invalid locale name */
      DISPLAY ('Locale LC_ALL Call '||FC.MsgNo);
      STOP;
   END;
MONETARY = 12345.62; /* monetary numeric value */
MAXSIZE_FMON = 60; /* max char length returned */
FORMAT_FMON = '%i'; /* international currency */
CALL CEEFMON ( *, /* optional argument */
   MONETARY, /* input, 8 byte floating point */
   MAXSIZE_FMON, /* maximum size of output string */
   FORMAT_FMON, /* conversion request */
   RESULT_FMON, /* no. of chars in OUTPUT_FMON */
   OUTPUT_FMON, /* string returned by CEEFMON */
   FC ); /* feedback code structure */

IF RESULT_FMON = -1 THEN
   DO;
      /* FBCHECK macro used (defined in CEEIBMCT) */
      IF FBCHECK (FC, CEE3VM ) THEN
         DISPLAY ( 'Invalid input '||MONETARY );
      ELSE
         DISPLAY ( 'CEEFMON not completed '||FC.MsgNo );
         STOP;
      END;
      ELSE
         DO;
            PUT SKIP LIST ( 'International Format '||OUTPUT_FMON );
         END;
   END;
ELSE
   DO;
      PUT SKIP LIST ( 'International Format '||OUTPUT_FMON );
   END;
END PLIFMON;

CEEFMTM—Get default time format

CEEFMTM returns to the calling routine the default time picture string for the country specified by country_code. For a list of the default settings for a specified country, see Table 33 on page 419. CEEFMTM is affected only by the country code setting of the COUNTRY runtime option or CEE3CTY callable service, not the CEESETL callable service or the setlocale() function.
**country_code (input)**
A 2-character fixed-length string representing one of the country codes found in Table 33 on page 419. The `country_code` is not case-sensitive. Also, if no value is specified, the default country code (as set by either the COUNTRY runtime option or the CEE3CTY callable service) is used. If you specify a `country_code` that is not valid, the default time picture string is 'HH:MI:SS'.

**time_pic_str (output)**
A fixed-length 80-character string (VSTRING), representing the default time picture string for the country specified. The picture string is left-justified and padded on the right with blanks if necessary.

**fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to "Invoking callable services" on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE3CD</td>
<td>2</td>
<td>3469</td>
<td>The country code <code>country_code</code> was invalid for CEEFMTM. The default time picture string <code>time_pic_string</code> was returned.</td>
</tr>
<tr>
<td>CEE3CE</td>
<td>2</td>
<td>3470</td>
<td>The date and time string <code>datetime_str</code> was truncated and was not defined in CEEFMDT.</td>
</tr>
</tbody>
</table>

**Usage notes**
- z/OS UNIX considerations—CEEFMTM applies to the enclave. Every enclave has a single current country setting that has a single time format. Every thread in every enclave has the same default.

**For more information**
- See "COUNTRY" on page 20 for an explanation of the COUNTRY runtime option.
- See "CEE3CTY—Set the default country" on page 122 for an explanation of the CEE3CTY callable service.

**Examples**
1. Following is an example of CEEFMTM called by C/C++.

```c
/*Module/File Name: EDCFMTM */
#include <stdio.h>
#include <string.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>
int main(void) {
    _FEEDBACK fc;
    _CHAR2 country;
    _CHAR80 time_pic;
    /* get the default time format for Canada */
    memcpy(country,"CA",2);
    CEEFMTM(country,time_pic,&fc);
    if ( _FBCHECK ( fc , "CEE000" ) != 0 ) {
        printf("CEEFMTM failed with message number %d\n", fc.tok_msgno);
        exit(2999);
    }
```
2. Following is an example of CEEFMTM called by COBOL.

```cobol
CBL LIB,QUOTE
*Module/File Name: IGZTFMTM
******************************************************************************
** IGZTFMTM - Call CEEFMTM to obtain the **
** default time format **
********************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. IGZTFMTM.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01 COUNTRY                 PIC X(2).
  01 PICSTR                  PIC X(80).
  01 FC.
    02 Condition-Token-Value.
      COPY CEEIGZCT.
      03 Case-1-Condition-ID.
        04 Severity    PIC S9(4) BINARY.
        04 Msg-No      PIC S9(4) BINARY.
      03 Case-2-Condition-ID
        REDEFINES Case-1-Condition-ID.
        04 Class-Code  PIC S9(4) BINARY.
        04 Cause-Code  PIC S9(4) BINARY.
      03 Case-Sev-Ctl    PIC X.
      03 Facility-ID     PIC XXX.
    02 I-S-Info            PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBLFMTM.
** Specify country code for the US.
  MOVE "US" TO COUNTRY.
** Call CEEFMTM to return the default time format
** for the US.
  CALL "CEEFMTM" USING COUNTRY , PICSTR , FC.
** If CEEFMTM runs successfully, display result.
  IF CEE000 of FC THEN
    DISPLAY "The default time format for "
    "the US is: " PICSTR
  ELSE
    DISPLAY "CEEFMTM failed with msg 
    Msg-No of FC UPON CONSOLE
    STOP RUN
  END-IF.
GOBACK.
```

3. Following is an example of CEEFMTM called by PL/I.

```pli
*PROCESS MACRO;
/* Module/File Name: IBMFMTM */
******************************************************************************
** Function: CEEFMTM - obtain default time **
** format **
********************************************************************************
** This example calls CEEFMTM to request the **
** default time format for the US and print **
** it out. **
******************************************************************************
PLIFMTM: PROC OPTIONS(MAIN);
  %INCLUDE CEEIBMMAW;
  %INCLUDE CEEIBMCT;
  DCL COUNTRY CHARACTER ( 2 );
  DCL PICSTR CHAR(80);
  DCL 01 FC, /* Feedback token */
    03 MsgSev  REAL FIXED BINARY(15,0),
    03 MsgNo   REAL FIXED BINARY(15,0),
    03 Flags,  /* Feedback token */
    05 Case    BIT(2),
    05 Severity BIT(3),
05 Control BIT(3),
03 FacID CHAR(3), /* Facility ID */
03 ISI /* Instance-Specific Information */
         REAL FIXED BINARY(31,0);

COUNTRY = 'US'; /* Specify country code for */
         /* the United States */

/* Call CEEFMTM to get default time format for */
/* the US */
CALL CEEFMTM ( COUNTRY , PICSTR , FC );

/* Print the default time format for the US */
IF  FBCHECK( FC, CEE000)  THEN  DO;
  PUT SKIP LIST(
      'The default time format for the US is ' || PICSTR);
  END;
ELSE  DO;
  DISPLAY( 'CEEFMTM failed with msg ' || FC.MsgNo );
  STOP;
  END;
END PLIFMTM;

### CEEFRST—Free heap storage

CEEFRST frees storage previously allocated by CEEGTST or by a language intrinsic function. Normally, you do not need to call CEEFRST because Language Environment automatically returns all heap storage to the operating system when the enclave terminates. However, if you are allocating a large amount of heap storage, you should free the storage when it is no longer needed. This freed storage then becomes available for later requests for heap storage, thus reducing the total amount of storage needed to run the application.

All requests for storage are conditional. If storage is not available, the feedback code (fc) is set and returned to you, but the thread does not abend. An attempt to free storage that was already marked as free produces no action and returns a non-CEE000 symbolic feedback code. An attempt to free storage at anything other than a valid starting address produces no action and returns a non-CEE000 symbolic feedback code. The application does not abend.

However, if you call CEEFRST for an invalid address, and you had specified TRAP(OFF), your application can abend. The reaction of Language Environment to this is undefined. Also, partial freeing of an allocated area is not supported.

When storage is allocated by CEEGTST, its allocated size is used during free operations. Storage allocated by CEEGTST, but not explicitly freed, is automatically freed at enclave termination.

CEEFRST generates a system-level free storage call to return a storage increment to the operating system only when:

- The last heap element within an increment is being freed, and
- The HEAP runtime option or a call to CEECRHP specifies FREE (note that KEEP is the IBM-supplied default setting for the initial heap).

Otherwise, the freed storage is simply added to the free list; it is not returned to the operating system until termination. The out-of-storage condition can cause freeing of empty increments even when KEEP is specified.

```plaintext
CEEFRST(address, fc)
```

**address (input)**

A fullword address pointer. `address` is the address returned by a previous CEEGTST call or a language intrinsic function such as `ALLOCATE` or `malloc()`. The storage at this address is deallocated.
fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following feedback codes can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE0P2</td>
<td>4</td>
<td>0802</td>
<td>Heap storage control information was damaged.</td>
</tr>
<tr>
<td>CEE0PA</td>
<td>3</td>
<td>0810</td>
<td>The storage address in a free storage (CEEFRST) request was not recognized, or heap storage (CEECZST) control information was damaged.</td>
</tr>
</tbody>
</table>

Usage notes
- If you specify heap_free_value in the STORAGE runtime option, all freed storage is overwritten with heap_free_value. Otherwise, it is simply marked as available.

Portions of the freed storage area can be used to hold internal storage manager control information. These areas are overwritten, but not with heap_free_value.

- The heap identifier is inferred from the address of the storage to be freed. The storage is freed from the heap in which it was allocated.

- The address passed as the argument is a dangling pointer after a call to CEEFRST. The storage freed by this operation can be reallocated on a subsequent CEEGTST call. If the pointer is not reassigned, any further use of it causes unpredictable results.

- z/OS UNIX considerations—CEEFRST applies to the enclave. One thread can allocate storage, and another can free it.

For more information
- See “CEEGTST—Get heap storage” on page 276 for more information about the CEEGTST callable service.
- See “HEAP” on page 32 for further information about the HEAP runtime option.
- See “CEECRHP—Create new additional heap” on page 197 for more information about the CEECRHP callable service.
- See “STORAGE” on page 70 for further information about the STORAGE runtime option.

Examples
1. An example of CEEFRST called by C/C++:

```c
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {
    _INT4 heapid, size;
    _POINTER address;
    _FEEDBACK fc;
    /*  . 
        . */
    heapid = 0;  /* get storage from initial heap */
    size = 4000;  /* number of bytes of heap storage */
    /* obtain the storage using CEEGTST */
    CEEGTST(&heapid,&size,&address,&fc);
```
2. An example of CEEFRST called by COBOL:

```cobol
CBL LIB,QUOTE
*Module/File Name: IGZTFRST
*******************************************************************************
** IGZTFRST - Call CEEFRST to free heap **
** storage **
**
** In this example, a call is made to **
** CEEGTST to obtain 4000 bytes of storage **
** from the initial heap (HEAPID = 0). **
** A call is then made to CEEFRST to free **
** the storage. **
*******************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. IGZTFRST.
DATA DIVISION.
WORKING-STORAGE SECTION.
 01 HEAPID PIC S9(9) BINARY.
 01 STGSIZE PIC S9(9) BINARY.
 01 ADDRSS USAGE IS POINTER.
 01 FC.
    02 Condition-Token-Value.
      COPY CEEIGZCT.
      03 Case-1-Condition-ID.
      04 Severity PIC S9(4) BINARY.
      04 Msg-No PIC S9(4) BINARY.
      03 Case-2-Condition-ID
        REDEFINES Case-1-Condition-ID.
        04 Class-Code PIC S9(4) BINARY.
        04 Cause-Code PIC S9(4) BINARY.
      03 Case-Sev-Ctl PIC X.
      03 Facility-ID PIC XXX.
    02 I-S-Info PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBLFRST.
** Specify 0 to get storage from the initial **
** heap. **
** Specify 4000 to get 4000 bytes of storage. **
** Call CEEGTST to obtain storage. **
MOVE 0 TO HEAPID.
MOVE 4000 TO STGSIZE.
CALL "CEEGTST" USING HEAPID,STGSIZE,
   ADDRSS,FC.
IF CEE000 OF FC THEN
   DISPLAY "Obtained " STGSIZE " bytes of"
   "storage at location " ADDRSS
```

" from heap number " HEAPID
ELSE
  DISPLAY "CEEGTST failed with msg "
     Msg-No of FC UPON CONSOLE
  STOP RUN
END-IF.
** To free storage, use the address returned
** by CEECRHP in the call to CEEFRST.
CALL "CEEFRST" USING ADDRMS, FC.
IF CEE000 of FC THEN
  DISPLAY "Returned " STGSIZE " bytes of"
     storage at location " ADDRMS
     " to heap number " HEAPID
ELSE
  DISPLAY "CEEFRST failed with msg "
     Msg-No of FC UPON CONSOLE
END-IF.
GOBACK.

3. An example of CEEFRST called by PL/I:

*PROCESS MACRO;
/*Module/File Name: IBMFRST                       */
/**************************************************/
/**                                              **/
/** Function: CEEFRST - free heap storage        **/
/**                                              **/
/** This example calls CEEGTST to obtain storage **/
/** from the initial heap, and then calls        **/
/** CEEFRST to discard it.                       **/
/**                                              **/
/**************************************************/
PLIFRST: PROC OPTIONS(MAIN);
%INCLUDE  CEEIBMMAW;
%INCLUDE  CEEIBMCT;
DCL ADDRMS   POINTER;
DCL HEAPID   REAL FIXED BINARY(31,0);
DCL STGSIZE  REAL FIXED BINARY(31,0);
DCL 01 FC,                      /* Feedback token */
  03 MsgSev   REAL FIXED BINARY(15,0),
  03 MsgNo    REAL FIXED BINARY(15,0),
  03 Flagnos  REAL FIXED BINARY(15,0),
  03 Flags,   05 Case     BIT(2),
              05 Severity BIT(3),
              05 Control BIT(3),
  03 FacID    CHAR(3),    /* Facility ID */
  03 ISI      /* Instance-Specific Information */
              REAL FIXED BINARY(31,0);
DCL 01 FC2,                     /* Feedback token */
  03 MsgSev   REAL FIXED BINARY(15,0),
  03 MsgNo    REAL FIXED BINARY(15,0),
  03 Flagnos  REAL FIXED BINARY(15,0),
  03 Flags,   05 Case     BIT(2),
              05 Severity BIT(3),
              05 Control BIT(3),
  03 FacID    CHAR(3),    /* Facility ID */
  03 ISI      /* Instance-Specific Information */
              REAL FIXED BINARY(31,0);
HEAPID = 0; /* get storage from the initial heap */
STGSIZE = 4000;   /* get 4000 bytes of storage   */
/* Call CEEGTST to obtain the storage            */
CALL CEEGTST ( HEAPID, STGSIZE, ADDRMS, FC );
IF FBCHECK( FC, CEE000) THEN DO;
  PUT SKIP LIST( 'Obtained ' || STGSIZE
  || ' bytes of storage at location ' ||
  DECIMAL( UNSPEC( ADDRMS ) )
  || ' from heap ' || HEAPID );
END;
ELSE DO;
  DISPLAY( 'CEEGTST failed with msg '
     || FC.MsgNo );
  STOP;
END; /* Call CEEFRST with the address returned from */
/* CEEGTST to free the storage allocated by */
CEEFTDS is analogous to the C function `strftime()`, converts the internal time and date to character strings according to the specifications passed to it by the TD_STRUCT. These specifications work in conjunction with the format conversions set in the current locale. The current locale’s LC_TIME category affects the behavior of this service, including the actual values for the format specifiers. CEEFTDS is sensitive to the locales set by `setlocale()` or CEESETL, not to the Language Environment settings from COUNTRY or CEE3CTY.

**omitted_parm**
This parameter is reserved for future expansion and must be omitted. For information about how to code an omitted parm, see “Invoking callable services” on page 104.

**time_and_date** (input)
Points to the time structure that is to be converted. The structure has the following format:

- **td_sec**
  A 4-byte integer that describes the number of seconds in the range of 0 through 59.
- **td_min**
  A 4-byte integer that describes the number of minutes in the range of 0 through 59.
- **td_hour**
  A 4-byte integer that describes the number of hours in the range of 0 through 23.
- **td_mday**
  A 4-byte integer that describes the day of the month in the range of 1 through 31.
- **td_mon**
  A 4-byte integer that describes the month of the year in the range of 0 through 12.
- **td_year**
  A 4-byte integer that describes the year of an era.
- **td_wday**
  A 4-byte integer that describes the day of the week in the range of 0 through 6.
- **td_yday**
  A 4-byte integer that describes the day of the year in the range of 0 through 365.
- **td_isdst**
  A 4-byte integer that is a flag for daylight savings time.

**maxsize** (input)
A 4-byte integer that specifies the maximum length (including the string terminator) of the string that can be placed in `stringout`.
**format (input)**

A halfword length-prefixed character string (VSTRING) of 256 bytes that contains the conversion specifications. The format parameter is a character string containing two types of objects: plain characters that are placed in the output string and conversion specifications that convert information from *time_and_date* into readable form in the output string. Each conversion specification is a sequence of this form:

`%[-][width][.precision]type`

**%**

A percent sign (%) introduces a conversion specification. This character is required.

**width (optional)**

An optional decimal digit string that specifies a minimum field width. A converted value that has fewer characters than the field width is padded with spaces to the left. If the decimal digit string is preceded by a minus sign, padding with spaces occurs to the right of the converted value.

If no width is given, for numeric fields the appropriate default width is used with the field padded on the left with zeros, as required. For strings, the output field is made exactly wide enough to contain the string.

**precision (optional)**

An optional value that specifies the maximum number of characters to be printed for the conversion specification. The precision value is a decimal digit string preceded by a period. If the value to be output is longer than the precision, it is truncated on the right.

**type**

Specifies the type of conversion to be performed. The characters and their meanings are:

- **%a**
  
  The abbreviated weekday name (for example, Sun) defined by the abday statement in the current locale.

- **%A**
  
  The full weekday name (for example, Sunday) defined by the day statement in the current locale.

- **%b**
  
  The abbreviated month name (for example, Jan) defined by the abmon statement in the current locale.

- **%B**
  
  The full month name (for example, January) defined by the month statement in the current locale.

- **%c**
  
  The date and time format defined by the d_t_fmt statement in the current locale.

- **%d**
  
  The day of the month as a decimal number (01 to 31).

- **%D**
  
  The date in `%m/%d/%y` format (for example, 01/31/91).

- **%e**
  
  The day of the month as a decimal number (1 to 31). The `%e` field descriptor uses a two-digit field. If the day of the month is not a two-digit number, the leading digit is filled with a space character.

- **%E**
  
  The combined alternative era year and name, respectively, in `%o %N` format in the current locale.

- **%F**
  
  The ISO 8601:2000 standard date format, equivalent to `%Y-%m-%d`.

- **%g**
  
  The last 2 digits of the week-based year as a decimal number [00,99].
%G
The week-based year as a 4-digit decimal number.

%h
The abbreviated month name (for example, Jan) defined by the abmon statement in the current locale. This field descriptor is a synonym for the %b field descriptor.

%H
The 24-hour clock hour as a decimal number (00 to 23).

%I
The 12-hour clock hour as a decimal number (01 to 12).

%j
The day of the year as a decimal number (001 to 366).

%m
The month of the year as a decimal number (01 to 12).

%M
The minutes of the hour as a decimal number (00 to 59).

%n
Specifies a new-line character.

%N
The alternative era name in the current locale.

%o
The alternative era year in the current locale.

%p
The AM or PM string defined by the am_pm statement in the current locale.

%r
The 12-hour clock time with AM/PM notation as defined by the t_fmt_ampm statement (%I:%M:%S [AM|PM]) in the current locale.

%S
The seconds of the minute as a decimal number (00 to 60).

%t
Specifies a tab character.

%T
Represents 24-hour clock time in the format %H:%M:%S (for example, 16:55:15).

%U
The week of the year as a decimal number (00 to 53). Sunday, or its equivalent as defined by the day statement, is considered the first day of the week for calculating the value of this field descriptor.

%W
The week of the year as a decimal number (00 to 53). Monday, or its equivalent as defined by the day statement, is considered the first day of the week for calculating the value of this field descriptor.

%x
The date format defined by the d_fmt statement in the current locale.

%X
The time format defined by the t_fmt statement in the current locale.

%y
The year of the century (00 to 99).

%Y
The year as a decimal number (for example, 1989).
%z
The offset from UTC in ISO8601:2000 standard format (+hhmm or -hhmm). For example, 
“-0430” means 4 hours 30 minutes behind UTC (west of Greenwich).

%Z
The time-zone name, if one can be determined (for example, EST); no characters are displayed 
if a time zone cannot be determined.

%%
Specifies a percent sign (%) character.

**stringout (output)**
A halfword length-prefixed character string (VSTRING) of 256 bytes that contains the formatted time 
and date output of the CEEFTDS service.

**fc (output/optional)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you 
choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate 
syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE3T1</td>
<td>3</td>
<td>4001</td>
<td>General Failure: Service could not be completed.</td>
</tr>
<tr>
<td>CEE3VM</td>
<td>3</td>
<td>4086</td>
<td>Input Error: The number of characters to be formatted must be greater than zero.</td>
</tr>
</tbody>
</table>

**Usage notes**

- PL/I MTF consideration—CEEFTDS is not supported in PL/I MTF applications.
- This callable service uses the C/C++ runtime library. The C/C++ library must be installed and accessible 
even when this service is called from a non-C program.

**For more information**

- For more information about the `setlocale()` function, see “COUNTRY” on page 20, “CEE3CTY—Set the default country” on page 122, and “CEE3LNG—Set national language” on page 155.
- For more information about the CEESETL callable service, see “CEESETL—Set locale operating environment” on page 362.

**Examples**

1. An example of CEEFTDS called by COBOL:

```cobol
CBL LIB,QUOTE
*Module/File Name: IGZFTDS
*******************************************************************************
* Example for callable service CEEFTDS *
* Function: Convert numeric time and date values to a string using specified *
* format string and locale format *
* Valid only for COBOL for MVS & VM Release 2 *
* or later. *
*******************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. MAINFTDS.
DATA DIVISION.
WORKING-STORAGE SECTION.
* Use TD-Struct for CEEFTDS calls
COPY CEEIGZTD.
```
PROCEDURE DIVISION.
* Subroutine needed for pointer addressing
   CALL "COBFTDS" USING TD-Struct.

   STOP RUN.
*
IDENTIFICATION DIVISION.
PROGRAM-ID. COBFTDS.
DATA DIVISION.
WORKING-STORAGE SECTION.
* Use Locale category constants
COPY CEEIGZLC.
*
01  Ptr-FTDS POINTER.
01  Output-FTDS.
   02  O-Length PIC S9(4) BINARY.
   02  O-String PIC X(72).
01  Format-FTDS.
   02  F-Length PIC S9(4) BINARY.
   02  F-String PIC X(64).
01  Max-Size PIC S9(9) BINARY.
01  FC.
   02  Condition-Token-Value.
COPY CEEIGZCT.
   03  Case-1-Condition-ID.
   04  Severity PIC S9(4) BINARY.
   04  Msg-No PIC S9(4) BINARY.
   03  Case-2-Condition-ID
REDEFINES Case-1-Condition-ID.
   04  Class-Code PIC S9(4) BINARY.
   04  Cause-Code PIC S9(4) BINARY.
   03  Case-Sev-Ctl 
   03  Facility-ID   PIC XXX.
   02  I-S-Info PIC S9(9) BINARY.

LINKAGE SECTION.
* Use TD-Struct for calls to CEEFTDS
COPY CEEIGZTD.
*
PROCEDURE DIVISION USING TD-Struct.
*
* Set up time and date values
MOVE 1 TO TM-Sec.
MOVE 2 TO TM-Min.
MOVE 3 TO TM-Hour.
MOVE 9 TO TM-Day.
MOVE 11 TO TM-Mon.
MOVE 94 TO TM-Year.
MOVE 5 TO TM-Wday.
MOVE 344 TO TM-Yday.
MOVE 1 TO TM-Is-DLST.
*
* Set up format string for CEEFTDS call
MOVE 72 TO Max-Size.
MOVE 36 TO F-Length.
MOVE "Today is %A, %b %d  Time:  %I:%M  %p" TO F-String (1:F-Length).
*
* Set up pointer to structure for CEEFTDS call
SET Ptr-FTDS TO ADDRESS OF TD-Struct.
*
* Call CEEFTDS to convert numeric values
CALL "CEEFTDS" USING OMITTED, Ptr-FTDS,
   Max-Size, Format-FTDS,
   Output-FTDS, FC.
*
* Check feedback code and display result
IF Severity = 0
   DISPLAY "Format " F-String (1:F-Length)
   DISPLAY "Result " O-String (1:O-Length)
ELSE
   DISPLAY "Call to CEEFTDS failed. " Msg-No
END-IF.

EXIT PROGRAM.
END PROGRAM COBFTDS.
*
END PROGRAM MAINFTDS.

2. An example of CEEFTDS called by PL/I:

*PROCESS MACRO;
 /*Module/File Name: IBMFTDS */
/*****************************/
CEEGMT—Get current Greenwich Mean Time

CEEGMT returns the current Greenwich Mean Time (GMT) as both a Lilian date and as the number of seconds since 00:00:00 14 October 1582. The returned values are compatible with those generated and used by the other Language Environment date and time services. In order for the results of this service to be meaningful, your system’s TOD (time-of-day) clock must be set to Greenwich Mean Time and be based on the standard epoch. Use CEEGMTO to get the offset from GMT to local time.

The values returned by CEEGMT are handy for elapsed time calculations. For example, you can calculate the time elapsed between two calls to CEEGMT by calculating the differences between the returned values.
Language Environment treats Coordinated Universal Time (UTC) and Greenwich Mean Time (GMT) as the same. You can use the CEEUTC service, which is an alias of the CEEGMT service, to get the same value.

output\_GMT\_Lilian (output)
A 32-bit binary integer representing the current time in Greenwich, England, in the Lilian format (the number of days since 14 October 1582). For example, 16 May 1988 is day number 148138. If GMT is not available from the system, output\_GMT\_Lilian is set to 0 and CEEGMT terminates with a non-CEE000 symbolic feedback code.

output\_GMT\_seconds (output)
A 64-bit double floating-point number representing the current date and time in Greenwich, England, as the number of seconds since 00:00:00 on 14 October 1582, not counting leap seconds. For example, 00:00:01 on 15 October 1582 is second number 86,401 (24*60*60 + 01). 19:00:01.078 on 16 May 1988 is second number 12,799,191,601.078. If GMT is not available from the system, output\_GMT\_seconds is set to 0 and CEEGMT terminates with a non-CEE000 symbolic feedback code.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to "Invoking callable services" on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE2E6</td>
<td>3</td>
<td>2502</td>
<td>The UTC/GMT was not available from the system.</td>
</tr>
</tbody>
</table>

Usage notes
- CEEDATE converts output\_GMT\_Lilian to a character date, and CEEDATM converts output\_GMT\_seconds to a character timestamp.
- CICS consideration—CEEGMT does not use the OS TIME macro.
- z/OS UNIX consideration—In multithread applications, CEEGMT affects only the calling thread.
- Setting the TOD (time-of-day) clock to anything before January 1, 1972 may produce unpredictable results in your applications.

For more information
- See “CEEGMTO—Get offset from Greenwich Mean Time to local time” on page 262 for more information about the CEEGMTO callable service.

Examples
1. Following is an example of CEEGMT called by C/C++.

```c
#include <string.h>
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main(void) {
    _FEEDBACK fc;
    _INT4   lilGMT_date;
    _FLOAT8 secGMT_date;
    CEEGMT(&lilGMT_date,&secGMT_date,&fc);
} /*Module/File Name: EDCGMT   */
```
if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
    printf("CEEGMT failed with message number %d\n", fc.tok_msgno);
    exit(2999);
} else {
    printf("The current Lilian date in Greenwich,\n");
    printf(" England is %d\n", lilGMT_date);
}

2. Following is an example of CEEGMT called by COBOL.

   CBL LIB,QUOTE
   *Module/File Name: IGZTGMT
   *************************************************
   **                                             **
   ** IGZTGMT - Call CEEGMT to get current        **
   **           Greenwich Mean Time               **
   **                                             **
   ** In this example, a call is made to CEEGMT  **
   ** to return the current GMT as a Lilian date  **
   ** and as Lilian seconds. The results are      **
   ** displayed.                                  **
   **                                             **
   *************************************************
   IDENTIFICATION DIVISION.
   PROGRAM-ID. IGZTGMT.
   DATA DIVISION.
   WORKING-STORAGE SECTION.
   01 LILIAN                  PIC S9(9) BINARY.
   01 SECS                    COMP-2.
   01 FC.
   02 Condition-Token-Value.
      COPY CEEIGZCT.
       03 Case-1-Condition-ID.
       04 Severity    PIC S9(4) BINARY.
       04 Msg-No      PIC S9(4) BINARY.
       03 Case-2-Condition-ID
       REDEFINES Case-1-Condition-ID.
       04 Class-Code  PIC S9(4) BINARY.
       04 Cause-Code  PIC S9(4) BINARY.
       03 Case-Sev-Ctl    PIC X.
       03 Facility-ID     PIC XXX.
       02 I-S-Info            PIC S9(9) BINARY.
   PROCEDURE DIVISION.
   PARA-CBLGMT.
      CALL "CEEGMT" USING LILIAN , SECS , FC.
      IF CEE000 of FC THEN
      DISPLAY "The current GMT is also "
      "known as Lilian day: " LILIAN
      DISPLAY "The current GMT in Lilian "
      "seconds is: " SECS
      ELSE
      DISPLAY "CEEGMT failed with msg "
      Msg-No of FC UPON CONSOLE
      STOP RUN
      END-IF.
      GOBACK.

3. Following is an example of CEEGMT called by PL/I.

   *PROCESS MACRO;
   /* Module/File Name: IBMGMT                        */
   /********************************************************************/
   /** ** Function: CEEGMT - get current Greenwich Mean **
   /**           Time                                     **
   /** In this example, CEEGMT is called to return    **
   /** the current Greenwich Mean Time as the number  **
   /** of days and number of seconds since             **
   /** 14 October 1582. The Lilian date is then        **
   /** printed.                                        **
   /**-------------------------------------------------**
   ********************************************************************/
   PLICGMT: PROC OPTIONS(MAIN);
   %INCLUDE CEEIBMFW;
   %INCLUDE CEEIBMCT;
CEEGMTO returns values to the calling routine representing the difference between the local system time and Greenwich Mean Time (GMT).

- **offset_hours (output)**
  A 32-bit binary integer representing the offset from GMT to local time, in hours. For example, for Pacific Standard Time, `offset_hours` equals -8. If local time offset is not available, `offset_hours` equals 0 and CEEGMTO terminates with a non-CEE000 symbolic feedback code.

- **offset_minutes (output)**
  A 32-bit binary integer representing the number of additional minutes that local time is ahead of or behind GMT. The range of `offset_minutes` is 0 to 59. If the local time offset is not available, `offset_minutes` equals 0 and CEEGMTO terminates with a non-CEE000 symbolic feedback code.

- **offset_seconds (output)**
  A 64-bit double floating-point number representing the offset from GMT to local time, in seconds. For example, Pacific Standard Time is eight hours behind GMT. If local time is in the Pacific time zone during standard time, CEEGMTO would return -28,800 (-8 * 60 * 60). `offset_seconds` can be used with CEEGMTO to calculate local date and time. See “CEEGMTO—Get current Greenwich Mean Time” on page 259 for more information.

- **fc (output)**
  A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
</tbody>
</table>
**Usage notes**

- CEEDATM is used to convert number of seconds to a character time stamp.
- CICS consideration: CEEGMTO does not use the OS TIME macro.
- z/OS UNIX consideration: If the MVS command SET DATE is issued, the output value that is returned by CEEGMTO might not represent an accurate date or time.

**For more information**

- See “CEEDATM—Convert seconds to character timestamp” on page 210 for more information about the CEEDATM callable service.

**Examples**

1. An example of CEEGMTO called by C/C++:

```c
/*Module/File Name: EDCGMTO */
#include <string.h>
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main(void) {

_FEEDBACK fc:
_INT4     GMT_hours,GMT_mins;
_FLOAT8   GMT_secs;

CEEGMTO(&GMT_hours,&GMT_mins,&GMT_secs,&fc);
if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
    printf("CEEGMTO failed with message number %d\n", fc.tok_msgno);
    exit(2999);
}
printf("The difference between GMT and the local ");
printf("time is:\n");
printf("%d hours, %d minutes\n",GMT_hours,GMT_mins);
}
```

2. An example of CEEGMTO called by COBOL:

```cobol
CBL LIB,QUOTE
*Module/File Name: IGZTGMTO
**************************************************************************
** IGZTGMTO - Call CEEGMTO to get offset from **
** Greenwich Mean Time to local **
** time **
** In this example, a call is made to CEEGMTO **
** to return the offset from GMT to local time **
** offset hours, minutes, and seconds. The **
** results are displayed. **
**************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. IGZTGMTO.

DATA DIVISION.
WORKING-STORAGE SECTION.
01 HOURS PIC S9(9) BINARY.
01 MINUTES PIC S9(9) BINARY.
01 SECONDS COMP-2.
01 FC.
   02 Condition-Token-Value.
```
3. An example of CEEGMTO called by PL/I:

```pli
*PROCESS MACRO;
/* Module/File Name: IBMGMTO                      */
/*****************************/
/** Function: CEEGMTO - get the offset from      */
/**                     Greenwich Mean Time        */
/**                     to local time              */
/*****************************/
PLIGMTO: PROC OPTIONS(MAIN);
%INCLUDE  CEEIBMAW;
%INCLUDE  CEEIBMCT;
DCL HOURS REAL FIXED BINARY(31,0);
DCL MINUTES REAL FIXED BINARY(31,0);
DCL SECONDS REAL FLOAT DECIMAL(16);
DCL 01 FC,                     /* Feedback token */
     03 MsgSev   REAL FIXED BINARY(15,0),
     03 MsgNo    REAL FIXED BINARY(15,0),
     03 Flags,
     05 Case    BIT(2),
     05 Severity BIT(3),
     05 Control BIT(3),
     03 FacID   CHAR(3),      /* Facility ID */
     03 ISI     /* Instance-Specific Information */
     REAL FIXED BINARY(31,0);  

/* Call CEEGMTO to return hours, minutes, and     */
/* seconds that local time is offset from GMT     */
CALL CEEGMTO ( HOURS, MINUTES, SECONDS, FC );
/* If CEEGMTO ran successfully, print results     */
/* IF FBCHECK( FC, CEE000) THEN DO;              */
/* PUT SKIP EDIT('The difference between GMT and '*/
/* 'local time is ', HOURS, ':', MINUTES )        */
/* (A, P'S99', A, P'99' );                      */
END;                                           
ELSE DO;                                       
  DISPLAY( 'CEEGMTO failed with msg '  
               || FC.MsgNo ) ;
  STOP;
END;                                           
END PLIGMTO;
```
CEEGBPID—Retrieve the Language Environment version and platform ID

CEEGBPID retrieves the Language Environment version ID and the platform ID of the version and platform of Language Environment that is processing the currently active condition.

**CEE_Version_ID (output)**
A four-byte hexadecimal number representing the version of Language Environment that created this data block.

\[
|pp|vv|rr|mm|
\]

- **pp** = Product Number
- **vv** = Version
- **rr** = Release
- **mm** = Modification

The current value of this parameter is:
- `X'04010800'`
  - Version 1 Release 8 Modification 0
- `X'04010900'`
  - Version 1 Release 9 Modification 0
- `X'04010A00'`
  - Version 1 Release 10 Modification 0
- `X'04010B00'`
  - Version 1 Release 11 Modification 0
- `X'04010C00'`
  - Version 1 Release 12 Modification 0
- `X'04010D00'`
  - Version 1 Release 13 Modification 0
- `X'04020100'`
  - Version 2 Release 1 Modification 0
- `X'04020200'`
  - Version 2 Release 2 Modification 0
- `X'04020300'`
  - Version 2 Release 3 Modification 0

**Plat_ID (output)**
A fullword integer representing the platform used for processing the current condition. The current values of this parameter are:

- **3**
  - z/OS or VM
- **4**
  - AS/400

**fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
</tbody>
</table>
Usage notes

- z/OS UNIX consideration—In multithread applications, CEEGPID affects only the calling thread.
- To make a decision concerning Language Environment and z/OS levels at assembly time instead of runtime, use CEEGLOB instead. See z/OS Language Environment Programming Guide for more information.

Examples

1. Following is an example of CEEGPID called by C/C++.

```c
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {

    _INT4 cee_ver_id, plat_id;
    _FEEDBACK fc;
    int Vmask= 0x00FF0000;
    int Rmask= 0x0000FF00;
    int Mmask= 0x000000FF;

    /* get the LE version and the platform id */
    CEEGPID(cee_ver_id,plat_id,fc);
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEEGPID failed with message number %d\n", fc.tok_msgno);
        exit(2999);
    }

    /* If platform is z/OS and LE is at release 2.10 or later, */
    /* use the new interface definition.                         */
    if ((plat_id == 3) & (cee_ver_id > 290)) {
        printf("The LE version id is %08X\n",cee_ver_id);
        printf("             Version:   %d\n",(Vmask & cee_ver_id)>>16);
        printf("             Release:    %d\n",(Rmask & cee_ver_id)>>8);
        printf("        Modification:       %d\n\n",Mmask & cee_ver_id);
    }
    /* else use the old interface */
    else {
        printf("The LE version is %d\n",cee_ver_id);
    }

    printf("The current platform is ");
    switch(plat_id) {
        case 3: printf("z/OS\n");
            break;
        case 4: printf("AS/400\n");
            break;
        default: printf("unrecognized platform id\n");
    }
}
```

2. Following is an example of CEEGPID called by COBOL.

```cobol
IDENTIFICATION DIVISION.
PROGRAM-ID. IGZTGPID.
DATA DIVISION.
WORKING-STORAGE SECTION.
01 VERSION PIC S9(9) BINARY.
01 VER-MAP REDEFINES VERSION.
03 FILLER PIC X(1).
```
03 VER-VERSION PIC X(1).
03 VER-RELEASE PIC X(1).
03 VER-MOD PIC X(1).
01 WORK-AREA.
03 WORK-BIN PIC S9(4) BINARY.
03 WORK-BIN-BY-BYTE REDEFINES WORK-BIN.
05 WORK-BIN-BYTE1 PIC X(1).
05 WORK-BIN-BYTE2 PIC X(1).
01 VERSION-F PIC 99.
01 RELEASE-F PIC 99.
01 MOD-F PIC 99.
01 PLATID PIC S9(9) BINARY.
01 FC.
02 Condition-Token-Value.
COPY CEEIGZCT.
03 Case-1-Condition-ID.
04 Severity PIC S9(4) BINARY.
04 Msg-No PIC S9(4) BINARY.
03 Case-2-Condition-ID REDEFINES Case-1-Condition-ID.
04 Class-Code PIC S9(4) BINARY.
04 Cause-Code PIC S9(4) BINARY.
03 Case-Sev-Ctl PIC X.
03 Facility-ID PIC XXX.
02 I-S-Info PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBLGPID.
** Call CEEGPID to return the version and
** platform ID
CALL "CEEGPID" USING VERSION , PLATID , FC.
IF NOT CEE000 of FC THEN
DISPLAY "CEEGPID failed with msg 
Msg-No of FC UPON CONSOLE
STOP RUN
END-IF.
** If platform is OS/390 or VM and version is greater than 290,
** then use different format of VERSION.
IF PLATID = 3 AND
VERSION > 290 THEN
** Format the version, release, and modification level
MOVE 0 to WORK-BIN
MOVE VER-VERSION TO WORK-BIN-BYTE2
MOVE WORK-BIN TO VERSION-F
MOVE VER-RELEASE TO WORK-BIN-BYTE2
MOVE WORK-BIN TO RELEASE-F
MOVE VER-MOD TO WORK-BIN-BYTE2
MOVE WORK-BIN TO MOD-F
DISPLAY "Currently running version " VERSION-F
" release " RELEASE-F " modification " MOD-F
" of IBM Language Environment"
ELSE
DISPLAY "Currently running version " VERSION
" of IBM Language Environment"
END-IF
** Evaluate PLATID to display this platform
EVALUATE PLATID
WHEN 3
DISPLAY "on OS/390 or VM"
WHEN 4
DISPLAY "on an AS/400"
END-EVALUATE
GOBACK.

3. Following is an example of CEEGPID called by PL/I.

*PROCESS MACRO;
/* Module/File Name: IBMGPID */
/*******************/
/***/
/** Function: CEEGPID - Get LE/370 Version */
/** and Platform ID */
/** This example calls CEEGPID to get the */
/** version and platform of Language */
/** Environment that is currently running. */
/** This information is then printed out. */
/***/
CEEGQDT—Retrieve q_data_token

CEEGQDT retrieves the q_data_token from the Instance-Specific Information (ISI). CEEGQDT is particularly useful when you have user-written condition handlers registered by CEEHDLR.

cond_rep (input)
A condition token that defines the condition for which the q_data_token is retrieved.

q_data_token (output)
A pointer to the q_data associated with condition token cond_rep.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service.

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE0EE</td>
<td>3</td>
<td>0462</td>
<td>Instance-specific information for the condition token with message number message-number and facility ID facility-id could not be found.</td>
</tr>
</tbody>
</table>
Usage notes

- z/OS UNIX consideration—In multithread applications, CEEQGDT affects only the calling thread.

For more information

- For more information about the various types of q_data structures, see z/OS Language Environment Programming Guide.
- For more information about the CEEHDLR callable service, see “CEEHDLR—Register user-written condition handler” on page 281.
- For more information about the CEESGL callable service, see “CEESGL—Signal a condition” on page 365.

Examples

1. Following is an example of CEEQGDT called by C/C++.

```c
/*Module/File Name: EDCQGDT */
#include <stdio.h>
#include <stdlib.h>
#include <string.h>
#include <leawi.h>
#include <ceeedcct.h>
#ifdef __cplusplus
extern "C" {
#endif
void handler(_FEEDBACK *,_INT4 *,_INT4 *,_FEEDBACK *);
#ifdef __cplusplus
}
#endif
typedef struct {       /* condition info structure */
    int   error_value;
    char err_msg_80¨;
    int   retcode;
} info_struct;
int main(void) {
    _FEEDBACK fc,condtok;
    _ENTRY routine;
    _INT4 token,qdata;
    _INT2 c_1,c_2,cond_case,sev,control;
    _CHAR3 facid;
    _INT4 isi;
    info_struct *info;
    /* register the condition handler */
    token = 99;
    routine.address = (_POINTER)&handler;;
    routine.nesting = NULL;
    CEEHDLR(&routine,&token,&fc);
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEEHDLR failed with message number %d\n", fc.tok_msgno);
        exit(2999);
    }
    /* set up the condition info structure */
    info = (info_struct *)malloc(sizeof(info_struct));
    if (info == NULL) {
        printf("error allocating info_struct\n");
        exit(2399);
    }
```
info->error_value = 86;
strcpy(info->err_msg, "Test message");
info->retcode = 99;
/* set qdata to be the condition info structure */
qdata = (int)info;
/* build the condition token */
c_1 = 3;
c_2 = 99;
cond_case = 1;
sev = 3;
control = 0;
memcpy(facid, "ZZZ", 3);
isi = 0;
CEENCOD(&c_1, &c_2, &cond_case, &sev, &control,);
facid, &isi, &condtok, &fc);
if ( _FBCHECK ( fc, CEE000 ) != 0 ) {
    printf("CEENCOD failed with message number %d\n",
f. tok_msgno);
    exit(2999);
}
/* signal the condition */
CEESGL(&condtok, &qdata, &fc);
if ( _FBCHECK ( fc, CEE000 ) != 0 ) {
    printf("CEESGL failed with message number %d\n",
f. tok_msgno);
    exit(2999);
}
/* */
void handler(_FEEDBACK *fc, _INT4 *token, _INT4 *result,
    _FEEDBACK *newfc) {
    _FEEDBACK qdatafc;
    _INT4 idata;
    info_struct *qdata;
    /* */
    /* */
    /* get the q_data_token from the ISI */
    CEEGQDT(fc, &idata, &qdatafc);
    if ( _FBCHECK ( qdatafc, CEE000 ) != 0 ) {
        printf("CEEGQDT failed with message number %d\n",
            qdatafc.tok_msgno);
        *result = 20; /* percolate */
        return;
    }
    /* *********************************************************/
    /* set info_struct pointer to address return by */
    /* CEEGQDT */
    /* *********************************************************/
    qdata = (info_struct *) idata;
    /* use the condition info structure (qdata) */
    if (qdata->error_value == 86) {
        printf("%.12s\n", qdata->err_msg);
        printf("retcode = %d\n", qdata->retcode);
        *result = 10; /* resume this is what we want */
        return;
    }
    /* */
    /* */
    *result = 20; /* percolate */
}

2. Following is an example of CEEGQDT called by COBOL.

CBL LIB,QUOTE
*Module/File Name: IGZT6QDT
******************************************************************************
** DRVGQDT - Drive sample program for CEEGQDT **
******************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. DRVGQDT.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01 ROUTINE PROCEDURE-POINTER.
  01 TOKEN PIC S9(9) BINARY.
  01 SEV PIC S9(4) BINARY.

01 MSGNO  PIC S9(4) BINARY.
01 CASE   PIC S9(4) BINARY.
01 SEV2   PIC S9(4) BINARY.
01 CNTRL  PIC S9(4) BINARY.
01 FACID  PIC X(3).
01 ISINFO PIC S9(9) BINARY.
01 FC.
   02 Condition-Token-Value.
   COPY CEEIGZCT.
   03 Case-1-Condition-ID.
       04 Severity  PIC S9(4) BINARY.
       04 Msg-No   PIC S9(4) BINARY.
   03 Case-2-Condition-ID
       REDEFINES Case-1-Condition-ID.
       04 Class-Code PIC S9(4) BINARY.
       04 Cause-Code PIC S9(4) BINARY.
   03 Case-Sev-Ctl PIC X.
   03 Facility-ID PIC XXX.
   02 I-S-Info PIC S9(9) BINARY.
01 QDATA  PIC S9(9) BINARY.
01 CONDTOK.
   02 Condition-Token-Value.
   COPY CEEIGZCT.
   03 Case-1-Condition-ID.
       04 Severity  PIC S9(4) BINARY.
       04 Msg-No   PIC S9(4) BINARY.
   03 Case-2-Condition-ID
       REDEFINES Case-1-Condition-ID.
       04 Class-Code PIC S9(4) BINARY.
       04 Cause-Code PIC S9(4) BINARY.
   03 Case-Sev-Ctl PIC X.
   03 Facility-ID PIC XXX.
   02 I-S-Info PIC S9(9) BINARY.

PROCEDURE DIVISION.
** Register handler
   SET ROUTINE TO ENTRY "CBLGQDT".
   CALL "CEEHDLR" USING ROUTINE, TOKEN, FC.
   IF NOT CEE000 of FC THEN
      DISPLAY "CEEHDLR failed with msg "
      Msg-No of FC UPON CONSOLE
      STOP RUN
   END-IF.
** Signal a condition
   MOVE 1 TO QDATA.
   SET CEE001 of CONDTOK to TRUE.
   MOVE ZERO to I-S-Info of CONDTOK.
   CALL "CEESGL" USING CONDTOK, QDATA, FC.
   IF CEE000 of FC THEN
      DISPLAY "**** Resumed execution in the "
      "routine which registered the handler"
   ELSE
      DISPLAY "CEESGL failed with msg "
      Msg-No of FC UPON CONSOLE
   END-IF.
** UNregister handler
   CALL "CEEHDLU" USING ROUTINE, TOKEN, FC.
   IF NOT CEE000 of FC THEN
      DISPLAY "CEEHDLU failed with msg "
      Msg-No of FC UPON CONSOLE
   END-IF.
   STOP RUN.
END PROGRAM ORVGQDT.

******************************************************************************
** CBLGQDT - Call CEEGQDT to get the Q_DATA_TOKEN **
******************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLGQDT.
DATA DIVISION.
WORKING-STORAGE SECTION.
01 FC.
   02 Condition-Token-Value.
   COPY CEEIGZCT.
   03 Case-1-Condition-ID.
       04 Severity  PIC S9(4) BINARY.
       04 Msg-No   PIC S9(4) BINARY.
   03 Case-2-Condition-ID
       REDEFINES Case-1-Condition-ID.
       04 Class-Code PIC S9(4) BINARY.
       04 Cause-Code PIC S9(4) BINARY.
   03 Case-Sev-Ctl PIC X.
3. The following example uses a COBOL program and handler to establish the condition handling environment prior to calling a PL/I subroutine to illustrate the use of the callable service from PL/I.
04 Cause-Code PIC S9(4) BINARY.
03 Case-Sev-Ctl PIC X.
03 Facility-ID PIC XXX.
02 I-S-Info PIC S9(9) BINARY.
01 QDATA PIC S9(9) BINARY.
01 CONDTOK.
  02 Condition-Token-Value.
COPY CEEIGZCT.
  03 Case-1-Condition-ID.
  04 Severity PIC S9(4) BINARY.
  04 Msg-No PIC S9(4) BINARY.
  03 Case-2-Condition-ID
REDEFINES Case-1-Condition-ID.
  04 Class-Code PIC S9(4) BINARY.
  04 Cause-Code PIC S9(4) BINARY.
  03 Case-Sev-Ctl PIC X.
  03 Facility-ID PIC XXX.
  02 I-S-Info PIC S9(9) BINARY.
PROCEDURE DIVISION.
** Register handler
SET ROUTINE TO ENTRY "HDLGQDT".
CALL "CEEHDLR" USING ROUTINE, TOKEN, FC.
IF NOT CEE000 of FC THEN
  DISPLAY "CEEHDLR failed with msg "
  Msg-No of FC UPON CONSOLE
  STOP RUN
END-IF.
** Signal a condition
MOVE 1 TO QDATA.
SET CEE001 of CONDTOK to TRUE.
MOVE ZERO to I-S-Info of CONDTOK.
CALL "CEESGL" USING CONDTOK, QDATA, FC.
IF CEE000 of FC THEN
  DISPLAY "**** Resumed execution in the "
  "routine which registered the handler"
ELSE
  DISPLAY "CEESGL failed with msg "
  Msg-No of FC UPON CONSOLE
END-IF.
** Unregister handler
CALL "CEEHDLU" USING ROUTINE, FC.
IF NOT CEE000 of FC THEN
  DISPLAY "CEEHDLU failed with msg "
  Msg-No of FC UPON CONSOLE
END-IF.
END PROGRAM IGZTGQDP.

**************************************************************************
** HDLGQDT -- COBOL condition handler to call **
**               PL/I routine for actual work. **
**************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. HDLGQDT.
DATA DIVISION.
LINKAGE SECTION.
01 CURCOND.
  02 Condition-Token-Value.
COPY CEEIGZCT.
  03 Case-1-Condition-ID.
  04 Severity PIC S9(4) BINARY.
  04 Msg-No PIC S9(4) BINARY.
  03 Case-2-Condition-ID
REDEFINES Case-1-Condition-ID.
  04 Class-Code PIC S9(4) BINARY.
  04 Cause-Code PIC S9(4) BINARY.
  03 Case-Sev-Ctl PIC X.
  03 Facility-ID PIC XXX.
  02 I-S-Info PIC S9(9) BINARY.
01 TOKEN PIC S9(9) BINARY.
01 RESULT PIC S9(9) BINARY.
01 NEWCOND.
  02 Condition-Token-Value.
COPY CEEIGZCT.
  03 Case-1-Condition-ID.
  04 Severity PIC S9(4) BINARY.
  04 Msg-No PIC S9(4) BINARY.
  03 Case-2-Condition-ID
REDEFINES Case-1-Condition-ID.
  04 Class-Code PIC S9(4) BINARY.
  04 Cause-Code PIC S9(4) BINARY.
  03 Case-Sev-Ctl PIC X.
**Invoke the PL/I routine to handle condition**

```cobol
CALL "IBMGQDT"
USING ADDRESS OF CURCOND,
ADDRESS OF TOKEN,
ADDRESS OF RESULT,
ADDRESS OF NEWCOND.
GOBACK.
```

**END PROGRAM HDLGQDT.**

---

### 4. Following is an example of CEEQGDT called by COBOL.

```cobol
*PROCESS OPT(0), MACRO:
/* Module/File Name: IBMGQDT */
/*****************************/
/**
/** Function: CEEQGDT -- get qualifying data
/**
/*****************************/
IBMGQDT: PROC (@CONDTOK, @TOKEN, @RESULT, @NEWCOND)
OPTIONS(COBOL);

INCLUDE CEEIBMAW;
INCLUDE CEEIBMCT;

/* Parameters */
DCL @CONDTOK  POINTER;
DCL @TOKEN   POINTER;
DCL @RESULT  POINTER;
DCL @NEWCOND POINTER;
DCL 01 CONDTOK BASED(@CONDTOK),
/* Feedback token */
03 MsgSev  REAL FIXED BINARY(15,0),
03 MsgNo   REAL FIXED BINARY(15,0),
03 Flags,
  05 Case   BIT(2),
  05 Severity BIT(3),
  05 Control BIT(3),
03 FacID   CHAR(3),   /* Facility ID */
03 ISI   /* Instance-Specific Information */
  REAL FIXED BINARY(31,0);
DCL TOKEN BASED(@TOKEN) REAL FIXED BIN(31,0);
DCL RESULT BASED(@RESULT) REAL FIXED BIN(31,0);

DCL 01 NEWCOND BASED(@NEWCOND),
/* Feedback token */
03 MsgSev  REAL FIXED BINARY(15,0),
03 MsgNo   REAL FIXED BINARY(15,0),
03 Flags,
  05 Case   BIT(2),
  05 Severity BIT(3),
  05 Control BIT(3),
03 FacID   CHAR(3),   /* Facility ID */
03 ISI   /* Instance-Specific Information */
  REAL FIXED BINARY(31,0);
DCL QDATA REAL FIXED BINARY(31,0);
DCL 01 FC,   /* Feedback token */
03 MsgSev  REAL FIXED BINARY(15,0),
03 MsgNo   REAL FIXED BINARY(15,0),
03 Flags,
  05 Case   BIT(2),
  05 Severity BIT(3),
  05 Control BIT(3),
03 FacID   CHAR(3),   /* Facility ID */
03 ISI   /* Instance-Specific Information */
  REAL FIXED BINARY(31,0);

IF FBCHECK(CONDTOK, CEE001) THEN /* expected */ DO;
  /* Call CEEQGDT with condition token defined */
  /* above to retrieve associated q_data */
END.
```
CALL CEEGQDT ( CONDTOK, QDATA, FC );
IF FBCHECK( FC, CEE000) THEN DO;
    PUT SKIP LIST( 'Qualifying data for current ' || ' condition is ' || QDATA );
    RESULT = 10 /* Resume */;
END;
ELSE DO;
    DISPLAY('CEEGQDT failed with msg ' || FC.MsgNo);
    NEWCOND = FC;
    RESULT = 30 /* Promote */;
END;
ELSE /* Unexpected condition -- percolate */ DO;
    DISPLAY( 'User condition handler entered for ' || CONDTOK.FacID || ' condition...');
    DISPLAY( '... with message number ' || CONDTOK.MsgNo);
    RESULT = 20 /* Percolate */;
END;
RETURN;
END IBMGQDT;

CEEGTJS—Retrieves the value of an exported JCL symbol

CEEGTJS retrieves and returns to the caller the symbol value and length of the requested exported JCL symbol.

```
 function_code (input)
 A fullword integer that contains the function code of the following value:

  1
  Retrieves the value and its associated length of an exported JCL symbol.

 symbol_name (input)
 A halfword length-prefixed character string (VSTRING), representing the name of an exported JCL symbol to be retrieved.

 symbol_value (output)
 A 255-byte fixed-length string. On return from this service, the $symbol_value contains the value of the exported JCL symbol. If the length of the exported JCL symbol is shorter than 255 characters, the returned string is padded with blanks.

 value_length (output)
 A fullword integer that contains the length of the value of the specified JCL symbol.

 fc (output)
 A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

 The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE3L9</td>
<td>0</td>
<td>3753</td>
<td>The input symbol cannot be found in the current job step.</td>
</tr>
<tr>
<td>CEE3LA</td>
<td>3</td>
<td>3754</td>
<td>Incorrect parameters detected.</td>
</tr>
<tr>
<td>CEE3QS</td>
<td>1</td>
<td>3932</td>
<td>The system service service failed with return code return_code and reason code reason_code.</td>
</tr>
</tbody>
</table>
```
Usage notes

- Lowercase characters in the `symbol_name` are converted to uppercase by CEEGTJS.
- For more information about JCL symbols, refer to the topic on system symbols and JCL symbols in *z/OS MVS JCL Reference*.

Examples

1. This example uses CEEGTJS to retrieve the value of an exported JCL symbol.

```c
/*Module/File Name: EDCGTJS */
**************************************************************************
/*                                                                   */
/* THIS EXAMPLE CALLS CEEGTJS TO RETRIEVE THE VALUE OF AN EXPORTED   */
/* JCL SYMBOL.                                                       */
**************************************************************************
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {
    _FEEDBACK fc;
    _INT4 funcode;
    _CHAR255 symvalue;
    _VSTRING symname;
    _INT4 valuelen;
    char *symbol="SYM1";

    /* Setting the function code */
    funcode=1;

    /* Preparing the JCL symbol */
    symname.length=strlen(symbol);
    memcpy(symname.string, symbol,strlen(symbol));

    /* Retrieving the value of the JCL symbol */
    CEEGTJS(&funcode,&symname,symvalue,&valuelen,&fc);
    if( _FBCHECK (fc, CEE000) !=0) {
        printf("CEEGTJS failed with message number %d\n", fc.tok_msgno);
        exit(1);
    }
    symvalue[valuelen]='$0';
    printf("The value of JCL symbol %s is %s. The length of the value is %d\n", symbol,symvalue,valuelen);
}
```

Use the following JCL to run EDCGTJS:

```
//JOB1    JOB    FELE,MSGLEVEL=(2,0)
//STEP1   EXEC   PGM=EDCGTJS
//E1      EXPORT SYMLIST=(SYM1,SYM2,SYM3)
//S1      SET    SYM1=XXXX
//S2      SET    SYM2=YYYY
//STPLIB  DD     DSN=USER.LOADLIB,DISP=SHR
//SYSPRINT DD     SYSOUT=*  
//SYSSOUT DD     SYSOUT=* 
```

Running this example would produce the following output:

The value of JCL symbol SYM1 is XXXX. The length of the value is 4.
CEEGTST gets storage from a heap whose ID you specify. It is used to acquire both large and small blocks of storage. CEEGTST always allocates storage that is addressable by the caller. Therefore, if the caller is in 24-bit addressing mode, or if HEAP(,,BELOW) is in effect, the storage returned is always below the 16M line. Above-the-line storage is returned only if the caller is in 31-bit addressing mode and HEAP(,,ANY) is in effect.

All requests for storage are conditional. If storage is not available, the feedback code (fc) is set and returned to you, but the thread does not abend. When storage is not available, the appropriate action in the member environment should be taken. One option is to use the CEEESGL callable service to signal the Language Environment condition handler with the returned feedback code.

Storage obtained by CEEGTST can be freed by a call to CEEFRST or CEEDSHP. You can also free storage by using a language intrinsic function. If storage is not explicitly freed, it is freed automatically at termination.

If you have specified a heap_alloc_value in the STORAGE runtime option, all storage allocated by CEEGTST is initialized to heap_alloc_value. Otherwise, it is left uninitialized.

If the value specified in the size parameter of CEEGTST is greater than the size of an increment (as specified in the HEAP runtime option), all of the requested storage (rounded up to the nearest doubleword) is allocated in a single system-level call.

Heap storage is acquired by a system-level get storage call in increments of init_size and incr_size bytes as specified by the HEAP runtime option, or in the CEECRHP callable service. If the increment size is chosen appropriately, only a few of the calls to CEEGTST result in a system call. The storage report generated when the RPTSTG runtime option is specified shows the number of system-level get storage calls required. This helps you tune the init_size and incr_size fields in order to minimize calls to the operating system.

### Parameters

- **heap_id (input)**
  A fullword binary signed integer. heap_id is a token denoting the heap in which the storage is allocated. A heap_id of 0 allocates storage from the initial heap (or user heap). Any other heap_id must be a value obtained from the CEECRHP callable service. If the heap_id you specify is invalid, no storage is allocated. CEEGTST terminates with a non-CEE000 symbolic feedback code and the value of the address parameter is undefined.

- **size (input)**
  A fullword binary signed integer. size represents the amount of storage allocated, in bytes. If the specified amount of storage cannot be obtained, no storage is allocated, CEEGTST terminates with a non-CEE000 symbolic feedback code, and the value of the address parameter is undefined.

- **address (output)**
  A fullword address pointer. address is the main storage address of the first byte of allocated storage. If storage cannot be obtained, address remains undefined. Storage is always allocated on a doubleword boundary. This parameter contains an address that is returned as output to CEECZST.

- **fc (output)**
  A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE0P2</td>
<td>4</td>
<td>0802</td>
<td>Heap storage control information was damaged.</td>
</tr>
<tr>
<td>CEE0P3</td>
<td>3</td>
<td>0803</td>
<td>The heap identifier in a get storage request or a discard heap request was unrecognized.</td>
</tr>
</tbody>
</table>
**Usage notes**

- **COBOL considerations**—If you want to use the CEEGTST callable service in a 24-bit addressing mode COBOL program to request 24-bit heap storage, you can make a static call to CEEGTST without any additional changes. If you want to call it dynamically (either by using the COBOL DYNAM compiler option, or using the "CALL identifier" statement, where identifier is a variable that holds the name of the program you want to call), you must also specify \texttt{HEAP(,,BELOW,,,) as a runtime option.}

  This runtime specification affects all programs in the enclave using the user heap, not just the 24-bit addressing mode program. If this is undesirable, one alternative is to use the CEECRHP callable service to create an additional heap, specifying for the options parameter a value that will create the heap BELOW. The 24-bit addressing mode COBOL program can then obtain storage from this additional heap using the CEEGTST callable service.

- **PL/I considerations**—Storage allocated within PL/I AREAs is managed by PL/I. Therefore, only PL/I language functions can allocate and free storage within a PL/I area.

  Based upon the layout of a PL/I structure, PL/I might adjust the starting byte of the PL/I structure to a non-doubleword aligned byte. The difference between the doubleword boundary and the first byte of such a structure is known as the \textit{hang}. Because Language Environment callable storage services do not adjust the starting byte, you must be careful using callable services to allocate storage for PL/I structures. Use either the PL/I \texttt{ALLOCATE} statement or fully defined structures and aggregates to avoid this problem.

- **CICS considerations**—In a CICS environment, \textit{size} should not exceed 1024M (1 gigabyte or X'40000000') when running in AMODE ANY, and 65,504 bytes when running in 24-bit addressing mode. These CICS restrictions are subject to change from one release of CICS to another. Portable applications should respect current CICS limitations.

- **z/OS UNIX considerations**—CEEGTST applies to the enclave. Any thread can free the allocated storage.

**For more information**

- See “HEAP” on page 32 for further information about the HEAP runtime option.
- For more information about the CEESGL callable service, see “CEESGL—Signal a condition” on page 365.
- For more information about the CEEFRST callable service, see “CEEFRST—Free heap storage” on page 250.
- For more information about the CEEDSHP callable service, see “CEEDSHP—Discard heap” on page 228.
- For more information about the STORAGE runtime option, see “STORAGE” on page 70.
- For more information about the CEECRHP callable service, see “CEECRHP—Create new additional heap” on page 197.
- For more information about the RPTSTG runtime option, see “RPTSTG” on page 63.
- For more information about the CEECRHP callable service, see “CEECRHP—Create new additional heap” on page 197.
- For more information about the CEECZST callable service, see “CEECZST—Reallocate (change size of) storage” on page 201.

**Examples**
1. Following is an example of CEEGTST called by C/C++.

```c
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {
    _INT4 heapid, size;
    _POINTER address;
    _FEEDBACK fc;
    /* . */
    /* get storage from initial heap */
    heapid = 0;
    size = 4000;
    /* obtain the storage using CEEGTST */
    CEEGTST(&heapid,&size,&address,&fc);
    /* check the first 4 bytes of the feedback token */
    /* (0 if successful) */
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEEGETST failed with message number %d\n", fc.tok_msgno);
        exit(99);
    }
    /* . */
    /* free the storage that was previously obtained */
    /* using CEEGTST */
    CEEFRST(&address,&fc);
    /* check the first 4 bytes of the feedback token */
    /* (0 if successful) */
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEEFRST failed with message number %d\n", fc.tok_msgno);
        exit(99);
    }
    /* . */
}
```

2. Following is an example of CEEGTST called by COBOL.

```cobol
IDENTIFICATION DIVISION.
PROGRAM-ID. IGZTGTST.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01  HEAPID          PIC S9(9) BINARY.
  01  STGSIZE         PIC S9(9) BINARY.
  01  ADDRSS          POINTER.
  01  FC.
  02  Condition-Token-Value.
COPY CEEIEGZCT.
  03  Case-1-Condition-ID.
  04  Severity        PIC S9(4) BINARY.
  04  Msg-No          PIC S9(4) BINARY.
  03  Case-2-Condition-ID
     REDEFINES Case-1-Condition-ID.
  04  Class-Code      PIC S9(4) BINARY.
  04  Cause-Code      PIC S9(4) BINARY.
```
03 Case-Sev-Ctl  PIC X.
03 Facility-ID   PIC XXX.
02 I-S-Info     PIC S9(9) BINARY.

PROCEDURE DIVISION.
*************************************************
** Specify 0 to get storage from initial heap. **
** Specify 4000 to get 4000 bytes of storage. **
** Call CEEGTST to obtain storage. **
*************************************************

PARA-CBLGTST.
MOVE 0 TO HEAPID.
MOVE 4000 TO STGSIZE.
CALL "CEEGTST" USING HEAPID, STGSIZE,
      ADDRSS, FC.
IF CEE000 of FC THEN
  DISPLAY "Obtained " STGSIZE " bytes of"
      " storage at location " ADDRSS
      " from heap number " HEAPID
ELSE
  DISPLAY "CEEGTST failed with msg ",
      Msg-No of FC UPON CONSOLE
STOP RUN
END-IF.
GOBACK.

3. Following is an example of CEEGTST called by PL/I.

*PROCESS MACRO;
/* Module/File Name: IBMGTST */
/*******************************/
/**
/** Function: CEEGTST - Get Heap Storage
/**
/** In this example, a call is made to CEEGTST to
/** request 4000 bytes of storage from the
/** initial heap.
/**
/*******************************/
PLIGTST: PROC OPTIONS(MAIN);

%INCLUDE  CEEIBMAW;
%INCLUDE  CEEIBMCT;

DCL HEAPID   REAL FIXED BINARY(31,0);
DCL STGSIZE  REAL FIXED BINARY(31,0);
DCL ADDRSS   POINTER;
DCL 01 FC,                     /* Feedback token */
     03 MsgSev   REAL FIXED BINARY(15,0),
     03 MsgNo    REAL FIXED BINARY(15,0),
     03 Flags,   /* Flags */
     05 Case     BIT(2),
     05 Severity  BIT(3),
     05 Control   BIT(3),
     03 FacID    CHAR(3),      /* Facility ID */
     03 ISI      /* Instance-Specific Information */
                  REAL FIXED BINARY(31,0);

HEAPID = 0; /* get storage from the initial heap */
STGSIZE = 4000; /* get 4000 bytes of storage */

/* Call CEEGTST to obtain the storage */
CALL CEEGTST ( HEAPID, STGSIZE, ADDRSS, FC );
IF FBCHECK( FC, CEE000) THEN DO;
  PUT SKIP LIST( 'Obtained ' || STGSIZE
      ' bytes of storage at location ' ||
      ' from heap ' || HEAPID );
END;
ELSE DO;
  DISPLAY( 'CEEGTST failed with msg ",
      FC.MsgNo )
STOP;
END;
END PLIGTST;
CEEHDLR—Register user-written condition handler

CEEHDLR registers a user-written condition handler for the current stack frame. The user condition handler is invoked when:

• It is registered for the current stack frame by CEEHDLR, and
• The Language Environment condition manager requests the condition handler associated with the current stack frame handle the condition.

Language Environment places the user-written condition handlers associated with each stack frame in a queue. The queue can be empty at any given time. The Language Environment condition manager invokes the registered condition handlers in LIFO (last in, first out) order to handle the condition.

The opposite of CEEHDLR, which registers a user-written condition handler, is CEEHDLU, which unregisters the handler. You do not necessarily need to use CEEHDLU to remove user-written condition handlers you registered with CEEHDLR. Any user-written condition handlers created through CEEHDLR and not unregistered by CEEHDLU are unregistered automatically by Language Environment, but only when the associated stack frame is removed from the stack.

Language Environment condition handlers are driven only for synchronous conditions.

```
CEEHDLR (routine, token, fc)
```

**routine (input)**

An entry variable or entry constant for the routine called to process the condition. The entry variable or constant must be passed by reference. The routine must be an external routine; that is, it must not be a nested routine.

**token (input)**

A fullword integer of information you want passed to your user handler each time it is called. This can be a pointer or any other fullword integer you want to pass.

**fc (output)**

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE080</td>
<td>1</td>
<td>0256</td>
<td>The user-written condition handler routine specified was already registered for this stack frame. It was registered again.</td>
</tr>
<tr>
<td>CEE081</td>
<td>3</td>
<td>0257</td>
<td>The routine specified contained an invalid entry variable.</td>
</tr>
</tbody>
</table>

**Usage notes**

• PL/I MTF consideration—CEEHDLR is not supported in PL/I MTF applications. This includes any CEEHDLR service called from a COBOL program in the application.
• COBOL consideration—You should not call CEEHDLR from a nested COBOL program.
• z/OS UNIX consideration—in multithread applications, CEEHDLR affects only the calling thread.
• C consideration—The CEEHDLR service does not save Writeable Static Area (WSA) information about the user handler, so it's possible that the user handler will be given control with the wrong WSA. Specifically, the user handlers on the stack will be invoked with the WSA of the routine that incurred the condition. The preferred method of handling conditions from a C application is to use C signal handlers.
For more information

- For more information about the CEEHDLU callable service, see “CEEHDLU—Unregister user-written condition handler” on page 287.

Examples

1. Following is an example of CEEHDLR called by C/C++.

```c
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

void handler(_FEEDBACK *, _INT4 *, _INT4 *, _FEEDBACK *);

int main(void) {
    _FEEDBACK fc;
    _ENTRY routine;
    _INT4 token;

    CEEHDLR(&routine, &token, &fc);
    if ( _FBCHECK (fc, CEE000) != 0 ) {
        printf("CEEHDLR failed with message number %d\n", fc.tok_msgno);
        exit (2999);
    }
}
```

2. Following is an example of CEEHDLR called by a COBOL program that registers a handler routine.

```cobol
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLHDLR.
DATA DIVISION.
WORKING-STORAGE SECTION.
    01 ROUTINE PROCEDURE-POINTER.
    01 TOKEN PIC S9(9) BINARY.
    01 SEV PIC S9(4) BINARY.
```

CBL LIB,QUOTE
01 MSGNO        PIC S9(4) BINARY.
01 CASE         PIC S9(4) BINARY.
01 SEV2         PIC S9(4) BINARY.
01 CNTRL        PIC S9(4) BINARY.
01 FACID        PIC X(3).
01 ISINFO       PIC S9(9) BINARY.
01 QDATA        PIC S9(9) BINARY.
01 FC.
 02 Condition-Token-Value.
COPY CEEIGZCT.
  03 Case-1-Condition-ID.
   04 Severity   PIC S9(4) BINARY.
   04 Msg-No     PIC S9(4) BINARY.
  03 Case-2-Condition-ID
   REDEFINES Case-1-Condition-ID.
   04 Class-Code PIC S9(4) BINARY.
   04 Cause-Code PIC S9(4) BINARY.
  03 Case-Sev-Ctl PIC X.
  03 Facility-ID PIC XXX.
  02 I-S-Info    PIC S9(9) BINARY.
01 CONDTOK.
  02 Condition-Token-Value.
COPY CEEIGZCT.
  03 Case-1-Condition-ID.
   04 Severity   PIC S9(4) BINARY.
   04 Msg-No     PIC S9(4) BINARY.
  03 Case-2-Condition-ID
   REDEFINES Case-1-Condition-ID.
   04 Class-Code PIC S9(4) BINARY.
   04 Cause-Code PIC S9(4) BINARY.
  03 Case-Sev-Ctl PIC X.
  03 Facility-ID PIC XXX.
  02 I-S-Info    PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBLHDLR.
  SET ROUTINE TO ENTRY "HANDLER".
  CALL "CEEHDLR" USING ROUTINE, TOKEN, FC.
  IF NOT CEE000 of FC THEN
    DISPLAY "CEEHDLR failed with msg "
     Msg-No of FC UPON CONSOLE
    STOP RUN
  END-IF.
  * RAISE A SIGNAL
PARA-CBLSGL.
  *************************************************
  ** Call CEENCOD with the values assigned above **
  ** to build a condition token "CONDTOK"        **
  ** Set CONDTOK to sev=3, msgno=1 facid=CEE. We **
  ** raise a sev 3 to ensure our handler is driven*
  *************************************************
  MOVE 3 TO SEV.
  MOVE 1 TO MSGNO.
  MOVE 1 TO CASE.
  MOVE 3 TO SEV2.
  MOVE 1 TO CNTRL.
  MOVE "CEE" TO FACID.
  MOVE 0 TO ISINFO.
  CALL "CEENCOD" USING SEV, MSGNO, CASE,
    SEV2, CNTRL, FACID, ISINFO, CONDTOK, FC.
  IF NOT CEE000 of FC THEN
    DISPLAY "CEENCOD failed with msg "
     Msg-No of FC UPON CONSOLE
    STOP RUN
  END-IF.
  *************************************************
  ** Call CEESGL to signal the condition with    **
  ** the condition token and qdata described **
  ** in CONDTOK and QDATA                       **
  *************************************************
  MOVE 0 TO QDATA.
  CALL "CEESGL" USING CONDTOK, QDATA, FC.
  IF NOT CEE000 of FC THEN
    DISPLAY "CEESGL failed with msg "
     Msg-No of FC UPON CONSOLE
    STOP RUN
  END-IF.
GOBACK.
3. Following is an example of a COBOL user-written condition handler that is registered by CBLHDLR and unregistered by CBLHDLU.

```cobol
CBL LIB,QUOTE,NOOPT,NODYNAM
*Module/File Name: IGZTHAND
******************************************************************************
**_drvhand - Drive sample program for COBOL **
** user-written condition handler. **
******************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. DRVHAND.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01 ROUTINE             PROCEDURE-POINTER.
  01 DENOMINATOR         PIC S9(9) BINARY.
  01 NUMERATOR           PIC S9(9) BINARY.
  01 RATIO               PIC S9(9) BINARY.
  01 TOKEN               PIC S9(9) BINARY VALUE 0.
  01 FC.
     02 Condition-Token-Value.
COPY CEEIGZCT.
  03 Case-1-Condition-ID.
     04 Severity    PIC S9(4) BINARY.
     04 Msg-No      PIC S9(4) BINARY.
  03 Case-2-Condition-ID
     REDEFINES Case-1-Condition-ID.
     04 Class-Code  PIC S9(4) BINARY.
     04 Cause-Code  PIC S9(4) BINARY.
  03 Case-Sev-Ctl    PIC X.
  03 Facility-ID     PIC XXX.
  02 I-S-Info            PIC S9(9) BINARY.
PROCEDURE DIVISION.
REGISTER-HANDLER.
******************************************************************************
** Register handler **
******************************************************************************
SET ROUTINE TO ENTRY "HANDLER".
CALL "CEEHDLR" USING ROUTINE, TOKEN, FC.
IF  NOT CEE000 of FC  THEN
  DISPLAY "CEEHDLR failed with msg ",
              Msg-No of FC UPON CONSOLE
  STOP RUN
END-IF.
RAISE-CONDITION.
******************************************************************************
** Cause a zero-divide condition. **
******************************************************************************
MOVE 0 TO DENOMINATOR.
MOVE 1 TO NUMERATOR.
DIVIDE NUMERATOR BY DENOMINATOR
GIVING RATIO.
DISPLAY "Execution continues following 
"divide-by-zero exception".
UNREGISTER-HANDLER.
******************************************************************************
** Unregister handler **
******************************************************************************
CALL "CEEHDLU" USING ROUTINE, TOKEN, FC.
IF NOT CEE000 of FC  THEN
  DISPLAY "CEEHDLU failed with msg ",
              Msg-No of FC UPON CONSOLE
  STOP RUN
END-IF.
END PROGRAM DRVHAND.
IDENTIFICATION DIVISION.
PROGRAM-ID. HANDLER.
DATA DIVISION.
WORKING-STORAGE SECTION.
LINKAGE SECTION.
  01 TOKEN                  PIC S9(9) BINARY.
  01 RESULT                 PIC S9(9) BINARY.
  88 RESUME                VALUE 10.
  01 CURCOND.
```
4. Following is an example of a PL/I program to handle divide-by-zero condition.

```pli
*Process macro;
/* Module/File Name: IBMHDLR */
/*****************************************************************************/
/* * EXCOND ,-> DIVZERO */
/* - register handler | - force a divide-by-0 */
/* - call DIVZERO -- */
/* ==> "resume point" */
/* - unregister handler */
/* USRHDLR: */
/* - if divide-by-zero then */
/* - move resume cursor */
/* - resume at "resume" */
/* point */
/* */
/*****************************************************************************/
Excond :Proc Options(Main);

/*********************/
/* Important elements are found in these includes */
/* - feedback declaration */
/* - fbcheck macro call */
/* - condition tokens such as CEE000 */
/* - entry declarations such as ceehdlr */
/*********************/

%include ceeibmct;
%include ceeibmaw;

dcl Usrhdlr external entry;

dcl 1 fback feedback;
dcl divisor fixed bin(31);
dcl token fixed bin(31);

/*********************/
/* Register a user-written condition handler */
/*********************/
token = 97;
Call ceehdlr(Usrhdlr, token, fback);
If fbcheck (fback, cee000) then
display ('MAIN: registered USRHDLR');
```
else
do;
  display ('CEEHDLR failed with message number ' ||
  fback.MsgNo);
  stop;
end;

/*********************************************/
/* Call DIVZERO to divide by zero          */
/* and drive USRHDLR                       */
/*********************************************/
divisor = 0;
call divzero (divisor);
display ('MAIN: resumption after DIVZERO');

/*********************************************/
/* Unregister the user condition handler  */
/*********************************************/
Call ceehdlu (Usrhdlr, fback);
If fbcheck (fback, cee000) then
display ('MAIN: unregistered USRHDLR');
else
do;
  display ('CEEHDLU failed with message number ' ||
  fback.MsgNo);
  stop;
end;

/*********************************************/
/* Subroutine that simply raises ZERO/DEVIDE */
/*********************************************/
divzero: proc (arg);
dcl arg fixed bin(31);
display('  DIVZERO: starting.');
arg = 1 / arg;
display('  DIVZERO: Returning to its caller');
end divzero;
end Excond;

5. Following is an example of CEEHDLR called by PL/I.

<table>
<thead>
<tr>
<th>AHDL</th>
<th>TITLE 'Main program that registers a handler'</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>* Symbolic Register Definitions and Usage</td>
</tr>
<tr>
<td></td>
<td>* R0   EQU 0 Parm list addr (CMS only)</td>
</tr>
<tr>
<td></td>
<td>R1   EQU 1 Parm list addr, 0=no parms</td>
</tr>
<tr>
<td></td>
<td>R10  EQU 10 Base reg for executable code</td>
</tr>
<tr>
<td></td>
<td>R12  EQU 12 Language Environment Common Anchor Area addr</td>
</tr>
<tr>
<td></td>
<td>R13  EQU 13 Dynamic Storage Area addr</td>
</tr>
<tr>
<td></td>
<td>R14  EQU 14 Return point addr</td>
</tr>
<tr>
<td></td>
<td>R15  EQU 15 Entry point address</td>
</tr>
<tr>
<td></td>
<td>* Prologue</td>
</tr>
<tr>
<td></td>
<td>CEEHDLRA CEEENTRY AUTO=DSASIZ, Main memory to obtain *</td>
</tr>
<tr>
<td></td>
<td>MAIN=YES, This program is a MAIN prog *</td>
</tr>
<tr>
<td></td>
<td>PPA=PPA1, Our Program Prolog Area *</td>
</tr>
<tr>
<td></td>
<td>BASE=R10 Base reg for executable code</td>
</tr>
<tr>
<td></td>
<td>USING CEECAA,R12 Addressing for LE/370 CAA</td>
</tr>
<tr>
<td></td>
<td>USING CEDDSA,R13 Addressing for dynamic data</td>
</tr>
<tr>
<td></td>
<td>* * Announce ourselves</td>
</tr>
<tr>
<td></td>
<td>WTO 'CEEHDLRA Says &quot;HELLO&quot;',ROUTCDE=11</td>
</tr>
<tr>
<td></td>
<td>* Register User Handler</td>
</tr>
<tr>
<td></td>
<td>LA R1,USRHDLPP Get addr of proc-ptr to Hdlr</td>
</tr>
<tr>
<td></td>
<td>ST R1,PARM1 Make it 1st parameter</td>
</tr>
<tr>
<td></td>
<td>LA R1,TOKEN Get addr of 32-bit token</td>
</tr>
<tr>
<td></td>
<td>ST R1,PARM2 Make it 2nd parameter</td>
</tr>
<tr>
<td></td>
<td>LA R1,FEEDBACK Get addr of feedback code</td>
</tr>
<tr>
<td></td>
<td>ST R1,PARM3 Make it 3rd parameter</td>
</tr>
<tr>
<td></td>
<td>LA R1,HDLRPLST Point to CEEHDLR's parm list</td>
</tr>
<tr>
<td></td>
<td>CALL CEEHDLR Invoke CEEHDLR service</td>
</tr>
<tr>
<td></td>
<td>CLC FEEDBACK,=XL12 '09' Check for success</td>
</tr>
<tr>
<td></td>
<td>BE HDLRGOOD Skip diagnostics if success</td>
</tr>
</tbody>
</table>
**CEEHDLU—Unregister user-written condition handler**

CEEHDLU unregisters a user condition handler for the current stack frame. You do not necessarily need to use CEEHDLU to remove user-written condition handlers you registered with CEEHDLR. Any user-written condition handlers created through CEEHDLR and not unregistered by CEEHDLU are unregistered automatically by Language Environment, but only when the associated stack frame is removed from the stack.

**Note:** For information about restrictions on the use of CEEHDLU with PL/I, see z/OS Language Environment Programming Guide.
**routine (input)**
An entry variable or constant for the routine to be unregistered as a user condition handler. This routine must be previously registered (with CEEHDLR) by the same stack frame that invokes CEEHDLU.

**fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td></td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE07S</td>
<td>1</td>
<td>0252</td>
<td>CEEHDLU was unable to find the requested user-written condition handler routine.</td>
</tr>
</tbody>
</table>

**Usage notes**
- PL/I MTF consideration—CEEHDLU is not supported in PL/I MTF applications. This includes any CEEHDLR service called from a COBOL program in the application.
- z/OS UNIX consideration—in multithread applications, CEEHDLU affects only the calling thread.

**For more information**
- See “CEEHDLR—Register user-written condition handler” on page 281 for more information about specifying the routine parameter.

**Examples**
1. Following an example of CEEHDLU called by C/C++.

```c
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

#ifdef __cplusplus
extern "C" {
#endif

void handler(_FEEDBACK *,_INT4 *,_INT4 *,_FEEDBACK *);

#ifdef __cplusplus
}
#endif

int main(void) {
    _FEEDBACK fc;
    _ENTRY routine;
    _INT4 token;

    /* set the routine structure to point to the handler */
    /* and use CEEHDLR to register the user handler */

    token = 99;
    routine.address = (_POINTER)&handler;;
    routine.nesting = NULL;
    CEEHDLR(&routine,&token,&fc);

    /* verify that CEEHDLR was successful */
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEEHDLR failed with message number %d\n", fc.tok_msgno);
        exit (2999);
    }

    /* */ 
```
2. Following is an example of a COBOL program that unregisters a user-written condition handler.

```
CBL LIB,QUOTE
*Module/File Name: IGZTHDLU
*************************************************
**                                             **
** CBLHDLU - Call CEEHDLU to unregister a user **
**           condition handler                 **
**                                             **
** In this example, a call is made to CEEHDLU **
** to unregister a user condition handler      **
** previously registered using CEEHDLR.        **
**                                             **
*************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLHDLU.
DATA DIVISION.
WORKING-STORAGE SECTION.
01 ROUTINE                PROCEDURE-POINTER.
01 TOKEN                   PIC S9(9) BINARY.
01 FC.
   02 Condition-Token-Value.
      COPY CEEIGZCT.
         03 Case-1-Condition-ID.
            04 Severity    PIC S9(4) BINARY.
            04 Msg-No      PIC S9(4) BINARY.
            03 Case-2-Condition-ID
                    REDEFINES Case-1-Condition-ID.
            04 Class-Code  PIC S9(4) BINARY.
            04 Cause-Code  PIC S9(4) BINARY.
            03 Case-Sav-Ctl  PIC X.
            03 Facility-ID  PIC XXX.
   02 I-S-Info              PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBLHDLR.
   SET ROUTINE TO ENTRY "HANDLER".
   CALL "CEEHDLR" USING ROUTINE, TOKEN, FC.
   IF NOT CEE000 of FC THEN
      DISPLAY "CEEHDLR failed with msg ",
      Msg-No of FC UPON CONSOLE
      STOP RUN
   ELSE
      DISPLAY "HANDLER REGISTERED"
      END-IF.
* : PARA-CBLHDLU.
   CALL "CEEHDLU" USING ROUTINE, FC.
   IF NOT CEE000 of FC THEN
      DISPLAY "CEEHDLU failed with msg ",
      Msg-No of FC UPON CONSOLE
      STOP RUN
   ELSE
      DISPLAY "HANDLER UNREGISTERED"
      END-IF.
   GOBACK.
END PROGRAM CBLHDLU.
```
3. Following is an example of a COBOL user-written condition handler that is registered by CBLHDLR and unregistered by CBLHDLU.

```
CBL LIB,QUOTE,NOOPT,NODYNAM
*Module/File Name: IGZTHAND
******************************************************************************
**                                             **
** DRVHAND - Drive sample program for COBOL **
** user-written condition handler. **
**                                             **
******************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. DRVHAND.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01 ROUTINE             PROCEDURE-POINTER.
  01 DENOMINATOR         PIC S9(9) BINARY.
  01 NUMERATOR           PIC S9(9) BINARY.
  01 RATIO               PIC S9(9) BINARY.
  01 TOKEN               PIC S9(9) BINARY VALUE 0.
  01 FC.
     02 Condition-Token-Value.
COPY  CEEIGZCT.
     03 Case-1-Condition-ID.
         04 Severity    PIC S9(4) BINARY.
         04 Msg-No      PIC S9(4) BINARY.
     03 Case-2-Condition-ID
       REDEFINES Case-1-Condition-ID.
         04 Class-Code  PIC S9(4) BINARY.
         04 Cause-Code  PIC S9(4) BINARY.
     03 Case-Sev-Ctl    PIC X.
     03 Facility-ID     PIC XXX.
     02 I-S-Info            PIC S9(9) BINARY.
PROCEDURE DIVISION.
REGISTER-HANDLER.
******************************************************************************
** Register handler **
******************************************************************************
SET ROUTINE TO ENTRY "HANDLER".
CALL "CEEHDLR" USING ROUTINE , TOKEN , FC.
IF  NOT CEE000 of FC  THEN
   DISPLAY "CEEHDLR failed with msg 
   Msg-No of FC UPON CONSOLE
END-IF.
RAISE-CONDITION.
******************************************************************************
** Cause a zero-divide condition. **
******************************************************************************
MOVE 0 TO DENOMINATOR.
MOVE 1 TO NUMERATOR.
DIVIDE NUMERATOR BY DENOMINATOR
GIVING RATIO.
DISPLAY "Execution continues following "
"divide-by-zero exception".
UNREGISTER-HANDLER.
******************************************************************************
** Unregister handler **
******************************************************************************
CALL "CEEHDLU" USING ROUTINE, TOKEN, FC.
IF NOT CEE000 of FC THEN
   DISPLAY "CEEHDLU failed with msg 
   Msg-No of FC UPON CONSOLE
END-IF.
STOP RUN.
END PROGRAM DRVHAND.
IDENTIFICATION DIVISION.
PROGRAM-ID. HANDLER.
DATA DIVISION.
WORKING-STORAGE SECTION.
LINKAGE SECTION.
  01 TOKEN               PIC S9(9) BINARY.
  01 RESULT              PIC S9(9) BINARY.
  88 RESUME              VALUE 10.
  01 CURCOND.
```

290  z/OS: Language Environment Programming Reference
CEEISEC—Convert integers to seconds

CEEISEC converts separate binary integers representing year, month, day, hour, minute, second, and millisecond to a number representing the number of seconds since 00:00:00 14 October 1582. Use CEEISEC instead of CEESECS when the input is in numeric format rather than character format.

The inverse of CEEISEC is CEESECI, which converts number of seconds to integer year, month, day, hour, minute, second, and millisecond.

```
    CALL CEEISEC
```

```
    CEEISEC
```

```
    input_year (input)
    A 32-bit binary integer representing the year. The valid range for input_year is 1582 to 9999, inclusive.

    input_month (input)
    A 32-bit binary integer representing the month. The valid range for input_month is 1 to 12.

    input_day (input)
    A 32-bit binary integer representing the day. The valid range for input_day is 1 to 31.

    input_hours (input)
    A 32-bit binary integer representing the hours. The range of valid input_hours is 0 to 23.

    input_minutes (input)
    A 32-bit binary integer representing the minutes. The range of valid input_minutes is 0 to 59.

    input_seconds (input)
    A 32-bit binary integer representing the seconds. The range of valid input_seconds is 0 to 59.
input_milliseconds (input)
A 32-bit binary integer representing milliseconds. The range of valid input_milliseconds is 0 to 999.

output_seconds (output)
A 64-bit double floating-point number representing the number of seconds since 00:00:00 on 14 October 1582, not counting leap seconds. For example, 00:00:01 on 15 October 1582 is second number 86,401 (24*60*60 + 01). The valid range of output_seconds is 86,400 to 265,621,679,999.999 (23:59:59.999 31 December 9999). If any input values are invalid, output_seconds is set to zero. To convert output_seconds to a Lilian day number, divide output_seconds by 86,400 (the number of seconds in a day).

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE2EE</td>
<td>3</td>
<td>2510</td>
<td>The hours value in a call to CEEISEC or CEESECS was not recognized.</td>
</tr>
<tr>
<td>CEE2EF</td>
<td>3</td>
<td>2511</td>
<td>The day parameter passed in a CEEISEC call was invalid for year and month specified.</td>
</tr>
<tr>
<td>CEE2EH</td>
<td>3</td>
<td>2513</td>
<td>The input date passed in a CEEISEC, CEEDAYS, or CEESECS call was not within the supported range.</td>
</tr>
<tr>
<td>CEE2EI</td>
<td>3</td>
<td>2514</td>
<td>The year value passed in a CEEISEC call was not within the supported range.</td>
</tr>
<tr>
<td>CEE2EJ</td>
<td>3</td>
<td>2515</td>
<td>The milliseconds value in a CEEISEC call was not recognized.</td>
</tr>
<tr>
<td>CEE2EK</td>
<td>3</td>
<td>2516</td>
<td>The minutes value in a CEEISEC call was not recognized.</td>
</tr>
<tr>
<td>CEE2EL</td>
<td>3</td>
<td>2517</td>
<td>The month value in a CEEISEC call was not recognized.</td>
</tr>
<tr>
<td>CEE2EN</td>
<td>3</td>
<td>2519</td>
<td>The seconds value in a CEEISEC call was not recognized.</td>
</tr>
</tbody>
</table>

Usage notes
• z/OS UNIX consideration—In multithread applications, CEEISEC affects only the calling thread.

For more information
• For more information about the CEESECS callable service, see “CEESECS—Convert timestamp to seconds” on page 357.
• See “CEESECI—Convert seconds to integers” on page 353 for more information about the CEESECI callable service.

Examples
1. Following is an example of CEEISEC called by C/C++.

```c
/*Module/File Name: EDCISEC */
#include <string.h>
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main(void) {

    _INT4 year, month, day, hours, minutes, seconds,
    _FLOAT8 output;
```
year = 1991;
month = 9;
day = 13;
hours = 4;
minutes = 34;
seconds = 25;
millisecs = 746;
CEEISEC(&year,&month,&day,&hours,&minutes,&seconds,;
&millisecs,&output,&fc);
if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
    printf("CEEISEC failed with message number %d\n", fc.tok_msgno);
    exit(2999);
}
printf("The number of seconds between 00:00:00.00"
" 10/14/1582 and 04:34:25.746 09/13/1991"
" is %.3f\n",output);
}

2. Following is an example of CEEISEC called by COBOL.

CBL LIB,QUOTE
*Module/File Name: IGZTISEC
******************************************************************************
** **
** CBLISEC - Call CEEISEC to convert integers **
** to seconds **
** **
******************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLISEC.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01 YEAR                    PIC S9(9) BINARY.
  01 MONTH                   PIC S9(9) BINARY.
  01 DAYS                    PIC S9(9) BINARY.
  01 HOURS                   PIC S9(9) BINARY.
  01 MINUTES                 PIC S9(9) BINARY.
  01 SECONDS                 PIC S9(9) BINARY.
  01 MILLSEC                 PIC S9(9) BINARY.
  01 OUTSECS                 COMP-2.
  01 FC.
    02 Condition-Token-Value.
      COPY CEEIGZCT.
        03 Case-1-Condition-ID.
          04 Severity    PIC S9(4) BINARY.
          04 Msg-No      PIC S9(4) BINARY.
        03 Case-2-Condition-ID
          REDEFINES Case-1-Condition-ID.
          04 Class-Code  PIC S9(4) BINARY.
          04 Cause-Code  PIC S9(4) BINARY.
        03 Case-Sev-Ctl    PIC X.
        03 Facility-ID     PIC XXX.
    02 I-S-Info            PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBLISEC.
******************************************************************************
** Specify seven binary integers representing **
** the date and time as input to be converted **
** to Lilian seconds **
******************************************************************************
MOVE 2000 TO YEAR.
MOVE 1 TO MONTH.
MOVE 1 TO DAYS.
MOVE 0 TO HOURS.
MOVE 0 TO MINUTES.
** MOVE 0 TO SECONDS.
** MOVE 0 TO MILLSEC.
******************************************************************************
** Call CEEISEC to convert the integers **
** to seconds **
******************************************************************************
CALL "CEEISEC" USING YEAR, MONTH, DAYS,
    HOURS, MINUTES, SECONDS,
    MILLSEC, OUTSECS , FC.
******************************************************************************
** If CEEISEC runs successfully, display result**
***************************************************
IF CEE000 of FC THEN
   DISPLAY MONTH "/" DAYS "/" YEAR
   " at ", HOURS ":", MINUTES ":", SECONDS
   " is equivalent to " OUTSECS " seconds"
ELSE
   DISPLAY "CEEISEC failed with msg ",
   Msg-No of FC UPON CONSOLE
   STOP RUN
END-IF.
GOBACK.

3. Following is an example of CEEISEC called by PL/I.

*PROCESS MACRO;
/*Module/File Name: IBMISEC
***************************************************
/**
/** Function: CEEISEC - Convert integers to seconds
/**
/** In this example, CEEISEC is called to convert integers representing the date and time to the number of seconds since 00:00 14 October 1582.
/**
***************************************************
PLIISEC: PROC OPTIONS(MAIN);
%INCLUDE CEEIBMAW;
%INCLUDE CEEIBMCT;
DCL YEAR REAL FIXED BINARY(31,0);
DCL MONTH REAL FIXED BINARY(31,0);
DCL DAYS REAL FIXED BINARY(31,0);
DCL HOURS REAL FIXED BINARY(31,0);
DCL MINUTES REAL FIXED BINARY(31,0);
DCL SECONDS REAL FIXED BINARY(31,0);
DCL MILLSEC REAL FIXED BINARY(31,0);
DCL OUTSECS REAL FLOAT DECIMAL(16);
DCL 01 FC,                 /* Feedback token */
   03 MsgSev REAL FIXED BINARY(15,0),
   03 MsgNo REAL FIXED BINARY(15,0),
   03 Flags,
   05 Case BIT(2),
   05 Severity BIT(3),
   05 Control BIT(3),
   03 FacID CHAR(3),      /* Facility ID */
   03 ISI /* Instance-Specific Information */
   REAL FIXED BINARY(31,0);
/* Specify integers representing 00:00:00 1 January 2000 */
   YEAR = 2000;
   MONTH = 1;
   DAYS = 1;
   HOURS = 0;
   MINUTES = 0;
   SECONDS = 0;
   MILLSEC = 0;
/* Call CEEISEC to convert integers to Lilian seconds */
CALL CEEISEC ( YEAR, MONTH, DAYS, HOURS, MINUTES, SECONDS, MILLSEC, OUTSECS, FC );
IF FBCHECK( FC, CEE000) THEN DO;
   PUT EDIT( OUTSECS, ' seconds corresponds to ',
      MONTH, ' / ', DAYS, ' / ', YEAR, ' at ', HOURS,
      ':', MINUTES, ':', SECONDS, ' ', MILLSEC )
      (SKIP, F(9), A, 2 (P'99', A), P'9999', A,
      3 (P'99', A), P'999' )
   END;
ELSE DO;
   DISPLAY( 'CEEISEC failed with msg ' || FC.MsgNo )
   STOP;
END;
END PLIISEC;
CEEITOK returns the condition that initially triggered the current condition. The current condition might be different from the initial condition if the initial condition has been promoted by a user-written condition handler.

**i_ctok (output)**
A 12-byte condition token identifying the initial condition in the current active data block being processed.

**fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE35S</td>
<td>1</td>
<td>3260</td>
<td>No condition was active when a call to a condition management routine was made.</td>
</tr>
</tbody>
</table>

**Usage notes**

• **z/OS UNIX considerations**—In multithread applications, CEEITOK affects only the calling thread. CEEITOK returns the initial token for the condition of the thread.

**For more information**

• See “CEENCOD—Construct a condition token” on page 331, for more information about the CEENCOD callable service.

**Examples**

1. Following is an example of CEEITOKC called by C/C++.

```c
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

void handler(_FEEDBACK *,_INT4 *,_INT4 *,_FEEDBACK *);

int main(void) {
    _FEEDBACK fc,condtok;
    _ENTRY routine;
    _INT4 token,qdata;
    ```
Following is an example of CEEITOKC called by COBOL.

```c
void handler(_FEEDBACK *fc, _INT4 *token, _INT4 *result, _FEEDBACK *newfc) {
  _FEEDBACK orig_fc, itok_fc;
  CEEITOK(orig_fc, itok_fc);
  if ( _FBCHECK ( itok_fc, CEE000 ) != 0 ) {
    printf("CEEITOK failed with message number %d\n", itok_fc.tok_msgno);
    exit(2999);
  }
  *result = 10;
}
```
PROCEDURE DIVISION.

REGISTER-HANDLER.

**********************************************************************
** Register handler                                                **
**********************************************************************
** Register handler                                                 **
**********************************************************************

    SET ROUTINE TO ENTRY "CBLITOK".
    CALL "CEEHDLR" USING ROUTINE, TOKEN, FC.
    IF NOT CEE000 of FC THEN
    DISPLAY "CEEHDLR failed with msg "
    Msg-No of FC UPON CONSOLE
    STOP RUN
END-IF.

RAISE-CONDITION.

**********************************************************************
** Cause a zero-divide condition.                                   **
**********************************************************************
** Cause a zero-divide condition.                                   **
**********************************************************************

    MOVE 0 TO DENOMINATOR.
    MOVE 1 TO NUMERATOR.
    DIVIDE NUMERATOR BY DENOMINATOR, GIVING RATIO.

UNREGISTER-HANDLER.

**********************************************************************
** UNRegister handler                                               **
**********************************************************************
** UNRegister handler                                                **
**********************************************************************

    CALL "CEEHDLU" USING ROUTINE, TOKEN, FC.
    IF NOT CEE000 of FC THEN
    DISPLAY "CEEHDLU failed with msg "
    Msg-No of FC UPON CONSOLE
    END-IF.
    STOP RUN.

END PROGRAM DRVITOK.

**********************************************************************
** **
** Function: CEEITOK - Return initial                              **
** condition token                                                  **
** **
**********************************************************************

IDENTIFICATION DIVISION.

PROGRAM-ID. CEEITOK.

DATA DIVISION.

WORKING-STORAGE SECTION.

01 ITOKEN.
    02 Condition-Token-Value.
    COPY CEEIGZCT.
        03 Case-1-Condition-ID.
            04 Severity PIC S9(4) BINARY.
            04 Msg-No PIC S9(4) BINARY.
        03 Case-2-Condition-ID
            REDEFINES Case-1-Condition-ID.
            04 Class-Code PIC S9(4) BINARY.
            04 Cause-Code PIC S9(4) BINARY.
        03 Case-Sev-Ctl PIC X.
        03 Facility-ID PIC XXX.
    02 I-S-Info PIC S9(9) BINARY.

01 FC.
    02 Condition-Token-Value.
    COPY CEEIGZCT.
        03 Case-1-Condition-ID.
            04 Severity PIC S9(4) BINARY.
            04 Msg-No PIC S9(4) BINARY.
        03 Case-2-Condition-ID
            REDEFINES Case-1-Condition-ID.
            04 Class-Code PIC S9(4) BINARY.
            04 Cause-Code PIC S9(4) BINARY.
        03 Case-Sev-Ctl PIC X.
        03 Facility-ID PIC XXX.
    02 I-S-Info PIC S9(9) BINARY.

LINKAGE SECTION.
Following is an example of CEEITOKC called by PL/I.

```
*PROCESS OPT(0), MACRO;
/* Module/File Name: IBMITOK */
/****************************************************/
/**                                                **
/** Function: CEEITOK - example of CEEITOK **
/**       invoked from PL/I ON-unit **
/**                                                */
****************************************************/
IBMITOK:  PROCEDURE OPTIONS(MAIN);
%INCLUDE CEEIBMAW;
%INCLUDE CEEIBMCT;
DECLARE
  01 ITOKEN,                   /* Feedback token */
     REAL FIXED BINARY(15,0),
  03 MsgSev    REAL FIXED BINARY(15,0),
  03 MsgNo     REAL FIXED BINARY(15,0),
  03 Flags,                         
    05 Case     BIT(2),
    05 Severity BIT(3),
    05 Control  BIT(3),
  03 FacID     CHAR(3),        /* Facility ID */
  03 ISI     /* Instance-Specific Information */
     REAL FIXED BINARY(31,0),
  01 FC,                       /* Feedback token */
  03 MsgSev    REAL FIXED BINARY(15,0),
  03 MsgNo     REAL FIXED BINARY(15,0),
  03 Flags,                         
    05 Case     BIT(2),
```
CEELCNV—Query locale numeric conventions

CEELCNV, which calls the C function localeconv(), queries the numeric formatting information from the current locale and sets the components of a structure with values pertaining to the LC_NUMERIC and LC_MONETARY categories. It sets the components of an object of the type NM_STRUCT with the values appropriate for the formatting of the numeric quantities (monetary and otherwise) according to the rules of the current locale.

CEELCNV is sensitive to the locales set by setlocale() or CEESETL, not to the Language Environment settings from COUNTRY or CEE3CTY.

version

This parameter points to a user supplied VERSION_INFO structure, in which the first four bytes contain the callable service version number.

Requirement: If the parameter does not point to a user supplied VERSION_INFO structure, it must be omitted.

If the parameter points to a VERSION_INFO containing version number 2, CEELCNV returns a num_and_mon structure with the international monetary string formatting elements added for ISO/IEC 9899:1999 (C99). This corresponds to the current C language lconv structure. If the parameter is omitted, CEELCNV returns the structure format used before C99. For information about how to code this parameter, see “Invoking callable services” on page 104.

num_and_mon (output)

Points to the numeric and monetary structure that is filled in by this service. If the service fails, the contents of the structure are undefined. num_and_mon has the following structure:

NM_STRUCT

A halfword length-prefixed character string (VSTRING). A pointer to the filled-in structure NM_STRUCT is returned. The structure pointed to by the return value should not be modified by the program but can be overridden by subsequent calls to CEELCNV. In addition, calls to CEESETL with the LC_ALL, LC_MONETARY or LC_NUMERIC categories can cause subsequent calls to CEELCNV to return different values based on the selection of the locale.

The members of the structure with the type VSTRING are strings, any of which (except decimal_point) can point to an empty string, to indicate that the value is not available in the current locale or is of zero length. The members with type VINT are non-negative numbers, any of which can be CHAR_MAX to indicate that the value is not available in the current locale. The members include the following:
VSTRING decimal_point
A halfword length-prefixed character string (VSTRING) of 22 bytes that is the decimal-point character used to format non-monetary quantities.

VSTRING thousands_sep
A halfword length-prefixed character string (VSTRING) of 22 bytes that is the character used to separate groups of digits to the left of the decimal point in formatted non-monetary quantities.

VSTRING grouping
A halfword length-prefixed character string (VSTRING) of 22 bytes whose elements indicate the size of each group of digits in formatted non-monetary quantities.

VSTRING int_curr_symbol
A halfword length-prefixed character string (VSTRING) of 22 bytes that is the international currency symbol applicable to the current locale, left justified within a four-character space-padded field.

VSTRING currency_symbol
A halfword length-prefixed character string (VSTRING) of 22 bytes that is the local currency symbol applicable to the current locale.

VSTRING mon_decimal_point
A halfword length-prefixed character string (VSTRING) of 22 bytes that is the decimal point character used to format monetary quantities.

VSTRING mon_thousands_sep
A halfword length-prefixed character string (VSTRING) of 22 bytes that is the separator for groups of digits to the left of the decimal point in formatted monetary quantities.

VSTRING mon_grouping
A halfword length-prefixed character string (VSTRING) of 22 bytes whose elements indicate the size of each group of digits in formatted monetary quantities.

VSTRING positive_sign
A halfword length-prefixed character string (VSTRING) of 22 bytes that indicates a non-negative-formatted monetary quantity.

VSTRING negative_sign
A halfword length-prefixed character string (VSTRING) of 22 bytes used to indicate a negative-formatted monetary quantity.

VINT int_frac_digits
A 1-byte integer that is the number of fractional digits (those to the right of the decimal point) to be displayed in an internationally-formatted monetary quantity.

VINT frac_digits
A 1-byte integer that is the number of fractional digits (those to the right of the decimal point) to be displayed in a formatted monetary quantity.

VINT p_cs_precedes
A 1-byte integer that is set to 1 if the currency_symbol precedes the value for a non-negative-formatted monetary quantity. It is set to 0 if it follows.

VINT p_sep_by_space
A 1-byte integer that is set to 1 if the currency_symbol is separated by a space from the value for a non-negative-formatted monetary quantity. It is set to 0 if it is not separated.

VINT n_cs_precedes
A 1-byte integer that is set to 1 if the currency_symbol precedes the value for a negative-formatted monetary quantity. It is set to 0 if it follows.

VINT n_sep_by_space
A 1-byte integer that is set to 1 if the currency_symbol is separated by a space from the value for a negative-formatted monetary quantity. It is set to 0 is it is not separated.
VINT p_sign_posn
A 1-byte integer that is set to a value indicating the positioning of the positive_sign for non-negative-formatted monetary quantity.

VINT n_sign_posn
A 1-byte integer that is set to a value indicating the position of the negative_sign for negative-formatted monetary quantity.

VSTRING left_parenthesis
A halfword length-prefixed character string (VSTRING) of 22 bytes that is the used to denote a negative monetary quantity.

VSTRING right_parenthesis
A halfword length-prefixed character string (VSTRING) of 22 bytes that is the used to denote a negative monetary quantity.

VSTRING debit_sign
A halfword length-prefixed character string (VSTRING) of 22 bytes that is the debit sign character in monetary formats.

VSTRING credit_sign
A halfword length-prefixed character string (VSTRING) of 22 bytes that is the credit sign character in monetary formats.

VINT int_p_cs_precedes
A 1-byte integer that is set to 1 if the currency_symbol precedes the value for a non-negative-formatted international monetary quantity. It is set to 0 if it follows.

VINT int_p_sep_by_space
A 1-byte integer that is set to 1 if the currency_symbol is separated by a space from the value for a non-negative-formatted international monetary quantity. It is set to 0 if it is not separated.

VINT int_n_cs_precedes
A 1-byte integer that is set to 1 if the currency_symbol precedes the value for a negative-formatted international monetary quantity. It is set to 0 if it follows.

VINT int_n_sep_by_space
A 1-byte integer that is set to 1 if the currency_symbol is separated by a space from the value for a negative-formatted international monetary quantity. It is set to 0 is it is not separated.

VINT int_p_sign_posn
A 1-byte integer that is set to a value indicating the positioning of the positive_sign for non-negative-formatted international monetary quantity.

VINT n_sign_posn
A 1-byte integer that is set to a value indicating the position of the negative_sign for negative-formatted international monetary quantity.

fc (output/optional)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE3T1</td>
<td>3</td>
<td>4001</td>
<td>General Failure: Service could not be completed.</td>
</tr>
<tr>
<td>CEE3VN</td>
<td>3</td>
<td>4087</td>
<td>Input Error: The version_info control block contains a version number that is not valid.</td>
</tr>
</tbody>
</table>

Usage notes
- PL/I MTF consideration—CEELCNV is not supported in PL/I MTF applications.
This callable service uses the C/C++ runtime library. The C/C++ library must be installed and accessible even when this service is called from a non-C program.

CEELCNV does not return all numeric conventions.

CHAR_MAX determines when no further grouping is to be performed. The elements of grouping and mon_grouping are interpreted according to the following CHAR_MAX settings:

- 0 specifies that the previous element is to be repeatedly used for the remainder of the digits. Indicates that no further grouping is to be performed.
- Any other value represents the number of digits comprising the current group. The next element is examined to determine the size of the next group of digits to the left of the current group.

The value of p_sign_posn and n_sign_posn is interpreted according to the following:

0
Parentheses surround the quantity and currency_symbol.

1
The sign string precedes the quantity and currency_symbol.

2
The sign string follows the quantity and currency_symbol.

3
The sign string immediately precedes the currency_symbol.

4
The sign string immediately follows the currency_symbol.

For more information

- See “CEEQRYL—Query active locale environment” on page 342 for a description of LC_NUMERIC and LC_MONETARY catagories.
- See “CEESETL—Set locale operating environment” on page 362 for details on the CEESETL callable service.

Examples

1. Following is an example of CEELCNV called by COBOL.

```cobol
CBL LIB,QUOTE
*Module/File Name: IGZTLCNV
*****************************************************************************
** Example for callable service CEELCNV **
** Function: Retrieve numeric and monetary **
** format for default locale and **
** print an item. **
** **
** Set locale to France, retrieve **
** structure, and print an item. **
** Valid only for COBOL for MVS & VM Release 2 **
** or later. **
*****************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. MAINLCNV.
DATA DIVISION.
WORKING-STORAGE SECTION.
*****************************************************************************
** Use Locale NM-Struct for CEELCNV calls **
*****************************************************************************
COPY CEEIGZN2M.
*
PROCEDURE DIVISION.
*****************************************************************************
** Subroutine needed for addressing **
*****************************************************************************
CALL "COBLCNV" USING NM-Struct.
STOP RUN.
*
IDENTIFICATION DIVISION.
PROGRAM-ID. COBLCNV.
DATA DIVISION.
WORKING-STORAGE SECTION.
```
** Use Locale category constants **
COPY CEEIGZLC.

** FC. **
COPY CEEIGZCT.

** Case-1-Condition-ID. **
04 Severity PIC S9(4) BINARY.
04 Msg-No PIC S9(4) BINARY.

** Case-2-Condition-ID **
REDEFINES Case-1-Condition-ID.
04 Class-Code PIC S9(4) BINARY.
04 Cause-Code PIC S9(4) BINARY.
03 Case-Sev-Ctl PIC X.
03 Facility-ID PIC XXX.

** I-S-Info **
PIC S9(9) BINARY.

** Use Locale NM-Struct for CEELCNV calls **
COPY CEEIZN2M.

** Call CEELCNV to retrieve values for locale**
CALL "CEELCNV" USING OMITTED,
ADDRESS OF NM-Struct, FC.

** Check feedback code and display result **
IF Severity = 0 THEN
DISPLAY "Default decimal point is "
DECIMAL-PT-String(1:DECIMAL-PT-Length)
ELSE
DISPLAY "Call to CEELCNV failed. " Msg-No
END-IF.

** Set up locale for France **
MOVE 54 TO LN-Length.
MOVE "Fr_FR" TO LN-String (1:LN-Length).

** Call CEESETL to set monetary locale **
CALL "CEESETL" USING Locale-Name,
LC-MONETARY, FC.

** Call CEESETL to set numeric locale **
CALL "CEESETL" USING Locale-Name,
LC-NUMERIC, FC.

** Check feedback code and call CEELCNV again **
** using version 2 to get at C99 mapping. **
IF Severity = 0
MOVE 2 TO Version
set PTR1 to address of Version-Info
CALL "CEELCNV" USING PTR1,
ADDRESS OF NM-Struct, FC
ELSE
DISPLAY "French decimal point is "
DECIMAL-PT-String(1:DECIMAL-PT-Length)
END-IF
ELSE
DISPLAY "Call to CEESETL failed. " Msg-No
END-IF.
EXIT PROGRAM.
END PROGRAM COBLCNV.
END PROGRAM MAINLCNV.

2. Following is an example of CEELCNV called by PL/I.

```pli
*PROCESS MACRO;
/*Module/File Name: IBMLCNV                         */
/****************************************************/
/* Example for callable service CEELCNV             */
/* Function: Retrieve numeric and monetary format   */
/*  structure for default locale and print an item. */
/*  Set locale to France, retrieve structure and    */
/*  print an item.                                   */
/****************************************************/
PLILCNV: PROC OPTIONS(MAIN);
%INCLUDE CEEIBMAW; /* ENTRY defs, macro defs        */
%INCLUDE CEEIBMCT; /* FBCHECK macro, FB constants   */
%INCLUDE CEEIBMLC; /* Locale category constants     */
%INCLUDE CEEIBMN2M; /* NM_STRUCT for CEELCNV calls */
/* use explicit pointer for local NM_STRUCT struct  */
DCL NUM_AND_MON POINTER INIT(ADDR(NM_STRUCT));
/* Point to local version_info struct and initialize*/
/* VERSION TO 2 TO USE C99 MAPPING OF NM_STRUCT */
DCL VERSN POINTER INIT(ADDR(version_info));
VERSION_INFO.VERSION = 2;
/* CEESETL service call arguments */
DCL LOCALE_NAME CHAR(256) VARYING;
DCL 01 FC,                      /* Feedback token */
03 MsgSev REAL FIXED BINARY(15,0),
03 MsgNo REAL FIXED BINARY(15,0),
03 Flags,
  05 Case BIT(2),
  05 Severity BIT(3),
  05 Control BIT(3),
03 FacID CHAR(3),    /* Facility ID */
03 ISI /* Instance-Specific Information */
REAL FIXED BINARY(31,0);
/* retrieve structure for default locale */
CALL CEELCNV ( *, NUM_AND_MON, FC );
PUT SKIP LIST('Default DECIMAL_POINT is ',
  NM_STRUCT.DECIMAL_POINT);
/* set locale for France */
LOCALSET( LOCALE_NAME CHAR(256) VARYING,
  LOCALE_NAME = 'Fr_FRFRAN';
/* use LC_NUMERIC category const from CEEIBMLC */
CALL CEESETL ( LOCALE_NAME, LC_NUMERIC, FC );
/* use LC_MONETARY category const from CEEIBMLC */
CALL CEESETL ( LOCALE_NAME, LC_MONETARY, FC );
/* FBCHECK macro used (defined in CEEIBMCT) */
IF FBCHECK( FC, CEE000 ) THEN
  DO;
    /* retrieve active NM_STRUCT, France Locale */
    CALL CEELCNV ( *VERSN, NUM_AND_MON, FC );
    PUT SKIP LIST('French DECIMAL_POINT is ',
      NM_STRUCT.DECIMAL_POINT);
  END;
END PLILCNV;
```

**CEELOCT—Get current local date or time**

CEELOCT returns the current local date or time in three formats:
- Lilian date (the number of days since 14 October 1582)
- Lilian seconds (the number of seconds since 00:00:00 14 October 1582)
- Gregorian character string (in the form YYYYMMDDHHMISS999)
These values are compatible with other Language Environment date and time services, and with existing language intrinsic functions.

CEELOCT performs the same function as calling the CEEGMT, CEEGTO, and CEEDATM date and time services separately. CEELOCT, however, performs the same services with much greater speed.

The character value returned by CEELOCT is designed to match that produced by existing language intrinsic functions. The numeric values returned can be used to simplify date calculations.

**output_Lilian (output)**
A 32-bit binary integer representing the current local date in the Lilian format, that is, day 1 equals 15 October 1582, day 148,887 equals 4 June 1990. If the local time is not available from the system, output_Lilian is set to 0 and CEELOCT terminates with a non-CEE000 symbolic feedback code.

**output_seconds (output)**
A 64-bit double-floating point number representing the current local date and time as the number of seconds since 00:00:00 on 14 October 1582, not counting leap seconds. For example, 00:00:01 on 15 October 1582 is second number 86,401 (24*60*60 + 01). 19:00:01.078 on 4 June 1990 is second number 12,863,905,201.078. If the local time is not available from the system, output_seconds is set to 0 and CEELOCT terminates with a non-CEE000 symbolic feedback code.

**output_Gregorian (output)**
A 17-byte fixed-length character string in the form YYYYMMDDHHMISS999 representing local year, month, day, hour, minute, second, and millisecond. If the format of output_Gregorian does not meet your needs, you can use the CEEDATM callable service to convert output_seconds to another format.

**fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE2F3</td>
<td>3</td>
<td>2531</td>
<td>The local time was not available from the system.</td>
</tr>
</tbody>
</table>

**Usage notes**

- z/OS consideration: The MVS command SET DATE will not affect the value that is returned by CEELOCT.
- CICS consideration: CEELOCT does not use the OS TIME macro.
- z/OS UNIX consideration: If the MVS command SET DATE is issued, the output value returned by CEELOCT might not represent an accurate date or time.

**For more information**

- See “CEEDATM—Convert seconds to character timestamp” on page 210 for more information about the CEEDATM callable service.

**Examples**

1. Following is an example of CEELOCT called by C/C++.

```c
/*Module/File Name: EDCL0C   */
#include <string.h>
#include <stdio.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>
```
int main(void) {
    _FEEDBACK fc;
    _INT4     lil_date;
    _FLOAT8   local_date;
    _CHAR17   gregorian_date;

    CEELOCT(&lil_date,&local_date,gregorian_date,&fc);
    if (_FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEELOCT failed with message number %d\n", fc.tok_msgno);
        exit(2999);
    }

    printf("The current date is YYYYMMDDHHMISS999\n");
    printf("                    %.17s\n",gregorian_date);
}

2. Following is an example of CEELOCT called by COBOL.

CBL LIB,QUOTE
*Module/File Name: IGZTOCT
************************************************
**                                            **
** CBLLOCT - Call CEELOCT to get current      **
**           local time                       **
**                                            **
** In this example, a call is made to CEELOCT **
** to return the current local time in Lilian **
** days (the number of days since 14 October **
** 1582), Lilian seconds (the number of **
** seconds since 00:00:00 14 October 1582), **
** and a Gregorian string (in the form **
** YYYYMMDDMISS999). The Gregorian character **
** string is then displayed.                  **
**                                            **
************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLLOCT.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01  LILIAN                  PIC S9(9) BINARY.
  01  SECONDS                 COMP-2.
  01  GREGORN                 PIC X(17).
  01  FC.
    02  Condition-Token-Value.
        COPY  CEEIGZCT.
          03  Case-1-Condition-ID.
            04  Severity    PIC S9(4) BINARY.
            04  Msg-No      PIC S9(4) BINARY.
          03  Case-2-Condition-ID
              REDEFINES Case-1-Condition-ID.
            04  Class-Code  PIC S9(4) BINARY.
            04  Cause-Code  PIC S9(4) BINARY.
          03  Case-Sev-Ctl    PIC X.
          03  Facility-ID     PIC XXX.
    02  I-S-Info            PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBLLOCT.
CALL "CEELOCT" USING LILIAN, SECONDS, GREGORN, FC.
************************************************
** If CEELOCT runs successfully, display **
** Gregorian character string                 **
************************************************
IF CEE000 of FC THEN
    DISPLAY "Local Time is " GREGORN
ELSE
    DISPLAY "CEELOCT failed with msg ",
            Msg-No of FC UPON CONSOLE
    STOP RUN
END-IF.
GOBACK.
3. Following is an example of CEELOCT called by PL/I.

```pli
*PROCESS MACRO;
/* Module/File Name: IBMLOCT */
/*****************************/
/**                     **/
/** Function: CEELOCT - get current local time **/
/**                     **/
/** In this example, CEELOCT is called to return **/
/** the current local time as a Lilian date, **/
/** Lilian timestamp, and Gregorian character **/
/** string. **/
/**                     **/
/*****************************/
PLILOCT: PROC OPTIONS(MAIN);
%INCLUDE  CEEIBMAW;
%INCLUDE  CEEIBMCT;
DCL LILIAN   REAL FIXED BINARY(31,0);
DCL SECONDS  REAL FLOAT DECIMAL(16);
DCL GREGORN  CHARACTER ( 17 );
DCL 01 FC,                     /* Feedback token */
03 MsgSev    REAL FIXED BINARY(15,0),
03 MsgNo     REAL FIXED BINARY(15,0),
03 Flags,    /* Flags */
05 Case      BIT(2),
05 Severity  BIT(3),
05 Control   BIT(3),
03 FacID     CHAR(3),      /* Facility ID */
03 ISI       /* Instance-Specific Information */
            REAL FIXED BINARY(31,0);
/* Call CEELOCT to return local time in 3 formats */
CALL CEELOCT ( LILIAN, SECONDS, GREGORN, FC );
/* If CEELOCT ran successfully, print Gregorian */
/* result */
IF  FBCHECK( FC, CEE000)  THEN  DO;
    PUT SKIP LIST( 'The local date and time are ' || GREGORN || '.' );
END;
ELSE  DO;
    DISPLAY( 'CEELOCT failed with msg ' || FC.MsgNo );
    STOP;
END;
END PLILOCT;
```

### CEEMGET—Get a message

CEEMGET retrieves, formats, and stores in a passed message area a message corresponding to a condition token that is either returned from a callable service or passed to a user-written condition handler. The caller can later retrieve the message to change or to write as output.

```
CEEMGET(cond_token, message_area, msg_ptr, fc)
```

**cond_token (input/output)**
A 12-byte condition token received or returned as the result of a Language Environment callable service.

**message_area (input/output)**
A fixed-length 80-character string (VSTRING), where the message is placed. The message is left-justified and padded on the right with blanks.
CEEMGET

**msg_ptr (input/output)**
A 4-byte binary integer returned to the calling routine. The `msg_ptr` should be passed a value of zero on the initial call to CEEMGET. If a message is too large to be contained in the `message_area`, `msg_ptr` (containing the index) is returned into the message. This index is used on subsequent calls to CEEMGET to retrieve the remaining portion of the message. A feedback code is also returned, indicating that the message was truncated. When the entire message is returned, `msg_ptr` is zero.

The `msg_ptr` contains different results based on the length of the message:

- If a message contains fewer than 80 characters, the entire message is returned on the first call. `msg_ptr` contains 0.
- If a message contains exactly 80 characters, the entire message is returned on the first call. `msg_ptr` contains 0.
- If the message is too long, CEEMGET splits it into segments. The `msg_ptr` does not contain the cumulative index for the entire message returned so far, but contains only the index into the segment that was just returned. It is up to the user of CEEMGET to maintain the cumulative count if needed. When a message is too long, the following can occur:
  - If a message contains more than 80 characters and at least one blank is contained in the first 80 characters, the string up to and including the last blank is returned on the first call.
  - If the 80th character is non-blank (even if the 81st character is a blank), `msg_ptr` contains the index of the last blank (something less than 80), and the next call starts with the next character.
  - If the 80th character is a blank, `msg_ptr` contains 80 and the next call starts with the 81st character, blank or non-blank.
  - If a message contains more than 80 characters and at least the first 80 are all nonblank, the first 80 are returned and the next call does not add any blanks and starts with the 81st character. `msg_ptr` contains 80.

**fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE036</td>
<td>3</td>
<td>0102</td>
<td>An unrecognized condition token was passed to routine and could not be used.</td>
</tr>
<tr>
<td>CEE0E2</td>
<td>3</td>
<td>0450</td>
<td>The message inserts for the condition token with message number <code>message-number</code> and facility ID <code>facility-id</code> could not be located.</td>
</tr>
<tr>
<td>CEE0E6</td>
<td>3</td>
<td>0454</td>
<td>The message number <code>message-number</code> could not be found for facility ID <code>facility-id</code>.</td>
</tr>
<tr>
<td>CEE0E7</td>
<td>1</td>
<td>0455</td>
<td>The message with message number <code>message-number</code> and facility ID <code>facility-id</code> was truncated.</td>
</tr>
<tr>
<td>CEE0EA</td>
<td>3</td>
<td>0458</td>
<td>The message repository <code>repository-name</code> could not be located.</td>
</tr>
</tbody>
</table>

**Usage notes**

- z/OS UNIX considerations—In multithread applications, CEEMGET affects only the calling thread. However, CEEMGET uses the NATLANG value of the enclave. Any subsequent calls to CEEMGET, for a given condition, use the NATLANG value in effect at the time of the first call.
For more information

- See “CEENCOD—Construct a condition token” on page 331 for a description of the 12-byte condition token constructed by the CEENCOD callable service.

Examples

1. Following is an example of CEEMGET called by C/C++.

```c
/* Module/File Name: EDCMGET */
#include <string.h>
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main(void) {
    _VSTRING message;
    _INT4 dest,msgindx;
    _INT2 c_1,c_2,cond_case,sev,control;
    _CHAR3 facid;
    _INT4 isi;
    _CHAR80 msgarea;
    _FEEDBACK fc,token;

    /* construct a token for CEE message 2523 */
    c_1 = 1;
    c_2 = 2523;
    cond_case = 1;
    sev = 1;
    control = 1;
    memcpy(facid,"CEE",3);
    isi = 0;
    CEENCOD(&c_1,&c_2,&cond_case,&sev,&control,;
            facid,&isi,&token,&fc);

    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEENCOD failed with message number %d\n", fc.tok_msgno);
        exit(2999);
    }

    msgindx = 0;
    memset(msgarea,' ',79); /* initialize the message area */
    msgarea_80" = '\0';
    /* use CEEMGET until all the message has been */
    /* retrieved */
    /* msgindx will be zero when all the message has */
    /* been retrieved */
    do { 
        CEEMGET(&token,msgarea,&msgindx,&fc);
        if ( fc.tok_sev > 1 ) {
            printf("CEEMGET failed with message number %d\n", fc.tok_msgno);
            exit(2999);
        }
        /* put out the message using CEEMOUT */
        memcpy(message.string,msgarea,80);
        message.length = 80;
        dest = 2;
        CEEMOUT(&message,&dest,&fc);

        if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
            printf("CEEMOUT failed with message number %d\n", fc.tok_msgno);
            exit(2999);
        }
    } while (msgindx != 0);
}
```
2. Following is an example of CEEMGET called by COBOL.

```cobol
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLMGET.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01  MSGBUF                PIC X(80).
  01  MSGPTR                PIC S9(9) BINARY.
  01  SEV                   PIC S9(4) BINARY.
  01  MSGNO                 PIC S9(4) BINARY.
  01  CASE                  PIC S9(4) BINARY.
  01  SEV2                  PIC S9(4) BINARY.
  01  CNTRL                 PIC S9(4) BINARY.
  01  FACID                 PIC X(3).
  01  ISINFO                PIC S9(9) BINARY.
  01  NEWTOK.
     02  Condition-Token-Value.
        COPY  CEEIGZCT.
           03  Case-1-Condition-ID.
             04  Severity  PIC S9(4) BINARY.
             04  Msg-No    PIC S9(4) BINARY.
             03  Case-2-Condition-ID
                REDEFINES Case-1-Condition-ID.
                04  Class-Code PIC S9(4) BINARY.
                04  Cause-Code PIC S9(4) BINARY.
             03  Case-Sev-Ctl    PIC X.
                03  Facility-ID     PIC XXX.
             02  I-S-Info            PIC S9(9) BINARY.
  01  FC.
     02  Condition-Token-Value.
        COPY  CEEIGZCT.
           03  Case-1-Condition-ID.
             04  Severity  PIC S9(4) BINARY.
             04  Msg-No    PIC S9(4) BINARY.
             03  Case-2-Condition-ID
                REDEFINES Case-1-Condition-ID.
                04  Class-Code PIC S9(4) BINARY.
                04  Cause-Code PIC S9(4) BINARY.
             03  Case-Sev-Ctl    PIC X.
                03  Facility-ID     PIC XXX.
             02  I-S-Info            PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBLMGET.

**** Give contok value of ****
** sev = 0, msgno = 1 facid = CEE **
MOVE 0 TO SEV.
MOVE 1 TO MSGNO.
MOVE 1 TO CASE.
MOVE 0 TO SEV2.
MOVE 1 TO CNTRL.
MOVE "CEE" TO FACID.
MOVE 0 TO ISINFO.

CALL "CEENCOD" USING SEV, MSGNO, CASE,
     SEV2, CNTRL, FACID,
     ISINFO, NEWTOK, FC.
IF NOT CEE000 of FC THEN
  DISPLAY "CEENCOD failed with msg "
  Msg-No of FC UPON CONSOLE
  STOP RUN
END-IF.

**** Always pass 0 in MSGPTR on the initial ****
```
** call to CEEMGET. If the message is too **
** long to be returned in a single call, **
** MSGPTR will be returned containing an **
** index to the message that can be used on **
** subsequent calls to CEEMGET. **
*************************************************
MOVE 0 TO MSGPTR.
*************************************************
** Call CEEMGET to get the message associated **
** with the condition token **
*************************************************
CALL "CEEMGET" USING NEWTOK, MSGBUF,
MSGPTR , FC.
IF NOT CEE000 of FC THEN
  DISPLAY "CEEMGET failed with msg "
  Msg-No of FC UPON CONSOLE
  STOP RUN
ELSE
  DISPLAY "The message is: " MSGBUF
END-IF.
GOBACK.

3. Following is an example of CEEMGET called by PL/I.

*PROCESS MACRO;
/* Module/FileName: IBMMGET                        */
/**                                                **
/**Function       : CEEMGET - Get a Message        **
/**                                                **
/****************************************************/
PLIMGET: PROC OPTIONS(MAIN);
  %INCLUDE  CEEIBMAW;
  %INCLUDE  CEEIBMCT;
  DCL 01 CONTOK,                 /* Feedback token */
       03 MsgSev   REAL FIXED BINARY(15,0),
       03 MsgNo   REAL FIXED BINARY(15,0),
       03 Flags,   05 Case      BIT(2),
                   05 Severity  BIT(3),
                   05 Control   BIT(3),
       03 FacID  /* Facility ID */
             CHAR(3),      /* Facility ID */
       03 ISI   /* Instance-Specific Information */
             REAL FIXED BINARY(31,0);
  DCL 01 FC,                     /* Feedback token */
       03 MsgSev   REAL FIXED BINARY(15,0),
       03 MsgNo   REAL FIXED BINARY(15,0),
       03 Flags,   05 Case      BIT(2),
                   05 Severity  BIT(3),
                   05 Control   BIT(3),
       03 FacID  /* Facility ID */
             CHAR(3),      /* Facility ID */
       03 ISI   /* Instance-Specific Information */
             REAL FIXED BINARY(31,0);
  DCL MSGBUF      CHAR(80);
  DCL MSGPTR      REAL FIXED BINARY(31,0);
  /* Give CONTOK value of condition CEE001 */
  ADDR( CONTOK ) -> CEEIBMCT = CEE001;
  MSGPTR = 0;
  /* Call CEEMGET to retrieve msg corresponding */
  /* to condition token */
  CALL CEEMGET ( CONTOK, MSGBUF, MSGPTR, FC );
  IF FBCHECK( FC, CEE000) THEN DO;
    PUT SKIP LIST( 'Message text for message number'
                   || CONTOK.MsgNo || ' is "'|| MSGBUF || '"');
  END;
  ELSE DO;
    DISPLAY ( 'CEEMGET failed with msg ' || FC.MsgNo );
    STOP;
  END;
END PLIMGET;
CEEMOUT—Dispatch a message

CEEMOUT dispatches a user-defined message string to the message file.

**message_string (input)**
A halfword-prefixed printable character string containing the message. DBCS characters must be enclosed within shift-out (byte X'0F') shift-in (X'0E') characters. Insert data cannot be placed in the message with CEEMOUT. The halfword-prefixed message string (input) must contain only printable characters. For length greater than zero, unpredictable results will occur if the byte following the halfword prefix is X'00'.

**destination_code (input)**
A 4-byte binary integer. The only accepted value for destination_code is 2. Under systems other than CICS, Language Environment writes the message to the ddname of the file specified in the MSGFILE runtime option. Under CICS, the message is written to a transient data queue named CESE.

**fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE0E3</td>
<td>3</td>
<td>0451</td>
<td>An invalid destination code destination-code was passed to routine routine-name.</td>
</tr>
<tr>
<td>CEE0E9</td>
<td>3</td>
<td>0457</td>
<td>The message file destination ddname could not be located.</td>
</tr>
</tbody>
</table>

**Usage notes**

- z/OS UNIX considerations—In multithread applications, CEEMOUT affects only the calling thread. When multiple threads write to the message file, the output is interwoven by line. To group lines of output, serialize MSGFILE access (by using a mutex, for example).
- If the message file is defined with an LRECL greater than 256, and the input to CEEMOUT is greater than 256 bytes, the output results in multiple records. The first 256 bytes of each record contains output data. The remaining bytes of each record, up to the LRECL size, might contain unpredictable data.

**For more information**
- See “MSGFILE” on page 48 for more information about the MSGFILE runtime option.
- See z/OS Language Environment Programming Guide for more information about CESE.

**Examples**

1. Following is an example of CEEMOUT called by C/C++.

```c
/*Module/File Name: EDCMOUT */
#include <string.h>
#include <stdio.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>
```
int main(void) {
    _VSTRING message;
    _INT4 dest;
    _FEEDBACK fc;
    
    strcpy(message.string,"This is a test message");
    message.length = strlen(message.string);
    dest = 2;
    CEEMOUT($message,$dest,&fc);
    *
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEEMOUT failed with message number %d\n", fc.tok_msgno);
        exit(2999);
    }
    /*
     */
}

2. Following is an example of CEEMOUT called by COBOL.

CBL LIB,QUOTE
*Module/File Name: IGZTMOUT
*******************************************************************************
** CBLMOUT - Call CEEMOUT to dispatch a msg.  **
** In this example, a call is made to CEEMOUT **
** to dispatch a user-defined message string **
** to the ddname specified defaulted in the **
** MSGFILE runtime option. **
*******************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLMOUT.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01 MSGSTR.
     02 Vstring-length PIC S9(4) BINARY.
     02 Vstring-text.
        03 Vstring-char PIC X,
           OCCURS 0 TO 256 TIMES
           DEPENDING ON Vstring-length
           of MSGSTR.
  01 DESTIN
     01 FC.
        02 Condition-Token-Value.
           COPY CEEIGZCT.
        03 Case-1-Condition-ID.
           04 Severity PIC S9(4) BINARY.
           04 Msg-No PIC S9(4) BINARY.
        03 Case-2-Condition-ID
           REDEFINES Case-1-Condition-ID.
           04 Class-Code PIC S9(4) BINARY.
           04 Cause-Code PIC S9(4) BINARY.
        03 Case-Sev-Ctl PIC X.
        03 Facility-ID PIC XXX.
        02 I-S-Info PIC S9(4) BINARY.
PROCEDURE DIVISION.
PARA-CBLMOUT.
*******************************************************************************
** Create message string and specify length **
*******************************************************************************
    MOVE 25 TO Vstring-length of MSGSTR.
    MOVE "CEEMOUT ran successfully"
         TO Vstring-text of MSGSTR.
*******************************************************************************
** Specify 2 to send the message to the ddname **
** specified or defaulted in the MSGFILE **
** runtime option. **
*******************************************************************************
    MOVE 2 TO DESTIN.
    CALL "CEEMOUT" USING MSGSTR, DESTIN, FC.
    IF NOT CEE000 of FC THEN
        DISPLAY "CEEMOUT failed with msg ";
        Msg-No of FC UPON CONSOLE
        STOP RUN
    END-IF.
    GOBACK.
CEEMRCE

3. Following is an example of CEEMOUT called by PL/I.
*PROCESS MACRO;
/* Module/File Name: IBMMOUT
*/
/****************************************************/
/** Function: CEEMOUT - Dispatch a message
**/
/**
**/
/** In this example, CEEMOUT is called to dispatch **/
/** a user-defined message string to the ddname
**/
/** specified or defaulted in the MSGFILE runtime **/
/** option.
**/
/****************************************************/
PLIMOUT: PROC OPTIONS(MAIN);
%INCLUDE
%INCLUDE

CEEIBMAW;
CEEIBMCT;

DCL MSGSTR CHAR(255) VARYING;
DCL DESTIN REAL FIXED BINARY(31,0);
DCL 01 FC,
/* Feedback token */
03 MsgSev
REAL FIXED BINARY(15,0),
03 MsgNo
REAL FIXED BINARY(15,0),
03 Flags,
05 Case
BIT(2),
05 Severity BIT(3),
05 Control
BIT(3),
03 FacID
CHAR(3),
/* Facility ID */
03 ISI
/* Instance-Specific Information */
REAL FIXED BINARY(31,0);
MSGSTR = 'CEEMOUT ran successfully.';
/* Set message string
*/
DESTIN = 2;
/* Send to MSGFILE ddname */
/* Dispatch message to destination by a */
/*
call to CEEMOUT
*/
CALL CEEMOUT ( MSGSTR, DESTIN, FC );
IF FBCHECK( FC, CEE000) THEN DO;
PUT SKIP LIST( 'Message "' || MSGSTR
|| '" sent to destination ' || DESTIN );
END;
ELSE DO;
DISPLAY( 'CEEMOUT failed with msg '
|| FC.MsgNo );
STOP;
END;
END PLIMOUT;

CEEMRCE—Move resume cursor explicit
The CEEMRCE service resumes execution of a user routine at the location established by CEE3SRP.
CEEMRCE is designed to be called from a user condition handler and works only in conjunction with the
CEE3SRP service.
CEEMRCE

(

resume_token

,

fc

)

resume_token (input)
An INT4 data type that contains a token, returned from the CEE3SRP service, representing the resume
point in the user routine.
fc (output/optional)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you
choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate
syntax to indicate that the feedback code was omitted.
The following symbolic conditions can result from this service:

314 z/OS: Language Environment Programming Reference


### Usage notes

- Exit DSA routines are invoked as the resume cursor is moved back across stack frames.
- When a resume is requested, the state of the machine indicated in the machine state block is established prior to entry at the resume point.

### For more information

- See *z/OS Language Environment Programming Guide* for more information about the CEEMRCE callable service.

### Examples

1. An example of CEEMRCE called by COBOL:

```cobol
CBL NODYNAM APOST
IDENTIFICATION DIVISION.
PROGRAM-ID. PGM2.
*Module/File Name: IGZTMRCE
*------------------------------------------------------------*
*                     * Sample program using CEE3SRP and CEEMRCE.*
* handler UCH1 using CEEHDLR. It *
* sets a resume point using CEE3SRP. After *
* incurring a condition and returning *
* to PGM2, PGM3 is called. PGM3 sets up *
* new resume point, does a divide-by-zero, *
* and after resuming in PGM3, resets the *
* resume point to PGM2 and does a GOBACK. *
*------------------------------------------------------------*
DATA DIVISION.
WORKING-STORAGE SECTION.
01 RECOVERY-AREA EXTERNAL.
   05 RECOVERY-POINT POINTER.
   05 ERROR-INDICATOR PIC X(01).
01 UCH-ROUTINE PROCEDURE-POINTER.
   01 FIELDS.
      05 FIRST-TIME-SW PIC X(03) VALUE ' ON'.
      05 FIRST-TIME-88 VALUE ' ON'.
      05 ANSWER PIC S9(02) COMP-3 VALUE 0.
      05 UCH1 PIC X(08) VALUE 'UCH1 '.
      05 PGM3 PIC X(08) VALUE 'PGM3 '.
      05 CEEHDLR PIC X(08) VALUE 'CEEHDLR'.
      05 CEE3SRP PIC X(08) VALUE 'CEE3SRP'.
      05 TOKEN PIC S9(09) BINARY.
      05 FC.
         10 CASE-1.
            15 SEVERITY PIC S9(04) BINARY.
            15 MSG-NO PIC S9(04) BINARY.
            10 SEV-CTL PIC X(01).
            10 FACILITY-ID PIC X(03).
            10 I-S-INFO PIC S9(09) BINARY.
PROCEDURE DIVISION.
SET UCH-ROUTINE TO ENTRY 'UCH1'.
*------------------------------------------------------------*
* Register the condition handler, UCH1. *
*------------------------------------------------------------*
CALL CEEHDLR USING UCH-ROUTINE, TOKEN, FC.
```

IF CASE-1 NOT = LOW-VALUE
GOBACK.
PERFORM COMPUTE-LOOP 3 TIMES.
CALL PGM3 USING RECOVERY-AREA.
SET RECOVERY-POINT TO NULL.
GOBACK.
COMPUTE-LOOP.
IF FIRST-TIME-88
MOVE 'OFF' TO FIRST-TIME-SW
*---------------------------------------------------------------*
* Set up a new resume point.                                  *
*---------------------------------------------------------------*
CALL CEE3SRP USING RECOVERY-POINT,
CASE-1
SERVICE LABEL

IF CASE-1 NOT = LOW-VALUE
GOBACK.

IF ERROR-INDICATOR = 'E'
MOVE SPACE TO ERROR-INDICATOR
MOVE 1 TO ANSWER.
* Application code may go here.
COMPUTE ANSWER = 1 / ANSWER.
* Put application code here.
CBL NODYNAM APOST
IDENTIFICATION DIVISION.
PROGRAM-ID. PGM3.
*---------------------------------------------------------------*
* Sample program using CEE3SRP and CEEMRCE.*
* PGM2 registered UCH1. This program sets a*
* new resume point, does a divide-by-zero, *
* and after resuming in PGM3, resets the   *
* resume point to PGM2 and does a GOBACK. *
*---------------------------------------------------------------*
DATA DIVISION.
WORKING-STORAGE SECTION.
01 RECOVERY-AREA EXTERNAL.
  05 RECOVERY-POINT POINTER.
  05 ERROR-INDICATOR PIC X(01).
01 UCH-ROUTINE PROCEDURE-POINTER. 01 FIELDS.
  05 FIRST-TIME-SW PIC X(03) VALUE 'ON'.
  88 FIRST-TIME-88 VALUE 'ON'.
  05 ANSWER PIC S9(02) COMP-3 VALUE 0.
  05 CEEHDLR PIC X(08) VALUE 'CEEHDLR'.
  05 CEE3SRP PIC X(08) VALUE 'CEE3SRP'.
  05 TOKEN PIC S9(09) BINARY.
  05 SEV PIC -9(05).
  05 MSG PIC -9(05).
  05 FC.
    10 CASE-1.
      15 SEVERITY PIC S9(04) BINARY.
      15 MSG-NO PIC S9(04) BINARY.
      10 SEV-CTL PIC X(01).
      10 FACILITY-ID PIC X(03).
      10 I-S-INFO PIC S9(09) BINARY.
PROCEDURE DIVISION.
PERFORM COMPUTE-LOOP 3 TIMES.
SET RECOVERY-POINT TO NULL.
GOBACK.
COMPUTE-LOOP.
IF FIRST-TIME-88
MOVE 'OFF' TO FIRST-TIME-SW
*---------------------------------------------------------------*
* Set new resume point.                                     *
*---------------------------------------------------------------*
CALL CEE3SRP USING RECOVERY-POINT, FC

SERVICE LABEL

IF CASE-1 NOT = LOW-VALUE
    GOBACK.

IF ERROR-INDICATOR = 'E'
    MOVE SPACE TO ERROR-INDICATOR
    MOVE 1 TO ANSWER.

* Application code may go here.

    COMPUTE ANSWER = 1 / ANSWER.

* Put application code here.

CBL NODYNAM APOST
IDENTIFICATION DIVISION.

PROGRAM-ID. UCH1.

*__________________________________________*
*                                          *
* Sample user condition handler using      *
* CEEMRCE. This program sets an error      *
* and issues a call to CEEMRCE to return   *
* control to the statement following the   *
* call to CEE3SRP.                         *
*__________________________________________*

DATA DIVISION.
WORKING-Storage SECTION.

01  RECOVERY-AREA EXTERNAL.
   05 RECOVERY-POINT         POINTER.
   05 ERROR-INDICATOR        PIC X(01).

01  FC.
   10  CASE-1.
      15  SEVERITY PIC S9(04) BINARY.
      15  MSG-NO   PIC S9(04) BINARY.
   10  SEV-CTL      PIC  X(01).
   10  FACILITY-ID  PIC  X(03).
   10  I-S-INFO     PIC S9(09) BINARY.

01  CEEMRCE       PIC X(08) VALUE 'CEEMRCE '.
LINKAGE SECTION.

01  CURRENT-CONDITION         PIC  X(12).
01  TOKEN                     PIC  X(04).
01  RESULT-CODE             PIC S9(09) BINARY.
   88  RESUME       VALUE +10.
   88  PERCOLATE   VALUE +20.
   88  PERC-SF     VALUE +21.
   88  PROMOTE     VALUE +30.
   88  PROMOTE-SF  VALUE +31.
01  NEW-CONDITION             PIC  X(12).

PROCEDURE DIVISION USING CURRENT-CONDITION, 
   TOKEN, 
   RESULT-CODE, 
   NEW-CONDITION.

    MOVE 'E' TO ERROR-INDICATOR.

*__________________________________________*
*                                          *
* Call CEEMRCE to return control to the   *
* last resume point.                      *
*__________________________________________*

CALL CEEMRCE USING RECOVERY-POINT, FC.

IF CASE-1 NOT = LOW-VALUE
    GOBACK.

    MOVE +10 TO RESULT-CODE.

GOBACK.
2. An example of CEEMRCE called by PL/I:

```plaintext
+Process lc(101),opt(0),s,map,list,stmt,a(f),ag;
+Process macro;
DRV3SRP: Proc Options(Main);

/*Module/File Name: IBM3SRP                      */
/*******************************************************************************/
**                       **
**  DRV3SRP - Set an explicit resume point by  **
**                   calling CEE3SRP then registering a **
**                   condition handler that calls CEEMRCE **
**                   to resume at the explicitly set  **
**                   resume point.                     **
**                       **
/*******************************************************************************/
%include CEEIBMCT;
%include CEEIBMAW;
declare 01 FBCODE   feedback;  /* Feedback token */
declare DENOMINATOR fixed binary(31,0);
declare NUMERATOR   fixed binary(31,0);
declare RATIO       fixed binary(31,0);
declare PLI3SRP     external entry;
declare U_PTR       pointer;
declare 01 U_DATA,
03 U_CNTL fixed binary(31),
03 U_TOK  pointer;
U_PTR = addr(U_DATA);
U_CNTL = 0;

/* Set Resume Point          */
Display('Setting resume point via CEE3SRP');
Call CEE3SRP(U_TOK,FBCODE);
Display('After CEE3SRP ... Resume point');
If U_CNTL = 0 Then
  Do;
    Display('First time through...');
    Display('Registering user handler');
    Call CEEMHDLR(PLI3SRP, U_PTR, FBCODE);
    If FBCHECK(FBCODE, CEE000) Then
      Do;
        /* Cause a zero-divide condition */
        DENOMINATOR = 0;
        NUMERATOR = 1;
        RATIO = NUMERATOR / DENOMINATOR;
      End;
    Else;
      Do;
        Display('CEEHDLR failed with msg ');
        Display(MsgNo);
      End;
  Else;
    Display('Second time through...');
  End;
Else;
  Display('Unregister handler          */
  Call CEEHDLU(PLI3SRP, FBCODE);
  If FBCHECK(FBCODE, CEE000) Then
    Display('Main: unregistered PLI3SRP');
  Else;
    Do;
      Display('CEEHDLU failed with msg ');
      Display(MsgNo);
    End;
End;
End DRV3SRP;
```

*Process lc(101),opt(0),s,map,list,stmt,a(f),ag;
*Process macro;
PLI3SRP: Proc (PTR1,PTR2,PTR3,PTR4) Options(byvalue);
/*******************************************************************************/
**                       **
**  PLI3SRP - Call CEEMCRE to resume at the resume  **
**                   point explicitly set in user  **
**                   program.                     **
**                       **
/*******************************************************************************/
CEEMRCR—Move resume cursor

CEEMRCR moves the resume cursor to a position relative to the current position of the handle cursor. The actions supported are:

- Moving the resume cursor to the call return point of the routine registering the executing condition handler.
- Moving the resume cursor to the caller of the routine registering the executing condition handler.

Initially, the resume cursor is placed after the instruction that caused the condition. Whenever CEEMRCR moves the resume cursor and passes stack frames, associated exit routines are invoked. Note that “exit routine” refers to user condition handlers as well as language-specific condition handlers. In addition, any associated user condition handlers are unregistered. The movement direction is always toward earlier stack frames, never toward more recent stack frames. The movement occurs only after the condition handler returns to the Language Environment condition manager.

Multiple calls to CEEMRCR yield the net results of the calls; that is, if two calls move the resume cursor to different places for the same stack frame, the most restrictive call (that closest to the earliest stack frame) is used for that stack frame.

Moving the resume cursor to a particular stack frame:

- Cancels all stack frames from the previous resume point up to but not including the new resume point
- Unregisters any user condition handlers registered for the canceled stack frames

\[CEEMRCR\left(type_{\text{of\_move}}\right)\]

\textbf{type\_of\_move (input)}

A fullword binary signed integer indicating the target of the resume cursor movement. The possible values for type\_of\_move are:

0

Move the resume cursor to the call return point of the stack frame associated with the handle cursor.

1

Move the resume cursor to the call return point of the stack frame prior to the stack frame associated with the handle cursor. The handle cursor is moved to the most recently established condition handler of the stack frame. The new resume cursor position now points to this condition handler for the stack frame. Do not use a type\_of\_move value of 1 if the caller of the stack frame associated with the handle cursor is a nested COBOL program.
Modifying the resume cursor to point to stack frame 0 is not allowed. You cannot move the resume
cursor beyond the earliest stack frame.

*fc* (output)

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you
choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE07U</td>
<td>1</td>
<td>0254</td>
<td>The first parameter passed to CEEMRCR was not 0 or 1.</td>
</tr>
<tr>
<td>CEE083</td>
<td>3</td>
<td>0259</td>
<td>A move to stack frame zero using CEEMRCR was attempted from a MAIN routine.</td>
</tr>
<tr>
<td>CEE084</td>
<td>3</td>
<td>0260</td>
<td>No condition was active when a call to a condition management routine was made. The requested function was not performed.</td>
</tr>
<tr>
<td>CEE08L</td>
<td>1</td>
<td>0277</td>
<td>CEEMRCR was called to perform an unnecessary move.</td>
</tr>
</tbody>
</table>

Usage notes

- **PL/I MTF consideration**—CEEMRCR is not supported in PL/I MTF applications. This includes any CEEHDLR service called from a COBOL program in the application.
- **z/OS UNIX considerations**—In multithread applications, CEEMRCR affects only the calling thread. You can use CEEMRCR only within the thread's call chain.

Illustration of CEEMRCR Usage

The following three figures illustrate how you can move the resume cursor by using the CEEMRCR service.

In Figure 2 on page 321, routine A calls routine B, which in turn calls C, which calls D. User condition handlers are registered in routines B and C.

When a condition is raised in routine D, the Language Environment condition manager passes control to the user condition handler established for routine C. The handle cursor now points to the stack frame for routine C. Routine C percolates the condition.

The handle cursor now points to the stack frame for routine B. The next user condition handler to gain control is that one established for routine B; it recognizes the condition and issues a resume by calling CEEMRCR.

A 0 *type_of_move*, meaning move the resume cursor to the stack frame associated with the handle cursor, causes control to resume at the call return point in routine B, the instruction immediately following the call to routine C. A 1 *type_of_move*, meaning move the resume cursor to the call return point of the stack frame immediately preceding the one to which the handle cursor points, moves the resume cursor to the instruction immediately following a call in routine A to routine B.
The same scenario is illustrated in Figure 3 on page 322, except that HDLR2 issues a resume for the signaled condition rather than percolating it. HDLR1 never gains control. Because the handle cursor now points to the stack frame for routine C, a 0 type_of_move causes control to resume at the call return point in routine C, the instruction immediately following the call to routine D. A 1 type_of_move moves the resume cursor to the instruction immediately following a call in routine B to routine C.
In Figure 4 on page 323, the user condition handlers are established for routines C and D. When a condition is raised in routine D, only a 1 type_of_move is permitted. A 0 type_of_move results in error warning message CEE0277.

Figure 3: Second example moving resume cursor using CEEMRCR
Examples

1. Following is an example of CEEMRCR called by C/C++.

```c
/* Module/File Name: EDCMRCR */
#include <stdio.h>
#include <string.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

#ifdef __cplusplus
extern "C"
#else
#endif
void handler(_FEEDBACK *,_INT4 *,_INT4 *,_FEEDBACK *);
#endif

void b(void);
int main(void) {
    b();
    /* the CEEMRCR call in the handler will place the */
    /* resume cursor at this point. */
    /* */
    void b(void) {
        _FEEDBACK fc,condtok;
        _ENTRY routine;
        _INT4 token,qdata;
        _INT2 c_1,c_2,cond_case,sev,control;
        _CHAR3 facid;
        _INT4 isi;
```
/* register the condition handler */
token = 99;
routine.address = (_POINTER)&handler;;
routine.nesting = NULL;
CEEHDLR(&routine,&token,&fc);
if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
    printf("CEEHDLR failed with message number %d\n", fc.tok_msgno);
    exit (2999);
}
/* set up the condition using CEENCOD */
c_1 = 3;
c_2 = 2523;
cond_case = 1;
sev = 3;
control = 0;
memcpy(facid,"CEE",3);
isi = 0;
CEENCOD(&c_1,&c_2,&cond_case,&sev,&control,;
facid,&isi,&condtok,&fc);
if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
    printf("CEENCOD failed with message number %d\n", fc.tok_msgno);
    exit(2999);
}
/* signal the condition */
CEESGL(&condtok,&qdata,&fc);
if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
    printf("CEESGL failed with message number %d\n", fc.tok_msgno);
    exit(2999);
}
/* move the resume cursor to the caller of the */
/* routine that registered the condition handler */
type = 1;
CEEMRCR(&type,&cursorfc);
if ( _FBCHECK ( cursorfc , CEE000 ) != 0 ) {
    printf("CEEMRCR failed with message number %d\n", cursorfc.tok_msgno);
    exit (2999);
}
printf("condition handled\n");
*result = 10;
return;
}

2. Following is an example of CEEMRCR called by COBOL.

CBL LIB,QUOTE

*****************************************************************************
** CBLMAIN - Main for sample program for CEEMRCR. **
*****************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLMAIN.
PROCEDURE DIVISION.
    CALL "DRVMRCR"
    DISPLAY "Resumed execution in the CALLER "
        "of the routine which registered the "
        "handler"
 IDENTIFICATION DIVISION.
 PROGRAM-ID. DRVMRCR.
 DATA DIVISION.
 WORKING-STORAGE SECTION.
  01 ROUTINE               PROCEDURE-POINTER.
  01 TOKEN                PIC S9(9) BINARY.
  01 SEV                  PIC S9(4) BINARY.
  01 MSGNO                PIC S9(4) BINARY.
  01 CASE                 PIC S9(4) BINARY.
  01 SEV2                 PIC S9(4) BINARY.
  01 CNTRL                PIC S9(4) BINARY.
  01 FACID                PIC X(3).
  01 ISINFO               PIC S9(9) BINARY.
  01 FC.
       02 Condition-Token-Value.
       COPY CEEIGZCT.
       03 Case-1-Condition-ID.
       04 Severity    PIC S9(4) BINARY.
       04 Msg-No      PIC S9(4) BINARY.
       03 Case-2-Condition-ID
       REDEFINES Case-1-Condition-ID.
       04 Class-Code  PIC S9(4) BINARY.
       04 Cause-Code  PIC S9(4) BINARY.
       03 Case-Sev-Ctl PIC X.
       03 Facility-ID  PIC XXX.
       02 I-S-Info        PIC S9(9) BINARY.
       01 QDATA               PIC S9(9) BINARY.
       01 CONDTOK.
       02 Condition-Token-Value.
       COPY CEEIGZCT.
       03 Case-1-Condition-ID.
       04 Severity    PIC S9(4) BINARY.
       04 Msg-No      PIC S9(4) BINARY.
       03 Case-2-Condition-ID
       REDEFINES Case-1-Condition-ID.
       04 Class-Code  PIC S9(4) BINARY.
       04 Cause-Code  PIC S9(4) BINARY.
       03 Case-Sev-Ctl PIC X.
       03 Facility-ID  PIC XXX.
       02 I-S-Info        PIC S9(9) BINARY.
 PROCEDURE DIVISION.
 ************************************************
 ** Register handler                          **
 ************************************************
 SET ROUTINE TO ENTRY "CBLMRCR".
 CALL "CEEHDLR" USING ROUTINE, TOKEN, FC.
 IF NOT CEE000 of FC THEN
  DISPLAY "CEEHDLR failed with msg "
  Msg-No of FC UPON CONSOLE
 STOP RUN
 END-IF.

 ************************************************
 ** Signal a condition                        **
 ************************************************
 MOVE 1 TO QDATA.
 SET CEE001 of CONDTOK to TRUE.
 MOVE ZERO to I-S-Info of CONDTOK.
 CALL "CEESGL" USING CONDTOK, QDATA, FC.
 IF CEE000 of FC THEN
  DISPLAY "**** Resumed execution in the "
  "routine which registered the handler"
 ELSE
  DISPLAY "CEESGL failed with msg "
  Msg-No of FC UPON CONSOLE
 END-IF.

 ************************************************
 ** Unregister handler                        **
 ************************************************
 CALL "CEEHDLU" USING ROUTINE, TOKEN, FC.
 IF NOT CEE000 of FC THEN
  DISPLAY "CEEHDLU failed with msg "
  Msg-No of FC UPON CONSOLE
 END-IF.
STOP RUN.
END PROGRAM DRVMRCR.
************************************************
**                                            **
** CBLMRCR - Invoke CEEMRCR to Move resume **
** cursor relative to handle cursor **
**                                            **
************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLMRCR.
DATA DIVISION.
WORKING-STORAGE SECTION.
01 MOVETYP PIC S9(9) BINARY.
01 DEST PIC S9(9) BINARY VALUE 2.
01 FC.
   02 Condition-Token-Value.
COPY CEEIGZCT.
   03 Case-1-Condition-ID.
      04 Severity PIC S9(4) BINARY.
      04 Msg-No PIC S9(4) BINARY.
   03 Case-2-Condition-ID
      REDEFINES Case-1-Condition-ID.
      04 Class-Code PIC S9(4) BINARY.
      04 Cause-Code PIC S9(4) BINARY.
      02 I-S-Info PIC S9(9) BINARY.
   02 I-S-Info PIC S9(9) BINARY.
01 FC2.
   02 Condition-Token-Value.
COPY CEEIGZCT.
   03 Case-1-Condition-ID.
      04 Severity PIC S9(4) BINARY.
      04 Msg-No PIC S9(4) BINARY.
   03 Case-2-Condition-ID
      REDEFINES Case-1-Condition-ID.
      04 Class-Code PIC S9(4) BINARY.
      04 Cause-Code PIC S9(4) BINARY.
      02 I-S-Info PIC S9(9) BINARY.
   02 I-S-Info PIC S9(9) BINARY.
LINKAGE SECTION.
01 CURRENT-CONDITION.
   02 Condition-Token-Value.
COPY CEEIGZCT.
   03 Case-1-Condition-ID.
      04 Severity PIC S9(4) BINARY.
      04 Msg-No PIC S9(4) BINARY.
   03 Case-2-Condition-ID
      REDEFINES Case-1-Condition-ID.
      04 Class-Code PIC S9(4) BINARY.
      04 Cause-Code PIC S9(4) BINARY.
      02 I-S-Info PIC S9(9) BINARY.
   02 I-S-Info PIC S9(9) BINARY.
01 TOKEN
01 RESULT-CODE PIC S9(9) BINARY.
   88 RESUME VALUE +10.
   88 PERCOLATE VALUE +20.
   88 PROMOTE VALUE +30.
01 NEW-CONDITION.
   02 Condition-Token-Value.
COPY CEEIGZCT.
   03 Case-1-Condition-ID.
      04 Severity PIC S9(4) BINARY.
      04 Msg-No PIC S9(4) BINARY.
   03 Case-2-Condition-ID
      REDEFINES Case-1-Condition-ID.
      04 Class-Code PIC S9(4) BINARY.
      04 Cause-Code PIC S9(4) BINARY.
      02 I-S-Info PIC S9(9) BINARY.
   02 I-S-Info PIC S9(9) BINARY.
PROCEDURE DIVISION USING CURRENT-CONDITION,
   TOKEN, RESULT-CODE, NEW-CONDITION
************************************************
** Move the resume cursor to the caller of **
** the routine that registered the condition **
** handler **
************************************************
MOVE 1 TO MOVETYP.
CALL "CEEMRCR" USING MOVETYP , FC.
IF NOT CEE000 of FC THEN
    DISPLAY "CEEMRCR failed with msg "
    Msg-No of FC UPON CONSOLE
    CALL "CEEMSG" USING FC, DEST, FC2
    IF NOT CEE000 of FC2 THEN
        DISPLAY "CEEMSG failed with msg "
        Msg-No of FC2 UPON CONSOLE
        MOVE FC TO NEW-CONDITION
        SET PROMOTE TO TRUE
        GOBACK
    END-IF.
SET RESUME TO TRUE.
GOBACK.
END PROGRAM CBLMRCR.

3. Following is an example of a PL/I to handle divide-by-zero condition.

*Process macro;
/* Module/File Name: IBMMRCR                        */
/****************************************************/
/*                                                  */
/* Usrhdlr - the user handler routine.              */
/* Handle DIVIDE-BY-ZERO conditions,                */
/*     percolate all others.                        */
/*                                                  */
/****************************************************/
Usrhdlr:  Proc (@condtok, @token, @result, @newcond)
options(byvalue);
%include ceeibmct;
%include ceeibmaw;
/* Parameters */
dcl  @condtok    pointer;
dcl  @token      pointer;
dcl  @result     pointer;
dcl  @newcond    pointer;
dcl 1 condtok based(@condtok) feedback;
dcl token  fixed bin(31) based(@token);
dcl result fixed bin(31) based(@result);
dcl 1 newcond based(@newcond) feedback;
dcl 1 fback feedback;
dcl move_type fixed bin(31);
dcl resume    fixed bin(31) static initial(10);
dcl percolate fixed bin(31) static initial(20);
dcl promote  fixed bin(31) static initial(30);
dcl promote_sf fixed bin(31) static initial(31);
display ('>>> USRHDLR: Entered user handler');
display ('>>> USRHDLR: passed token value is ' ||
    token);
/* Check if this is the divide-by-zero token */
if fbcheck (condtok, cee349) then do;
    move_type = 0;
    call ceemrcr (move_type, fback);
    if fbcheck (fback, cee000) then do;
        result = resume;
        display ('>>> USRHDLR: Resuming execution');
        end;
    else do;
        display ('CEEMRCR failed with message number ' ||
            fback.MsgNo);
        stop;
    end;
else /* something besides div-zero token */
do;
    result = percolate;
    display ('>>> USRHDLR: Percolating it');
end;
end Usrhdlr;
CEEMSG—Get, format, and dispatch a message

CEEMSG gets, formats, and dispatches a message corresponding to an input condition token received from a callable service or passed to a user-written condition handler. You can use this service to print a message after a call to any Language Environment service that returns a condition token.

**CEEMSG**

```plaintext
CEEMSG(cond_token, destination_code, fc)
```

**cond_token (input)**
A 12-byte condition token received as the result of a Language Environment callable service.

**destination_code (input)**
A 4-byte binary integer. `destination_code` can be specified only as 2, meaning write the message to the `ddname` of the file specified in the MSGFILE runtime option.

**fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE0E2</td>
<td>3</td>
<td>0450</td>
<td>The message inserts for the condition token with message number <code>message-number</code> and facility ID <code>facility-id</code> could not be located.</td>
</tr>
<tr>
<td>CEE0E3</td>
<td>3</td>
<td>0451</td>
<td>An invalid destination code <code>destination-code</code> was passed to routine <code>routine-name</code>.</td>
</tr>
<tr>
<td>CEE0E6</td>
<td>3</td>
<td>0454</td>
<td>The message number <code>message-number</code> could not be found for facility ID <code>facility-id</code>.</td>
</tr>
<tr>
<td>CEE0E9</td>
<td>3</td>
<td>0457</td>
<td>The message file destination <code>ddname</code> could not be located.</td>
</tr>
<tr>
<td>CEE0EA</td>
<td>3</td>
<td>0458</td>
<td>The message repository <code>repository-name</code> could not be located.</td>
</tr>
<tr>
<td>CEE3CT</td>
<td>3</td>
<td>3485</td>
<td>An internal message services error occurred while locating the message number within a message file.</td>
</tr>
<tr>
<td>CEE3CU</td>
<td>3</td>
<td>3486</td>
<td>An internal message services error occurred while formatting a message.</td>
</tr>
<tr>
<td>CEE3CV</td>
<td>3</td>
<td>3487</td>
<td>An internal message services error occurred while locating a message number within the ranges specified in the repository.</td>
</tr>
</tbody>
</table>

**Usage notes**

- **z/OS UNIX considerations**—In multithread applications, CEEMSG affects only the calling thread. When multiple threads write to the message file, the output is interwoven by line. To group lines of output, serialize MSGFILE access (by using a mutex, for example).

**For more information**

- See “CEENCOD—Construct a condition token” on page 331 for more information about the CEENCOD callable service.
- See “MSGFILE” on page 48 for more information about the MSGFILE runtime option.
Examples

1. Following is an example of CEEMSG called by C/C++.

```c
/*Module/File Name: EDCMSG*/
#include <string.h>
#include <stdio.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {

_VSTRING message;
_INT4 dest,msgindx;
_CHAR80 msgarea;
_FEEDBACK fc,token;

strcpy(message.string,"This is a test message");
message.length = strlen(message.string);
dest = 5; /* invalid dest so CEEMOUT will fail */

CEEMOUT(&message,&dest,&fc);
if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
/* put the message if CEEMOUT failed */
dest = 2;
CEEMSG(&fc,&dest,NULL);
exit(2999);
}
}
```

2. Following is an example of CEEMSG called by COBOL.

```cobol
CBL LIB,QUOTE
*Module/File Name: IGZTMSG
*************************************************
**                                             **
** CBLMSG - Call CEEMSG to get, format and     **
**                     dispatch a message      **
**                                             **
** In this example, CEE3MDS is called with an  **
** invalid country code so that a condition    **
** token would be returned to use as input to  **
** Any Lang Env service could have been called.**
** CEEMSG uses the condition token to get,    **
** format and dispatch the message associated  **
** with the condition that occurred in CEE3MDS.**
**
*************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLMSG.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01 COUNTRY PIC X(2).
  01 DECSEP PIC X(2).
  01 MSGDEST PIC S9(9) BINARY.
  01 FC.
     02 Condition-Token-Value.
COPY CEEIGZCT.
  03 Case-1-Condition-ID.
     04 Severity PIC S9(4) BINARY.
     04 Msg-No PIC S9(4) BINARY.
  03 Case-2-Condition-ID
     REDEFINES Case-1-Condition-ID.
     04 Class-Code PIC S9(4) BINARY.
     04 Cause-Code PIC S9(4) BINARY.
  03 Case-Sev-Ctl PIC X.
  03 Facility-ID PIC XXX.
  02 I-S-Info PIC S9(9) BINARY.
  01 FC2.
     02 Condition-Token-Value.
COPY CEEIGZCT.
  03 Case-1-Condition-ID.
     04 Severity PIC S9(4) BINARY.
     04 Msg-No PIC S9(4) BINARY.
  03 Case-2-Condition-ID
     REDEFINES Case-1-Condition-ID.
     04 Class-Code PIC S9(4) BINARY.
```
04 Cause-Code  PIC S9(4) BINARY.
03 Case-Sev-Ctl  PIC X.
03 Facility-ID  PIC XXX.
02 I-S-Info  PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBL3MDS.

*************************************************
** Call a Lang Env svc, CEE3MDS in this case, **
** to receive a condition token that CEEMSG    **
** can format as a message. Specify an        **
** invalid value for country code so that a    **
** condition will be built                      **
*************************************************
MOVE "LN" TO COUNTRY.
CALL "CEE3MDS" USING COUNTRY, DECSEP, FC.
PARA-CBLMSG.

*************************************************
** Specify 2 for destination, so message will **
** be written to the ddname specified or **    **
** defaulted in the MSGFILE runtime option. **
*************************************************
MOVE 2 TO MSGDEST.

*************************************************
** Call CEEMSG using the FC returned from     **
** CEE3MDS as the input condition token. **    **
*************************************************
CALL "CEEMSG" USING FC, MSGDEST, FC2.
IF NOT CEE000 of FC2 THEN
  DISPLAY "CEEMSG  failed with msg ",
  Msg-No of FC2 UPON CONSOLE
  STOP RUN
END-IF.
GOBACK.

3. Following is an example of CEEMSG called by PL/I.

```plaintext
*PROCESS LANGVL(SAA), MACRO;
/* Module/File Name: IBMMSG */
/**************************************************/
/**                                                **
/** Function: CEEMSG - get, format and dispatch  **
/**                     a message                  **
/**                                                **
/** In this example, CEE3MDS is called with an    **
/** invalid country code so that a condition token **
/** would be returned to use as input to CEEMSG.    **
/** Any LE/370 could have been called. CEEMSG uses **
/** the condition to get, format and dispatch the  **
/** message associated with the condition that    **
/** occurred in CEE3MDS                           **
/**                                                **
/**************************************************/
PLIMSG: PROC OPTIONS(MAIN);
%INCLUDE  CEEIBM3A;
%INCLUDE  CEEIBMCT;
DCL COUNTRY  CHARACTER (2);
DCL DECSEP  CHARACTER (2);
DCL 01 FC,                     /* Feedback token */
  03 MsgSev  REAL FIXED BINARY(15,0),
  03 MsgNo   REAL FIXED BINARY(15,0),
  03 Flags,
    05 Case   BIT(2),
    05 Severity BIT(3),
    05 Control BIT(3),
  03 FacID   CHAR(3),      /* Facility ID */
  03 ISI    /* Instance-Specific Information */
            REAL FIXED BINARY(31,0);
DCL MSGDEST REAL FIXED BINARY(31,0);
DCL 01 FC2,                    /* Feedback token */
  03 MsgSev  REAL FIXED BINARY(15,0),
  03 MsgNo   REAL FIXED BINARY(15,0),
  03 Flags,
    05 Case   BIT(2),
    05 Severity BIT(3),
    05 Control BIT(3),
  03 FacID   CHAR(3),      /* Facility ID */
  03 ISI    /* Instance-Specific Information */
            REAL FIXED BINARY(31,0);
```
CEENCOD—Construct a condition token

CEENCOD dynamically constructs a 12-byte condition token that communicates a condition in Language Environment. The condition token communicates with the Language Environment message and condition handling callable services, and user routines. Also, all Language Environment callable services use the condition-token data type to return information to the user as a feedback code.

CEENCOD(c_1, c_2, case, severity, control, facility_ID)

- **c_1 (input)**
  c_1 and c_2 together make up the condition_ID portion of the condition token. c_1 is a 2-byte binary integer representing the value of the first 2 bytes of the 4-byte condition_ID. For case 1, c_1 represents the severity; for case 2, it is the class_code.

- **c_2 (input)**
  A 2-byte binary integer representing the value of the second 2 bytes of the condition_ID. For case 1, this is the Msg_No; for case 2, it is the cause_code.

- **case (input)**
  A 2-byte binary integer defining the format of the condition_ID portion of the token.

- **severity (input)**
  A 2-byte binary integer indicating the condition's severity. For case 1 conditions, the value of this field is the same as the severity value specified in the condition_ID. For case 1 and 2 conditions, this field is also used to test the condition's severity. severity can be specified with the following values:

  - **0** Information only (or, if the entire token is 0, no information).
  - **1** Warning; service completed, probably correctly.
  - **2** Error detected and correction attempted; service completed, perhaps incorrectly.
  - **3** Severe error; service not completed.
Critical error; service not completed; condition signaled. A critical error is a condition jeopardizing the environment. If a critical error occurs during a Language Environment callable service, it is always signaled to the condition manager instead of returning synchronously to the caller.

**control (input)**
A 2-byte binary integer containing flags describing or controlling various aspects of condition handling. Valid values for the control field are 1 and 0. 1 indicates the facility_ID is assigned by IBM. 0 indicates the facility_ID is assigned by the user.

**facility_ID (input)**
A 3-character field containing three alphanumeric characters (A-Z, a-z and 0-9) identifying the product or component of a product generating this condition or feedback information, for example, CEE.

The facility_ID is associated with the repository (for example, a file) of the runtime messages. If a unique ID is required (for IBM and non-IBM products), an ID can be obtained by contacting an IBM project office.

If you create a new facility_ID to use with a message file you created by using the CEEBLDXT utility, be aware that the facility_ID must be part of the message file name. It is therefore important to follow the naming guidelines described below in order to have a module name that does not cause your application to abend.

Begin a non-IBM assigned product facility_ID with letters J through Z. (See the preceding description control (input) parameter on how to indicate whether the facility_ID has been assigned by IBM.) Special characters, including blank spaces, cannot be used in a facility_ID. There are no other constraints (besides the alphanumeric requirement) on a non-IBM assigned facility_ID.

**i_s_info (input)**
A fullword binary integer identifying the ISI, that contains insert data. Whenever a condition is detected by the Language Environment condition manager, insert data is generated describing the instance of its occurrence is generated. This insert data is used, for example, to write to a file a message associated with that instance or occurrence of the condition.

**cond_token (output)**
The 12-byte representation of the constructed condition token.

**fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE0CH</td>
<td>3</td>
<td>0401</td>
<td>An invalid case code case-code was passed to routine routine-name.</td>
</tr>
<tr>
<td>CEE0CI</td>
<td>3</td>
<td>0402</td>
<td>An invalid control code control-code was passed to routine routine-name.</td>
</tr>
<tr>
<td>CEE0CJ</td>
<td>3</td>
<td>0403</td>
<td>An invalid severity code severity-code was passed to routine routine-name.</td>
</tr>
<tr>
<td>CEE0CK</td>
<td>1</td>
<td>0404</td>
<td>Facility ID facility-id with non-alphanumeric characters was passed to routine routine-name.</td>
</tr>
<tr>
<td>CEE0E4</td>
<td>3</td>
<td>0452</td>
<td>An invalid facility ID facility-id was passed to routine routine-name.</td>
</tr>
</tbody>
</table>
Usage notes

• C/C++ considerations—The structure of the condition token (type_FEEDBACK) is described in the leawi.h header file shipped with Language Environment. You can assign values directly to the fields of the token in the header file without using the CEENCOD service.

Figure 5 on page 333 shows the layout of the type_FEEDBACK condition token in the header file.

```
typedef struct {
    short     tok_sev     ; /* severity            */
    short     tok_msgno   ; /* message number      */
    int       tok_case :2,  /* flags-case/sev/cont */
              tok_sever:3,
              tok_ctrl :3 ;
    char      tok_facid[3]; /* fac ID    */
    int       tok_isi     ; /* index in ISI block */
} _FEEDBACK;
```

Figure 5: type_FEEDBACK data type as defined in the leawi.h header file

• z/OS UNIX consideration—In multithread applications, CEENCOD affects only the calling thread.

For more information

• For more information about case 1 and case 2, see CEENCOD “Usage notes” on page 333.

Examples

1. Following is an example of CEENCOD called by C/C++.

```c
/*Module/File Name: EDCNCOD   */
/*********************************************************/
/* Note that it is not necessary to use this service.    */
/* The fields may be manipulated directly.               */
/*********************************************************/
#include <stdio.h>
#include <string.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>
int main(void) {
    _FEEDBACK fc,condtok;
    _INT2 c_1,c_2,cond_case,sev,control;
    _CHAR3 facid;
    _INT4 isi;
    c_1 = 1;
    c_2 = 99;
    cond_case = 1;
    sev = 1;
    control = 0;
    memcpy(facid,"ZZZ",3);
    isi = 0;
    CEENCOD(&c_1,&c_2,&cond_case,&sev,&control,;
             facid,&isi,&condtok,&fc);
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEENCOD failed with message number %d\n", fc.tok_msgno);
        exit(2999);
    }
    /* . */
    /* . */
    /* . */
    /* . */
}
2. Following is an example of CEENCOD called by COBOL.

```cobol
CBL LIB,QUOTE
*Module/FileName: IGZTNCOD
******************************************************************************
**                                   **
** CBLNCOD - Call CEENCOD to construct a **
** condition token **
**                                   **
******************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLNCOD.
DATA DIVISION.
WORKING-STORAGE SECTION.
 01 SEV                    PIC S9(4) BINARY.
 01 MSGNO                  PIC S9(4) BINARY.
 01 CASE                   PIC S9(4) BINARY.
 01 SEV2                  PIC S9(4) BINARY.
 01 CNTRL                 PIC S9(4) BINARY.
 01 FACID                  PIC X(3).
 01 ISINFO                 PIC S9(9) BINARY.
 01 NEWTOK.
 02 Condition-Token-Value.
    COPY CEEIGZCT.
    03 Case-1-Condition-ID.
       04 Severity    PIC S9(4) BINARY.
       04 Msg-No      PIC S9(4) BINARY.
    03 Case-2-Condition-ID
       REDEFINES Case-1-Condition-ID.
       04 Class-Code  PIC S9(4) BINARY.
       04 Cause-Code  PIC S9(4) BINARY.
    03 Case-Sev-Ctl    PIC X.
    03 Facility-ID     PIC XXX.
 02 I-S-Info              PIC S9(9) BINARY.
 01 FC.
 02 Condition-Token-Value.
    COPY CEEIGZCT.
    03 Case-1-Condition-ID.
       04 Severity    PIC S9(4) BINARY.
       04 Msg-No      PIC S9(4) BINARY.
    03 Case-2-Condition-ID
       REDEFINES Case-1-Condition-ID.
       04 Class-Code  PIC S9(4) BINARY.
       04 Cause-Code  PIC S9(4) BINARY.
    03 Case-Sev-Ctl    PIC X.
    03 Facility-ID     PIC XXX.
 02 I-S-Info              PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBLNCOD.
******************************************************************************
** Set severity portion of Condition-ID to 0, **
** or information only. **
** Set msg number portion of Condition-ID to 1.**
** Set case to 1. This is a service condition. **
** Set severity to 0, for information only. **
** Set control to 1, for Facility-ID has been **
** assigned by IBM. **
** Set Facility-ID to CEE for a Language **
** Environment condition token. **
** Set I-S-Info to 0, indicating that no **
** Instance Specific Information (ISI) is **
** to be supplied. **
******************************************************************************
MOVE 0 TO SEV.
MOVE 1 TO MSGNO.
MOVE 1 TO CASE.
MOVE 0 TO SEV2.
MOVE 1 TO CNTRL.
MOVE "CEE" TO FACID.
MOVE 0 TO ISINFO.
******************************************************************************
** Call CEENCOD with the values assigned above **
** to build a condition token "NEWTOK" **
******************************************************************************
CALL "CEENCOD" USING SEV, MSGNO, CASE, SEV2, CNTRL, FACID, ISINFO, NEWTOK, FC.
IF NOT CEE000 of FC THEN
  DISPLAY "CEENCOD failed with msg "
  Msg-No of FC UPON CONSOLE
```
3. Following is an example of CEENCOD called by PL/I.

```pli
*PROCESS MACRO;
/* Module/File Name: IBMNCOD */
/**************************************************************/
/**                                                         */
/** Function: CEENCOD - construct a condition token         */
/**                                                         */
/***************************************************************/
PLINCOD: PROC OPTIONS(MAIN);

%INCLUDE  CEEIBMAW;
%INCLUDE  CEEIBMCT;

DCL SEV        REAL FIXED BINARY(15,0);
DCL MSGNO      REAL FIXED BINARY(15,0);
DCL CASE       REAL FIXED BINARY(15,0);
DCL SEV2       REAL FIXED BINARY(15,0);
DCL CNTRL      REAL FIXED BINARY(15,0);
DCL FACID      CHARACTER ( 3 );
DCL ISINFO     REAL FIXED BINARY(31,0);

DCL 01 NEWTOK,                 /* Feedback token */
     03 MsgSev    REAL FIXED BINARY(15,0),
     03 Flags,    /* Flags */
     05 Case      BIT(2),
     05 Severity  BIT(3),
     05 Control   BIT(3),
     03 FacID     CHAR(3),      /* Facility ID */
     03 ISI       /* Instance-Specific Information */
     03MsgNo     REAL FIXED BINARY(15,0),
     CALL CEENCOD ( SEV, MSGNO, CASE, SEV2, CNTRL, FACID, ISINFO, NEWTOK, FC );

DCL 01 FC,                     /* Feedback token */
     03 MSGNO     REAL FIXED BINARY(15,0),
     03 Flags,    /* Flags */
     05 Case      BIT(2),
     05 Severity  BIT(3),
     05 Control   BIT(3),
     03 FacID     CHAR(3),      /* Facility ID */
     03 ISI       /* Instance-Specific Information */

SEV = 0;       /* Set severity portion of        */
    /* Condition_ID to 0, or          */
    /* information only.  */
MSGNO = 1;     /* Set msg number portion of      */
    /* Condition_ID to 1.  */
CASE = 1;      /* Set case to 1. This is a       */
    /* service condition.  */
SEV2 = 0;      /* Set severity to 0, or          */
    /* information only.  */
CNTRL = 0;     /* Set control to 0, or Facility    */
    /* ID has been assigned by user    */
FACID = 'USR'; /* Set Facility_ID to USR for a   */
    /* user condition token. */
ISINFO = 0;    /* Set I_S_Info to 0, indicating    */
    /* that no Instance Specific      */
    /* Information is to be supplied. */

EENCOD ( SEV, MSGNO, CASE, SEV2,
CALL CEENCOD ( SEV, MSGNO, CASE, SEV2,
    CNTRL, FACID, ISINFO, NEWTOK, FC );

IF FBCHECK( FC,CEE000 ) THEN DO;
    PUT SKIP LIST( 'CEENCOD created token for msg ' || NEWTOK.MsgNo || ' and facility ' || NEWTOK.FacID );
END;
ELSE DO;
    DISPLAY( 'CEENCOD failed with msg ' || FC.MsgNo );
    STOP;
END;
END PLINCOD;
```
CEEQCEN—Query the century window

CEEQCEN queries the century in which Language Environment contains the 2-digit year value. When you want to change the setting, use CEEQCEN to get the setting and then use CEESCEN to save and restore the current setting.

\[\text{CEEQCEN}(\text{century\_start}, \text{fc})\]

**century\_start (output)**

An integer between 0 and 100 indicating the year on which the century window is based. For example, if the Language Environment default is in effect, all 2-digit years lie within the 100-year window starting 80 years prior to the system date. CEEQCEN then returns the value 80. An 80 value indicates to Language Environment that, in 1995, all 2-digit years lie within the 100-year window starting 80 years before the system date (between 1915 and 2014, inclusive).

**fc (output)**

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td></td>
<td>The service completed successfully.</td>
</tr>
</tbody>
</table>

**Usage notes**

- z/OS UNIX considerations—CEEQCEN applies to the enclave, as does the century window.

**For more information**

- See “CEESCEN—Set the century window” on page 348 for more information about the CEESCEN callable service.

**Examples**

1. Following is an example of CEEQCEN called by C/C++.

```c
/*Module/File Name: EDCQCEN */
#include <string.h>
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main ( void ) {
  _INT4 century_start;
  _FEEDBACK fc;

  /* query the century window */
  CEEQCEN(&century_start,&fc);
  if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
    printf("CEEQCEN failed with message number %d\n", fc.tok_msgno);
    exit(2999);
  }

  /* if the century window is not 50 set it to 50 */
  if (century_start != 50) {
    CEEQCEN(50,&fc);
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
      printf("CEEQCEN failed with message number %d\n", fc.tok_msgno);
      exit(2999);
    }
  }
```

336  z/OS: Language Environment Programming Reference
2. Following is an example of CEEQCEN called by COBOL.

```
CBL LIB,QUOTE
*Module/File Name: IGZTQCEN
*******************************************************************************
** CBLQCEN - Call CEEQCEN to query the Lang Env**
** 1. century window **
** In this example, CEEQCEN is called to query **
** the date at which the century window starts **
** The century window is the 100-year window **
** within which Lang Envir **
** assumes all two-digit years lie. **
*******************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLQCEN.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01 STARTCW     PIC S9(9) BINARY.
  01 FC.
  02 Condition-Token-Value.
COPY CEEIGZCT.
  03 Case-1-Condition-ID.
    04 Severity  PIC S9(4) BINARY.
    04 Msg-No    PIC S9(4) BINARY.
  03 Case-2-Condition-ID
    REDEFINES Case-1-Condition-ID.
    04 Class-Code  PIC S9(4) BINARY.
    04 Cause-Code  PIC S9(4) BINARY.
  03 Case-Sev-Ctl  PIC X.
  03 Facility-ID  PIC XXX.
  02 I-S-Info    PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBLQCEN.
*******************************************************************************
** Call CEEQCEN to return the start of the **
** century window **
*******************************************************************************
CALL "CEEQCEN" USING STARTCW, FC.
*******************************************************************************
** CEEQCEN has no non-zero feedback codes to **
** check, so just display result. **
*******************************************************************************
IF CEE000 of FC THEN
  DISPLAY "The start of the century "
  "window is: " STARTCW
ELSE
  DISPLAY "CEEQCEN failed with msg "
  Msg-No of FC UPON CONSOLE
END-IF.
GOBACK.
```

3. Following is an example of CEEQCEN called by PL/I.

```
*PROCESS MACRO;
/* Module/File Name: IBMQCEN */
*******************************************************************************
** Function: CEEQCEN - query the century window **
*******************************************************************************
** In this example, CEEQCEN is called to query **
** The date at which the century window starts. **
** The century window is the 100-year window **
** within which Language Environment assumes **
** all two-digit years lie. **
*******************************************************************************
PLIQCN: PROC OPTIONS(MAIN);
%INCLUDE CEEIBMAW;
%INCLUDE CEEIBMCT;

DCL STARTCW REAL FIXED BINARY(31,0); /* Feedback token */
DCL 01 FC, 03 MsgSev REAL FIXED BINARY(15,0),
03 MsgNo REAL FIXED BINARY(15,0),
03 Flags,
05 Case BIT(2),
05 Severity BIT(3),
05 Control BIT(3),
03 FacID CHAR(3), /* Facility ID */
03 ISI /* Instance-Specific Information */
REAL FIXED BINARY(31,0);

/* Call CEEQCEN to return the start of the       */
/*    century window                             */
CALL CEEQCEN ( STARTCW, FC );

/* CEEQCEN has no non-zero feedback codes        */
/* to check, so print result                     */
IF FBCHECK( FC, CEE000) THEN DO;
  PUT SKIP LIST ( 'The century window starts ' ||
                 STARTCW || ' years before today.' );
END;
ELSE DO;
  DISPLAY( 'CEEQCEN failed with msg ' ||
           FC.MsgNo );
  STOP;
END;
END PLIQCEN;

CEEQDTC—Query locale date and time conventions

CEEQDTC, analogous to the C language function localdtconv(), queries the date and time conventions from the current locale and sets the components of a structure with values appropriate to the settings for the LC_TIME category. CEEQDTC is sensitive to the locales set by setlocale() or CEESETL, not to the Language Environment settings from COUNTRY or CEE3CTY.

CEEQDTC

version
This parameter points to a user supplied VERSION_INFO structure, in which the first four bytes contain the callable service version number.

If the parameter does not points to a user supplied VERSION_INFO structure, it must be omitted.

If the parameter points to a VERSION_INFO containing version number 1, CEEQDTC returns a DTCONV structure with the new element showing the format of the ISO 8601:2000 standard date. If the parameter is omitted, CEEQDTC returns the DTCONV format used before C99. For information about how to code this parameter, see “Invoking callable services” on page 104.

localdt (output)
A pointer to the data structure containing the date and time formatting information from the current, active locale. The fields used to populate the structure come from the LC_TIME category. The LC_TIME category structure fields used to retrieve the date and time values are:

abmon
Abbreviated month names (12 instances of a halfword length-prefixed character string, VSTRING, of 22 bytes)

mon
Month names (12 instances of a halfword length-prefixed character string, VSTRING, of 62 bytes)
abday
Abbreviated day names (7 instances of a halfword length-prefixed character string, VSTRING, of 22 bytes)

day
Day names (7 instances of a halfword length-prefixed character string, VSTRING, of 62 bytes)

d_t_fmt
Date and time format (1 instance of a halfword length-prefixed character string, VSTRING, of 82 bytes)

d_fmt
Date format (1 instance of a halfword length-prefixed character string, VSTRING, of 42 bytes)

t_fmt
Time format (1 instance of a halfword length-prefixed character string, VSTRING, of 42 bytes)

am_fmt
AM string (1 instance of a halfword length-prefixed character string, VSTRING, of 22 bytes)

pm_fmt
PM string (1 instance of a halfword length-prefixed character string, VSTRING, of 22 bytes)

t_fmt_ampm
Time format ampm (1 instance of a halfword length-prefixed character string, VSTRING, of 42 bytes)

ISO_STD8601_2000
ISO8601:2000 standard date format (1 instance of a halfword length-prefixed character string, VSTRING, of 42 bytes)

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td></td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE3T1</td>
<td>3</td>
<td>4001</td>
<td>General Failure: Service could not be completed.</td>
</tr>
<tr>
<td>CEE3VN</td>
<td>3</td>
<td>4087</td>
<td>Input Error: The version_info control block contains a version number that is not valid.</td>
</tr>
</tbody>
</table>

Usage notes

- PL/I MTF consideration—CEEQDTC is not supported in PL/I MTF applications.
- If no call to CEESETL has been made, the default locale values to be used are determined at installation time for Language Environment.
- This callable service uses the C/C++ runtime library. The C/C++ library must be installed and accessible even when this service is called from a non-C program.

For more information

- See “CEESETL—Set locale operating environment” on page 362 for more information about the current locale.

Examples

1. Following is an example of CEEQDTC called by COBOL.

```
CBL LIB,QUOTE
*Module/File Name: IGZTQDTC
***************************************************************************
```
Example for callable service CEEQDTC

MAINQDTC - Retrieve date and time convention structures for two countries and compare an item.

Valid only for COBOL for MVS & VM Release 2 or later.

************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID.  MAINQDTC.
DATA DIVISION.
WORKING-STORAGE SECTION.
* Use DTCONV structure for CEEQDTC calls
COPY CEEIGZDT.
*
PROCEDURE DIVISION.
* Subroutine needed for addressing
CALL "COBQDTC" USING DTCONV.

STOP RUN.
*
IDENTIFICATION DIVISION.
PROGRAM-ID.  COBQDTC.
DATA DIVISION.
WORKING-STORAGE SECTION.
01  Locale-Name.
   02  LN-Length  PIC S9(4) BINARY.
   02  LN-String  PIC X(256).
* Use Locale category constants
COPY CEEIGZLC.
*
01  Test-Length1 PIC S9(4) BINARY.
01  Test-String1 PIC X(80).
01  Test-Length2 PIC S9(4) BINARY.
01  Test-String2 PIC X(80).
01  FC.
   02  Condition-Token-Value.
COPY CEEIGZCT.
03  Case-1-Condition-ID.
   04  Severity  PIC S9(4) BINARY.
   04  Msg-No    PIC S9(4) BINARY.
03  Case-2-Condition-ID
   REDEFINES Case-1-Condition-ID.
   04  Class-Code  PIC S9(4) BINARY.
   04  Cause-Code  PIC S9(4) BINARY.
03  Case-Sev-Ctl  PIC X.
03  Facility-ID   PIC XXX.
   02  I-S-Info  PIC S9(9) BINARY.
*
LINKAGE SECTION.
* Use Locale structure DTCONV for CEEQDTC calls
COPY CEEIGZDT.
*
PROCEDURE DIVISION USING DTCONV.
* Set up locale for France
   MOVE 4 TO LN-Length.
   MOVE "FFEY" TO LN-String (1:LN-Length).
* Call CEESETL to set all locale categories
   CALL "CEESETL" USING Locale-Name, LC-ALL, FC.
* Check feedback code
   IF Severity > 0
      DISPLAY "Call to CEESETL failed. " Msg-No
      EXIT PROGRAM
   END-IF.
* Call CEEQDT for French values
   CALL "CEEQDT" USING OMITTED, ADDRESS OF DTCONV, FC.
* Check feedback code
   IF Severity > 0
      DISPLAY "Call to CEEQDT failed. " Msg-No
      EXIT PROGRAM
   END-IF.
* Save date and time format for FFEY locale
   MOVE D-T-FMT-Length IN DTCONV TO Test-Length1
   MOVE D-T-FMT-String IN DTCONV TO Test-String1
* Set up locale for French Canadian
   MOVE 4 TO LN-Length.
   MOVE "FCEY" TO LN-String (1:LN-Length).
Call CEESETL to set locale for all categories
CALL "CEESETL" USING Locale-Name, LC-ALL, FC.

Check feedback code
IF Severity > 0
   DISPLAY "Call to CEESETL failed. " Msg-No
   EXIT PROGRAM
END-IF.

Call CEEQDTC again for French Canadian values
CALL "CEEQDTC" USING OMITTED, ADDRESS OF DTCONV, FC.

Check feedback code and display results
IF Severity = 0
   Save date and time format for FCEY locale
   MOVE D-T-FMT-Length IN DTCONV TO Test-Length2
   MOVE D-T-FMT-String IN DTCONV TO Test-String2
   IF Test-String1(1:Test-Length1) = Test-String2(1:Test-Length2)
      DISPLAY "Same date and time format."
   ELSE
      DISPLAY "Different formats."
      DISPLAY Test-String1(1:Test-Length1)
      DISPLAY Test-String2(1:Test-Length2)
   END-IF
ELSE
   DISPLAY "Call to CEEQDTC failed. " Msg-No
END-IF.

EXIT PROGRAM.
END PROGRAM COBQDTC.

END PROGRAM MAINQDTC.

2. Following is an example of CEEQDTC called by PL/I.

*PROCESS MACRO;
//Module/File Name: IBMQDTC
  /* Example for callable service CEEQDTC */
  /* Function: Retrieve date and time convention */
  /* structures for two countries, compare an item. */
  /***************************************************************************/
PLIQDTC: PROC OPTIONS(MAIN);
  %INCLUDE CEEIBMAW; /* ENTRY defs, macro defs */
  %INCLUDE CEEIBMCT; /* FBCHECK macro, FB constants */
  %INCLUDE CEEIBMLC; /* Locale category constants */
  %INCLUDE CEEIBMDT; /* DTCONV for CEEQDTC calls */
  /* use explicit pointer to local DTCONV structure */
  DCL LOCALDT POINTER INIT(ADDR(DTCONV));
  /* CEESETL service call arguments */
  DCL LOCALE_NAME CHAR(256) VARYING;
  DCL 1 DTCONVC LIKE DTCONV; /* Def Second Structure */
  DCL 1 FC, /* Feedback token */
     3 MsgSev REAL FIXED BINARY(15,0),
     3 MsgNo REAL FIXED BINARY(15,0),
     3 Flags,
        5 Case BIT(2),
        5 Severity BIT(3),
        5 Control BIT(3),
     3 FacID CHAR(3), /* Facility ID */
     3 ISI /* Instance-Specific Information */
          REAL FIXED BINARY(31,0);
  /* set locale with IBM default for France */
  LOCALE_NAME = 'FFEY'; /* or Fr_FR.IBM-1047 */
  /* use LC_ALL category constant from CEEIBMLC */
  CALL CEESETL ( LOCALE_NAME, LC_ALL, FC );
  /* retrieve date and time structure, France Locale*/
CALL CEEQDTC ( *, LOCALDT, FC );
/* set locale with French Canadian(FCEY) defaults */
/* literal constant -1 used to set all categories */
CALL CEESETL ('FCEY', -1, FC );

/* retrieve date and time tables for French Canada*/
/* example of temp pointer used for service call */
CALL CEEQDTC ( *, ADDR(DTCONVC), FC );

/* compare date and time formats for two countries*/
IF DTCONVC.D_T_FMT = DTCONV.D_T_FMT THEN
  DO;
    PUT SKIP LIST('Countries have same D_T_FMT' );
  END;
ELSE
  DO;
    PUT SKIP LIST('Date and Time Format ',
                   DTCONVC.D_T_FMT||' vs '||
                   DTCONV.D_T_FMT );
  END;
END PLIQDTC;

---

### CEEQRYL—Query active locale environment

CEEQRYL, analogous to the C language function `localename=setlocale(category, NULL)`, queries the environment for which locale defines the current setting for the locale category. CEEQRYL is sensitive to the locales set by `setlocale()` or `CEESETL`, not to the Language Environment settings from `COUNTRY` or `CEE3CTY`.

```
 CEEQRYL category localename fc
```

**category (input)**
A symbolic integer number that represents all or part of the locale for a program. Depending on the value of the `localename`, these categories can be initiated by the values of global categories of corresponding names. The following values for the `category` parameter are valid; Language Environment locale callable services do not support the LC_TOD and LC_SYNTAX categories.

- **LC_ALL**
  A 4-byte integer (with a value of -1) that affects all locale categories associated with a program's locale.

- **LC_COLLATE**
  A 4-byte integer (with a value of 0) that affects the behavior of regular expression and collation subroutines.

- **LC_CTYPE**
  A 4-byte integer (with a value of 1) that affects the behavior of regular expression, character classification, case conversion, and wide character subroutines.

- **LC_MESSAGES**
  A 4-byte integer (with a value of 6) that affects the format and values for positive and negative responses.

- **LC_MONETARY**
  A 4-byte integer (with a value of 3) that affects the behavior of subroutines that format monetary values.

- **LC_NUMERIC**
  A 4-byte integer (with a value of 2) that affects the behavior of subroutines that format non-monetary numeric values.

- **LC_TIME**
  A 4-byte integer (with a value of 4) that affects the behavior of time conversion subroutines.
localename (output)
Returns the name of the locale that describes the current setting of the category requested.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE2KD</td>
<td>3</td>
<td>2701</td>
<td>An invalid category parameter was passed to a locale function.</td>
</tr>
<tr>
<td>CEE3T1</td>
<td>3</td>
<td>4001</td>
<td>General Failure: Service could not be completed.</td>
</tr>
</tbody>
</table>

Usage notes
- PL/I MTF consideration—CEEQRYL is not supported in PL/I MTF applications.
- CEEQRYL does not change the status of the active locales.
- This callable service uses the C/C++ runtime library. The C/C++ library must be installed and accessible even when this service is called from a non-C program.
- If the active locale is not explicitly set with CEESETL or setlocale(category, localename), then the locale chosen is as follows:
  - With POSIX(OFF), the SAA C locale is chosen, and querying the locale with CEEQRYL returns "C" as the locale name.
  - With POSIX(ON), the POSIX C locale is chosen, and querying the locale with CEEQRYL returns "POSIX" as the locale name.

The SAA C locale provides compatibility with previous releases of C/370. The POSIX C locale provides consistency with POSIX requirements and supports the z/OS UNIX System Services environment.

For more information
- See “CEESETL—Set locale operating environment” on page 362 for more information about the current locale.
- For more information about LC_TIME, see “CEEQDTC—Query locale date and time conventions” on page 338.
- For information about the definition of the SAA C and POSIX C locales and the differences between them, see z/OS XL C/C++ Programming Guide.

Examples

For examples of how to use CEEQRYL with other Language Environment locale callable services, see “CEESETL—Set locale operating environment” on page 362.

**CEERANO—Calculate uniform random numbers**
CEERAN0 generates a sequence of uniform pseudo-random numbers between 0.0 and 1.0 using the multiplicative congruential method with a user-specified seed. The uniform (0,1) pseudo-random numbers are generated using the multiplicative congruential method:

\[
\text{seed}(i) = (950706376 \times \text{seed}(i-1)) \mod 2147483647;
\]

\[
\text{randomno}(i) = \frac{\text{seed}(i)}{2147483647};
\]

**seed (input/output)**
A fullword binary signed integer representing an initial value used to generate random numbers. `seed` must be a variable; it cannot be an input-only parameter. The valid range is 0 to +2,147,483,646. If `seed` equals 0, the seed is generated from the current Greenwich Mean Time. On return to the calling routine, CEERAN0 changes the value of `seed` so that it can be used as the new seed in the next call.

**random_no (output)**
An 8-byte double precision floating-point number with a value between 0 and 1, exclusive. If `seed` is invalid, `random_no` is set to -1 and CEERAN0 terminates with a non-CEE000 symbolic feedback code.

**fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE2ER</td>
<td>1</td>
<td>2523</td>
<td>The system time was not available when CEERAN0 was called. A seed value of 1 was used to generate a random number and a new seed value.</td>
</tr>
<tr>
<td>CEE2ES</td>
<td>3</td>
<td>2524</td>
<td>An invalid seed value was passed to CEERAN0. The random number was set to -1.</td>
</tr>
</tbody>
</table>

**Usage notes**
- **z/OS UNIX considerations**—In multithread applications, CEERAN0 affects only the calling thread. The seed is unique to the thread.

**Examples**
1. Following is an example of CEERAN0 called by C/C++.

```c
#include <string.h>
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceedcct.h>

int main (void) {
  _INT4 seed;
  _FLOAT8 random;
  _FEEDBACK fc;
  int number;
  seed = 0;
  CEERAN0(&seed,&random,&fc);
```
if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
    printf("CEERAN0 failed with message number %d\n", fc.tok_msgno);
    exit(2999);
}

number = random * 1000;
printf("The 3 digit random number is %d\n",number);

2. Following is an example of CEERAN0 called by COBOL.

CBL LIB,QUOTE
*Module/File Name: IGZTRAN0
************************************************
** CBLRAN0 - Call CEERAN0 to generate uniform **
**                     random numbers         **
************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLRAN0.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01  SEED                    PIC S9(9) BINARY.
  01  RANDNUM                 COMP-2.
  01  FC.
      02  Condition-Token-Value.
          COPY  CEEIGZCT.
      03  Case-1-Condition-ID.
          04  Severity    PIC S9(4) BINARY.
          04  Msg-No      PIC S9(4) BINARY.
      03  Case-2-Condition-ID
          REDEFINES Case-1-Condition-ID.
          04  Class-Code  PIC S9(4) BINARY.
          04  Cause-Code  PIC S9(4) BINARY.
      03  Case-Sev-Ctl    PIC X.
      03  Facility-ID     PIC XXX.
  02  I-S-Info            PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBLRAN0.
************************************************
** Specify 0 for SEED, so the seed will be
** derived from the current Greenwich Mean Time
************************************************
MOVE 0 TO SEED.
************************************************
** Call CEERAN0 to return random number between
**     0.0 and 1.0
************************************************
CALL "CEERAN0" USING SEED, RANDNUM, FC.
************************************************
** If CEERAN0 runs successfully, display result.
************************************************
IF CEE000 of FC THEN
   DISPLAY "The random number is: " RANDNUM
ELSE
   DISPLAY "CEERAN0 failed with msg ",
       Msg-No of FC UPON CONSOLE
   STOP RUN
END-IF.
GOBACK.

3. Following is an example of CEERAN0 called by PL/I.

*PROCESS MACRO;
/* Module/File Name: IBMRAN0 */
/*****************************************************************************/*
/**/**
/** Function: CEERAN0 - calculate uniform random /**
/** numbers /**
*****************************************************************************/**
PLIRAN0: PROC OPTIONS(MAIN);
  %INCLUDE CEEIBMAW;
  %INCLUDE CEEIBMCT;
  DCL SEED     REAL FIXED BINARY(31,0);
  DCL RANDNUM  REAL FLOAT DECIMAL(16);
  DCL 01 fc, /* Feedback token */
CEERCDM—Record information for an active condition

CEERCDM records information for an active condition so that the information can be retrieved later from the condition information block (CIB). Use this service only during condition handling.

**CEERCDM**

```
CEERCDM( function code, information, fc )
```

**function_code (input)**

A fullword integer that contains the function code of the following value:

1

Record the data set name of a dump for an active condition.

**information (input)**

The information to be recorded. When the `function_code` is 1, the information is a halfword length-prefixed EBCDIC character string that is expected to be the data set name of a dump for an active condition. Language Environment validates that the length is positive and that it does not exceed 44.

**fc (output)**

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions are possible:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service was successfully completed.</td>
</tr>
<tr>
<td>CEE3LA</td>
<td>3</td>
<td>3754</td>
<td>Incorrect parameters were detected.</td>
</tr>
<tr>
<td>CEE35S</td>
<td>3</td>
<td>3260</td>
<td>No condition was active when a call was made to condition management.</td>
</tr>
</tbody>
</table>
Usage notes

- After the condition handling functions return control to the application, the CIB that represents the conditions is no longer valid and the recorded information is no longer accessible.
- If CEERCDM is called more than once for the same condition, the information of the last call is recorded.

Examples

1. Following is an example of CEERCDM called by C/C++.

```c
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <string.h>
#include <ceeedcct.h>

void handler(_FEEDBACK *, _INT4 *, _INT4 *, _FEEDBACK *);

int main() {
    _FEEDBACK fc;
    _ENTRY routine;
    _INT4 token;
    int x, y, z;

    token = 99;
    routine.address = (_POINTER)&handler;
    CEEHDLR(&routine, &token, &fc);
    if ( _FBCHECK ( fc, CEE000 ) != 0 ) {
        printf("CEEHDLR failed with message number %d\n", fc.tok_msgno);
        exit(2999);
    }
    x = 5;
    y = 0;
    z = x / y;
}

void handler(_FEEDBACK *fc, _INT4 *token, _INT4 *result, _FEEDBACK *newfc) {
    _FEEDBACK lfc;
    _INT4 funcode;
    _VSTRING info;
    char *ds_name = "XXXX.YYYY";
    info.length = strlen(ds_name);
    memcpy(info.string, ds_name, info.length);
    funcode = 1;
    CEERCDM(&funcode, &info, &lfc);
    if ( _FBCHECK ( lfc, CEE000 ) != 0 ) {
        printf("CEERCDM failed with message number %d\n", lfc.tok_msgno);
        exit(2999);
    }
    *result = 10;
}
```
CEESCEN—Set the century window

CEESCEN sets the century in which Language Environment contains the 2-digit year value. Use it in conjunction with CEEDAYS or CEESECS when:

- You process date values containing 2-digit years (for example, in the YYMMDD format).
- The Language Environment default century interval does not meet the requirements of a particular application.

Century intervals are kept as thread-level data, so changing the interval in one thread does not affect the interval in another thread. To query the century window, use CEEQCEN.

CEEQCEN affects and is affected by only the Language Environment NLS and date and time services, not the Language Environment locale callable services or the C locale-sensitive functions.

\[
\begin{array}{c}
\text{CEEQCEN} \\
\text{(century_start, fc)}
\end{array}
\]

**century_start**
An integer between 0 and 100, setting the century window. A value of 80, for example, places all two-digit years within the 100-year window starting 80 years before the system date. In 1995, therefore, all two-digit years are assumed to represent dates between 1915 and 2014, inclusive.

**fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE2E6</td>
<td>3</td>
<td>2502</td>
<td>The UTC/GMT was not available from the system.</td>
</tr>
</tbody>
</table>

**Usage notes**
- z/OS UNIX considerations—CEESCEN applies to the enclave. The century window applies to the enclave.

**For more information**
- See “CEEDAYS—Convert date to Lilian format” on page 215 for more information about the CEEDAYS callable service.
- See “CEESECS—Convert timestamp to seconds” on page 357 for more information about the CEESECS callable service.
- See “CEEQCEN—Query the century window” on page 336 for more information about the CEEQCEN callable service.

**Examples**
1. Following is an example of CEESCEN called by C/C++.

```c
#include <string.h>  
#include <stdio.h>   
#include <leawi.h>   
#include <stdlib.h>  
#include <ceeedcct.h>
```
int main (void) {
    _INT4 century_start;
    _FEEDBACK fc;

    century_start = 50;
    CEESCEN(&century_start,&fc);
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEESCEN failed with message number %d\n", fc.tok_msgno);
        exit(2999);
    }
}

2. Following is an example of CEESCEN called by COBOL.

CBL LIB,QUOTE
*Module/File Name: IGZTSCEN
**************************************************
**                                              **
** CBLSCEN - Call CEESCEN to set the Lang. Env. **
**           century window                     **
**                                              **
** In this example, CEESCEN is called to change **
** the start of the century window to 30 years **
** before the system date. CEEQCEN is then **
** called to query that the change made. A **
** message that this has been done is then **
** displayed. **
**                                              **
**************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLSCEN.
DATA DIVISION.
WORKING-STORAGE SECTION.
01 STARTCW PIC S9(9) BINARY.
01 FC.
   02 Condition-Token-Value.
      COPY CEEIGZCT.
         03 Case-1-Condition-ID.
            04 Severity PIC S9(4) BINARY.
            04 Msg-No PIC S9(4) BINARY.
         03 Case-2-Condition-ID.
            REDEFINES Case-1-Condition-ID.
            04 Class-Code PIC S9(4) BINARY.
            04 Cause-Code PIC S9(4) BINARY.
            03 Case-Sev-Ctl PIC X.
            03 Facility-ID PIC XXX.
   02 I-S-Info PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-CBLSCEN.
**************************************************
** Specify 30 as century start, and two-digit **
** years will be assumed to lie in the **
** 100-year window starting 30 years before **
** the system date. **
**************************************************
MOVE 30 TO STARTCW.
**************************************************
** Call CEESCEN to change the start of the century **
** window. **
**************************************************
CALL "CEESCEN" USING STARTCW, FC.
IF NOT CEE000 of FC THEN
    DISPLAY "CEESCEN failed with msg "
    Msg-No of FC UPON CONSOLE
    STOP RUN
END-IF.
PARA-CBLQCEN.
**************************************************
** Call CEEQCEN to return the start of the century **
** window. **
**************************************************
CALL "CEEQCEN" USING STARTCW, FC.
**************************************************
** CEEQCEN has no non-zero feedback codes to check, so just display result.

**************************************************
DISPLAY "The start of the century window is: " STARTCW
GOBACK.

3. Following is an example of CEESCEN called by PL/I.

```plaintext
*PROCESS MACRO;
/* Module/File Name: IBMSCEN */
/***************************************************************************/
/** Function: CEESCEN - set the century window **/
/***************************************************************************/
PLISCEN: PROC OPTIONS(MAIN);
  %INCLUDE  CEEIBMAW;
  %INCLUDE  CEEIBMCT;
  DCL STARTCW  REAL FIXED BINARY(31,0);
  DCL 01 FC,                     /* Feedback token */
       03 MsgSev    REAL FIXED BINARY(15,0),
       03 MsgNo     REAL FIXED BINARY(15,0),
       03 Flags,                      /* Flags */
       05 Case      BIT(2),
       05 Severity  BIT(3),
       05 Control   BIT(3),
       03 FacID     CHAR(3),      /* Facility ID */
       03 ISI       /* Instance-Specific Information */
             REAL FIXED BINARY(31,0);
  STARTCW = 20; /* Set 20 as century start */
  CALL CEESCEN ( STARTCW, FC );
  IF  FBCHECK( FC, CEE000)  THEN  DO;
      PUT SKIP LIST ( 'The century window now starts ' || STARTCW || ' years before today.' );
  END;
  ELSE  DO;
      DISPLAY( 'CEESCEN failed with msg ' || FC.MsgNo );
      STOP;
  END;
END PLISCEN;
```

**CEESCOL—Compare collation weight of two strings**

CEESCOL, which is analogous to the C language function `strcoll()`, compares two character strings based on the collating sequence specified in the LC_COLLATE category of the current locale. CEESCOL associates a collation weight with every character in the code set for the locale. The characters in the input strings are converted to their collation weights and then compared on the basis of these weights. CEESCOL is sensitive to the locales set by `setlocale()` or CEESETL, not to the Language Environment settings from COUNTRY or CEE3CTY.

**omitted_parm**

This parameter is reserved for future expansion and must be omitted. For information about how to code an omitted parameter, see “Invoking callable services” on page 104.
string1 (input)
A halfword length-prefixed character string (VSTRING) with a maximum length of 4K bytes. string1 points to a string of characters that are to be compared against string2.

string2 (input)
A halfword length-prefixed character string (VSTRING) with a maximum length of 4K bytes. string2 points to a string of characters that string1 is compared against.

result (output)
Specifies the result of the string comparison. If successful, the following values are returned:
• Less than 0, if string1 is less than string2
• Equal to 0, if string1 is equal to string2
• Greater than 0, if string1 is greater than string2

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td></td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE3T1</td>
<td>3</td>
<td>4001</td>
<td>General Failure: Service could not be completed.</td>
</tr>
</tbody>
</table>

Usage notes
• PL/I MTF consideration—CEESCOL is not supported in PL/I MTF applications.
• This callable service uses the C/C++ runtime library. The C/C++ library must be installed and accessible even when this service is called from a non-C program.

For more information
• See “CEESETL—Set locale operating environment” on page 362 for more information about the CEESETL callable service.

Examples
1. Following is an example of CEESCOL called by COBOL.

```cobol
CBL LIB,QUOTE
*Module/File Name: IGZTSCOL
******************************************************************************
* Example for callable service CEESCOL *
* COBSCOL - Compare two character strings *
* and print the result. *
* Valid only for COBOL for MVS & VM Release 2 *
* or later. *
******************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. COBSCOL.
DATA DIVISION.
WORKING-STORAGE SECTION.
01 String1.
   02 Str1-Length PIC S9(4) BINARY.
   02 Str1-String.
      03 Str1-Char PIC X OCCURS 0 TO 256 TIMES DEPENDING ON Str1-Length.
01 String2.
   02 Str2-Length PIC S9(4) BINARY.
   02 Str2-String.
      03 Str2-Char PIC X OCCURS 0 TO 256 TIMES DEPENDING ON Str2-Length.
```
PROCEDURE DIVISION.
***************
** Set up two strings for comparison
***************
MOVE 9 TO Str1-Length.
MOVE "12345a789" TO Str1-String (1:Str1-Length)
MOVE 9 TO Str2-Length.
MOVE "12346$789" TO Str2-String (1:Str2-Length)
***************
** Call CEESCOL to compare the strings
***************
CALL "CEESCOL" USING OMITTED, String1, String2, Result, FC.
***************
** Check feedback code
***************
IF Severity > 0
   DISPLAY "Call to CEESCOL failed. " Msg-No
   STOP RUN
END-IF.
***************
** Check result of compare
***************
EVALUATE TRUE
   WHEN Result < 0
      DISPLAY "1st string < 2nd string."
   WHEN Result > 0
      DISPLAY "1st string > 2nd string."
   WHEN OTHER
      DISPLAY "Strings are identical."
END-EVALUATE.
STOP RUN.
END PROGRAM COBSCOL.

2. Following is an example of CEESCOL called by PL/I.

*PROCESS MACRO;
/*Module/File Name: IBMSCOL */
/****************/
/* Example for callable service CEESCOL */
/* Function: Compare two character strings and */
/* print the result. */
/****************/
PLISCOL: PROC OPTIONS(MAIN);
%INCLUDE CEEIBMMA; /* ENTRY defs, macro defs for Language Environment */
%INCLUDE CEEIBMCT; /* FBCHECK macro, FB constants */
%INCLUDE CEEIBMLC; /* Locale category constants */
/* CEESCOL service call arguments */
DCL STRING1 CHAR(256) VARYING;/* first string */
DCL STRING2 CHAR(256) VARYING;/* second string */
DCL RESULT_SCOL BIN FIXED(31);/* result of compare */
DCL FC, MsgSev REAL FIXED BINARY(15,0),
     MsgNo REAL FIXED BINARY(15,0),
     Flags, Case BIT(2),
     Severity BIT(3),
CEESECI—Convert seconds to integers

CEESECI converts a number representing the number of seconds since 00:00:00 14 October 1582 to seven separate binary integers representing year, month, day, hour, minute, second, and millisecond. Use CEESECI instead of CEEDATM when the output is needed in numeric format rather than in character format.

The inverse of CEESECI is CEEISEC, which converts integer year, month, day, hour, second, and millisecond to number of seconds. If the input value is a Lilian date instead of seconds, multiply the Lilian date by 86,400 (number of seconds in a day), and pass the new value to CEESECI.

**input_seconds**

A 64-bit double floating-point number representing the number of seconds since 00:00:00 on 14 October 1582, not counting leap seconds. For example, 00:00:01 on 15 October 1582 is second number 86,401 (24*60*60 + 01). The valid range for `input_seconds` is 86,400 to 265,621,679,999.999 (23:59:59.999 31 December 9999). If `input_seconds` is invalid, all output parameters except the feedback code are set to 0.

**output_year (output)**

A 32-bit binary integer representing the year. The range of valid `output_years` is 1582 to 9999, inclusive.

**output_month (output)**

A 32-bit binary integer representing the month. The range of valid `output_months` is 1 to 12.

**output_day (output)**

A 32-bit binary integer representing the day. The range of valid `output_days` is 1 to 31.
**output_hours (output)**
A 32-bit binary integer representing the hour. The range of valid output_hours is 0 to 23.

**output_minutes (output)**
A 32-bit binary integer representing the minutes. The range of valid output_minutes is 0 to 59.

**output_seconds (output)**
A 32-bit binary integer representing the seconds. The range of valid output_seconds is 0 to 59.

**output_milliseconds (output)**
A 32-bit binary integer representing milliseconds. The range of valid output_milliseconds is 0 to 999.

**fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE2E9</td>
<td>3</td>
<td>2505</td>
<td>The input_seconds value in a call to CEEDATM or CEESECI was not within the supported range.</td>
</tr>
</tbody>
</table>

**Usage notes**

- z/OS UNIX consideration—In multithread applications, CEESECI affects only the calling thread.

**For more information**

- For more information about the CEEISEC callable service, see “CEEISEC—Convert integers to seconds” on page 291.

**Examples**

1. Following is an example of CEESECI called by C/C++.

```c
#include <string.h>
#include <stdio.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>

int main(void) {
    _INT4 year, month, day, hours, minutes, seconds,
    millisecs;
    _FLOAT8 input,
    _FEEDBACK fc;
    input = 13166064000.0;
    CEESECI(&input,&year,&month,&day,&hours,&minutes,
    &seconds,&millisecs,&fc);
    if ( _FBCHECK ( fc, CEE000 ) != 0 ) {
        printf("CEESECI failed with message number %d\n", 
        fc.tok_msgno);
        exit(2999);
    }
    printf("%f seconds corresponds to the date" 
    " %d:%d:%d.%d %d/%d/%d\n",input,hours,minutes,
    seconds,millisecs,month,day,year);
}
```

2. Following is an example of CEESECI called by COBOL.

```cobol
CBL LIB,QUOTE
*Module/File Name: IGZTSECI
```
** CBLSECI - Call CEESECI to convert seconds to integers
**
** In this example a call is made to CEESECI to convert a number representing the number of seconds since 00:00:00 14 October 1582 to seven binary integers representing year, month, day, hour, minute, second, and millisecond. The results are displayed in this example.
**
** IDENTIFICATION DIVISION.
** PROGRAM-ID. CBLSECI.
** DATA DIVISION.
** WORKING-STORAGE SECTION.
** 01 INSECS COMP-2.
** 01 YEAR PIC S9(9) BINARY.
** 01 MONTH PIC S9(9) BINARY.
** 01 DAYS PIC S9(9) BINARY.
** 01 HOURS PIC S9(9) BINARY.
** 01 MINUTES PIC S9(9) BINARY.
** 01 SECONDS PIC S9(9) BINARY.
** 01 MILLSEC PIC S9(9) BINARY.
** 01 IN-DATE.
** 02 Vstring-length PIC S9(4) BINARY.
** 02 Vstring-text.
** 03 Vstring-char PIC X, OCCURS 0 TO 256 TIMES DEPENDING ON Vstring-length of IN-DATE.
** 01 PICSTR.
** 02 Vstring-length PIC S9(4) BINARY.
** 02 Vstring-text.
** 03 Vstring-char PIC X, OCCURS 0 TO 256 TIMES DEPENDING ON Vstring-length of PICSTR.
** 01 FC.
** 02 Condition-Token-Value.
** COPY CEEIGZCT.
** 03 Case-1-Condition-ID.
** 04 Severity PIC S9(4) BINARY.
** 04 Msg-No PIC S9(4) BINARY.
** 03 Case-2-Condition-ID.
** REDEFINES Case-1-Condition-ID.
** 04 Class-Code PIC S9(4) BINARY.
** 04 Cause-Code PIC S9(4) BINARY.
** 03 Case-Sev-Ctl PIC X.
** 03 Facility-ID PIC XXX.
** 02 I-S-Info PIC S9(9) BINARY.
** PROCEDURE DIVISION.
** PARA-CBLSECS.
**
** Call CEESECS to convert timestamp of 6/2/88 at 10:23:45 AM to Lilian representation
**
** CALL "CEESECS" USING IN-DATE, PICSTR, INSECS, FC.
** IF NOT CEE000 of FC THEN
** DISPLAY "CEESECS failed with msg " Msg-No of FC UPON CONSOLE
** STOP RUN
** PARA-CBLSECI.
**
** Call CEESECI to convert seconds to integers
**
** CALL "CEESECI" USING INSECS, YEAR, MONTH, DAYS, HOURS, MINUTES, SECONDS, MILLSEC, FC.
**
** If CEESECI runs successfully, display results
**
IF CEE000 of FC THEN
  DISPLAY "Input seconds of " INSECS
  " represents:
  DISPLAY " Year......... " YEAR
  DISPLAY " Month........ " MONTH
  DISPLAY " Day......... " DAYS
  DISPLAY " Hour......... " HOURS
  DISPLAY " Minute....... " MINUTES
  DISPLAY " Second...... " SECONDS
  DISPLAY " Millisecond.. " MILLSEC
ELSE
  DISPLAY "CEESECI failed with msg ":
  Msg-No of FC UPON CONSOLE
  STOP RUN
END-IF.
GOBACK.

3. Following is an example of CEESECI called by PL/I.

*PROCESS MACRO;
/* Module/File Name: IBMSECI                        */
/****************************************************/
/**                                                 */
/** Function: CEESECI - convert seconds to integers */
/**                                                 */
/****************************************************/
PLISECI: PROC OPTIONS(MAIN);
%INCLUDE CEEIBMAW;
%INCLUDE CEEIBMCT;
DCL INSECS REAL FLOAT DECIMAL(16);
DCL YEAR REAL FIXED BINARY(31,0);
DCL MONTH REAL FIXED BINARY(31,0);
DCL DAYS REAL FIXED BINARY(31,0);
DCL HOURS REAL FIXED BINARY(31,0);
DCL MINUTES REAL FIXED BINARY(31,0);
DCL SECONDS REAL FIXED BINARY(31,0);
DCL MILLSEC REAL FIXED BINARY(31,0);
DCL 01 FC,                     /* Feedback token */
  03 MsgSev REAL FIXED BINARY(15,0),
  03 MsgNo REAL FIXED BINARY(15,0),
  03 Flags,
    05 Case BIT(2),
    05 Severity BIT(3),
    05 Control BIT(3),
  03 FacID /* Facility ID */
  03 ISI /* Instance-Specific Information */
    REAL FIXED BINARY(31,0);

INSECS = 13166064060; /* number of seconds since */
/* 14 October 1582         */
/* Call CEESECI to convert INSECS to separate */
/*    binary integers representing the year, */
/*    month, day, hours, minutes, seconds and */
/*    milliseconds. */
CALL CEESECI ( INSECS, YEAR, MONTH, DAYS, HOURS, MINUTES, SECONDS, MILLSEC, FC );
IF FBCHECK( FC, CEE000) THEN DO;
  PUT EDIT( INSECS, ' seconds corresponds to ',
    MONTH, '/', DAYS, '/', YEAR, ' at ', HOURS,
    ':', MINUTES, ':', SECONDS, '.', MILLSEC )
  (SKIP, F(9), A, 2 (P'99',A), P'9999', A,
    3 (P'99', A), P'999' );
END;
ELSE DO;
  DISPLAY( 'CEESECI failed with msg ' || FC.MsgNo );
  STOP;
END;
END PLISECI;
CEESECS—Convert timestamp to seconds

CEESECS converts a string representing a timestamp into the number of Lilian seconds (number of seconds since 00:00:00 14 October 1582). This service makes it easier to perform time arithmetic, such as calculating the elapsed time between two timestamps.

CEESECS is affected only by the country code setting of the COUNTRY runtime option or CEE3CTY callable service, not the CEESETL callable service or the setlocale() function.

The inverse of CEESECS is CEEDATM, which converts output_seconds to character format. By default, 2-digit years lie within the 100 year range starting 80 years prior to the system date. Thus, in 1995, all 2-digit years represent dates between 1915 and 2014, inclusive. You can change this range by using the callable service CEESCEN.

\[
\text{input_timestamp} \rightarrow \text{picture_string} \rightarrow \text{output_seconds} \rightarrow \text{fc}
\]

**input_timestamp (input)**

A length-prefixed character string representing a date or timestamp in a format matching that specified by picture_string. The character string must contain between 5 and 80 picture characters, inclusive. input_timestamp can contain leading or trailing blanks. Parsing begins with the first nonblank character (unless the picture string itself contains leading blanks; in this case, CEESECS skips exactly that many positions before parsing begins).

After a valid date is parsed, as determined by the format of the date you specify in picture_string, all remaining characters are ignored by CEESECS. Valid dates range between and including the dates 15 October 1582 to 31 December 9999. A full date must be specified. Valid times range from 00:00:00.000 to 23:59:59.999.

As the following example shows, if any part or all of the time value is omitted, zeros are substituted for the remaining values.

1992-05-17-19:02 is equivalent to 1992-05-17-19:02:00
1992-05-17 is equivalent to 1992-05-17-00:00:00

**picture_string (input)**

A halfword length-prefixed character string (VSTRING), indicating the format of the date or timestamp value specified in input_timestamp. Each character in the picture_string represents a character in input_timestamp. For example, if you specify MMDDYY HH.MI.SS as the picture_string, CEESECS reads an input_char_date of 060288 15.35.02 as 3:35:02 PM on 02 June 1988. If delimiters such as the slash (/) appear in the picture string, leading zeros can be omitted. For example, the following calls to CEESECS all assign the same value to variable secs:

```
CALL CEESECS('92/06/03 15.35.03', 'YY/MM/DD
HH.MM.SS', secs, fc);
CALL CEESECS('92/6/3 15.35.03', 'YY/MM/DD
HH.MM.SS', secs, fc);
CALL CEESECS('92/6/3 3.35.03 PM', 'YY/MM/DD
HH.MM.SS AP', secs, fc);
CALL CEESECS('92.155 3.35.03 pm', 'YY.DDD
HH.MM.SS AP', secs, fc);
```

If picture_string is left null or blank, CEESECS gets picture_string based on the current value of the COUNTRY runtime option. For example, if the current value of the COUNTRY runtime option is FR (France), the date format would be DD.MM.YYYY.

If picture_string includes a Japanese era symbol <JJJJ>, the YY position in input_timestamp represents the year number within the Japanese era. For example, the year 1988 equals the
Japanese year 63 in the Showa era. See Table 36 on page 426 for a list of Japanese eras supported by CEESECS.

If picture_string includes era symbol <CCCC> or <CCCCCCCC>, the YY position in input_timestamp represents the year number within the era.

See Table 34 on page 425 for a list of valid picture characters, and Table 35 on page 426 for examples of valid picture strings.

**output_seconds (output)**

A 64-bit double floating-point number representing the number of seconds since 00:00:00 on 14 October 1582, not counting leap seconds. For example, 00:00:01 on 15 October 1582 is second 86,401 (24*60*60 + 01) in the Lilian format. 19:00:01.12 on 16 May 1988 is second 12,799,191,601.12.

The largest value represented is 23:59:59.999 on 31 December 9999, which is second 265,621,679,999.999 in the Lilian format.

A 64-bit double floating-point value can accurately represent approximately 16 significant decimal digits without loss of precision. Therefore, accuracy is available to the nearest millisecond (15 decimal digits).

If input_timestamp does not contain a valid date or timestamp, output_seconds is set to 0 and CEESECS terminates with a non-CEE000 symbolic feedback code.

Elapsed time calculations are performed easily on the output_seconds, because it represents elapsed time. Leap year and end-of-year anomalies do not affect the calculations.

**fc (output)**

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE2EB</td>
<td>3</td>
<td>2507</td>
<td>Insufficient data was passed to CEEDAYS or CEESECS. The Lilian value was not calculated.</td>
</tr>
<tr>
<td>CEE2EC</td>
<td>3</td>
<td>2508</td>
<td>The date value passed to CEEDAYS or CEESECS was invalid.</td>
</tr>
<tr>
<td>CEE2ED</td>
<td>3</td>
<td>2509</td>
<td>The era passed to CEEDAYS or CEESECS was not recognized.</td>
</tr>
<tr>
<td>CEE2EE</td>
<td>3</td>
<td>2510</td>
<td>The hours value in a call to CEEISEC or CEESECS was not recognized.</td>
</tr>
<tr>
<td>CEE2EH</td>
<td>3</td>
<td>2513</td>
<td>The input date passed in a CEEISEC, CEEDAYS, or CEESECS call was not within the supported range.</td>
</tr>
<tr>
<td>CEE2EK</td>
<td>3</td>
<td>2516</td>
<td>The minutes value in a CEEISEC call was not recognized.</td>
</tr>
<tr>
<td>CEE2EL</td>
<td>3</td>
<td>2517</td>
<td>The month value in a CEEISEC call was not recognized.</td>
</tr>
<tr>
<td>CEE2EM</td>
<td>3</td>
<td>2518</td>
<td>An invalid picture string was specified in a call to a date/time service.</td>
</tr>
<tr>
<td>CEE2EN</td>
<td>3</td>
<td>2519</td>
<td>The seconds value in a CEEISEC call was not recognized.</td>
</tr>
<tr>
<td>CEE2EP</td>
<td>3</td>
<td>2521</td>
<td>The year-within-era value passed to CEEDAYS or CEESECS was zero.</td>
</tr>
<tr>
<td>CEE2ET</td>
<td>3</td>
<td>2525</td>
<td>CEESECS detected non-numeric data in a numeric field, or the timestamp string did not match the picture string.</td>
</tr>
</tbody>
</table>

**Usage notes**
The probable cause for receiving message number 2518 is a picture string that contains an invalid DBCS string. You should verify that the data in the picture string is correct.

z/OS UNIX consideration—In multithread applications, CEESECS affects only the calling thread.

For more information

- See “CEESCEN—Set the century window” on page 348 for more information about the CEESCEN callable service.
- See “COUNTRY” on page 20 for more information about the COUNTRY runtime option.

Examples

1. Following is an example of CEESECS called by C/C++.

```c
#include <stdio.h>
#include <string.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main(void) {
    _FEEDBACK fc;
    _FLOAT8 seconds1, seconds2;
    _VSTRING date, date_pic;

    /* use CEESECS to convert to seconds timestamp */
    strcpy(date.string, "09/13/91 23:23:23");
    date.length = strlen(date.string);
    strcpy(date_pic.string, "MM/DD/YY HH:MI:SS");
    date_pic.length = strlen(date_pic.string);
    CEESECS(&date, &date_pic, &seconds1, &fc);
    if ( _FBCHECK ( fc, CEE000 ) != 0 ) {
        printf("CEESECS failed with message number %d\n", fc.tok_msgno);
        exit(2999);
    }
    strcpy(date.string, "December 15, 1992 at 8:23:45 AM");
    date.length = strlen(date.string);
    strcpy(date_pic.string, "MM/DD/YYYY ZH:MI:SS AP");
    date_pic.length = strlen(date_pic.string);
    CEESECS(&date, &date_pic, &seconds2, &fc);
    if ( _FBCHECK ( fc, CEE000 ) != 0 ) {
        printf("CEESECS failed with message number %d\n", fc.tok_msgno);
        exit(2999);
    }
    printf("The number of seconds between:
    September 13, 1991 at 11:23:23 PM 
    and December 15, 1992 at 8:23:45 AM is:
    %f
", seconds2 - seconds1);
}
```

2. Following is an example of CEESECS called by COBOL.

```cobol
CBL LIB,QUOTE
*Module/File Name: IGZTSECS
************************************************
** CBLSECS - Call CEESECS to convert          **
**           timestamp to number of seconds   **
**                                            **
** In this example, calls are made to CEESECS **
** to convert two timestamps to the number of **
** seconds since 00:00:00 14 October 1582.     **
** The Lilian seconds for the earlier          **
** timestamp are then subtracted from the      **
```
** Lilian seconds for the later timestamp **
** to determine the number of between the **
** two. This result is displayed. **
************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLSECS.
DATA DIVISION.
WORKING-STORAGE SECTION.
 01 SECOND1                 COMP-2.
 01 SECOND2                 COMP-2.
 01 TIMESTP.
  02 Vstring-length      PIC S9(4) BINARY.
  02 Vstring-text.
  03 Vstring-char        PIC X,
                             OCCURS 0 TO 256 TIMES
                             DEPENDING ON Vstring-length
                             of TIMESTP.
 01 TIMESTP2.
  02 Vstring-length      PIC S9(4) BINARY.
  02 Vstring-text.
  03 Vstring-char        PIC X,
                             OCCURS 0 TO 256 TIMES
                             DEPENDING ON Vstring-length
                             of TIMESTP2.
 01 PICSTR.
  02 Vstring-length      PIC S9(4) BINARY.
  02 Vstring-text.
  03 Vstring-char        PIC X,
                             OCCURS 0 TO 256 TIMES
                             DEPENDING ON Vstring-length
                             of PICSTR.
 01 FC.
  02 Condition-Token-Value.
     COPY CEEIGZCT.
     03 Case-1-Condition-ID.
     04 Severity    PIC S9(4) BINARY.
     04 Msg-No      PIC S9(4) BINARY.
     03 Case-2-Condition-ID
     REDEFINES Case-1-Condition-ID.
     04 Class-Code  PIC S9(4) BINARY.
     04 Cause-Code  PIC S9(4) BINARY.
     03 Case-Sev-Ctl    PIC X.
     03 Facility-ID     PIC XXX.
     02 I-S-Info            PIC S9(9) BINARY.
PROCEDURE DIVISION.
  PARA-SECS1.
************************************************
** Specify first timestamp and a picture string
** describing the format of the timestamp
** as input to CEESECS
******************************************************************************************
MOVE 25 TO Vstring-length of TIMESTP.
MOVE "1969-05-07 12:01:00.000"
TO Vstring-text of TIMESTP.
MOVE 25 TO Vstring-length of PICSTR.
MOVE "YYYY-MM-DD HH:MI:SS.999"
TO Vstring-text of PICSTR.
******************************************************************************************
** Call CEESECS to convert the first timestamp
** to Lilian seconds
******************************************************************************************
CALL "CEESECS" USING TIMESTP, PICSTR,
 SECONDO, FC.
IF NOT CEE000 of FC THEN
  DISPLAY "CEESECS failed with msg "
  Msg-No of FC UPON CONSOLE
  STOP RUN
END-IF.
PARA-SECS2.
******************************************************************************************
** Specify second timestamp and a picture string
** describing the format of the timestamp as
** input to CEESECS.
******************************************************************************************
MOVE 25 TO Vstring-length of TIMESTP2.
MOVE "2000-01-01 00:00:01.000"
TO Vstring-text of TIMESTP2.
MOVE 25 TO Vstring-length of PICSTR.
MOVE "YYYY-MM-DD HH:MI:SS.999"
TO Vstring-text of PICSTR.
** Call CEESECS to convert the second timestamp
** to Lilian seconds
*******************************************************************************
CALL "CEESECS" USING TIMESTP2, PICSTR,
SECOND2, FC.
IF NOT CEE000 of FC THEN
   DISPLAY "CEESECS failed with msg "
   Msg-No of FC UPON CONSOLE
   STOP RUN
END-IF.
PARA-SECS2.
*******************************************************************************
** Subtract SECOND2 from SECOND1 to determine the
** number of seconds between the two timestamps
*******************************************************************************
SUBTRACT SECOND1 FROM SECOND2.
DISPLAY "The number of seconds between "
Vstring-text OF TIMESTP " and "
Vstring-text OF TIMESTP2 " is: " SECOND2.
GOBACK.

3. Following is an example of CEESECS called by PL/I.

*PROCESS_MACRO:
/*/ Module/File Name: IBMSECS */
*******************************************************************************
** Function: CEESECS - Change timestamp to seconds */
** In this example, CEESECS is called to return an */
** input timestamp as the number of seconds since */
** 14 October 1582. */
*******************************************************************************
PLISECS: PROC OPTIONS(MAIN);

%INCLUDE CEEIBMAW;
%INCLUDE CEEIBMCT;

DCL TIMESTP CHAR(255) VARYING;
DCL PICSTR CHAR(255) VARYING;
DCL SECONDS REAL FLOAT DECIMAL(16);

DCL 01 FC, /* Feedback token */
   03 MsgSev REAL FIXED BINARY(15,0),
   03 MsgNo REAL FIXED BINARY(15,0),
   03 Flags, 
   05 Case BIT(2),
   05 Severity BIT(3),
   05 Control BIT(3),
   03 FacID CHAR(3), /* Facility ID */
   03 ISI /* Instance-Specific Information */
      REAL FIXED BINARY(31,0);

TIMESTP = '10 November 1992'; /* Specify input */
   /* date as timestamp */
PICSTR = 'ZD Mmmmmmmmmmmmmmz YYYY';
   /* Picture string that describes timestamp */

/* Call CEESECS to return the input date as */
   /* Lilian seconds */
CALL CEESECS ( TIMESTP, PICSTR, SECONDS, FC );
IF FBCHECK( FC, CEE000) THEN DO;
   PUT SKIP LIST( 'There were ' || SECONDS
                  || ' seconds between 14 Oct 1582 and '
                  || TIMESTP );
   END;
ELSE DO;
   DISPLAY( 'CEESECS failed with msg '
            || FC.MsgNo );
   STOP;
   END;

END PLISECS;
CEESETL—Set locale operating environment

CEESETL, analogous to the C language function setlocale(), establishes a global locale operating environment, which determines the behavior of character collation, character classification, date and time formatting, numeric punctuation, and positive/negative response patterns. CEESETL is sensitive to the locales set by setlocale() or CEESETL, not to the Language Environment settings from COUNTRY or CEE3CTY.

```
 CEESETL(localename, category, fc)
```

**localename (input)**
A halfword length-prefixed character string (VSTRING) with a maximum of 256 bytes. *localename* is a valid locale name known to the locale model. The category named in the call is set according to the named locale. If *localename* is null or blank, CEESETL sets the locale environment according to the environment variables. This is the equivalent to specifying `setlocale(LC_ALL,"\"`)`. If these environment variables are defined, you can locate them in the following order:

- LC_ALL if it is defined and not null
- LANG if it is defined and not null
- The default C locale

**category (input)**
A symbolic integer number that represents all or part of the locale for a program. Depending on the value of the *localename*, these categories can be initiated by the values of global categories of corresponding names. The following values for the *category* parameter are valid:

- **LC_ALL**
  A 4-byte integer (with a value of -1) that affects all locale categories associated with a program's locale.

- **LC_COLLATE**
  A 4-byte integer (with a value of 0) that affects the behavior of regular expression and collation subroutines.

- **LC_CTYPE**
  A 4-byte integer (with a value of 1) that affects the behavior of regular expression, character classification, case conversion, and wide character subroutines.

- **LC_MESSAGES**
  A 4-byte integer (with a value of 6) that affects the format and values for positive and negative responses.

- **LC_MONETARY**
  A 4-byte integer (with a value of 3) that affects the behavior of subroutines that format monetary values.

- **LC_NUMERIC**
  A 4-byte integer (with a value of 2) that affects the behavior of subroutines that format non-monetary numeric values.

- **LC_TIME**
  A 4-byte integer (with a value of 4) that affects the behavior of time conversion subroutines.

Language Environment locale callable services do not support the LC_TOD and LC_SYNTAX categories.

**fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:
### Usage notes

- **PL/I MTF consideration—**CEESETL is not supported in PL/I MTF applications.
- This callable service uses the C/C++ runtime library. The C/C++ library must be installed and accessible even when this service is called from a non-C program.
- The LC_ALL category indicates that all categories are to be changed with regard to the specific locale. The LC_ALL value, when set by CEESETL, becomes the current values for all six LC_* categories.
- If the active locale is not explicitly set with CEESETL or setlocale(category, localename), then the locale chosen is as follows:
  - With POSIX(OFF), the SAA C locale is chosen, and querying the locale with CEEQRYL returns "C" as the locale name.
  - With POSIX(ON), the POSIX C locale is chosen, and querying the locale with CEEQRYL returns "POSIX" as the locale name.

The SAA C locale provides compatibility with previous releases of C/370. The POSIX C locale provides consistency with POSIX requirements and supports the z/OS UNIX environment.

### For more information

- See **z/OS XL C/C++ Runtime Library Reference** for details of how various locale categories affect C/C++ language functions.
- For more information about specifying environment variables to set the locale, see **z/OS XL C/C++ Programming Guide**.
- For information about the definition of the SAA C and POSIX C locales and the differences between them, see **z/OS XL C/C++ Programming Guide**.
- For more information about LC_TIME, see “**CEEQDTC—Query locale date and time conventions**” on page 338.

### Examples

1. Following is an example of CEESETL called by COBOL.

```
CBL LIB,QUOTE
*Module/File Name: IGZTSETL
******************************************************************************
* Example for callable service CEESETL *
* COBSETL - Set all global locale environment *
* categories to country Sweden. *
* Query one category. *
******************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. COBSETL.
DATA DIVISION.
WORKING-STORAGE SECTION.
 01 Locale-Name.
    02 LN-Length PIC S9(4) BINARY.
    02 LN-String PIC X(256).
 01 Locale-Time.
    02 LT-Length PIC S9(4) BINARY.
    02 LT-String PIC X(256).
* Use Locale category constants
COPY CEEIGZLC.
```
01 FC.
  02 Condition-Token-Value.
  COPY CEEIGZCT.
  03 Case-1-Condition-ID.
    04 Severity PIC S9(4) BINARY.
    04 Msg-No PIC S9(4) BINARY.
  03 Case-2-Condition-ID
    REDEFINES Case-1-Condition-ID.
    04 Class-Code PIC S9(4) BINARY.
    04 Cause-Code PIC S9(4) BINARY.
    03 Case-Sev-Ctl PIC X.
    03 Facility-ID PIC XXX.
  02 I-S-Info PIC S9(9) BINARY.

*  PROCEDURE DIVISION.
*************************************************
*  Set up locale name for Sweden
*************************************************
MOVE 14 TO LN-Length.
MOVE 'Sv_SE.IBM-1047'
  TO LN-String (1:LN-Length).
*************************************************
*  Set all locale categories to Sweden
*  Use LC-ALL category constant from CEEIGZLC
*************************************************
CALL 'CEESETL' USING Locale-Name, LC-ALL, FC.
*************************************************
*  Check feedback code
*************************************************
IF Severity > 0
  DISPLAY 'Call to CEESETL failed. ' Msg-No
  STOP RUN
END-IF.
*************************************************
*  Retrieve active locale for LC-TIME category
*************************************************
CALL 'CEEQRYL' USING LC-TIME, Locale-Time, FC.
*************************************************
*  Check feedback code and correct locale
*************************************************
IF Severity = 0
  IF LT-String(1:LT-Length) =
    LN-String(1:LN-Length)
    DISPLAY 'Successful query.'
  ELSE
    DISPLAY 'Unsuccessful query.'
  END-IF
ELSE
  DISPLAY 'Call to CEEQRYL failed. ' Msg-No
END-IF.
STOP RUN.
END PROGRAM COBSETL.

2. Following is an example of CEESETL called by COBOL.

*PROCESS MACRO;
 /*Module/File Name: IBMSETL */
/*****************************/
/* Example for callable service CEESETL */
/* Function: Set all global locale environment */
/* categories to country. Query one category. */
/*****************************/
PLISETL: PROC OPTIONS(MAIN);
%INCLUDE CEEIBMIAW; /* ENTRY defs, macro defs */
%INCLUDE CEEIBMCT; /* FBCHECK macro, FB constants */
%INCLUDE CEEIBMLC; /* Locale category constants */
/* CEESETL service call arguments */
DCL LOCALE_NAME CHAR(14) VARYING;
/* CEEQRYL service call arguments */
DCL LOCALE_NAME_TIME CHAR(256) VARYING;
CEESGL—Signal a condition

CEESGL raises, or signals, a condition to the Language Environment condition manager. It also provides qualifying data and creates an ISI for a particular instance of the condition. The ISI contains information used by the Language Environment condition manager to identify and react to conditions.

CEESGL is typically used to generate application-specific conditions that are recognized by condition handlers registered using CEEHDLR. Conditions can also be selected to simulate a Language Environment or system condition. If you plan on using a routine that signals a new condition with a call to CEESGL, you should first call the CEECMI callable service to copy any insert information into the ISI associated with the condition.

CEESGL generates a Language Environment condition. You can map some of the Language Environment condition tokens to POSIX signals. Unique conditions signaled by CEESGL are considered to be enabled under Language Environment. Therefore, they undergo Language Environment condition handling.

CEESGL can signal a POSIX condition. If CEESGL signals a POSIX condition and the signal is blocked at the time of the generation but later unblocked and delivered, the POSIX signal processing semantics are applied. The Language Environment synchronous condition manager semantics do not apply.
Severity 0 and 1 conditions are considered safe conditions. They can be ignored if they are not handled and if no feedback token is passed when the condition is raised.

Each signaled condition (of severity 2 or above) increments the error count by one. If the error count exceeds the error count limit (as specified by the ERRCOUNT runtime option—see “ERRCOUNT” on page 28) the condition manager terminates the enclave with abend code 4091, reason code 11. T_I_U (Termination Imminent due to an Unhandled Condition) is not issued. Promoted conditions do not increment the error count. A program established using the CEEHDR callable service or one of the HLL condition handlers, can then process the raised condition.

ERRCOUNT applies to CEESGL only if the condition generated by CEESGL is delivered synchronously. POSIX signal handling semantics are then applied to the condition.

Table 25 on page 182 contains a list of the S/370 program interrupt codes and their corresponding Language Environment condition token names and message numbers.

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEEE069</td>
<td>0</td>
<td>0201</td>
<td>An unhandled condition was returned in a feedback code.</td>
</tr>
<tr>
<td>CEEE0CE</td>
<td>1</td>
<td>0398</td>
<td>Resume with new input.</td>
</tr>
<tr>
<td>CEEE0CF</td>
<td>1</td>
<td>0399</td>
<td>Resume with new output.</td>
</tr>
<tr>
<td>CEEE0EB</td>
<td>3</td>
<td>0459</td>
<td>Not enough storage was available to create a new instance-specific information block.</td>
</tr>
<tr>
<td>CEEE0EE</td>
<td>3</td>
<td>0462</td>
<td>Instance-specific information for the condition token with message number message-number and facility ID facility-id could not be found.</td>
</tr>
</tbody>
</table>

Usage notes
• PL/I consideration: Conditions with a facility_ID of IBM cannot be used in CEESGL.
• z/OS UNIX consideration: In multithread applications, CEESGL affects only the calling thread. Delivery of a CEESGL generated condition is limited to the thread that generated the condition. However, if the condition is a severity 2 or higher, and is not handled by the application, the default action of terminate applies to the enclave, not just the calling thread.

• COBOL consideration: When a resume occurs and control resumes to the next instruction that follows the call to CEE3SRP, the COBOL RETURN-CODE special register contains an unpredictable value.

For more information

• See “CEECMI—Store and load message insert data” on page 193 for more information about the CEECMl callable service.

• See z/OS Language Environment Programming Guide for more information about mapping Language Environment condition tokens to POSIX signals.

• See “ERRCOUNT” on page 28 for more information about the ERRCOUNT runtime option.

• To construct your own condition token, see “CEENCOD—Construct a condition token” on page 331.

• For more information about condition handling, see z/OS Language Environment Programming Guide.

• See “CEEGQDT—Retrieve q_data_token” on page 268 for more information about the CEEGQDT callable service.

Examples

1. Following is an example of CEESGL called by C/C++.

```c
/*Module/File Name: EDCSGL */
#include <stdio.h>
#include <string.h>
#include <stdlib.h>
#include <leawi.h>
#include <ceeedcct.h>
int main(void) {
    _FEEDBACK fc,condtok;
    _ENTRY routine;
    _INT4 token,qdata;
    _INT2 c_1,c_2,cond_case,sev,control;
    _CHAR3 facid;
    _INT4 isi;
    /* . . */
    /* build the condition token */
    c_1 = 1;
    c_2 = 99;
    cond_case = 1;
    sev = 1;
    control = 0;
    memcpy(facid,"ZZZ",3);
    isi = 0;
    CEENCOD(&c_1,&c_2,&cond_case,&sev,&control,;
    facid,&isi,&condtok,&fc);
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEENCOD failed with message number %d\n", fc.tok_msgno);
        exit(2999);
    }
    /* signal the condition */
    CEESGL(&condtok,&qdata,&fc);
    if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
        printf("CEESGL failed with message number %d\n", fc.tok_msgno);
        exit(2999);
    }
    /* */
```
2. Following is an example of CEESGL called by COBOL.

CBL LIB,QUOTE
+Module/File Name: IGZTSGL
*****************************************************************************
** CALL CEESGL to signal a condition **
*****************************************************************************
IDENTIFICATION DIVISION.
PROGRAM-ID. CBLSGL.
DATA DIVISION.
WORKING-STORAGE SECTION.
01 CONDTOK.
  02 Condition-Token-Value.
    COPY CEEIGZCT.
    03 Case-1-Condition-ID.
      04 Severity    PIC S9(4) BINARY.
      04 Msg-No      PIC S9(4) BINARY.
    03 Case-2-Condition-ID
      REDEFINES Case-1-Condition-ID.
      04 Class-Code  PIC S9(4) BINARY.
      04 Cause-Code  PIC S9(4) BINARY.
      03 Case-Sev-Ctl  PIC X.
    02 Facility-ID  PIC XXX.
    02 I-S-Info     PIC S9(9) BINARY.
01 QDATA       PIC S9(9) BINARY.
01 FC.
  ** 02 Condition-Token-Value.
    COPY CEEIGZCT.
    03 Case-1-Condition-ID.
      04 Severity    PIC S9(4) BINARY.
      04 Msg-No      PIC S9(4) BINARY.
    03 Case-2-Condition-ID
      REDEFINES Case-1-Condition-ID.
      04 Class-Code  PIC S9(4) BINARY.
      04 Cause-Code  PIC S9(4) BINARY.
      03 Case-Sev-Ctl  PIC X.
    02 Facility-ID  PIC XXX.
    02 I-S-Info     PIC S9(9) BINARY.
01 SEV          PIC S9(4) BINARY.
01 MSGNO       PIC S9(4) BINARY.
01 CASE        PIC S9(4) BINARY.
01 SEV2        PIC S9(4) BINARY.
01 CNTRL       PIC S9(4) BINARY.
01 FACID       PIC X(3).
01 ISINFO      PIC X(4).
PROCEDURE DIVISION.
PARA-CBLSGL.
*****************************************************************************
** Call CEENCOD with the values assigned above **
** to build a condition token "CONDTOK" **
** Set CONDTOK to sev = 0, msgno = 1 facid = CEE **
*****************************************************************************
MOVE 0 TO SEV.
MOVE 1 TO MSGNO.
MOVE 1 TO CASE.
MOVE 0 TO SEV2.
MOVE 1 TO CNTRL.
MOVE "CEE" TO FACID.
MOVE 0 TO ISINFO.
CALL "CEENCOD" USING SEV, MSGNO, CASE,
  SEV2, CNTRL, FACID, ISINFO, CONDTOK, FC.
IF NOT CEE000 OF FC THEN
  DISPLAY "CEENCOD failed with msg ",
  Msg-No OF FC UPON CONSOLE
  STOP RUN
END-IF.

** Call CEESGL to signal the condition with
*****************************************************************************
** the condition token and qdata described **
** in CONDTOK and QDATA **
*****************************************************************************
MOVE 0 TO QDATA.
CALL "CEESGL" USING CONDTOK, QDATA, FC.
IF NOT CEE000 of FC THEN
   DISPLAY "CEESGL failed with msg ",
   Msg-No of FC UPON CONSOLE
   STOP RUN
END-IF.
GOBACK.

3. Following is an example of CEESGL called by PL/I.

    *PROCESS MACRO;
    /*! Module/File Name: IBMSGL */
    /******************************************************************************/
    /**
    /** Function: CEESGL - Signal a Condition 
    /********************************************************************************/
    PLISGL: PROC OPTIONS(MAIN);
    %INCLUDE  CEEIBMCT;
    DCL 01 CONDTOK, /* Feedback token */
        03 MsgSev   REAL FIXED BINARY(15,0),
        03 MsgNo    REAL FIXED BINARY(15,0),
        03 Flags,
        05 Case     BIT(2),
        05 Severity  BIT(3),
        05 Control  BIT(3),
        03 FacID    CHAR(3), /* Facility ID */
        03 ISI  /* Instance-Specific Information */
        REAL FIXED BINARY(31,0);
    DCL QDATA REAL FIXED BINARY(31,0);
    DCL 01 FC, /* Feedback token */
        03 MsgSev   REAL FIXED BINARY(15,0),
        03 MsgNo    REAL FIXED BINARY(15,0),
        03 Flags,
        05 Case    BIT(2),
        05 Severity BIT(3),
        05 Control BIT(3),
        03 FacID   CHAR(3), /* Facility ID */
        03 ISI  /* Instance-Specific Information */
        REAL FIXED BINARY(31,0);
    /* Give CONDTOK value of condition CEE001 */
    ADDR( CONDTOK ) -> CEEIBMCT = CEE001;
    /* Signal condition CEE001 with qualifying data */
    QDATA = 1;
    CALL CEESGL( CONDTOK, QDATA, FC );
    IF FBCHECK( FC, CEE000 ) THEN DO;
        PUT SKIP LIST( 'Condition CEE001 signalled' );
    END;
    ELSE DO;
        DISPLAY( 'CEESGL failed with msg '
            || FC.MsgNo );
        STOP;
    END;
    END PLISGL;

**CEESTXF—Transform string characters into collation weights**

CEESTXF, which is analogous to the C language function `strcfrm()`, transforms every character in a character string to its unique collation weight. The collation weights are established from the LC_COLLATE category for the locale. CEESTFX also returns the length of the transformed string. CEESTXF is sensitive to the locales set by `setlocale()` or `CEESETL`, not to the Language Environment settings from `COUNTRY` or `CEE3CTY`. 
omitted_parm
This parameter is reserved for future expansion and must be omitted. For information about how to code an omitted parm, see “Invoking callable services” on page 104.

mbstring (input)
A halfword length-prefixed character string (VSTRING) that is to be transformed.

number (input)
A 4-byte integer that specifies the number of bytes of mbstring to be transformed. The value of this parameter must be greater than zero; otherwise, an error is reported, and no transformation is attempted.

txfstring (output)
A halfword length-prefixed character string (VSTRING) where the transformation of mbstring is to be placed.

length (output)
A 4-byte integer that specifies the length of the transformed string, if successful.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE3T1</td>
<td>3</td>
<td>4001</td>
<td>General Failure: Service could not be completed.</td>
</tr>
<tr>
<td>CEE3TF</td>
<td>3</td>
<td>4015</td>
<td>Input Error: The number of characters to be transformed must be greater than zero.</td>
</tr>
</tbody>
</table>

Usage notes
• PL/I MTF consideration—CEESETL is not supported in PL/I MTF applications.
• This callable service uses the C/C++ runtime library. The C/C++ library must be installed and accessible even when this service is called from a non-C program.

For more information
• For more information about the setlocale(), see “COUNTRY” on page 20, “CEE3CTY—Set the default country” on page 122, and “CEE3LNG—Set national language” on page 155.
• For more information about the CEESETL callable service, see “CEESETL—Set locale operating environment” on page 362.

Examples
1. Following is an example of CEESTXF called by COBOL.

```plaintext
CBL LIB,QUOTE
*Module/File Name: IGZTSTXF
**************************************************************************
* Example for callable service CEESTXF *
* COBSTXF - Query current collate category and *
* build input string as function of *
* locale name.
* Translate string as function of *
```
IDENTIFICATION DIVISION.
PROGRAM-ID. COBSTXF.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01 MBS.
  02 MBS-Length PIC S9(4) BINARY.
  02 MBS-String PIC X(10).
  01 TXF.
  02 TXF-Length PIC S9(4) BINARY.
  02 TXF-String PIC X(256).
  01 Locale-Name.
  02 LN-Length PIC S9(4) BINARY.
  02 LN-String PIC X(256).

* Use Locale category constants
COPY CEEIGZLC.
  01 MBS-Size PIC S9(9) BINARY VALUE 0.
  01 TXF-Size PIC S9(9) BINARY VALUE 0.
  01 FC.
  02 Condition-Token-Value.
COPY CEEIGZCT.
  03 Case-1-Condition-ID.
  04 Severity PIC S9(4) BINARY.
  04 Msg-No PIC S9(4) BINARY.
  03 Case-2-Condition-ID
   REDEFINES Case-1-Condition-ID.
  04 Class-Code PIC S9(4) BINARY.
  04 Cause-Code PIC S9(4) BINARY.
  03 Case-Sev-Ctl PIC X.
  03 Facility-ID PIC XXX.
  02 I-S-Info PIC S9(9) BINARY.

PROCEDURE DIVISION.

* Call CEEQRYL to retrieve locale name
CALL "CEEQRYL" USING LC-COLLATE, Locale-Name, FC.

* Check feedback code and set input string
IF Severity = 0
  IF LN-String (1:LN-Length) = "Sv-SE.IBM-1047"
    MOVE 10 TO MBS-Length
    MOVE 10 TO MBS-Size
    MOVE "7,123,456." TO MBS-String (1:MBS-Length)
  ELSE
    MOVE 7 TO MBS-Length
    MOVE 7 TO MBS-Size
    MOVE "8765432" TO MBS-String (1:MBS-Length)
  END-IF
ELSE
  DISPLAY "Call to CEEQRYL failed. " Msg-No
  STOP RUN
END-IF.
  MOVE SPACES TO TXF-String.
  MOVE 0 to TXF-Length.

* Call CEESTXF to translate the string
CALL "CEESTXF" USING OMITTED, MBS, MBS-Size, TXF, TXF-Size, FC.

* Check feedback code and return length
IF Severity = 0
  IF TXF-Length > 0
    DISPLAY "Translated string is " TXF-String
  ELSE
    DISPLAY "String not translated."
  END-IF
ELSE
  DISPLAY "Call to CEESTXF failed. " Msg-No
END-IF.
STOP RUN.
END PROGRAM COBSTXF.

2. Following is an example of CEESTXF called by PL/I.

*PROCESS MACRO;
/*Module/File Name: IBMSTXF                          */
/* Example for callable service CEESTXF               */
/* Function: Query current collate category and       */
/*   build input string as function of locale name.   */
/* Translate string as function of locale.           */
/**********************************************************************/
PLISTXF: PROC OPTIONS(MAIN);
%INCLUDE CEEIBMAMW; /* ENTRY defs, macro defs */
%INCLUDE CEEIBMCT; /* FBCHECK macro, FB constants */
%INCLUDE CEEIBMLC; /* Locale category constants */
/* CEESTXF service call arguments */
DCL MBSTRING  CHAR(10) VARYING;   /* input string   */
DCL MBNUMBER  BIN FIXED(31);      /* input length   */
DCL TXFSTRING CHAR(256) VARYING;  /* output string  */
DCL TXFLENGTH BIN FIXED(31);      /* output length  */
/* CEEQRYL service call arguments */
DCL LOCALE_NAME_COLLATE CHAR(256) VARYING; /* locale name */
DCL 01 FC,                        /* Feedback token */
03 MsgSev    REAL FIXED BINARY(15,0),
03 MsgNo     REAL FIXED BINARY(15,0),
03 Flags,    /* Flags */
05 Case      BIT(2),
05 Severity  BIT(3),
05 Control   BIT(3),
03 FacID     CHAR(3),       /* Facility ID */
03 ISI      /* Instance-Specific Information */
   REAL FIXED BINARY(31,0);
/* retrieve active locale for collate category */
/* Use LC_COLLATE category const from CEEIBMLC */
CALL CEEQRYL ( LC_COLLATE, LOCALE_NAME_COLLATE, FC);
/* FBCHECK macro used (defined in CEEIBMCT) */
IF FBCHECK( FC, CEE000 ) THEN
   DO; /* successful query, set string for CEESTXF */
      IF LOCALE_NAME_COLLATE = 'Sv_SE.IBM-1047' THEN
         MBSTRING = '7,123,456.';
      ELSE
         MBSTRING = '8765432';
         MBNUMBER = LENGTH(MBSTRING);
      END;
   ELSE
      MBSTRING = '8765432';
      MBNUMBER = LENGTH(MBSTRING);
   END;
ELSE
   DO;
      DISPLAY ( 'Locale LC_COLLATE '||FC.MsgNo );
   STOP;
END;
ENDIF;
/* TXFSTRING = ' ;*/
CALL CEESTXF ( *, MBSTRING, MBNUMBER,
   TXFSTRING, TXFLENGTH, FC);
IF FBCHECK( FC, CEE000 ) THEN
   DO; /* successful call, use transformed length */
      IF TXFLENGTH >0 THEN
         DO;
            PUT SKIP LIST( 'Transformed string is '||
               SUBSTR(TXFSTRING,1, TXFLENGTH) );
         END;
      ELSE
         IF FBCHK( FC, CEE3TF ) THEN
            DO;
               DISPLAY ( 'Zero length input string' );
            END;
         END;
      END;
   ELSE
      IF FBCHK( FC, CEE3TF ) THEN
         DO;
            DISPLAY ( 'Zero length input string' );
         END;
      END;
   END;
ENDIF;
CEETDLI—Invoke IMS

CEETDLI provides an interface to PL/I facilities that operates in IMS. In assembler, COBOL, PL/I, and C/C++, you can also invoke IMS by using the following interfaces:

- In assembler, the ASMTDLI interface
- In COBOL, the CBLTDLI interface
- In PL/I, the PLITDLI interface
- In C/C++, the CTDLI interface, a `ctdli()` function call

CEETDLI performs essentially the same functions as these interfaces, but it offers some advantages, particularly if you plan to run an ILC application in IMS.

The names CEETDLI, AIBTDLI, ASMTDLI, CBLTDLI, CTDLI, and PLITDLI are all interpreted as IMS interfaces. If you are currently using them in any other way in your application, you must change them.

The CEETDLI interface supports calls to IMS that use an application interface block (AIB) or a program communication block (PCB).

```
parmcount
```

A fullword integer specifying the total number of arguments for the CEETDLI call. This option usually is not needed and can be omitted; it is supported for compatibility with earlier interface modules.

```
function
```

The IMS function that you want to perform. The possible values for this field are defined by IMS, not Language Environment.

```
args
```

Arguments that you pass to IMS. You cannot pass runtime options as CEETDLI arguments. You cannot alter the settings of runtime options when invoking IMS facilities. The order and meaning of the arguments is defined by IMS, not Language Environment.

Usage notes

- CEETDLI is not supported with CICS.
- z/OS UNIX considerations—IMS supports only applications that use the POSIX(ON) runtime option from a single thread. Calls to z/OS UNIX threading functions are restricted under IMS. See z/OS XL C/C++ Programming Guide for a list of restrictions on running IMS and z/OS UNIX.

For more information

- For more information about AIB and a complete description of all available IMS functions and argument parameters you can specify in CEETDLI, see IMS Application Programming Guide.
- For more information about CEETDLI in the context of other DLI interfaces, and in the context of IMS condition handling, see z/OS Language Environment Programming Guide.

Examples

1. Following is an example of CEETDLI called by C.

```c
/*Module/File Name: EDCMRCR */
#pragma runopts(env(IMS),plist(IMS))
#include <ims.h>
#include <leawi.h>
define io_pcb ((IO_PCB_TYPE *)(__pcblist??(0??)))
```
2. Following is an example of CEETDLI called by COBOL.

```
IDENTIFICATION DIVISION.
PROGRAM-ID. CBL2IMS.
DATA DIVISION.
WORKING-STORAGE SECTION.
  77  FUNC-GU              PIC X(4) VALUE "GU  ".
  01  MSG-SEG-IO-AREA      PIC X(32).
LINKAGE SECTION.
  01  IO-PCB               PIC X(48).
** ENTRY POINT:                               */
PROCEDURE DIVISION USING IO-PCB.
  CALL "CEETDLI" USING FUNC-GU,IO-PCB,
                MSG-SEG-IO-AREA.
  GOBACK.
```

3. Following is an example of CEETDLI called by PL/I.

```
*PROCESS MACRO SYSTEM(IMS);
 /*Module/File Name: IBMTDLI                           */
 /* ----------------------------------------------- */
 /* Function: Use CEETDLI - interface to IMS         */
 /* from PL/I.                                      */
 /* In this example, a call is made to CEETDLI      */
 /* to interface to IMS for an IMS service.         */
 /* ----------------------------------------------- */
 /*               ENTRY POINT                        */
 /* ----------------------------------------------- */
 PLI2IMS: PROCEDURE(IO_PTR) OPTIONS(MAIN NOEXECOPS);
%INCLUDE   CEEIBMAW;
DCL   FUNC_GU         CHAR(4)   INIT('GU  ');
DCL   IO_PTR          PTR;
DCL 1 IO_PCB          CHAR(48) BASED (IO_PTR);
DCL 1 MSG_SEG_IO_AREA CHAR(32);
CALL CEETDLI (FUNC GU, IO_PCB, MSG_SEG_IO_AREA);
RETURN;
END PLI2IMS;
```
**CEETEST—Invoke the debug tool**

CEETEST invokes a debug service such as IBM z/OS Debugger.

IBM z/OS Debugger supports debugging of Language Environment, except for some noted restrictions. For more information about Debug Tool for z/OS, see the IBM z/OS Debugger (developer.ibm.com/mainframe/products/ibm-zos-debugger). If you want to invoke another interactive debug service, refer to the appropriate user's guide.

```
CEETEST (string_of_commands, fc)
```

*string_of_commands (input)*

A halfword-prefixed string containing a debug tool command list. *string_of_commands* is optional. If a debug tool is available, the commands in the list are passed to the debug tool and carried out. If this parameter is omitted, your debug service defines the action taken. For more information, refer to the appropriate user's guide for your debug service.

*fc (output)*

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE2F2</td>
<td>3</td>
<td>2530</td>
<td>A debug tool was not available.</td>
</tr>
<tr>
<td>CEE2F7</td>
<td>3</td>
<td>2535</td>
<td>Profiler loaded; a debug tool was not available.</td>
</tr>
</tbody>
</table>

**Usage notes**

- z/OS UNIX considerations—CEETEST applies to the enclave. All threads in the enclave can access debugger information.

**For more information**

- If you are using CEETEST to invoke IBM z/OS Debugger and need more information about how to create an IBM z/OS Debugger command list, refer to the IBM z/OS Debugger (developer.ibm.com/mainframe/products/ibm-zos-debugger).

**Examples**

1. Following is an example of CEETEST called by C/C++.

```c
/*Module/File Name: EDCTEST   */
#include <string.h>
#include <stdio.h>
#include <leawi.h>
#include <stdlib.h>
#include <ceeedcct.h>

int main (void) {
    int x,y,z;
    _VSTRING commands;
    _FEEDBACK fc;
    strcpy(commands.string, "AT LINE 30 { LIST(x); LIST(y); GO; }");
    commands.length = strlen(commands.string);
}```
CEETEST(&commands,&fc);

if ( _FBCHECK ( fc , CEE000 ) != 0 ) {
    printf("CEETEST failed with message number %d\n", fc.tok_msgno);
    exit(2999);
}

x = y = 12;
/* . */
/* debug tool displays the values of x and y */
/* at statement 30 */
/* . */

2. Following is an example of CEETEST called by COBOL.

CBL LIB,QUOTE
*Module/File Name: IGZTTEST
IDENTIFICATION DIVISION.
PROGRAM-ID. IBCT002.

DATA DIVISION.
WORKING-STORAGE SECTION.
01 MANVAR1 PIC S9(9) BINARY.
01 CEETEST-PARMS.
   02 Vstring-length PIC S9(4) BINARY.
   02 Vstring-text.
      03 Vstring-char PIC X,
         OCCURS 0 TO 256 TIMES
         DEPENDING ON Vstring-length
         of CEETEST-PARMS.
   01 FC.
   02 Condition-Token-Value.
   COPY CEEIGZCT.
      03 Case-1-Condition-ID.
      04 Severity PIC S9(4) BINARY.
      04 Msg-No PIC S9(4) BINARY.
      03 Case-2-Condition-ID
      REDEFINES Case-1-Condition-ID.
      04 Class-Code PIC S9(4) BINARY.
      04 Cause-Code PIC S9(4) BINARY.
      03 Case-Sev-Ctl PIC X.
      03 Facility-ID PIC XXX.
   02 I-S-Info PIC S9(9) BINARY.
PROCEDURE DIVISION.
PARA-IBCT002.
    MOVE 0 TO MANVAR1
    COMPUTE MANVAR1 = MANVAR1 + 100
    DISPLAY "The value of MANVAR1 is ", MANVAR1
    ***************************************************
    * CALL CEETEST FOR FIRST TIME.                   *
    ***************************************************
    MOVE 70 TO Vstring-length of CEETEST-PARMS.
    MOVE "DESC PROGRAM AT ENTRY IBCT002:SUBRTN"
       TO Vstring-text of CEETEST-PARMS(1:37).
    MOVE "PERFORM Q LOC GO END-PERFORM GO"
       TO Vstring-text of CEETEST-PARMS(38:33).
    CALL "CEETEST" USING CEETEST-PARMS, FC.
    IF NOT CEE000 of FC THEN
       DISPLAY "CEETEST(1st call) failed with msg "
          Msg-No of FC UPON CONSOLE
       STOP RUN
    END-IF.
    ***************************************************
    * CALL CEETEST A SECOND TIME.                     *
    ***************************************************
    MOVE 4 TO Vstring-length of CEETEST-PARMS.
    MOVE "QUIT"
       TO Vstring-text of CEETEST-PARMS.
    CALL "CEETEST" USING CEETEST-PARMS, FC.
    IF NOT CEE000 of FC THEN
       DISPLAY "CEETEST(2nd call) failed with msg "
          Msg-No of FC UPON CONSOLE
       STOP RUN
IDENTIFICATION DIVISION.
PROGRAM-ID. SUBRTN.
DATA DIVISION.
WORKING-STORAGE SECTION.
  01  MANVAR1                 PIC S9(9) BINARY.
  01  MVAR                    PIC S9(9) BINARY.
PROCEDURE DIVISION.
  PARA-SUBRTN.
    COMPUTE MVAR = MVAR + 100 .
    COMPUTE MANVAR1 = MANVAR1 + 100 .
  GOBACK.
END PROGRAM SUBRTN.
END PROGRAM IBCT002.

3. Following is an example of CEETEST called by PL/I.

*PROCESS MACRO;
/* Module/File Name: IBMTEST                        */
//**************************************************************************
/**                                                ***/
/** Function: CEETEST - Invoke a Debug Tool        ***/
/**                                                ***/
**************************************************************************
PLITEST: PROC OPTIONS(MAIN);
%INCLUDE  CEEIBMAW;
%INCLUDE  CEEIBMCT;
DCL DBGCMD CHAR(255) VARYING;
DCL 01 FC,                     /* Feedback token */
  03 MsgSev    REAL FIXED BINARY(15,0),
  03 MsgNo     REAL FIXED BINARY(15,0),
  03 Flags,    
    05 Case     BIT(2),
    05 Severity  BIT(3),
    05 Control   BIT(3),
  03 FacID     CHAR(3),      /* Facility ID */
  03 ISI /* Instance-Specific Information */
                   REAL FIXED BINARY(31,0);

DBGCMD = 'QUERY PROGRAMMING LANGUAGE';
CALL CEETEST ( DBGCMD, FC );
IF VBFCHECK( FC, CEE000) THEN DO;
  PUT SKIP LIST('Debug tool called with command: ' || DBGCMD );
END;
ELSE DO;
  DISPLAY('CEETEST failed with msg ' || FC.MsgNo);
  STOP;
END;
END PLITEST;

** CEEUTC—Get coordinated universal time **

CEEUTC is an alias of CEEGMT. See “CEEGMT—Get current Greenwich Mean Time” on page 259 for more information.
Chapter 6. Bit manipulation routines

This topic lists the Language Environment bit manipulation routines. Bits are numbered from right to left, starting from 0.

CEESICLR—Bit clear

Purpose

CEESICLR returns a copy of its parm1 input, but with one bit selectively set to 0.

Syntax

```
CEESICLR(parm1, parm2, fc, result)
```

parm1 (input)
The first input to the Bit Clear routine. The input can be any 32-bit integer.

parm2 (input)
The second input to the Bit Clear routine. The parm2 value is a 32-bit integer in the range between 0 and 31, inclusive.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td></td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1VC</td>
<td>2</td>
<td>2028</td>
<td>The value of the second argument was outside the valid range range in math routine routine-name.</td>
</tr>
</tbody>
</table>

result (output)
The result of the Bit Clear routine. The output is a copy of parm1, but with the bit numbered parm2 (counting from the right) set to 0.

CEESISET—Bit set

Purpose

CEESISET returns a copy of its parm1 input, but with one bit selectively set to 1.

Syntax

```
CEESISET(parm1, parm2, fc, result)
```

parm1 (input)
The first input to the Bit Set routine. The input can be any 32-bit integer.
**parm2 (input)**

The second input to the Bit Set routine. The `parm2` value is a 32-bit integer in the range between 0 and 31, inclusive.

**fc (output)**

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td></td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1VC</td>
<td>2</td>
<td>2028</td>
<td>The value of the second argument was outside the valid range range in math routine routine-name.</td>
</tr>
</tbody>
</table>

**result (output)**

The result of the Bit Set routine. The output is a copy of `parm1`, but with the bit numbered `parm2` (counting from the right) set to 1.

---

**CEESISHF—Bit shift**

**Purpose**

CEESISHF returns a copy of its `parm1` input right- or left-shifted by the number of bits indicated by `parm2`.

**Syntax**

```
CEESISHF(par1, parm2, fc, result)
```

**parm1 (input)**

The first input to the Bit Shift routine. The input can be any 32-bit integer.

**parm2 (input)**

The second input to the Bit Shift routine. The `parm2` value is a 32-bit integer in the range between -32 and 32, inclusive.

**fc (output)**

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td></td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1VC</td>
<td>2</td>
<td>2028</td>
<td>The value of the second argument was outside the valid range range in math routine routine-name.</td>
</tr>
</tbody>
</table>

**result (output)**

The result of the Bit Shift routine. The output is a 32-bit integer whose value depends upon the value of `parm2`; in either case, vacated bits are set to 0:

- If `parm2` is greater than or equal to 0, `result` is a copy of `parm1` shifted left by `parm2` bits.
- If `parm2` is less than 0, `result` is a copy of `parm1` shifted right by `|parm2|` bits.
CEESITST—Bit test

Purpose

CEESITST selectively tests a bit in its parm1 input to determine if the bit is on.

Syntax

```
CEESITST parm1 parm2 fc result
```

`parm1` (input)
The first input to the Bit Test routine. The input can be any 32-bit integer.

`parm2` (input)
The second input to the Bit Test routine. The `parm2` value is a 32-bit integer in the range between 0 and 31, inclusive.

`fc` (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td></td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1VC</td>
<td>2</td>
<td>2028</td>
<td>The value of the second argument was outside the valid range range in math routine routine-name.</td>
</tr>
</tbody>
</table>

`result` (output)
The result of the Bit Test routine. The output is a 32-bit integer with one of the following values; bits are counted from the right:

- 1 if bit number `parm2` in `parm1` is 1
- 0 if bit number `parm2` in `parm1` is 0
Chapter 7. Language Environment math services

Language Environment math services provide standard math computations. You can call them from Language Environment-conforming languages or from assembler routines by using the call interface, or the syntax specific to the HLL of your application.

Math services do not depend on enclave-level resources. You can invoke them from any thread.

If your application uses extended-precision arithmetic and runs on a 370-mode machine under VM, you must specify the TRAP(ON) runtime option (the default) and add the CMSLIB TXTLIB with the GLOBAL TXTLIB command.

Call interface to math services

The syntax for math services has two forms, depending on how many input parameters the routine requires. The first four letters of the math services are always CEES. The fifth character is x, which you replace according to the parameter types listed in “Parameter types: parm1 and parm2” on page 383. The last three letters name the math function performed. In the following examples, the first function performed is the absolute value (ABS), and the second function is the positive difference (DIM).

**One parameter**

```
CEESxABS (parm1, fc, result)
```

**Two parameters**

```
CEESxDIM (parm1, parm2,fc, result)
```

Parameter types: parm1 and parm2

The first parameter (parm1) is mandatory. The second parameter (parm2) is used only when you use a math service with two parameters. The x in the fifth space of CEESx must be replaced by a parameter type for input and output. Substitute I, S, D, Q, T, E, or R for x:

- **I**
  - 32-bit binary integer

- **S**
  - 32-bit single floating-point number

- **D**
  - 64-bit double floating-point number

- **Q**
  - 128-bit extended floating-point number

- **T**
  - 32-bit single floating-point complex number. This parameter type consists of a real part and an imaginary part, each of which is a 32-bit single floating-point number.

- **E**
  - 64-bit double floating-point complex number. This parameter type consists of a real part and an imaginary part, each of which is a 64-bit double floating-point number.
R

128-bit extended floating-point complex number. This parameter type consists of a real part and an imaginary part, each of which is a 128-bit extended floating-point number.

Language Environment math services expect normalized input.

In the described routines, the output range for complex-valued functions can be determined from the input range. For functions of complex variables, the image of the input is generally a non-rectangular shape. For this reason, the output range is not provided.

**Feedback code parameter (fc)**

The fc value is a feedback code that indicates the result of the math service. If you specify fc as an argument, feedback information in the form of a condition token is returned to the calling routine. The condition token indicates whether the routine completed successfully or whether a condition was encountered while the routine was running. If you do not specify fc as an argument and the requested service does not successfully complete, the condition is signaled. Math services call other services that might generate feedback codes.

**Language-specific built-in math services**

C/C++, COBOL, FORTRAN, and PL/I offer built-in math services that you can also use under Language Environment. For a description of these functions, refer to the reference documentation associated with each language.

**Calls to math services from different languages**

Table 29 on page 384 shows sample calls to the Language Environment math service CEESLOG—logarithm base e, as made from C/C++, COBOL, and PL/I. For more examples, see “Examples of math services” on page 415.

<table>
<thead>
<tr>
<th>Called from</th>
<th>Code example</th>
</tr>
</thead>
</table>
| C/C++       | ```
#include <leawi.h>
#include <string.h>
#include <stdio.h>

int main (void) {
    float int1, intr;
    _FEEDBACK fc;
    #define SUCCESS "\0\0\0\0"
    int1 = 39;
    CEESLOG(&int1,&fc,&intr);
    if (memcmp(&fc,SUCCESS,4) != 0) {
        printf("CEESLOG failed with message number %d\n", fc.tok_msgno);
        exit(2999);
    }
    printf("Log base e of %f is %f\n",int1,intr);
} ``` |
Table 29: Examples of calls to CEESLOG (continued)

<table>
<thead>
<tr>
<th>Called from</th>
<th>Code example</th>
</tr>
</thead>
</table>
| COBOL       | 77 ARG1RS  COMP-1.  
|             | 77 FBCODE PIC X(12).  
|             | 77 RESLTRS COMP-1.  
|             | CALL "CEESLOG" USING ARG1RS , FBCODE , RESLTRS.  |
| PL/I        | DCL ARG1 RESULT REAL FLOAT DEC (6);  
|             | DCL FC CHARACTER (12);  
|             | CALL CEESSLOG (ARG1, FC, RESULT)  |

Math services

This section describes the Language Environment math services. It also provides examples of how various services are called by different programming languages.

**CEESxABS—Absolute value**

CEESxABS returns the absolute value of the parameter by using the equation: 
\[ \text{result} = |\text{parm1}| \]

The following routines are provided for the various data types supported:

- **CEESIABS**
  - 32-bit binary integer

- **CEESSABS**
  - 32-bit single floating-point number

- **CEESDABS**
  - 64-bit double floating-point number

- **CEESQABS**
  - 128-bit extended floating-point number

- **CEESTABS**
  - 32-bit single floating-point complex number

- **CEESEABS**
  - 64-bit double floating-point complex number

- **CEESRABS**
  - 128-bit extended floating-point complex number

\[ \text{CEESxABS} (\text{parm1}, \text{fc}, \text{result}) \]

**parm1 (input)**

The input to the absolute value routine. The input range is not restricted.

**fc (output)**

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.
The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1V9</td>
<td>1</td>
<td>2025</td>
<td>An underflow occurred in math routine <em>routine-name</em>.</td>
</tr>
</tbody>
</table>

**result (output)**

The result of the absolute value routine. The output range is the non-negative numbers:

\[ \leq \Omega \]

Omega varies depending on the precision of *parm1*:

- For single-precision routines, \( \Omega = 16^{63}(1-16^{-6}) \)
- For double-precision routines, \( \Omega = 16^{63}(1-16^{-16}) \)
- For extended-precision routines, \( \Omega = 16^{63}(1-16^{-28}) \)

**CEESxACS—Arccosine**

CEESxACS returns the arccosine of the parameter by using the equation: \( \text{result} = \arccos(\text{parm1}) \)

The following routines are provided for the various data types supported:

- **CEESSACS**: 32-bit single floating-point number
- **CEESDACS**: 64-bit double floating-point number
- **CEESQACS**: 128-bit extended floating-point number

**parm1 (input)**

The input to the arccosine routine. The input range is:

\[ |\text{parm1}| \leq 1 \]

**fc (output)**

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1V0</td>
<td>2</td>
<td>2016</td>
<td>The absolute value of the parameter was greater than ( \text{limit} ) in math routine <em>routine-name</em>.</td>
</tr>
</tbody>
</table>

**result (output)**

The result, in radians, of the arccosine routine.

\[ 0 \leq \text{result} \leq \pi \]
**CEESxASN—Arcsine**

CEESxASN returns the arcsine of the parameter by using the equation: \( \text{result} = \arcsin(parm1) \)

The following routines are provided for the various data types supported:

**CEESSASN**
32-bit single floating-point number

**CEESDASN**
64-bit double floating-point number

**CEESQASN**
128-bit extended floating-point number

- **parm1 (input)**
  The input to the arcsine routine. The input range is:
  \[ |parm1| \leq 1 \]

- **fc (output)**
  A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td></td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1V0</td>
<td>2</td>
<td>2016</td>
<td>The absolute value of the parameter was greater than ( \text{limit} ) in math routine routine-name.</td>
</tr>
</tbody>
</table>

- **result (output)**
  The result, in radians, of the arcsine routine. The output range is:
  \[ |result| < \pi/2 \]

**CEESxATH—Hyperbolic arctangent**

CEESxATH returns the hyperbolic arctangent of the parameter by using the following equation:

\[ \text{result} = \tanh^{-1}(parm1) \]

The following routines are provided for the various data types supported:

**CEESSATH**
32-bit single floating-point number

**CEESDATH**
64-bit double floating-point number

**CEESQATH**
128-bit extended floating-point number

**CEESTATH**
32-bit single floating-point complex number
**CEESATH**

64-bit double floating-point complex number

**CEESRATH**

128-bit extended floating-point complex number

---

**parm1 (input)**

The input to the hyperbolic arctangent routine. The input range for real variables is:

\[ |parm1| \leq 1 \]

For complex variables, \( \text{parm1} \) cannot be equal to 1 or -1.

**fc (output)**

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1V1</td>
<td>2</td>
<td>2017</td>
<td>The absolute value of the argument was greater than or equal to ( \text{limit} ) in math routine ( \text{routine-name} ).</td>
</tr>
<tr>
<td>CEE1V6</td>
<td>2</td>
<td>2022</td>
<td>The value of the argument was plus or minus ( \text{limit} ) in math routine ( \text{routine-name} ).</td>
</tr>
</tbody>
</table>

**result (output)**

The result of the hyperbolic arctangent routine. The output range for functions of real variables is:

\[ |result| \leq \Omega \]

Omega varies, depending on the precision of \( \text{parm1} \):

- For single-precision routines, \( \Omega = 16^{63}(1 - 16^{-6}) \)
- For double-precision routines, \( \Omega = 16^{63}(1 - 16^{-24}) \)
- For extended-precision routines, \( \Omega = 16^{63}(1 - 16^{-28}) \)

---

**CEESxATN—Arctangent**

CEESxATN returns the arctangent of the parameter by using the equation:\n\[ result = \arctan(parm1) \]

The following routines are provided for the various data types supported:

**CEESSATN**

32-bit single floating-point number.

**CEESDATN**

64-bit double floating-point number.

**CEESQATN**

128-bit extended floating-point number.

**CEESTATN**

32-bit single floating-point complex number.
CEESEATN
64-bit double floating-point complex number.

CEESRATN
128-bit extended floating-point complex number.

parm1 (input)
The input to the arctangent routine. The input range for real variables is not restricted. The input range of complex variables in parm1 is not equal to i or -i, where:

\[ i = \sqrt{-1} \]

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1V6</td>
<td>2</td>
<td>2022</td>
<td>The value of the parameter was plus or minus limit in math routine routine-name.</td>
</tr>
<tr>
<td>CEE1V9</td>
<td>1</td>
<td>2025</td>
<td>An underflow occurred in math routine routine-name.</td>
</tr>
</tbody>
</table>

result (output)
The result, in radians, of the arctangent routine. The output range for functions of real variables is:

\[ |\text{result}| < \pi/2 \]

CEESxAT2—Arctangent2
CEESxAT2 calculates a result by using the equation: result = the angle (in radians) between the positive X axis and a vector defined by (parm2, parm1) with a range from:

-\( \pi \) to \( \pi \), with \( \pi \),

For example, if parm1 and parm2 are positive, then result = arctan (parm1/parm2).

The following routines are provided for the various data types supported:

CEESSAT2
32-bit single floating-point number

CEESDAT2
64-bit double floating-point number

CEESQAT2
128-bit extended floating-point number
**parm1** (input)
The first input to the arctangent2 routine. The input range of **parm1** cannot equal 0 if **parm2** equals 0.

**parm2** (input)
The second parameter to the arctangent2 routine. The input range of **parm2** cannot equal 0 if **parm1** equals 0.

**fc** (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1UU</td>
<td>2</td>
<td>2014</td>
<td>Both parameters were equal to limit in math routine <em>routine-name</em>.</td>
</tr>
<tr>
<td>CEE1V9</td>
<td>1</td>
<td>2025</td>
<td>An underflow occurred in math routine <em>routine-name</em>.</td>
</tr>
</tbody>
</table>

**result** (output)
The result, in radians, of the arctangent2 routine. The output range is:

\[
|result| \leq \pi
\]

**CEESxCJG—Conjugate of complex**

**CEESxCJG** returns the conjugate of the complex number by using the equation: \( result = u - vi \), where \( parm1 = u + vi \).

The following routines are provided for the various data types supported:

- **CEEESTCJG**
  32-bit single floating-point complex number

- **CEESECJG**
  64-bit double floating-point complex number

- **CEESRCJG**
  128-bit extended floating-point complex number

**parm1** (input)
The input to the math service. Any representable complex number can be used as input.

**fc** (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
</tbody>
</table>

**result** (output)
The result of the conjugate of complex routine.
**CEESxCOS—Cosine**

CEESxCOS returns the cosine of the parameter by using the equation: \( result = \cos(\text{parm1}) \)

The following routines are provided for the various data types supported:

- **CEESSCOS**
  32-bit single floating-point number

- **CEESDCOS**
  64-bit double floating-point number

- **CEESQCOS**
  128-bit extended floating-point number

- **CEESTCOS**
  32-bit single floating-point complex number

- **CEESECOS**
  64-bit double floating-point complex number

- **CEESRCOS**
  128-bit extended floating-point complex number

**parm1 (input)**

The type is determined by the fifth character of the service name. The input range for real variables varies:

<table>
<thead>
<tr>
<th>For Real Variables</th>
<th>Input range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single floating-point numbers:</td>
<td>(</td>
</tr>
<tr>
<td>Double floating-point numbers:</td>
<td>(</td>
</tr>
<tr>
<td>Extended floating-point numbers:</td>
<td>(</td>
</tr>
</tbody>
</table>

For complex functions, the input range differs for the imaginary and real parts of the input.

<table>
<thead>
<tr>
<th>For Complex Functions</th>
<th>Input range</th>
</tr>
</thead>
<tbody>
<tr>
<td>The imaginary part:</td>
<td>(</td>
</tr>
<tr>
<td>The real part: single floating-point complex numbers:</td>
<td>(</td>
</tr>
<tr>
<td>The real part: double floating-point complex numbers:</td>
<td>(</td>
</tr>
<tr>
<td>The real part: extended floating-point complex numbers:</td>
<td>(</td>
</tr>
</tbody>
</table>

**fc (output)**

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to "Invoking callable services" on page 104 for the appropriate syntax to indicate that the feedback code was omitted.
The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1UT</td>
<td>2</td>
<td>2013</td>
<td>The absolute value of the imaginary part of the parameter was greater than ( \text{limit} ) in math routine ( \text{routine-name} ).</td>
</tr>
<tr>
<td>CEE1V1</td>
<td>2</td>
<td>2017</td>
<td>The absolute value of the parameter was greater than or equal to ( \text{limit} ) in math routine ( \text{routine-name} ).</td>
</tr>
<tr>
<td>CEE1V3</td>
<td>2</td>
<td>2019</td>
<td>The absolute value of the real part of the parameter was greater than or equal to ( \text{limit} ) in math routine ( \text{routine-name} ).</td>
</tr>
</tbody>
</table>

**result (output)**

The result of the cosine routine. The output range for functions of real variables is:

\[ |\text{result}| \leq 1 \]

**CEExCSH—Hyperbolic cosine**

CEExCSH returns the hyperbolic cosine of the parameter by using the equation: \( \text{result} = \cosh(\text{parm1}) \)

The following routines are provided for the various data types supported:

- **CEESSCSH**
  32-bit single floating-point number
- **CEESDCSH**
  64-bit double floating-point number
- **CEESQCSH**
  128-bit extended floating-point number
- **CEESTCSH**
  32-bit single floating-point complex number
- **CEEECSH**
  64-bit double floating-point complex number
- **CEESRCSH**
  128-bit extended floating-point complex number

**parm1 (input)**

The input to the hyperbolic cosine routine. The input range varies, depending on the function and type of number:

<table>
<thead>
<tr>
<th>For ...</th>
<th>Input range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functions of real variables:</td>
<td>(</td>
</tr>
<tr>
<td>The real part of complex numbers:</td>
<td>(</td>
</tr>
<tr>
<td>The imaginary part of complex numbers:</td>
<td>(</td>
</tr>
<tr>
<td>single floating-point complex numbers:</td>
<td></td>
</tr>
</tbody>
</table>
For ... Input range
The imaginary part of complex numbers: double floating-point complex numbers: \(|\text{Im}(\text{parm1})| < (2^{50} \cdot \Pi)\)
The imaginary part of complex numbers: extended floating-point complex numbers: \(|\text{Im}(\text{parm1})| < 2^{100}\)

**fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>0</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1V0</td>
<td>2</td>
<td>2016</td>
<td>The absolute value of the parameter was greater than (\text{limit}) in math routine (\text{routine-name}).</td>
</tr>
</tbody>
</table>

**result (output)**
The result of the hyperbolic cosine routine. The output range for functions of real variables varies:

<table>
<thead>
<tr>
<th>For ...</th>
<th>Output range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-precision routines:</td>
<td>(1 \leq \text{result} \leq \Omega)</td>
</tr>
<tr>
<td>Double-precision routines:</td>
<td>(\Omega = 16^{63}(1 - 16^{-6}))</td>
</tr>
<tr>
<td></td>
<td>(16^{63}(1 - 16^{-14}))</td>
</tr>
<tr>
<td>Extended-precision routines:</td>
<td>(16^{63}(1 - 16^{-28}))</td>
</tr>
</tbody>
</table>

**CEESxCTN—Cotangent**
CEESxCTN returns the cotangent of the parameter by using the equation: \(\text{result} = \cot(\text{parm1})\)

The following routines are provided for the various data types supported:

- **CEESSCTN**
  32-bit single floating-point number
- **CEESDCTN**
  64-bit double floating-point number
- **CEESQCTN**
  128-bit extended floating-point number

**parm1 (input)**
The input, in radians, into the cotangent routine. The input range varies, depending on the value of \(\text{parm1}\):

- If \(\text{parm1}\) is a 32-bit single floating-point number: \(|\text{parm1}| < (2^{18} \cdot \Pi)\)
- If \(\text{parm1}\) is a 64-bit double floating-point number: \(|\text{parm1}| < (2^{50} \cdot \Pi)\)
If $parm1$ is a 128-bit extended floating-point number:

\[ |parm1| < 2^{100} \]

If this is an extended floating-point number, this argument cannot approach a multiple of pi. Single floating-point numbers and double floating-point numbers cannot approach zero.

**$fc$ (output)**

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1UI</td>
<td>2</td>
<td>2002</td>
<td>The parameter value was too close to one of the singularities (plus or minus pi/2, plus or minus 3pi/2, for the tangent; or plus or minus pi, plus or minus 2pi, for the cotangent) in math routine routine-name.</td>
</tr>
<tr>
<td>CEE1V1</td>
<td>2</td>
<td>2017</td>
<td>The absolute value of the parameter was greater than or equal to limit in math routine routine-name.</td>
</tr>
</tbody>
</table>

**$result$ (output)**

The result of the cotangent routine. The output range is:

\[ |result| \leq \Omega \]

For single-precision routines, $\Omega = 16^{63}(1 - 16^{-6})$

For double-precision routines, $\Omega = 16^{63}(1 - 16^{-14})$

For extended-precision routines, $\Omega = 16^{63}(1 - 16^{-28})$

The output range is:

\[ result \leq \Omega \]

**CEESxDIM—Positive difference**

CEESxDIM returns the positive difference between two numbers by using one of the following equations:

<table>
<thead>
<tr>
<th>If</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>$parm1 &gt; parm2$</td>
<td>Then, $result = parm1 - parm2$</td>
</tr>
<tr>
<td>$parm1 \leq parm2$</td>
<td>Then, $result = 0$</td>
</tr>
</tbody>
</table>

The following routines are provided for the various data types supported:

**CEESIDIM**

32-bit binary integer

**CEESSDIM**

32-bit single floating-point number

**CEESDDIM**

64-bit double floating-point number

**CEESQDIM**

128-bit extended floating-point number
**CEESxDIM**

$(parm1, parm2, fc, result)$

- **parm1** (input)
  - The first input to the positive difference routine. The input range is not restricted.

- **parm2** (input)
  - The second parameter to the positive difference routine. The input range is not restricted.

- **fc** (output)
  - A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td></td>
<td>The service completed successfully.</td>
</tr>
</tbody>
</table>

- **result** (output)
  - The result of the positive difference routine. The output range is the non-negative numbers.

The following routines are provided for the various data types supported:

- **CEESTDVD**
  - 32-bit single floating-point complex number

- **CEESEDVD**
  - 64-bit double floating-point complex number

- **CEESRDVD**
  - 128-bit extended floating-point complex number

**CEESxDVD—Floating-point complex divide**

CEESxDVD performs the mathematical function of floating-point complex divide by using the equation:

$$result = \frac{parm1}{parm2}$$

The following routines are provided for the various data types supported:

- **CEESTDVD**
  - 32-bit single floating-point complex number

- **CEESEDVD**
  - 64-bit double floating-point complex number

- **CEESRDVD**
  - 128-bit extended floating-point complex number

- **parm1** (input)
  - The first input to the math service. Any representable complex number can be used as input.

- **parm2** (input)
  - The second parameter to the math service. Do not set $parm2$ to 0.

- **fc** (output)
  - A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:
The service completed successfully.

**result (output)**
The result of the floating-point complex divide routine.

### CEESxERC—Error function complement

CEESxERC calculates the error function complement by using the equation:

\[
result = \left( 1 - \left( \frac{2}{\pi} \int_{0}^{\text{parm1}} e^{-u^2} du \right) \right)
\]

The following routines are provided for the various data types supported:

- **CEESSERC**: 32-bit single floating-point number
- **CEESDERC**: 64-bit double floating-point number
- **CEESQERC**: 128-bit extended floating-point number

**parm1 (input)**
The input to the error function complement routine. The input range is not restricted.

**fc (output)**
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
</tbody>
</table>

**result (output)**
The result of the error function complement routine. The output range is: \(0 < \text{result} < 2\).

### CEESxERF—Error function

CEESxERF calculates the error function by using the equation:

\[
result = \sqrt{\frac{2}{\pi}} \int_{0}^{\text{parm1}} e^{-u^2} du
\]

The following routines are provided for the various data types supported:

- **CEESSERF**: 32-bit single floating-point number
- **CEESDERF**: 64-bit double floating-point number
**CEESQERF**

128-bit extended floating-point number

---

**parm1** (input)

The input to the error function. The input range is not restricted.

**fc** (output)

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
</tbody>
</table>

**result** (output)

The result of the error function. The output range is:

\[ |result| \leq 1 \]

---

**CEESxEXP—Exponential base e**

CEESxEXP calculates the mathematical function of e raised to a power by using the equation:

\[ result = e^{parm1} \]

The following routines are provided for the various data types supported:

**CEESSEXP**

32-bit single floating-point number

**CEESDEXP**

64-bit double floating-point number

**CEESQEXP**

128-bit extended floating-point number

**CEESTEXP**

32-bit single floating-point complex number

**CEESEEXP**

64-bit double floating-point complex number

**CEESREXP**

128-bit extended floating-point complex number

---

**parm1** (input)

The input to the exponential base e routine. The input range varies, depending on the type of function and number:

<table>
<thead>
<tr>
<th>For Functions of real variables:</th>
<th>Input range</th>
</tr>
</thead>
<tbody>
<tr>
<td>(</td>
<td>parm1</td>
</tr>
</tbody>
</table>
For Input range

| The real part of complex numbers: | $|Re(\text{parm})| < 174.673$ |
|----------------------------------|----------------------------------|
| The imaginary part: single floating-point complex numbers: | $|Im(\text{parm})| < 2^{18}$ |
| The imaginary part: double floating-point complex numbers: | $|Im(\text{parm})| < 2^{50}$ |
| The imaginary part: extended floating-point complex numbers: | $|Im(\text{parm})| < 2^{100}$ |

$fc$ (output)

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1UP</td>
<td>2</td>
<td>2009</td>
<td>The value of the real part of the parameter was greater than $\text{limit}$ in math routine $\text{routine-name}$.</td>
</tr>
<tr>
<td>CEE1UR</td>
<td>2</td>
<td>2011</td>
<td>The parameter was greater than $\text{limit}$ in math routine $\text{routine-name}$.</td>
</tr>
<tr>
<td>CEE1UT</td>
<td>2</td>
<td>2013</td>
<td>The absolute value of the imaginary part of the parameter was greater than $\text{limit}$ in math routine $\text{routine-name}$.</td>
</tr>
<tr>
<td>CEE1UV</td>
<td>2</td>
<td>2015</td>
<td>The absolute value of the imaginary part of the parameter was greater than or equal to $\text{limit}$ in math routine $\text{routine-name}$.</td>
</tr>
<tr>
<td>CEE1V9</td>
<td>1</td>
<td>2025</td>
<td>An underflow occurred in math routine $\text{routine-name}$.</td>
</tr>
</tbody>
</table>

$result$ (output)

The result of the exponential base $e$ routine. The output range for functions of real variables is:

$$0 < result \leq \Omega$$

For single-precision routines, $\Omega = 16^{63}(1 - 16^{-6})$
For double-precision routines, $\Omega = 16^{63}(1 - 16^{-14})$
For extended-precision routines, $\Omega = 16^{63}(1 - 16^{-28})$

CEESxGMA—Gamma function

CEESxGMA performs the mathematical gamma function by using the equation:

$$result = \int_{0}^{\infty} u_{\text{parm}} e^{-u} \, du$$

The following routines are provided for the various data types supported:

**CEESSGMA**

32-bit single floating-point number
CEESDGMA
64-bit double floating-point number

parm1 (input)
The input to the gamma function. The input range is:

\[2^{-52} < \text{parm1} < 57.5744\]

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1UL</td>
<td>2</td>
<td>2005</td>
<td>The value of the parameter was outside the valid range in math routine routine-name.</td>
</tr>
</tbody>
</table>

result (output)
The result of the gamma function. The output range varies, depending on the type of routine:

<table>
<thead>
<tr>
<th>For</th>
<th>Output range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-precision routines:</td>
<td>(0.88560 \leq \text{result} \leq \Omega)</td>
</tr>
<tr>
<td></td>
<td>(\Omega = 16^{63} (1-16^6))</td>
</tr>
<tr>
<td>Double-precision routines:</td>
<td>(\Omega = 16^{63} (1-16^{14}))</td>
</tr>
</tbody>
</table>

CEESxIMG—Imaginary part of complex

CEESxIMG returns the imaginary part of a complex number using the equation \(\text{result} = v\), where \(\text{parm1} = u + vi\).

The following routines are provided for the various data types supported:

CEESTIMG
32-bit single floating-point complex number

CEESEIMG
64-bit double floating-point complex number

CEESRIMG
128-bit extended floating-point complex number

parm1 (input)
The input to the math service. Any complex number can be used as input.
**CEESxINT**

*fc (output)*
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
</tbody>
</table>

*result (output)*
The result of the math service is:

\[
|result|\leq|\Omega|
\]

For single-precision routines, \( \Omega = 16^{63}(1\cdot16^{-6}) \)
For double-precision routines, \( \Omega = 16^{63}(1\cdot16^{-10}) \)
For extended-precision routines, \( \Omega = 16^{63}(1\cdot16^{-28}) \)

**CEESxINT—Truncation**

CEESxINT returns the truncated value of the parameter by using the equation, where \( m \) is the greatest integer satisfying the relationship:

\[
result = (\text{sign of} \ parm1) \cdot n, \text{ where } n = |parm1|
\]
\[
|parm1| = |m|
\]

The result is expressed as a floating-point number:

\[
|m| \leq |parm1|
\]

The following routines are provided for the various data types supported:

**CEESSINT**
32-bit single floating-point number

**CEESDINT**
64-bit double floating-point number

**CEESQINT**
128-bit extended floating-point number

*parm1 (input)*
The input to the truncation routine. The input range is not restricted.

*fc (output)*
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
</tbody>
</table>

*result (output)*
The result of the truncation routine. The output range is:
For single-precision routines, \( \Omega = 16^{63}(1 - 16^{-6}) \)  
For double-precision routines, \( \Omega = 16^{63}(1 - 16^{-14}) \)  
For extended-precision routines, \( \Omega = 16^{63}(1 - 16^{-28}) \)

### CEESxLGM—Log gamma

CEESxLGM performs the mathematical function of log gamma by using either of the following equations:

<table>
<thead>
<tr>
<th>First equation</th>
<th>Alternate equation</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{result} = \log_{e} \Gamma(\text{parm1}) )</td>
<td>( \text{result} = \log_{a} \int_{0}^{\infty} u^{\text{parm1}-1} e^{-u} , du )</td>
</tr>
</tbody>
</table>

The following routines are provided for the various data types supported:

**CEESSLGM**  
32-bit single floating-point number

**CEESDLGM**  
64-bit double floating-point number

**parm1** (input)  
The input to the log gamma routine. The input range is:

\( \text{parm1} < 4.2913 \times 10^{73} \)

**fc** (output)  
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1UL</td>
<td>2</td>
<td>2005</td>
<td>The value of the parameter was outside the valid range range in math routine routine-name.</td>
</tr>
</tbody>
</table>

**result** (output)  
The result of the log gamma routine. The output range varies:

<table>
<thead>
<tr>
<th>For</th>
<th>Output range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single-precision routines:</td>
<td>(-0.12149 \leq \text{result} \leq \Omega )</td>
</tr>
</tbody>
</table>
| Double-precision routines: | \( \Omega = 16^{63}(1 - 16^{-6}) \)  
\( \Omega = 16^{63}(1 - 16^{-14}) \) |

### CEESxLG1—Logarithm base 10

CEESxLG1 returns the logarithm base 10 of the input parameter by using the equation:
result = log₁₀ parm1

The following routines are provided for the various data types supported:

**CEESSLG1**
32-bit single floating-point number

**CEESDLG1**
64-bit double floating-point number

**CEESQLG1**
128-bit extended floating-point number

parm1 (input)
The input to the log base 10 routine. The input range is: parm1 > 0.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1US</td>
<td>2</td>
<td>2012</td>
<td>The parameter was less than or equal to limit in math routine routine-name.</td>
</tr>
</tbody>
</table>

result (output)
The result of the log base 10 routine. The output range is: result is greater than or equal to -78.268 and is less than or equal to 75.859.

**CEESxLG2—Logarithm base 2**

CEESxLG2 performs the mathematical function logarithm base 2 by using the equation:

\[ result = \log₂ parm1 \]

The following routines are provided for the various data types supported:

**CEESSLG2**
32-bit single floating-point number

**CEESDLG2**
64-bit double floating-point number

**CEESQLG2**
128-bit extended floating-point number

parm1 (input)
The input to the log base 2 routine. The input range is: parm1 > 0.
fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1US</td>
<td>2</td>
<td>2012</td>
<td>The parameter was less than or equal to limit in math routine routine-name.</td>
</tr>
</tbody>
</table>

result (output)
The result of the log base 2 routine. The output range is: result is greater than or equal to -260 and is less than or equal to 252.

**CEESxLOG—Logarithm base e**

CEESxLOG performs the mathematical function logarithm base e by using the equation:

\[
result = \log_e parm1 \quad (result = \ln parm1)
\]

The following routines are provided for the various data types supported:

**CEESSLOG**
32-bit single floating-point number

**CEESDLOG**
64-bit double floating-point number

**CEESQLOG**
128-bit extended floating-point number

**CEESTLOG**
32-bit single floating-point complex number

**CEESLOG**
64-bit double floating-point complex number

**CEESRLOG**
128-bit extended floating-point complex number

parm1 (input)
The input to the log base e routine. The input range varies:

<table>
<thead>
<tr>
<th>For</th>
<th>Input range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real numbers:</td>
<td>parm1 &gt; 0</td>
</tr>
<tr>
<td>Complex numbers:</td>
<td>parm1 is not equal to 0</td>
</tr>
</tbody>
</table>

G

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:
CEE000 0 — The service completed successfully.
CEE1US 2 2012 The parameter was less than or equal to limit in math routine routine-name.
CEE1V2 2 2018 The real and imaginary parts of the parameter were equal to limit in math routine routine-name.

result (output)
The result of the log base e routine. The output range for functions of real variables is: result is greater than or equal to -180.218 and is less than or equal to ≤ 174.673.

CEESxMLT—Floating-point complex multiply
CEESxMLT performs the mathematical function floating-point complex multiply by using the equation:

\[
result = parm1 \cdot parm2
\]

The following routines are provided for the various data types supported:

**CEESTMLT**
32-bit single floating-point complex number

**CEESEMLT**
64-bit double floating-point complex number

**CEESRMLT**
128-bit extended floating-point complex number

parm1 (input)
The first input to the math service. Any representable complex number can be used as input.

parm2 (input)
The second parameter to the math service. Any representable complex number can be used as input.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
</tbody>
</table>

result (output)
The result of the floating-point complex multiply routine.

CEESxMOD—Modular arithmetic
CEESxMOD performs the mathematical function modular arithmetic by using the equation:

\[
result = parm1(modulo parm2)
\]

The expression \(parm1\)(modulo \(parm2\)) is defined as follows, with the brackets indicating an integer part:

\[parm1 - \left\lfloor \frac{parm1}{parm2} \right\rfloor \cdot parm2\]
That is, the largest integer whose magnitude does not exceed the magnitude of \(\text{parm1}/\text{parm2}\) is used.

The sign of the integer is the same as the sign of \(\text{parm1}/\text{parm2}\).

The following routines are provided for the various data types supported:

**CEESIMOD**
- 32-bit binary integer

**CEESSMOD**
- 32-bit single floating-point number

**CEESDMOD**
- 64-bit double floating-point number

**CEESQMOD**
- 128-bit extended floating-point number

**parm1** (input)
The first parameter to the modular arithmetic routine. The input range is not restricted.

**parm2** (input)
The second parameter to the modular arithmetic routine. The input range is: \(\text{parm2} \neq 0\).

If \(\text{parm2} = 0\), the modulus routine is undefined. In addition, a divide exception is recognized and an interrupt occurs.

**fc** (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td></td>
<td>The service completed successfully.</td>
</tr>
</tbody>
</table>

**result** (output)
The result of the mod routine. The output range is:

\[ |\text{result}| \leq \Omega \]

For single-precision routines, \(\Omega = 16^{63}(1 - 16^{-6})\)

For double-precision routines, \(\Omega = 16^{63}(1 - 16^{-14})\)

For extended-precision routines, \(\Omega = 16^{63}(1 - 16^{-28})\)

**CEESxNIN—Nearest integer**

CEESxNIN performs the mathematical function nearest integer by using the equation:

\[ \text{result} = (\text{sign of } \text{parm1}) \cdot n \]

If \(\text{parm1} \geq 0\), then \(n = |\text{parm1} + .5|\)

If \(\text{parm1} < 0\), then \(n = |\text{parm1} - .5|\)

\(n = |\text{m}|\), where \(m\) is the greatest integer satisfying the relationship \(|\text{m}| \leq |\text{parm1} + .5|\), or \(|\text{m}| \leq |\text{parm1} - .5|\), respectively.

The following routines are provided for the various data types supported:
**CEESSNIN**  
32-bit single floating-point number

**CEESDNIN**  
64-bit double floating-point number

---

**parm1** (input)  
The input to the nearest integer routine. The input range is not restricted.

**fc** (output)  
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td></td>
<td>The service completed successfully.</td>
</tr>
</tbody>
</table>

**result** (output)  
The result of the nearest integer routine. The output parameter is an unrestricted type I, a 32-bit binary integer.

---

**CEESxNWN—Nearest whole number**

**CEESxNWN** performs the mathematical function nearest whole number by using the equation:

\[
result = (\text{sign of } parm1) \times v
\]

If \(parm1 \geq 0\), then \(v = |parm1 + .5|\). If \(parm1 < 0\), then \(v = |parm1 - .5|\).

\(v = \lfloor m \rfloor\), where \(m\) is the greatest integer satisfying the relationship \(\lfloor m \rfloor \leq |parm1 + .5|\), or \(\lfloor m \rfloor \leq |parm1 - .5|\), respectively.

and the resulting \(v\) is expressed as a floating-point number.

The following routines are provided for the various data types supported:

**CEESSNWN**  
32-bit single floating-point number

**CEESDNWN**  
64-bit double floating-point number

---

**parm1** (input)  
The input to the nearest whole number routine. The input range is not restricted.

**fc** (output)  
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:
CEE000  0  —  The service completed successfully.

result (output)
The result of the nearest whole number routine. The output range varies:

<table>
<thead>
<tr>
<th>For</th>
<th>Output range</th>
</tr>
</thead>
</table>
| Single-precision routines:   | \(|result| \leq \Omega
\Omega = 16^{63}(1-16^{-6})
| Double-precision routines:   | \(\Omega = 16^{63}(1-16^{-14})\)

CEESxSGN—Transfer of sign

CEESxSGN performs the mathematical function transfer of sign by using either of the two equations:

\[ result = |parm1| \text{ if } parm2 \geq 0 \text{ or } result = -|parm1| \text{ if } parm2 < 0. \]

The following routines are provided for the various data types supported:

CEESISGN
32-bit binary integer

CEESSSGN
32-bit single floating-point number

CEESDSGN
64-bit double floating-point number

CEESQSGN
128-bit extended floating-point number

parm1 (input)
The first input to the transfer of sign routine. The input range is not restricted.

parm2 (input)
The second parameter to the transfer of sign routine. The input range is not restricted.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
</tbody>
</table>

result (output)
The result of the transfer of sign routine. The output range is:
CEESxSIN—Sine

CEESxSIN returns the sine of the parameter by using the equation: \( \text{result} = \sin(\text{parm1}) \)

The following routines are provided for the various data types supported:

- CEESSSIN
  32-bit single floating-point number
- CEESDSIN
  64-bit double floating-point number
- CEEQSIN
  128-bit extended floating-point number
- CEESTSIN
  32-bit single floating-point complex number
- CEESESIN
  64-bit double floating-point complex number
- CEESRSIN
  128-bit extended floating-point complex number

**parm1 (input)**

The input, in radians, to the sine routine. For real functions, the input range varies, depending on the value of \( \text{parm1} \):

<table>
<thead>
<tr>
<th>If</th>
<th>Input range</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \text{parm1} ) is a 32-bit single floating-point number:</td>
<td>(</td>
</tr>
<tr>
<td>( \text{parm1} ) is a 64-bit double floating-point number:</td>
<td>(</td>
</tr>
<tr>
<td>( \text{parm1} ) is an extended floating-point number:</td>
<td>(</td>
</tr>
</tbody>
</table>

For complex functions, the input range differs for the imaginary and real parts of the input:

<table>
<thead>
<tr>
<th>Part</th>
<th>Input range</th>
</tr>
</thead>
<tbody>
<tr>
<td>For the imaginary part:</td>
<td>(</td>
</tr>
<tr>
<td>For the real part: single floating-point complex numbers</td>
<td>(</td>
</tr>
<tr>
<td>Part</td>
<td>Input range</td>
</tr>
<tr>
<td>------</td>
<td>-------------</td>
</tr>
<tr>
<td>For the real part: double floating-point complex numbers</td>
<td>(</td>
</tr>
<tr>
<td>For the real part: extended floating-point complex numbers</td>
<td>(</td>
</tr>
</tbody>
</table>

**fc (output)**

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1UT</td>
<td>2</td>
<td>2013</td>
<td>The absolute value of the imaginary part of the parameter was greater than limit in math routine routine-name.</td>
</tr>
<tr>
<td>CEE1V1</td>
<td>2</td>
<td>2017</td>
<td>The absolute value of the parameter was greater than or equal to limit in math routine routine-name.</td>
</tr>
<tr>
<td>CEE1V3</td>
<td>2</td>
<td>2019</td>
<td>The absolute value of the real part of the parameter was greater than or equal to limit in math routine routine-name.</td>
</tr>
</tbody>
</table>

**result (output)**

The result of the sine routine. The output range for functions of real variables is: result is greater than or equal to -1 and is less than or equal to 1.

**CEESxSNH—Hyperbolic sine**

CEESxSNH performs the mathematical function hyperbolic sine by using the equation: \( \text{result} = \sinh(\text{parm1}) \)

The following routines are provided for the various data types supported:

- **CEESSSNH**  
  32-bit single floating-point number

- **CEEDSNH**  
  64-bit double floating-point number

- **CEESQSNH**  
  128-bit extended floating-point number

- **CEESTSNH**  
  32-bit single floating-point complex number

- **CEESESNH**  
  64-bit double floating-point complex number

- **CEESRSNH**  
  128-bit extended floating-point complex number
**parm1 (input)**

The input to the hyperbolic sine routine. The input range varies.

<table>
<thead>
<tr>
<th>For</th>
<th>Input range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input range for reals:</td>
<td>(</td>
</tr>
</tbody>
</table>

For complex functions, the input range differs for the imaginary and real parts of the input. The input range of the imaginary part also differs depending on the precision of \(\text{parm1}\).

<table>
<thead>
<tr>
<th>For</th>
<th>Input range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Complex functions: real part</td>
<td>(</td>
</tr>
<tr>
<td>Imaginary part: single floating-point complex numbers</td>
<td>(</td>
</tr>
<tr>
<td>Imaginary part: double floating-point complex numbers</td>
<td>(</td>
</tr>
<tr>
<td>Imaginary part: extended floating-point complex numbers:</td>
<td>(</td>
</tr>
</tbody>
</table>

**fc (output)**

A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1V0</td>
<td>2</td>
<td>2016</td>
<td>The absolute value of the parameter was greater than limit in math routine routine-name.</td>
</tr>
</tbody>
</table>

**result (output)**

The result of the hyperbolic sine routine. The output range for functions of real variables is:

\[|\text{result}| \leq \Omega\]

**CEESxSQT—Square root**

CEESxSQT returns the square root of \(\text{parm1}\) by using the equation:

\[\text{result} = \sqrt{\text{parm1}}\]

The following routines are provided for the various data types supported:

- **CEESSSQT**
  32-bit single floating-point number

- **CEESDSQT**
  64-bit double floating-point number

- **CEESQSQT**
  128-bit extended floating-point number
**CEESxSQT**
32-bit single floating-point complex number

**CEESESQT**
64-bit double floating-point complex number

**CEESRSQT**
128-bit extended floating-point complex number

Diagram:

```
parm1 (input)
The input to the square root routine. The input range for real number functions is: parm1 is greater than, or equal to, 0.
For complex numbers, the input range is not restricted.
```

```
f (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.
The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1UQ</td>
<td>2</td>
<td>2010</td>
<td>The parameter was less than limit in math routine routine-name.</td>
</tr>
</tbody>
</table>
```

```
result (output)
The result of the square root routine. The output range for functions of real variables is:

\[0 \leq \text{result} \leq \Omega^{1/2}\]
For single-precision routines, \(\Omega = 16^{63}(1 - 16^{-6})\)
For double-precision routines, \(\Omega = 16^{63}(1 - 16^{-14})\)
For extended-precision routines, \(\Omega = 16^{63}(1 - 16^{-28})\)
```

**CEESxTAN—Tangent**

CEESxTAN returns the tangent of the parameter by using the equation: result = \(\tan (\text{parm1})\)
The following routines are provided for the various data types supported:

**CEESSTAN**
32-bit single floating-point number

**CEESDTAN**
64-bit double floating-point number

**CEESQTAN**
128-bit extended floating-point number

**CEESTTAN**
32-bit single floating-point complex number

**CEESETAN**
64-bit double floating-point complex number

**CEESRTAN**
128-bit extended floating-point complex number
parm1 (input)
The input, in radians, to the tangent routine. The input range varies, depending on the value of parm1:

<table>
<thead>
<tr>
<th>For</th>
<th>Input range</th>
</tr>
</thead>
<tbody>
<tr>
<td>parm1 is a single floating-point number:</td>
<td>(</td>
</tr>
<tr>
<td>parm1 is a double floating-point number:</td>
<td>(</td>
</tr>
<tr>
<td>parm1 is an extended floating-point number:</td>
<td>(</td>
</tr>
</tbody>
</table>

Also, for extended and as complex functions, this argument cannot approach odd multiples of:

\(\pi/2\)

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1UI</td>
<td>2</td>
<td>2002</td>
<td>The parameter value was too close to one of the singularities (plus or minus (\pi/2), plus or minus (3\pi/2), for the tangent; or plus or minus (\pi), plus or minus 2(\pi), for the cotangent) in math routine (\text{routine-name}).</td>
</tr>
<tr>
<td>CEE1V1</td>
<td>2</td>
<td>2017</td>
<td>The absolute value of the parameter was greater than or equal to (\text{limit}) in math routine (\text{routine-name}).</td>
</tr>
<tr>
<td>CEE1V9</td>
<td>1</td>
<td>2025</td>
<td>An underflow occurred in math routine (\text{routine-name}).</td>
</tr>
</tbody>
</table>

result (output)
The result of the tangent routine. The output range for functions of real variables is:

\(|\text{result}| \leq \Omega\)

CEESxTNH—Hyperbolic tangent
CEESxTNH performs the mathematical function hyperbolic tangent by using the equation: \(\text{result} = \tanh(\text{parm1})\)

The following routines are provided for the various data types supported:

- **CEESSTNH**
  32-bit single floating-point number

- **CEESDTNH**
  64-bit double floating-point number

- **CEESQTNH**
  128-bit extended floating-point number
CEESTTNH
32-bit single floating-point complex number

CEESETNH
64-bit double floating-point complex number

CEESRTNH
128-bit extended floating-point complex number

parm1 (input)
The input to the hyperbolic tangent routine. The input range is not restricted for real functions. For complex functions, parm1 must not approach odd multiples of:

\[ \frac{\pi}{2}i, \text{ where } i = \sqrt{-1} \]

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
</tbody>
</table>

result (output)
The result of the hyperbolic tangent routine. The output range for functions of real variables is:

\[ |result| < 1 \]

**CEESxXPS—Exponentiation**

CEESxXPS performs the mathematical function exponentiation by using the equation:

\[ result = parm1 \cdot parm2 \]

The following routines are provided for the various data types supported:

**CEESIXPI**
32-bit binary integer raised to a 32-bit binary integer

**CEESSXPI**
32-bit single floating-point number raised to a 32-bit binary integer

**CEESDXPI**
64-bit double floating-point number raised to a 32-bit binary integer

**CEESQXPI**
128-bit extended floating-point number raised to a 32-bit binary integer

**CEESTXPI**
32-bit single floating-point complex number raised to a 32-bit binary integer

**CEESEXPI**
64-bit double floating-point complex number raised to a 32-bit binary integer

**CEESRXPI**
128-bit extended floating-point complex number raised to a 32-bit binary integer

**CEESSXPS**
32-bit single floating-pointing point raised to a 32-bit single floating-point
CEESDXPD
64-bit double floating-point raised to a 64-bit double floating-point

CEESQXPQ
128-bit extended floating-point raised to a 128-bit extended floating-point

CEESTXPT
32-bit single floating-point complex raised to a 32-bit single floating-point complex

CEESEXPE
64-bit double floating-point complex raised to a 64-bit double floating-point complex

CEESRXPR
128-bit extended floating-point complex raised to a 128-bit extended floating-point complex

parm1 (input)
The input for the base of the exponentiation routine. The input range varies.

<table>
<thead>
<tr>
<th>For functions of real variables:</th>
<th>if ( \text{parm1} = 0 ), then ( \text{parm2} &gt; 0 ).</th>
</tr>
</thead>
<tbody>
<tr>
<td>If ( \text{parm1} ) is a 32-bit number and ( \text{parm1} &lt; 0 ):</td>
<td>(</td>
</tr>
<tr>
<td>If ( \text{parm1} ) is a 64-bit number and ( \text{parm1} &lt; 0 ):</td>
<td>(</td>
</tr>
<tr>
<td>If ( \text{parm1} ) is a 128-bit number and ( \text{parm1} &lt; 0 ):</td>
<td>(</td>
</tr>
</tbody>
</table>

The input range for functions of complex variables: If \( \text{Re}(\text{parm1}) = 0 \) and \( \text{Im}(\text{parm1}) = 0 \), then \( \text{Re}(\text{parm2}) \) must be positive.

parm2 (input)
The input for the power of the exponentiation routine. The type is determined by the eighth character of the service name.

fc (output)
A 12-byte feedback code, optional in some languages, that indicates the result of this service. If you choose to omit this parameter, refer to “Invoking callable services” on page 104 for the appropriate syntax to indicate that the feedback code was omitted.

The following symbolic conditions can result from this service:

<table>
<thead>
<tr>
<th>Code</th>
<th>Severity</th>
<th>Message number</th>
<th>Message text</th>
</tr>
</thead>
<tbody>
<tr>
<td>CEE000</td>
<td>0</td>
<td>—</td>
<td>The service completed successfully.</td>
</tr>
<tr>
<td>CEE1UJ</td>
<td>2</td>
<td>2003</td>
<td>For an exponentiation operation ((I^{**}J)) where (I) and (J) are integers, (I) was equal to zero and (J) was less than or equal to zero in math routine (\text{routine-name}).</td>
</tr>
<tr>
<td>CEE1UK</td>
<td>2</td>
<td>2004</td>
<td>For an exponentiation operation ((R^{**}I)) where (R) is real and (I) is an integer, (R) was equal to zero and (I) was less than or equal to zero in math routine (\text{routine-name}).</td>
</tr>
<tr>
<td>CEE1UL</td>
<td>2</td>
<td>2005</td>
<td>The value of the parameter was outside the valid range (\text{range}) in math routine (\text{routine-name}).</td>
</tr>
<tr>
<td>Code</td>
<td>Severity</td>
<td>Message number</td>
<td>Message text</td>
</tr>
<tr>
<td>---------</td>
<td>----------</td>
<td>----------------</td>
<td>-----------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>CEE1UM</td>
<td>2</td>
<td>2006</td>
<td>For an exponentiation operation (R**S) where R and S are real values, R was equal to zero and S was less than or equal to zero in math routine <code>routine-name</code>.</td>
</tr>
<tr>
<td>CEE1UN</td>
<td>2</td>
<td>2007</td>
<td>The exponent exceeded <code>limit</code> in math routine <code>routine-name</code>.</td>
</tr>
<tr>
<td>CEE1UO</td>
<td>2</td>
<td>2008</td>
<td>For an exponentiation operation (Z**P) where the complex base Z equals zero, the real part of the complex exponent P, or the integer exponent P was less than or equal to zero in math routine <code>routine-name</code>.</td>
</tr>
<tr>
<td>CEE1V4</td>
<td>2</td>
<td>2020</td>
<td>For an exponentiation operation (R**S) where R and S are real values, either R is equal to zero and S is negative, or R is negative and S is not an integer whose absolute value is less than or equal to <code>limit</code> in math routine <code>routine-name</code>.</td>
</tr>
<tr>
<td>CEE1V5</td>
<td>2</td>
<td>2021</td>
<td>For an exponentiation operation (X**Y), the parameter combination of Y*log2(X) generated a number greater than or equal to <code>limit</code> in math routine <code>routine-name</code>.</td>
</tr>
<tr>
<td>CEE1V8</td>
<td>2</td>
<td>2024</td>
<td>An overflow occurred in math operation (X**Y).</td>
</tr>
<tr>
<td>CEE1V9</td>
<td>1</td>
<td>2025</td>
<td>An underflow occurred in math routine <code>routine-name</code>. The output value from the math routine is undefined.</td>
</tr>
<tr>
<td>CEE1VF</td>
<td>2</td>
<td>2031</td>
<td>The value of the argument was a non-positive whole number in math routine (X**Y).</td>
</tr>
</tbody>
</table>

**result (output)**

The result of the exponentiation routine. The output range for functions of real variables is:

\[ |result| \leq \Omega \]

### Examples of math services

The following sections contain examples of calls to various math services made from supported languages.

**C/C++ math service examples**

Table 30 on page 416 shows code examples of calling various math services from C/C++. 

### Examples

- The exponential function `exp(x)`...
Table 30: C/C++ examples

<table>
<thead>
<tr>
<th>Function called</th>
<th>Code example</th>
</tr>
</thead>
</table>
| Log base 10 and modular arithmetic (CEESDLG1 and CEESIMOD) | ```c
#include <leawi.h>
#include <string.h>
#include <stdio.h>

int main (void) {
    _FLOAT8 f1,result;
    _INT4 int1, int2, intr;
    _FEEDBACK fc;
    #define SUCCESS "\0\0\0\0"
    f1 = 1000.0;
    CEESDLG1(&f1,&fc,&result);
    if (memcmp(&fc,SUCCESS,4) != 0) {
        printf("CEESDLG1 failed with message number %d\n", fc.tok_msgno);
        exit(2999);
    }
    printf("%f log base 10 is %f\n",f1,result);
    int1 = 39;
    int2 = 7;
    CEESIMOD(&int1,&int2,&fc,&intr);
    if (memcmp(&fc,SUCCESS,4) != 0) {
        printf("CEESIMOD failed with message number %d\n", fc.tok_msgno);
        exit(2999);
    }
    printf("%d modulo %d is %d\n",int1,int2,intr);
}
``` |

COBOL math service examples

Table 31 on page 416 shows code examples of calling various math services from COBOL.

Table 31: COBOL examples

<table>
<thead>
<tr>
<th>Function called</th>
<th>Code example</th>
</tr>
</thead>
</table>
| Log base e (CEESSLOG) | ```cobol
77   ARG1RS COMP-1.
77   FBCODE PIC X(12).
77   RESLTRS COMP-1.

CALL "CEESSLOG" USING ARG1RS, FBCODE, RESLTRS.
``` |
| Log base 10 (CEESDLG1) | ```cobol
77   ARG1RL COMP-2.
77   FBCODE PIC X(12).
77   RESLTRL COMP-2.

CALL "CEESDLG1" USING ARG1RL, FBCODE, RESLTRL.
``` |
### Table 31: COBOL examples (continued)

<table>
<thead>
<tr>
<th>Function called</th>
<th>Code example</th>
</tr>
</thead>
</table>
| Exponentiation (CEESIXPI) | 77 ARG1IS PIC S9(9) COMP.  
77 ARG2IS PIC S9(9) COMP.  
77 FBCODE PIC X(12).  
77 RESLTIS PIC S9(9) COMP.  
  CALL "CEESIXPI" USING ARG1IS, ARG2IS, FBCODE, RESLTIS. |
| Exponentiation (CEESSXPI) | 77 ARG1RS COMP-1.  
77 ARG2IS PIC S9(9) COMP.  
77 FBCODE PIC X(12).  
77 RESLTRS COMP-1.  
  CALL "CEESSXPI" USING ARG1RS, ARG2IS, FBCODE, RESLTRS. |
| Arctangent2 (CEESSAT2) | 77 ARG1RS COMP-1.  
77 ARG2RS COMP-1.  
77 FBCODE PIC X(12).  
77 RESLTRS COMP-1.  
  CALL "CEESSAT2" USING ARG1RS, ARG2RS, FBCODE, RESLTRS. |

### PL/I math service examples

Table 32 on page 418 shows code examples of calling various math services from PL/I.
### Table 32: PL/I examples

<table>
<thead>
<tr>
<th>Function called</th>
<th>Code example</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Modular arithmetic and log base e</strong> (CEESIMOD and</td>
<td></td>
</tr>
<tr>
<td>CEESSLOG)</td>
<td>PLIMATH: PROC OPTIONS(MAIN);</td>
</tr>
<tr>
<td></td>
<td>DCL CEESSLOG ENTRY OPTIONS(ASM) EXTERNAL;</td>
</tr>
<tr>
<td></td>
<td>DCL CEESIMOD ENTRY OPTIONS(ASM) EXTERNAL;</td>
</tr>
<tr>
<td></td>
<td>DCL ARG1 RESULT REAL FLOAT DEC (6);</td>
</tr>
<tr>
<td></td>
<td>DCL ARGM1 ARGM2 RES2 FLOAT BINARY(21)</td>
</tr>
<tr>
<td></td>
<td>DCL FC CHARACTER (12);</td>
</tr>
<tr>
<td></td>
<td>/* Call log base e routine, which has only one input parameter */</td>
</tr>
<tr>
<td></td>
<td>CALL CEESSLOG (ARG1, FC, RESULT)</td>
</tr>
<tr>
<td></td>
<td>IF ( FC = '000000000000000000000000'X ) THEN DO;</td>
</tr>
<tr>
<td></td>
<td>PUT SKIP LIST ('Error occurred in call to CEESSLOG.');</td>
</tr>
<tr>
<td></td>
<td>ELSE;</td>
</tr>
<tr>
<td></td>
<td>/* Call modular arithmetic routine, which has two input parameters */</td>
</tr>
<tr>
<td></td>
<td>CALL CEESIMOD (ARGM1, ARGM2, FC, RES2);</td>
</tr>
<tr>
<td></td>
<td>IF ( FC = '000000000000000000000000'X ) THEN DO;</td>
</tr>
<tr>
<td></td>
<td>PUT SKIP LIST ('Error occurred in call to CEESIMOD.');</td>
</tr>
<tr>
<td></td>
<td>ELSE;</td>
</tr>
<tr>
<td></td>
<td>END;</td>
</tr>
<tr>
<td><strong>Double-precision complex tangent</strong> (CEESETAN)</td>
<td>TRYETAN: PROCEDURE OPTIONS( MAIN );</td>
</tr>
<tr>
<td></td>
<td>DECLARE FC CHARACTER(12);</td>
</tr>
<tr>
<td></td>
<td>DECLARE PARM1 COMPLEX FLOAT BINARY(53);</td>
</tr>
<tr>
<td></td>
<td>DECLARE RESULT COMPLEX FLOAT BINARY(53);</td>
</tr>
<tr>
<td></td>
<td>DECLARE CEESETAN ENTRY(COMPLEX FLOAT BINARY(53),</td>
</tr>
<tr>
<td></td>
<td>* COMPLEX FLOAT BINARY(53)) OPTIONS(ASSEMBLER) EXTERNAL;</td>
</tr>
<tr>
<td></td>
<td>PARM1 = COMPLEX(7,1.1);</td>
</tr>
<tr>
<td></td>
<td>CALL CEESETAN ( PARM1, FC, RESULT);</td>
</tr>
<tr>
<td></td>
<td>IF ( FC ~= '000000000000000000000000'X ) THEN</td>
</tr>
<tr>
<td></td>
<td>PUT SKIP LIST ('Error in call to CEESETAN.');</td>
</tr>
<tr>
<td></td>
<td>ELSE</td>
</tr>
<tr>
<td></td>
<td>PUT SKIP LIST ( 'Result is '</td>
</tr>
<tr>
<td></td>
<td>END TRYETAN;</td>
</tr>
</tbody>
</table>
Appendix A. IBM-supplied country code defaults

Table 33 on page 419 contains the currency symbols and default picture strings for the `country_code` parameters of the `COUNTRY` runtime option and the national language support callable services. See “COUNTRY” on page 20 and the services listed in Table 17 on page 102 for more information.

**Note:** In the table, some currency symbols are shown as hexadecimal strings. How these are displayed depends on the codeset in use by the terminal device. For example, when using code page 01140, X'9F404040’ is displayed as the Euro symbol followed by three blanks.

### Table 33: Defaults currency and picture strings based on COUNTRY setting.

<table>
<thead>
<tr>
<th>Country/region</th>
<th>Country code</th>
<th>Decimal separator</th>
<th>Thousand separator</th>
<th>Currency symbol</th>
<th>Int. currency symbol</th>
<th>Time picture string</th>
<th>Date picture string</th>
<th>Date and time picture string</th>
</tr>
</thead>
<tbody>
<tr>
<td>Afghanistan</td>
<td>AF</td>
<td>,</td>
<td>.</td>
<td>X'9F404040'</td>
<td>AFN</td>
<td>HH:MI:SS</td>
<td>YYYY-MM-DD</td>
<td>YYYY-MM-DD HH:MI:SS</td>
</tr>
<tr>
<td>Albania</td>
<td>AL</td>
<td>,</td>
<td>.</td>
<td>Lek</td>
<td>ALL</td>
<td>HH:MI:SS</td>
<td>YYYY-MM-DD</td>
<td>YYYY-MM-DD HH:MI:SS</td>
</tr>
<tr>
<td>Algeria</td>
<td>DZ</td>
<td>,</td>
<td>.</td>
<td>DZD</td>
<td>HH:MI:SS</td>
<td>YYYY-MM-DD</td>
<td>YYYY-MM-DD HH:MI:SS</td>
<td></td>
</tr>
<tr>
<td>Angola</td>
<td>AO</td>
<td>,</td>
<td>.</td>
<td>X'9F404040'</td>
<td>AOA</td>
<td>HH:MI:SS</td>
<td>YYYY-MM-DD</td>
<td>YYYY-MM-DD HH:MI:SS</td>
</tr>
<tr>
<td>Antigua and Barbuda</td>
<td>AG</td>
<td>,</td>
<td>.</td>
<td>X'9F404040'</td>
<td>XCD</td>
<td>HH:MI:SS</td>
<td>YYYY-MM-DD</td>
<td>YYYY-MM-DD HH:MI:SS</td>
</tr>
<tr>
<td>Armenia</td>
<td>AM</td>
<td>,</td>
<td>:</td>
<td>AMD</td>
<td>dr:</td>
<td>HH:MI:SS</td>
<td>MM/DD/YY</td>
<td>MMMMmmmzm DD, YYYY HH:MI:SS</td>
</tr>
<tr>
<td>Australia</td>
<td>AU</td>
<td>,</td>
<td>.</td>
<td>$</td>
<td>AUD</td>
<td>HH:MI:SS</td>
<td>DD/MM/YY</td>
<td>DD/MM/YY HH:MI:SS</td>
</tr>
<tr>
<td>Austria</td>
<td>AT</td>
<td>,</td>
<td>.</td>
<td>X'9F404040'</td>
<td>EUR</td>
<td>HH:MI:SS,999</td>
<td>YYYY-MM-DD</td>
<td>YYYY-MM-DD HH:MI:SS,999</td>
</tr>
<tr>
<td>Azerbaijan</td>
<td>AZ</td>
<td>,</td>
<td>.</td>
<td>AZN</td>
<td>man</td>
<td>HH:MI:SS</td>
<td>MM/DD/YY</td>
<td>ZD MMMMmmmzm , YY HH:MI:SS</td>
</tr>
<tr>
<td>Bahamas</td>
<td>BS</td>
<td>,</td>
<td>.</td>
<td>X'9F404040'</td>
<td>BSD</td>
<td>HH:MI:SS</td>
<td>YYYY-MM-DD</td>
<td>YYYY-MM-DD HH:MI:SS</td>
</tr>
<tr>
<td>Bahrain</td>
<td>BH</td>
<td>,</td>
<td>.</td>
<td>BHD</td>
<td>HH:MI:SS</td>
<td>YYYY/MM/DD</td>
<td>YYYY/MM/DD HH:MI:SS</td>
<td></td>
</tr>
<tr>
<td>Bangladesh</td>
<td>BD</td>
<td>,</td>
<td>.</td>
<td>X'9F404040'</td>
<td>BDT</td>
<td>HH:MI:SS</td>
<td>YYYY-MM-DD</td>
<td>YYYY-MM-DD HH:MI:SS</td>
</tr>
<tr>
<td>Bermuda</td>
<td>BM</td>
<td>,</td>
<td>.</td>
<td>X'9F404040'</td>
<td>BMD</td>
<td>HH:MI:SS</td>
<td>YYYY-MM-DD</td>
<td>YYYY-MM-DD HH:MI:SS</td>
</tr>
<tr>
<td>Bolivia</td>
<td>BO</td>
<td>,</td>
<td>.</td>
<td>BS</td>
<td>BOB</td>
<td>HH:MI:SS</td>
<td>DD/MM/YY</td>
<td>DD/MM/YY HH:MI:SS</td>
</tr>
<tr>
<td>Bosnia/Herzegovina</td>
<td>BA</td>
<td>,</td>
<td>.</td>
<td>Din</td>
<td>BAM</td>
<td>HH:MI:SS</td>
<td>YYYY-MM-DD</td>
<td>YYYY-MM-DD HH:MI:SS</td>
</tr>
<tr>
<td>Brazil</td>
<td>BR</td>
<td>,</td>
<td>.</td>
<td>NCz$</td>
<td>BRL</td>
<td>HH:MI:SS</td>
<td>DD/MM/YY</td>
<td>DD/MM/YY HH:MI:SS</td>
</tr>
<tr>
<td>Brunei Darussalam</td>
<td>BN</td>
<td>,</td>
<td>.</td>
<td>X'9F404040'</td>
<td>BND</td>
<td>HH:MI:SS</td>
<td>YYYY-MM-DD</td>
<td>YYYY-MM-DD HH:MI:SS</td>
</tr>
<tr>
<td>Burma</td>
<td>BU</td>
<td>,</td>
<td>.</td>
<td>X'9F404040'</td>
<td>MMK</td>
<td>HH:MI:SS</td>
<td>YYYY-MM-DD</td>
<td>YYYY-MM-DD HH:MI:SS</td>
</tr>
</tbody>
</table>

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<table>
<thead>
<tr>
<th>Country/region</th>
<th>Country code</th>
<th>Decimal separator</th>
<th>Thousand separator</th>
<th>Currency symbol</th>
<th>Int. currency symbol</th>
<th>Time picture string</th>
<th>Date picture string</th>
<th>Date and time picture string</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cayman Islands</td>
<td>KY</td>
<td>.</td>
<td>.</td>
<td>X'9F404040'</td>
<td>KYD</td>
<td>HH:MI:SS</td>
<td>YYYY-MM-DD</td>
<td>YYYY-MM-DD HH:MI:SS</td>
</tr>
<tr>
<td>Chad</td>
<td>TD</td>
<td>.</td>
<td>.</td>
<td>X'9F404040'</td>
<td>XAF</td>
<td>HH:MI:SS</td>
<td>YYYY-MM-DD</td>
<td>YYYY-MM-DD HH:MI:SS</td>
</tr>
<tr>
<td>Chile</td>
<td>CL</td>
<td>.</td>
<td>.</td>
<td>$</td>
<td>CLP</td>
<td>HH:MI:SS</td>
<td>DD/MM/YY</td>
<td>DD/MM/YY HH:MI:SS</td>
</tr>
<tr>
<td>Colombia</td>
<td>CO</td>
<td>.</td>
<td>.</td>
<td>$</td>
<td>COP</td>
<td>ZH:MI:SS AP</td>
<td>DD/MM/YY</td>
<td>DD/MM/YY ZZ:MI:SS</td>
</tr>
<tr>
<td>Croatia</td>
<td>HR</td>
<td>.</td>
<td>.</td>
<td>Din</td>
<td>HRK</td>
<td>HH:MI:SS</td>
<td>YYYY-MM-DD</td>
<td>YYYY-MM-DD HH:MI:SS</td>
</tr>
<tr>
<td>Cuba</td>
<td>CU</td>
<td>.</td>
<td>.</td>
<td>X'9F404040'</td>
<td>CUP</td>
<td>HH:MI:SS</td>
<td>YYYY-MM-DD</td>
<td>YYYY-MM-DD HH:MI:SS</td>
</tr>
<tr>
<td>Cyprus</td>
<td>CY</td>
<td>.</td>
<td>.</td>
<td>X'9F404040'</td>
<td>CYP</td>
<td>HH:MI:SS</td>
<td>YYYY-MM-DD</td>
<td>YYYY-MM-DD HH:MI:SS</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>CZ</td>
<td>.</td>
<td>.</td>
<td>X'D247A240'</td>
<td>CZK</td>
<td>HH:MI:SS</td>
<td>YYYY-MM-DD</td>
<td>YYYY-MM-DD HH:MI:SS</td>
</tr>
<tr>
<td>Dominican Republic</td>
<td>DO</td>
<td>.</td>
<td>.</td>
<td>$</td>
<td>DOP</td>
<td>ZH:MI:SS AP</td>
<td>DD/MM/YY</td>
<td>DD/MM/YY ZZ:MI:SS</td>
</tr>
<tr>
<td>Ecuador</td>
<td>EC</td>
<td>.</td>
<td>.</td>
<td>$</td>
<td>USD</td>
<td>HH:MI:SS</td>
<td>DD/MM/YY</td>
<td>DD/MM/YY HH:MI:SS</td>
</tr>
<tr>
<td>Egypt</td>
<td>EG</td>
<td>.</td>
<td>.</td>
<td>c/</td>
<td>SVC</td>
<td>HH:MI:SS</td>
<td>DD/MM/YY</td>
<td>DD/MM/YY HH:MI:SS</td>
</tr>
<tr>
<td>El Salvador</td>
<td>SV</td>
<td>.</td>
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<td>YYYY/MM/DD HH:MI:SS</td>
<td></td>
</tr>
<tr>
<td>Turkey</td>
<td>TR</td>
<td>,</td>
<td>YTL</td>
<td>TRY</td>
<td>HH:MI:SS</td>
<td>DD/MM/YY</td>
<td>DD/MM/YY HH:MI:SS</td>
<td></td>
</tr>
<tr>
<td>Uganda</td>
<td>UG</td>
<td>,</td>
<td>X’9F404040’</td>
<td>UGX</td>
<td>HH:MI:SS</td>
<td>YYYY-MM-DD</td>
<td>YYYY-MM-DD HH:MI:SS</td>
<td></td>
</tr>
</tbody>
</table>
Table 33: Defaults currency and picture strings based on COUNTRY setting. (continued)

<table>
<thead>
<tr>
<th>Country/region</th>
<th>Country code</th>
<th>Decimal separator</th>
<th>Thousand separator</th>
<th>Currency symbol</th>
<th>Int. currency symbol</th>
<th>Time picture string</th>
<th>Date picture string</th>
<th>Date and time picture string</th>
</tr>
</thead>
<tbody>
<tr>
<td>Union of Soviet Socialist Republics <em>(See note below)</em></td>
<td>SU</td>
<td>,</td>
<td>.</td>
<td>Rub</td>
<td>RUB</td>
<td>HH:MI:SS</td>
<td>DD mmm. YYYY g.</td>
<td>DD mmm. YYYY g. HH:MI:SS</td>
</tr>
<tr>
<td>United Arab Emirates</td>
<td>AE</td>
<td>,</td>
<td>.</td>
<td>AED</td>
<td>HH:MI:SS</td>
<td>YYYY/MM/DD</td>
<td>YYYY/MM/DD HH:MI:SS</td>
<td></td>
</tr>
<tr>
<td>United Kingdom</td>
<td>GB</td>
<td>,</td>
<td>.</td>
<td>GBP</td>
<td>HH:MI:SS</td>
<td>DD/MM/YY</td>
<td>DD/MM/YY HH:MI:SS</td>
<td></td>
</tr>
<tr>
<td>Uruguay</td>
<td>UY</td>
<td>,</td>
<td>.</td>
<td>N$</td>
<td>UYU</td>
<td>DD/MM/YY</td>
<td>DD/MM/YY HH:MI:SS</td>
<td></td>
</tr>
<tr>
<td>Venezuela</td>
<td>VE</td>
<td>,</td>
<td>.</td>
<td>BsF</td>
<td>VEB</td>
<td>HH:MI:SS AP</td>
<td>DD/MM/YY HH:MI:SS</td>
<td></td>
</tr>
<tr>
<td>Yemen</td>
<td>YE</td>
<td>,</td>
<td>.</td>
<td>YER</td>
<td>HH:MI:SS</td>
<td>YYYY/MM/DD</td>
<td>YYYY/MM/DD HH:MI:SS</td>
<td></td>
</tr>
<tr>
<td>Yugoslavia</td>
<td>YU</td>
<td>,</td>
<td>.</td>
<td>Din</td>
<td>YUM</td>
<td>YYYY-MM-DD</td>
<td>YYYY-MM-DD HH:MI:SS</td>
<td></td>
</tr>
</tbody>
</table>

**Note:**

1. The Czechoslovakia country code CS is obsolete. Use either the Czech Republic country code CZ, or the Slovakia country code SK.
2. Country code DE was used for the former Federal Republic of Germany and now represents the settings for Germany. The DD country code, used in the past for the German Democratic Republic, is obsolete and should be replaced by DE.
3. The SU country code is obsolete. Use the following country codes for the appropriate country: Estonia, EE; Latvia, LV; Lithuania, LT; Russian Federation, RU.
This appendix contains information to help you use date and time callable services for Language Environment. Included are tables for picture term and national language era usage.

<table>
<thead>
<tr>
<th>Picture terms</th>
<th>Explanations</th>
<th>Valid values</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Y</td>
<td>1-digit year</td>
<td>0-9</td>
<td>Y valid for output only.</td>
</tr>
<tr>
<td>YY</td>
<td>2-digit year</td>
<td>00-99</td>
<td>YY assumes range set by CEESCN.</td>
</tr>
<tr>
<td>YYY</td>
<td>3-digit year</td>
<td>000-999</td>
<td>YY and ZYY valid only if used with &lt;JJJJ&gt;, &lt;CCCC&gt;, or &lt;CCCCCC&gt;.</td>
</tr>
<tr>
<td>ZYY</td>
<td>3-digit year within era</td>
<td>1-999</td>
<td></td>
</tr>
<tr>
<td>YYYY</td>
<td>4-digit year</td>
<td>1582-9999</td>
<td></td>
</tr>
</tbody>
</table>

**Note**

- Y valid for output only.
- YY assumes range set by CEESCN.
- YYY and ZYY valid only if used with <JJJJ>, <CCCC>, or <CCCCCC>.

### <JJJJ>

Japanese era name in DBCS characters

- Reiwa (X'0E49C3457A0F')
- Heisei (X'0E458D45BA0F')
- Showa (X'0E45B3457A0F')
- Taisho (X'0E455B45770F')
- Meiji (X'0E45A645840F')

Affects YY field: if <JJJJ> specified, YY means the year within Japanese era, for example, 1988 equals Showa 63. See example in Table 35 on page 426.

### <CCCC> <CCCCCCCC>

Era name in DBCS characters

- (X'0E4D8256CE0F')
- (X'0E4C845ADD4D8256CE0F')

Affects YY field: if <CCCC> specified, YY means the year within the era. See example in Table 35 on page 426.

### MM ZM

2-digit month 1- or 2-digit month

- 01-12 1-12

For output, leading zero suppressed. For input, ZM treated as MM.

### RRRR RRRZ

Roman numeral month

- Ibbb-XIib (left-aligned)

For input, source string is folded to uppercase. For output, uppercase only. I=Jan, II=Feb, ..., XII=Dec.

### MMM Mmm MMMmm...m MmmM...M MmmMmmMmmMZ MmMmmmmmmmz

3-char month, uppercase
3-char month, mixed case
3-20 char mo., uppercase
3-20 char mo., uppercase trailing blanks suppressed
trailing blanks suppressed

- JAN-DEC
- Jan-Dec
- January-December
- JANUARY-DECEMBER
- JANUARYbb-DECEMBERb
- Januarybb-Decemberb

For input, source string that is always folded to uppercase. For output, M generates uppercase and m generates lowercase. Output is padded with blanks (b) (unless Z specified) or truncated to match the number of M's, up to 20.

### DD ZD DDD

2-digit day of month 1- or 2-digit day of mo. day of year (Julian day)

- 01-31 1-31 001-366

For output, leading zero is always suppressed. For input, ZD treated as DD.

### HH ZH

2-digit hour 1- or 2-digit hour

- 00-23 0-23

For output, leading zero suppressed. For input, ZH treated as HH. If AP specified, valid values are 01-12.

### MI

minute

- 00-59

### SS

second

- 00-59

### 9999 9999

tenths of a second
hundredths of a second
thousandths of a second

- 0-9
- 00-99
- 000-999

No rounding.

### AP ap A. P. a. p.

AM/PM indicator

- AM or PM am or PM A.M. or P.M. a.m. or p.m.

AP affects HH/ZH field. For input, source string always folded to uppercase. For output, AP generates uppercase and ap generates lowercase.

### W WWW WwW...W WwW...w WWWW...WWWZ WwWWWwwwzw

1-char day-of-week
3-char day, uppercase
3-char day, mixed case
3-20 char day, uppercase
3-20 char day, mixed case
trailing blanks suppressed
trailing blanks suppressed

- S, M, T, W, T, F, S
- SUN-SAT
- SUN-Saturday
- SUNDAY-SATURDAY
- Sunday-Saturday
- SUNDAYbb-SATURDAYb
- Sundaybb-Saturdayb

For input, Ws are ignored. For output, W generates uppercase and w generates lowercase. Output padded with blanks (unless Z specified) or truncated to match the number of Ws, up to 20.
### Table 34: Picture character terms used in picture strings for date and time services. (continued)

<table>
<thead>
<tr>
<th>Picture terms</th>
<th>Explanations</th>
<th>Valid values</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>All others</td>
<td>Delimiters Constants</td>
<td>X'01'–X'FF' (X'00' reserved for Language Environment use)</td>
<td>For input, treated as delimiters between the month, day, year, hour, minute, second, and fraction of a second. For output, copied exactly as is to the target string. Constant designating year in Russia, Estonia, Latvia, Lithuania, and the Russian Federation. Constant designating time in Sweden.</td>
</tr>
</tbody>
</table>

**Note:** If a Z/z could be interpreted as belonging to the preceding character string and to the following string, then it is always considered part of the following string, even if it would be legal with the preceding string but illegal with the following string. For clarity, always use a delimiter to define which string the Z/z belongs with. See Table 35 on page 426 for an example.

### Table 35: Examples of picture strings recognized by date and time services.

<table>
<thead>
<tr>
<th>Picture strings</th>
<th>Examples</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>YYMMDD</td>
<td>880516</td>
<td>1988-5-16 would also be valid input. Showa is a Japanese Era name. Showa 63 equals 1988.</td>
</tr>
<tr>
<td>YYYYMMDD</td>
<td>19880516</td>
<td></td>
</tr>
<tr>
<td>YYYY-MM-DD</td>
<td>1988-05-16</td>
<td></td>
</tr>
<tr>
<td>&lt;JJJJ&gt; YY.MM.DD</td>
<td>Showa 63.05.16</td>
<td></td>
</tr>
<tr>
<td>&lt;CCCC&gt; YY.MM.DD</td>
<td>MinKow 77.05.16</td>
<td></td>
</tr>
</tbody>
</table>

| MMDDYY          | 050688   | Accepts imbedded blanks 1-digit year format (Y) valid for output only |
|                 | 05 688   |       |
|                 | 05/06/88 |       |
|                 | 05/06/1988 |       |
|                 | 05/06/8  |       |

| DD.MM.YY        | 09.06.88 | Z suppresses zeros/blanks |
|                 | 09VI -88 |       |
| DD RRRR-YY      | 09 JUN 88 |       |
| DD MMM YY       | 09 June 88 |       |
| DD Mmmmmmmmmmm YY | 9 June 88 |       |
| ZD Mmmmmmmmmmmz YY | June 9, 1988 |       |
| Mmmmmmmmmmmz ZD, YYYY |       |       |

| YY.DDD          | 88.137   | Julian date |
|                 | 88137    |       |
| YYYY/DDD        | 1988/137 |       |

| YYMMDHHMISS     | 880516204229 | Timestamp valid only for CEESECS and CEEDATM. If used with CEEDATE, time positions are left blank. If used with CEEDAYS, HH, MI, SS, and 999 fields are ignored. |
| YYYMMDDHHMISS   | 19880516204229 |       |
| WWW, ZM/ZD/YY HH:MI AP | MON, 5/16/88 08:42 PM |       |
| Wwwwwwwwwz DD Mmm YYYY ZH:MI AP | Monday, 16 May 1988, 8:42 PM |       |

**Note:** Lowercase characters must be used only for alphabetic picture terms.

### Table 36: Japanese Eras used by date and time services when <JJJJ> is specified.

<table>
<thead>
<tr>
<th>First date of Japanese Era</th>
<th>Era name</th>
<th>Era name in IBM Japanese DBCS code</th>
<th>Valid year values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1868-09-08</td>
<td>Meiji</td>
<td>X'0E45A645840F'</td>
<td>01-45</td>
</tr>
<tr>
<td>1912-07-30</td>
<td>Taisho</td>
<td>X'0E455B45770F'</td>
<td>01-15</td>
</tr>
<tr>
<td>1926-12-25</td>
<td>Showa</td>
<td>X'0E45B3457A0F'</td>
<td>01-64</td>
</tr>
<tr>
<td>1989-01-08</td>
<td>Heisei</td>
<td>X'0E458D45BA0F'</td>
<td>01-31</td>
</tr>
<tr>
<td>2019-05-01</td>
<td>Reiwa</td>
<td>X'0E49C3457A0F'</td>
<td>01-999 (01 = 2019)</td>
</tr>
</tbody>
</table>

426 z/OS: Language Environment Programming Reference
Appendix C. Controlling storage allocation

To generate a report of the storage a routine (or more specifically, an enclave) used during its run, specify the RPTSTG(ON) runtime option. The storage report, generated during enclave termination, provides statistics that can help you understand how space is being consumed as the enclave runs. If storage management tuning is desired, the statistics can help you set the corresponding storage-related runtime options for future runs.

Neither the storage report nor the corresponding runtime options include the storage that Language Environment acquires during early initialization, before runtime options processing, and before the start of space management monitoring.

Storage statistics

Attention: This section does not apply to AMODE 64 applications. For information about AMODE 64 statistics, see “Storage statistics for AMODE 64 applications” on page 427.

The following runtime options control storage allocation:

- ANYHEAP
- BELOWHEAP
- HEAP
- HEAPPOOLS
- LIBSTACK
- STORAGE
- STACK
- THREADHEAP
- THREADSTACK

Ensure that these options are tuned appropriately to avoid performance problems. Tuning tips are provided in the z/OS Language Environment Programming Guide. For an example and complete description of the storage report, see z/OS Language Environment Debugging Guide.

Storage statistics for AMODE 64 applications

The following runtime options control storage allocation:

- HEAP64
- HEAPPOOLS
- HEAPPOOLS64
- IOHEAP64
- LIBHEAP64
- STACK64
- THREADSTACK64

Ensure that these options are tuned appropriately to avoid performance problems. Tuning tips are provided in the z/OS Language Environment Programming Guide for 64-bit Virtual Addressing Mode. For an example and complete description of the storage report, see z/OS Language Environment Debugging Guide.
Appendix D. Accessibility

Accessible publications for this product are offered through IBM Knowledge Center (www.ibm.com/support/knowledgecenter/SSLTBW/welcome).

If you experience difficulty with the accessibility of any z/OS information, send a detailed email message to mhvrdfs@us.ibm.com.

Accessibility features

Accessibility features help users who have physical disabilities such as restricted mobility or limited vision use software products successfully. The accessibility features in z/OS can help users do the following tasks:

• Run assistive technology such as screen readers and screen magnifier software.
• Operate specific or equivalent features by using the keyboard.
• Customize display attributes such as color, contrast, and font size.

Consult assistive technologies

Assistive technology products such as screen readers function with the user interfaces found in z/OS. Consult the product information for the specific assistive technology product that is used to access z/OS interfaces.

Keyboard navigation of the user interface

You can access z/OS user interfaces with TSO/E or ISPF. The following information describes how to use TSO/E and ISPF, including the use of keyboard shortcuts and function keys (PF keys). Each guide includes the default settings for the PF keys.

• z/OS TSO/E Primer
• z/OS TSO/E User’s Guide
• z/OS ISPF User’s Guide Vol I

Dotted decimal syntax diagrams

Syntax diagrams are provided in dotted decimal format for users who access IBM Knowledge Center with a screen reader. In dotted decimal format, each syntax element is written on a separate line. If two or more syntax elements are always present together (or always absent together), they can appear on the same line because they are considered a single compound syntax element.

Each line starts with a dotted decimal number; for example, 3 or 3.1 or 3.1.1. To hear these numbers correctly, make sure that the screen reader is set to read out punctuation. All the syntax elements that have the same dotted decimal number (for example, all the syntax elements that have the number 3.1) are mutually exclusive alternatives. If you hear the lines 3.1 USERID and 3.1 SYSTEMID, your syntax can include either USERID or SYSTEMID, but not both.

The dotted decimal numbering level denotes the level of nesting. For example, if a syntax element with dotted decimal number 3 is followed by a series of syntax elements with dotted decimal number 3.1, all the syntax elements numbered 3.1 are subordinate to the syntax element numbered 3.
Certain words and symbols are used next to the dotted decimal numbers to add information about the syntax elements. Occasionally, these words and symbols might occur at the beginning of the element itself. For ease of identification, if the word or symbol is a part of the syntax element, it is preceded by the backslash (\) character. The * symbol is placed next to a dotted decimal number to indicate that the syntax element repeats. For example, syntax element 3 FILE with dotted decimal number 3 is given the format 3 \* FILE. Format 3* FILE indicates that syntax element FILE repeats. Format 3* \* FILE indicates that syntax element FILE repeats.

Characters such as commas, which are used to separate a string of syntax elements, are shown in the syntax just before the items they separate. These characters can appear on the same line as each item, or on a separate line with the same dotted decimal number as the relevant items. The line can also show another symbol to provide information about the syntax elements. For example, the lines 5.1*, 5.1 LASTRUN, and 5.1 DELETE mean that if you use more than one of the LASTRUN and DELETE syntax elements, the elements must be separated by a comma. If no separator is given, assume that you use a blank to separate each syntax element.

If a syntax element is preceded by the % symbol, it indicates a reference that is defined elsewhere. The string that follows the % symbol is the name of a syntax fragment rather than a literal. For example, the line 2.1 %OP1 means that you must refer to separate syntax fragment OP1.

The following symbols are used next to the dotted decimal numbers.

? indicates an optional syntax element
The question mark (?) symbol indicates an optional syntax element. A dotted decimal number followed by the question mark symbol (?) indicates that all the syntax elements with a corresponding dotted decimal number, and any subordinate syntax elements, are optional. If there is only one syntax element with a dotted decimal number, the ? symbol is displayed on the same line as the syntax element, (for example 5? NOTIFY). If there is more than one syntax element with a dotted decimal number, the ? symbol is displayed on a line by itself, followed by the syntax elements that are optional. For example, if you hear the lines 5 ?, 5 NOTIFY, and 5 UPDATE, you know that the syntax elements NOTIFY and UPDATE are optional. That is, you can choose one or none of them. The ? symbol is equivalent to a bypass line in a railroad diagram.

! indicates a default syntax element
The exclamation mark (!) symbol indicates a default syntax element. A dotted decimal number followed by the ! symbol and a syntax element indicate that the syntax element is the default option for all syntax elements that share the same dotted decimal number. Only one of the syntax elements that share the dotted decimal number can specify the ! symbol. For example, if you hear the lines 2? FILE, 2.1! (KEEP), and 2.1 (DELETE), you know that (KEEP) is the default option for the FILE keyword. In the example, if you include the FILE keyword, but do not specify an option, the default option KEEP is applied. A default option also applies to the next higher dotted decimal number. In this example, if the FILE keyword is omitted, the default FILE(KEEP) is used. However, if you hear the lines 2? FILE, 2.1, 2.1.1! (KEEP), and 2.1.1 (DELETE), the default option KEEP applies only to the next higher dotted decimal number, 2.1 (which does not have an associated keyword), and does not apply to 2? FILE. Nothing is used if the keyword FILE is omitted.

* indicates an optional syntax element that is repeatable
The asterisk or glyph (*) symbol indicates a syntax element that can be repeated zero or more times. A dotted decimal number followed by the * symbol indicates that this syntax element can be used zero or more times; that is, it is optional and can be repeated. For example, if you hear the line 5.1* data area, you know that you can include one data area, more than one data area, or no data area. If you hear the lines 3* , 3 HOST, 3 STATE, you know that you can include HOST, STATE, both together, or nothing.

Notes:
1. If a dotted decimal number has an asterisk (*) next to it and there is only one item with that dotted decimal number, you can repeat that same item more than once.
2. If a dotted decimal number has an asterisk next to it and several items have that dotted decimal number, you can use more than one item from the list, but you cannot use the items more than once each. In the previous example, you can write HOST STATE, but you cannot write HOST HOST.
3. The ★ symbol is equivalent to a loopback line in a railroad syntax diagram.

+ indicates a syntax element that must be included

The plus (+) symbol indicates a syntax element that must be included at least once. A dotted decimal number followed by the + symbol indicates that the syntax element must be included one or more times. That is, it must be included at least once and can be repeated. For example, if you hear the line 6.1+ data area, you must include at least one data area. If you hear the lines 2+, 2 HOST, and 2 STATE, you know that you must include HOST, STATE, or both. Similar to the ★ symbol, the + symbol can repeat a particular item if it is the only item with that dotted decimal number. The + symbol, like the ★ symbol, is equivalent to a loopback line in a railroad syntax diagram.
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Index

Special Characters

' (straight single quote)
initializing storage with 71, 72
specifying in parameters of TEST runtime option 78, 79

" (straight double quote)
initializing storage with 71, 72
specifying in parameters of TEST runtime option 78, 79

* (asterisk) 78, 79

/ (slash)
NOEXECOPS alters behavior of 29
specifying in parameters of TEST runtime option 79

= (equal sign)
in ENVAR runtime option 26

Numerics

0 type_of_move 319, 322
1 type_of_move 319, 322
16M line
ALL31 runtime option and 12
allocating library heap storage not restricted to below 14
ANYHEAP runtime option and 14
HEAP runtime option and 33
storage received from CEEGTST and 277
2-digit years
querying within 100-year range (CEEQCEN)
examples of 337
setting within 100-year range (CEESCEN)
examples of 349
24-bit addressing
ANYHEAP runtime option and 14

A
abbreviating runtime options 9
abcode parameter 9, 113, 116
abend codes
abend 4088, reason code 1004 72
abend 4091, reason code 21 23
dumping 113, 117
ERRCOUNT runtime option and 366
in CEE3DMP callable service 132
percolating in ABPERC runtime option 9
abends
bad filenames in CEEBLDTX macro can cause 332
dumps, getting when enclave terminates with abend (CEE3ABD) 113, 117
ERRCOUNT runtime option and 28
in CEEFRST callable service 250
in CEEGTST callable service 277
not handled if initiated by SVC 13 88
options report not generated (RPTOPTS runtime option) 63
out-of-storage condition, cause 72
percolating

abends (continued)
percolating (continued)
ABPERC runtime option and 10
CEEEXITA and 88
percolating certain abends in CEEEXITA 87
side effects if encountered using TRAP(OFF) 88
storage report not generated (RPTSTG runtime option) 64
system abends
ABPERC runtime option and 10
percolating in the assembler user exit 88
terminating enclave with (CEE3ABD) 113, 116, 151
trapping 86
user
using ABPERC runtime option to percolate 10
when nested condition exceeded (DEPTHCONDLMT runtime option) 23
ABPERC runtime option
CICS ignores this option 10
S0Cx abends can't be percolated 10
syntax 9
absolute value math service (CEESxABS) 385
ABTERMENC runtime option
abend codes and 10
choosing between abend codes and return codes 10
syntax 10
access method service (AMS) 11
accessibility
contact IBM 429
features 429
active condition
CEE Gaz callable service and 265
CEERCDM callable service and recording information for an active condition 346
dumping information related to 132
additional heap
creating (CEECRHP) 197
discarding (CEEDSHP) 228
reducing the amount of storage you need to run an application 250
address parameter
CEECSZST callable service and 201
CEEFST callable service and 250
CEEGST callable service and 277
addressing exception 182
aggregate
dumping arrays and structures 130
AIXBLD runtime option
syntax 11
alignment
PL/I structures and Language Environment storage callable services 278
ALL31 runtime option
ALL31(ON) default under CICS 13
syntax 11
allocating
storage
allocating (continued)
storage (continued)
  additional heap, setting size of (CEECRHP) 197
anywhere heap, setting size of (ANYHEAP runtime option) 14
below heap, setting size of (BELOWHEAP runtime option) 15, 16
gett heap storage (CEEGTST) 277, 278, 280
initial heap, setting size of (HEAP runtime option) 32, 44
initializing when allocating (STORAGE runtime option) 70
library stack storage, setting size of LIBSTACK runtime option 47
stack storage, setting size of (STACK runtime option) 67, 69, 70, 84
alternate indices, building with AIXBLD | NOAIXBLD runtime option 11
AMODE
  ALL31 runtime option and 11, 12
callable services and 104
  heap storage 34
  STACK runtime option and 12
under CICS 278
AMS (access method service) 11
ANYHEAP runtime option 13
anywhere heap
  allocating storage from 14
  ANYHEAP runtime option and 14
  controlling whether storage is freed from 14
ANYWHERE suboption
  ANYHEAP runtime option and 13
  HEAP runtime option and 33
application writer interface (AWI) 103
arccosine math service (CEESxACS) 386
arcsine math service (CEESxASN) 387
arctangent math service (CEESxATN) 389
arctangent2 math service (CEESxAT2) 389
AREA storage for COBOL 278
ARGPARSE runtime option
CICS ignores this option 15
argument
dumping 130
  format of in invoked routine 58, 59
  list format
    effect of EXECOPS runtime option on 29
arithmetic
calculation on dates
  convert date to COBOL Lilian format (CEECBLDY) 190, 192
  convert date to Lilian format (CEEDAYS) 215, 217
  convert timestamp to number of seconds (CEESECS) 357, 358
  get current Greenwich Mean Time (CEEGMT) 259, 260
examples using 384, 415, 418
  parameter types 383
services
  Quick Reference Tables 101
  syntax variations of 101, 383
array 130
assembler language (continued)
routines (continued)
  calling math services from 383
  invoking callable services from 104
assistive technologies 429
asterisk (*) 78, 79
AT OCCURRENCE debug command for debug tool 78
AT TERMINATION debug command for debug tool 78
attention processing
  handling with a debug tool (TEST runtime option) 78
  handling with INTERRUPT runtime option 44
AUTOTASK runtime option
  syntax 15
B
below heap
  allocating storage from 15, 16
BELOWHEAP runtime option and 15, 16
  controlling whether storage is freed 16
BELOW suboption
  ANYHEAP runtime option and 14
BIF (built-in functions), in CEE3DMP 132
bimodal addressing
  ANYHEAP runtime option 13
  HEAP runtime option 33
bit manipulation services
  CEESICLR—bit clear 379
  CEESISET—bit set 379
  CEESITST—bit test 381
buffer
  dumping contents of buffers used by files 130
  storing messages in
    syntax description 307
building condition token
  examples of 333, 335
  syntax description 331
built-in functions (BIF) for PL/I, in CEE3DMP 129
C
C applications, specifying operating system for 26
calloc() function 32
CEE3PRM callable service considerations 172
declares for Language Environment data types 108
examples
  CEE3ABD—terminate enclave with abend 114, 117, 153
  CEE3CTY—set default country 124
  CEE3GRG—get enclave return code 136
  CEE3GRN—get name of routine that incurred condition 143
  CEE3LNG—set national language 158
  CEE3MCS—set default currency 162
  CEE3MDS—get default decimal separator 168
  CEE3MTS—set default thousands separator 170
  CEE3PRM—query parameter string 173
  CEE3RPH—set report heading 178
  CEE3SMP—query and modify Language Environment hardware condition enablement 182
  CEE3SRM—set enclave return code 136
  CEE3USR—set or query user area fields 187
C (continued)
examples (continued)
  CEECMI—store and load message insert data 194
  CEECHRHP—create new additional heap 199
  CEECZST—reallocate storage 202
  CEEDATE—convert Lilian date to character format
  207
  CEEDATM—convert seconds to character timestamp
  212
  CEECOD—decompose a condition token 222
  CEEDSHP—discard heap 230
  CEEYWK—calculate day of week from Lilian date
  232
  CEEFMDA—get default date format 239
  CEEFMTM—get default time format 248
  CEEFRST—free heap storage 252
  CEEGMT—get current GMT 260
  CEEPID—retrieve Language Environment
  version/platform ID 266
  CEEQDT—retrieve q_data_token 268
  CEEQDT—get heap storage 202, 222, 278
  CEEHDLR—register user-written condition handler
  136, 143, 282
  CEEHDLU—unregister user-written condition
  handler 289
  CEEESEC—convert integers to seconds 293
  CEEITOK—return initial condition token 295
  CEELOCT—get current local date or time 306
  CEEMOUT—dispatch a message 313
  CEERMCR—move resume cursor 323
  CEEMSG—get, format, and dispatch a message 319
  CEE3CIB—return pointer to condition information block
  115, 118
  CEE3CTY (set default country) 122
  CEE3DMP—generate dump 129
  CEE3GR—get the enclave return code 136
  CEE3GRN—get name of routine that incurred condition
  143
  CEE3GRO—get offset of condition 147
  CEE3LING—set national language 155
  CEE3MCS—set default currency symbol 161
  CEE3MDS—set default decimal separator 167
  CEE3MST—set default thousands separator 169
  CEE3PRM—query parameter string 172
  CEE3PRPH—set report heading 177
  CEE3SPM—query and modify Language Environment
  hardware condition enablement 180
  CEE3SRC—set the enclave return code 185
  CEE3SRP—set resume point 185
  CEE3USR—set or query user area fields 186
  CEE3BL—convert date to COBOL Lilian format 190
  CEE3MI—store and load message insert data 193
  CEE3CIB—create new additional heap 197
  CEE3CTY (set default country) 201
  CEE3DMP—generate dump 205
  CEE3EN—Process environmental variables 207
  CEE3GRC—get the enclave return code 210
  CEE3GRN—get name of routine that incurred condition
  215
  CEE3GRO—get offset of condition 220
  CEE3HDL—register user condition handler 228
  CEE3HDLU—unregister user condition handler 232
  CEE3SEC—convert integers to seconds 234
  CEE3SECS—convert timestamp to seconds 239
  CEE3SLG—signal a condition 243
  CEE3TDS—format date and time into character string
  248
  CEE3GMT—get current Greenwich Mean Time 252
  CEE3GRC—get the enclave return code 257
  CEE3GRN—get name of routine that incurred condition
  260
  CEE3GRO—get offset of condition 265
  CEE3HDL—register user condition handler 270
  CEE3HDLU—unregister user condition handler 274
  CEE3SEC—convert integers to seconds 279
  CEE3SECS—convert timestamp to seconds 284
  CEE3SLG—signal a condition 288
  CEE3TDS—format date and time into character string
  293
  CEE3GMT—get current Greenwich Mean Time 298
  CEE3GRC—get the enclave return code 293
  CEE3GRN—get name of routine that incurred condition
  304
  CEE3GRO—get offset of condition 309
  CEE3HDL—register user condition handler 314
  CEE3HDLU—unregister user condition handler 318
  CEE3SEC—convert integers to seconds 323
  CEE3SECS—convert timestamp to seconds 328
  CEE3SLG—signal a condition 333
  CEE3TDS—format date and time into character string
  338
  CEE3GMT—get current Greenwich Mean Time 339
  CEE3GRC—get the enclave return code 344
  CEE3GRN—get name of routine that incurred condition
  349
  CEE3GRO—get offset of condition 354
  CEE3HDL—register user condition handler 359
  CEE3HDLU—unregister user condition handler 364
  CEE3SEC—convert integers to seconds 369
  CEE3SECS—convert timestamp to seconds 374
  CEE3SLG—signal a condition 379
  CEE3TDS—format date and time into character string
  384
  CEE3GMT—get current Greenwich Mean Time 389
  CEE3GRC—get the enclave return code 394
  CEE3GRN—get name of routine that incurred condition
  399
  CEE3GRO—get offset of condition 404
  CEE3HDL—register user condition handler 409
  CEE3HDLU—unregister user condition handler 414
  CEE3SEC—convert integers to seconds 419
  CEE3SECS—convert timestamp to seconds 424
  CEE3SLG—signal a condition 429
  CEE3TDS—format date and time into character string
  434
  CEE3GMT—get current Greenwich Mean Time 439
  CEE3GRC—get the enclave return code 444
  CEE3GRN—get name of routine that incurred condition
  449
  CEE3GRO—get offset of condition 454
  CEE3HDL—register user condition handler 459
  CEE3HDLU—unregister user condition handler 464
  CEE3SEC—convert integers to seconds 469
  CEE3SECS—convert timestamp to seconds 474
  CEE3SLG—signal a condition 479
  CEE3TDS—format date and time into character string
  484
  CEE3GMT—get current Greenwich Mean Time 489
  CEE3GRC—get the enclave return code 494
  CEE3GRN—get name of routine that incurred condition
  499
  CEE3GRO—get offset of condition 504
  CEE3HDL—register user condition handler 509
  CEE3HDLU—unregister user condition handler 514
  CEE3SEC—convert integers to seconds 519
  CEE3SECS—convert timestamp to seconds 524
  CEE3SLG—signal a condition 529
  CEE3TDS—format date and time into character string
  534
  CEE3GMT—get current Greenwich Mean Time 539
  CEE3GRC—get the enclave return code 544
  CEE3GRN—get name of routine that incurred condition
  549
  CEE3GRO—get offset of condition 554
  CEE3HDL—register user condition handler 559
  CEE3HDLU—unregister user condition handler 564
  CEE3SEC—convert integers to seconds 569
  CEE3SECS—convert timestamp to seconds 574
  CEE3SLG—signal a condition 579
  CEE3TDS—format date and time into character string
  584
  CEE3GMT—get current Greenwich Mean Time 589
  CEE3GRC—get the enclave return code 594
  CEE3GRN—get name of routine that incurred condition
  599
  CEE3GRO—get offset of condition 604
  CEE3HDL—register user condition handler 609
  CEE3HDLU—unregister user condition handler 614
  CEE3SEC—convert integers to seconds 619
  CEE3SECS—convert timestamp to seconds 624
  CEE3SLG—signal a condition 629
  CEE3TDS—format date and time into character string
  634
  CEE3GMT—get current Greenwich Mean Time 639
  CEE3GRC—get the enclave return code 644
  CEE3GRN—get name of routine that incurred condition
  649
  CEE3GRO—get offset of condition 654
  CEE3HDL—register user condition handler 659
  CEE3HDLU—unregister user condition handler 664
  CEE3SEC—convert integers to seconds 669
  CEE3SECS—convert timestamp to seconds 674
  CEE3SLG—signal a condition 679
  CEE3TDS—format date and time into character string
  684
  CEE3GMT—get current Greenwich Mean Time 689
  CEE3GRC—get the enclave return code 694
  CEE3GRN—get name of routine that incurred condition
  699
callable services (continued)
- CEERANG—calculate uniform random numbers 343
- CEERCDM—record information for an active condition 346
- CEESCEN—set the century window 348
- CEESCOL—compare string collation weight 350
- CEESCI—convert seconds to integers 353
- CEESCS—convert timestamp to number of seconds 357
- CEESCL—set the locale operating environment 362
- CEESGL—signal a condition 365
- CEESCLR—bit clear 379
- CEESISET—bit set 379
- CEESITST—bit test 381
- CEESTXF—transform string characters into collation weights 369
- CEESxABS—absolute value 385
- CEESxACS—arccosine 386
- CEESxASN—arcsine 387
- CEESxAT2—artangent of two arguments 389
- CEESxATH—hyperbolic arctangent 387
- CEESxATN—arctangent 388
- CEESxCJG—conjugate complex 390
- CEESxCOS—cosine 391
- CEESxCSH—hyperbolic cosine 392
- CEESxCTN—cotangent 393
- CEESxDIM—positive difference 394
- CEESxDVD—division 395
- CEESxERC—error function 396
- CEESxERF—error function complement 396
- CEESxEXP—exponent (base e) 397
- CEESxELM—gamma function 398
- CEESxIMG—imaginary part of complex 399
- CEESxINT—truncation 400
- CEESxLG1—logarithm base 10 401
- CEESxLG2—logarithm base 2 402
- CEESxLGM—log gamma function 403
- CEESxLOG—logarithm base e 404
- CEESxMOD—floating complex multiply 405
- CEESxMOF—modular arithmetic 406
- CEESxNIN—nearest integer 407
- CEESxNWN—nearest whole number 408
- CEESxSGN—sign of 409
- CEESxSIN—sine 410
- CEESxSNH—hyperbolic sine 411
- CEESxSQR—square root 412
- CEESxTNH—hyperbolic tangent 413
- CEESxTPX—exponential (base e) 414
- CEETDLI—invoke IMS 373
- CEETEST—invoke debug tool 375

feedback code parameter 108

invoking
- in C 106
- in COBOL 106
- in PL/I 107, 108

Quick Reference Tables 97, 100
case 1 condition token 333
case 2 condition token 333
cause code condition 333
CBLOPTS runtime option syntax 16
CBLPSHPOP runtime option

CBLPSHPOP runtime option (continued)
- EXEC CICS PUSH and EXEC CICS POP commands and 17

CBLQDA runtime option
- CICS ignores this option 18

 relationships to dump and message file 17
syntax 17

CCEE_TABLE Language Environment data type and HLL equivalents 108
C3E3 prefix, meaning of 104
C3EE3ABD—terminate enclave with an abend
CICS considerations 113, 116
elements using 114, 115, 117, 118, 153
C3EE3CIB—return pointer to condition information block
syntax 115, 118

C3EE3CTY (set default country) 122
C3EE3CTY—set default country
COUNTRY runtime option and 21
date and time services and 122
elements using 124, 125
other national language support services and 122
RPTOPTS runtime option and 123
RPTSTG runtime option and 122
setlocale() and 123
table of default values for specified country_code 419

C3EE3DMP—generate dump
default dump file of 129
elements using 135
options used in TERMTHDACT runtime option 77
using TEST compile-time option with 131

C3EE3GRC—get the enclave return code
elements using 136, 142

C3EE3GRN—get name of routine that incurred condition
elements using 147, 153

C3EE3GRO—get offset of condition
elements using 147

C3EE3NIN—nearest integer 405
case 2 condition token 333
case 1 condition token 333
cause code condition 333
CBLOPTS runtime option syntax 16
CBLPSHPOP runtime option
CEE3RPH—set report heading
examples using 177
syntax 177
CEE3SPM—query and modify Language Environment
hardware condition enablement
examples using 182, 183
syntax 180
CEE3SRC—set the enclave return code
examples using 185
syntax 185
CEE3SRP—set resume point
examples using 186
syntax 185
CEE3USR—set or query user area fields
examples using 187, 189
syntax 186
CEEBLDTX EXEC
use caution when creating new facility ID for 332
CEEBXITA assembler user exit
percolating certain abends with TRAP(ON) 88
CEECBLDY—convert date to COBOL Lilian format
examples using 191
syntax 190
CEECMI—store and load message insert data
examples using 194, 196
syntax 193
CEECRHP—create new additional heap
examples using 199, 200
HEAP runtime option and 277
syntax 197
CEEC2ST—reallocating (change size of) storage
CEEGTST callable service and 200
examples using
example with CEEGTST and CEEFRST 202
examples with CEEHDLR, CEEGTST, and CEEEMRCR
202, 204
syntax 202
CEEDATE—convert Lilian date to character format
CEEDAYS callable service and 205
CEEFMDA callable service and 206
COUNTRY runtime option and 206
examples using 207
syntax 205
table of sample output 207
CEEDATM—convert seconds to character timestamp
CEEFMDT callable service and 211
CEESECI callable service and 353
CEESECS callable service and 210
COUNTRY runtime option and 211
examples using 212, 214
syntax 210
table of sample output 215
CEEDAYS—convert date to Lilian format
CEEDATE callable service and 215
CEESECN callable service and 190, 216
syntax 215
CEEDCOD—decompose a condition token
examples using
C example showing alternative to using 368
examples with CEEGTST 222, 224
syntax 220
CEEDLYM—suspend processing of the active enclave in milliseconds 225
CEEDOPT (continued)
CBLOPTS runtime option must be specified in CEEOPT
CEEUOPT 16
COUNTRY runtime option consideration 21
country_code and 21
ENVAR runtime option and 27
national language codes and 52
specifying nonexistent national language code in 52
CEEDSHP—discard heap
can overrule HEAP runtime option 228
CEECRHP callable service and 228
examples with CEECRHP 228, 230
HEAP runtime option and 228
syntax 228
CEEDUMP default dump file
CBLQDA runtime option and 17
CEE3DMP callable service and 129
CEEDUMP runtime option 18
CEEDYWK—calculate day of week from Lilian date
examples using 232
syntax 231
CEEBMAW file, description of 104
CEEEDCCT file, description of 104
CEEENV—Process environmental variables 234
CEEFMDA—get default date format
CEE3CTY callable service 239
COUNTRY runtime option and 239
default if invalid country_code specified 239
defaults of country_code parameter 419
examples using 239, 240
syntax 238
CEEFMDT—get default date and time format
CEE3CTY callable service and 241
COUNTRY runtime option and 241
default if invalid country_code specified 241
defaults of country_code parameter 419
examples using 242, 243
syntax 241
CEEFMON—format monetary string
about 243
examples using 245
CEEFMTM—get default time format
CEE3CTY callable service and 248
COUNTRY runtime option and 248
default if invalid country_code specified 248
defaults of country_code parameter 419
examples using 248, 249
syntax 247
CEEFRST—free heap storage
CEECRHP callable service and 250
CEEGTST callable service and 250
examples with CEEGTST 252, 253
HEAP runtime option and 250
syntax 250
CEEFDS—format date and time into character string
syntax 254
CEEGMT—get current Greenwich Mean Time
CEEDATE callable service and 260
CEEDATM callable service and 260
CEEGMTO callable service and 259
examples using 260, 261
syntax 259
CEEGMTO—get offset from Greenwich Mean Time to local time
CEEGMTO—get offset from Greenwich Mean Time to local time
CEEDATM callable service and CEEGMAT and 262
examples using 263, 264
syntax 262
CEEGPID—retrieve the Language Environment version and
platform ID
examples using 266, 267
CEEGPID—retrieve the version and platform ID 265
CEEGQDT—retrieve q_data_token
CEESGL callable service and 268
examples using
CEEGQDT by itself 270
examples with CEEHDLR and CEESGL 269, 270
instance specific information (ISI) and 268
CEEGTJS—retrieves the value of an exported JCL symbol
examples using 276
CEEGTST—get heap storage
CEECRHP callable service and 277
CEEDSHP callable service and 277
CEEFRST callable service and 277
CEESGL callable service and 277
examples using
examples with CEECZST and CEEFRST 202
examples with CEEFRST 252, 278, 280
HEAP runtime option and 277
syntax 276
using STORAGE runtime option to initialize storage
received from 277
CEEHDLR—register user condition handler
CEEHDLU callable service and 288
condition handling example 282
examples using
CEEHDLR by itself 282, 286
examples with CEE3SRC and CEE3GRC 143, 146
syntax 281
CEEHDLU—unregister user condition handler
CEEHDLR callable service and 288
examples with CEEHDLR 289, 290
syntax 287
CEEIBMCI file, description of 104
CEEIBMCT file, description of 104
CEEIGZCI file, description of 104
CEEIGZCT file, description of 104
CEEISEC—convert integers to seconds
CEESECI callable service and 291
examples using 293, 294
syntax 291
CEEITOK—return initial condition token
examples using 295, 298
syntax 295
CEELCNV—query locale numeric conventions
syntax 299
CEEOCT—get current locale numeric
CEEDATM callable service and 305
CEEGMT callable service and 305
CEEGMTO callable service and 305
examples using 306, 307
syntax 304
CEEMGET—get a message
examples using
CEEMGET by itself 311
examples with CEEMOUT 309
syntax 307
CEEMOUT—dispatch a message
CEEMOUT—dispatch a message (continued)
examples using 313, 314
MSGFILE runtime option and 312
syntax 312
CEEMRCE—move resume cursor explicit
examples using 315, 318
syntax 314
CEEMRCR—move resume cursor relative to handle cursor
examples with CEEHDLR and CEESGL 323, 327
illustrations of 321
syntax 319
CEEMSG—get, format, and dispatch a message
examples using 329, 330
MSGFILE runtime option and 328
MSGQ runtime option and 51
syntax 328
CEENCOD—construct a condition token
CEECOD callable service and 220
examples using 333, 335
how C users can use CEESGL callable service instead of
368
syntax 333
CEEQCEN—query the century window
CEESCEN callable service and 336
examples using 337
syntax 336
CEEQDTC—query locale, date, and time conventions
syntax 338
CEERAN0—calculate uniform random numbers
examples using 345
syntax 343
CEERCDM — record information for an active condition
examples using 347
CEERCDM— record information for an active condition 346
CEESCEN—set the century window
CEEDAYS callable service and 348
CEESECS callable service and 348
examples using 349, 350
syntax 348
CEESECOL—compare string collation weight
syntax 350
CEESECI—convert seconds to integers
examples using 354, 356
relationship to CEEISEC callable service 353
syntax 353
CEESECS—convert timestamp to number of seconds
CEEDATM callable service and 357
CEEISEC callable service and 291
CEESCEN callable service and 348
COUNTRY runtime option and 357
syntax 357
CEESETL—set locale operating environment
syntax 362
CEESGL—signal a condition
CEEGQDT callable service and 268
examples using 368, 369
HLL-specific condition handlers and 366
q_data_token and 268, 366
setting of ERRCOUNT runtime option can cause abend
366
syntax 365
TRAP runtime option does not affect 86
using to create an ISI 365, 366
CEESTXF—transform string into collation weights
CEESTXF—transform string into collation weights
syntax 369
CEETDLI interface to IMS
syntax 373
CEETEST—invoke debug tool
exaamples using 376, 377
NOTEST runtime option and 80
syntax 375
CEEUOPT
CBOPTS runtime option must be specified in CEEUOPT or CEDOPT 16
COUNTRY runtime option considerations 21
country_code and 21
national language codes and 52
specifying nonexistent national language code in 21
specifying UPSI runtime option in 22
century window
CEEDAYS callable service and 190, 216
CEEQCEN callable service and examples of 337
CEESCEN callable service and examples of 337, 349, 350
CESECS callable service and 357
CESE transient data queue
CEEMOUT callable service and 312
char_parm_string parameter 172
character timestamp
converting Lilian seconds to (CEEDATM) examples of 212, 214
converting to COBOL Lilian seconds (CEECBLDY) examples of 192
converting to Lilian seconds (CEESECS) examples of 357
CHARN Language Environment data type and HLL equivalents 108
CHECK runtime option
syntax 20
using while debugging 20
checking errors, flagging with CHECK runtime option 20
ChuHwaMinKow era 426
CIB (Condition Information Block) 115, 118
CICS
callable service behavior under
abend codes in CEE3ABD callable service 113, 116
storage considerations 278
CBLPSHPOP runtime option and 17
CEE3DMP ENCLAVE considerations 133
CESE transient data queue and 50
PLIST setting 58
storage and 278
class code condition 333
clean-up parameter 113, 116
CMS
CEE3DMP special considerations 133
CMSSTOR OBTAIN/RELEASE commands 64
OSRUN command 58
PLIST runtime option settings to specify when running under 58
specifying a C application is running under 26, 29
CMSCALL
CEE3DMP ENCLAVE considerations 133
CMSSTOR OBTAIN/RELEASE 64
COBOL
batch debugging features 22
COBOL (continued)

reusability of an environment when COBOL is main runtime options specific to
AIXBLD—invoke AMS 11
CBOPTS—specify format of argument string 16
CBLPSHPOP—control usage of CICS commands 17
CBLQDA—control QSAM dynamic allocation 17
CHECK—allow for checking errors 20
DEBUG—activate COBOL batch debugging 22
FLOW—control OS/VS COBOL FLOW output 32
RTEREUS—make first COBOL routine reusable 65
SIMVRD—specify VSAM KSDS 66
severity 0 and 1 conditions, ERRCOUNT runtime option and 28
space management tuning table, using HEAP runtime option with 34
STOP RUN statement 66
tuning, with HEAP runtime option 34
using VSAM KSDS to simulate variable length relative organization data sets 11
variables, where stored 67, 69
command
syntax diagrams xiv
command line
parsing of arguments (ARGPARSE runtime option) 14
specifying whether runtime options can be specified on (EXECOPS runtime option) 29
commands_file parameter 78
compatibility
CICS 17
complex numbers
complex number math services
conjugate of complex (CEEXCJG) 390
floating complex divide (CEEXDVDF) 395
floating complex multiply (CEEXMLT) 404
imaginary part of complex (CEEXIMG) 399
cond_rep parameter
CEECMI callable service and 193
CEEGQDT callable service and 268
CEESGL callable service and 366
cond_str parameter 181
cond_token parameter
CEEMGET callable service and 307
CEEMSG callable service and 328
CEENCOD callable service and 332
condition
active
CEEGPID callable service and 265
dumping information related to 132
cause code 333
class code 333
enabled 365
getting name of routine that incurred condition (CEE3GRN)
examples of 143, 146
getting offset of condition 147
initial
allowing the handling of 23
returning initial condition token for (CEEITOK) 295
nested, allowing levels of 22
providing q_data_token for (in CEESGL)
examples of 368, 369
syntax description 365
safe conditions 366
condition (continued)
severity
CEESGL callable service and 366
ERRCOUNT runtime option and 28
severity levels that cause the debug tool to gain control 78
tolerating a given number of 23
condition handler
C signal handlers
CEEMRCR callable service and 319
CEESGL callable service and 366
HLL semantics
ABPERC runtime option and 9
TRAP runtime option and 87
Language Environment condition handler 86
PL/I—ON-units
CEESGL callable service and 366
user-written
allowing nested conditions in 22
CEE3SPM callable service and 180
moving the resume cursor from a 319
registering with CEEHDLR 281
retrieving q_data_token 268
TRAP runtime option and 87
unregistering 288
vector facility and 90
condition handling
callable services for
CEE3ABD—terminate enclave with an abend 113, 116, 151
CEE3CIB—return pointer to condition information block 119
CEE3DLY—suspend processing of the active enclave in seconds 126
CEE3GRN—get name of routine that incurred condition 143
CEE3GRO—get offset of condition 147
CEE3SPM—query and modify Language Environment hardware condition enablement 180
CEECOD—decompose a condition token 220
CEEGPID—retrieve the Language Environment version and platform ID 265
CEEGQDT—retrieve q_data_token 268
CEEHDLR—register user condition handler 281
CEEHDLU—unregister user condition handler 287
CEEITOK—return initial condition token 295
CEEMRCE—move resume cursor explicit 314
CEEMRCR—move resume cursor relative to handle cursor 319
CEENCOD—construct a condition token 331
CEESGL—signal a condition 365
Quick Reference Tables 97
CICS, under 17
depth of conditions allowed 22
dumps, handling of conditions that arise when processing 129
runtime options for
ABPERC 9
DEPTCHONDLMT 22
ERRCOUNT 28
TRAP 86
XUFLOW 92
signaling condition with CEESGL 365
user-written condition handler
condition handling (continued)
  user-written condition handler (continued)
    allowing nested conditions in (DEPTCONDLMT runtime option) 22
    moving the resume cursor from a (CEEMCR) 319
    registering (CEEHDLR) 281
    retrieving q_data token (CEEGQDT) 268
    TRAP runtime option and 87
    unregistering (CEEHDLU) 288
    vector facility and 90
condition information block
  dumping information related to 132
  returning initial condition token for (CEEITOK) examples of 295, 298
Condition Information Block (CIB) 115, 118
condition token
  altering (CEEDCOD) 220, 221
  constructing (CEENCOD)
    examples of 333, 335
  decomposing (CEEDCOD) 220
  dumping information associated with (CEE3DMP) 132
  input to CEESGL, using as 366
  message corresponding to, getting
    get, format, and dispatch message (CEEMSG) 328, 330
    get, format, and store message in a buffer
      (CEEMGET) 307, 311
    q_data_token from the ISI, using to retrieve
      (CEEGQDT)
    examples of 269, 274
    returning initial condition token (CEEITOK)
    examples of 295, 298
SCEESAMP files for 104
condition_ID portion of condition token 333
conjugate of complex math service (CEESxCJG) 390
constructing a condition token (CEENCOD)
  contact
    z/OS 429
control portion of condition token 221, 332
convert character format to Lilian date (CEEDAYS) examples of 215
convert Lilian date to character format (CEEDATE)
  examples of 207
COPY statement, in COBOL 104
cosine math service (CEESxCOS) 391
cotangent math service (CEESxCCTN) 393
COUNTRY runtime option
  defaults of country_code parameter 419
  relationship to setlocale() 21
  setting
    with CEE3CTY callable service 122, 125
    with COUNTRY runtime option 20
D
data types
  definitions of Language Environment and HLL data types 108
  data, external
    relationship to ALL31 runtime option 12
DATAFIELD built-in function, in CEE3DMP 132
date and time format
  converting from character format to COBOL Lilian format (CEECBLDY) 190, 215
  converting from character format to Lilian format (CEEDAYS) 215
  converting from integers to seconds (CEEISEC) 291
  converting from Lilian format to character format (CEEDATE) 205
  converting from seconds to character timestamp (CEEDATM) 210
  converting from seconds to integers (CEESECI) 353
  converting from timestamp to number of seconds (CEESECS) 357
  default formats for given country 419
  setting default country (CEE3CTY) 122
  setting default country (COUNTRY runtime option) 20
  getting date and time (CEELOCT) 304
services
  CEEDATE—convert Lilian date to character format 205
  CEEDATM—convert seconds to character timestamp 210
  CEEDEYS—convert date to Lilian format 190, 215
  CEEDYWK—calculate day of week from Lilian date 231
  CEEGMT—get current Greenwich Mean Time 259
  CEEGMO—get offset from Greenwich Mean Time to local time 262
  CEEISEC—convert integers to seconds 291
  CEELOCT—get current local time 304
  CEEQCEN—query the century window 336
  CEESECSI—set the century window 348
  CEESECI—convert seconds to integers 353
date and time (continued)
services (continued)
CEESECS—convert timestamp to number of
seconds 357
Quick Reference Tables 98
day of week, calculating with CEEDYWK 231
DEBUG runtime option 22
debug tool
giving control to with TEST runtime option 78
TEST runtime option and 78
Debug Tool
CEETEST callable service, invoking with 375
invoking with CEETEST callable service 375
debugging
COBOL batch 22
decimal separator
default, obtaining with CEE3MDS callable service 167
for countries, defaults 419
setting defaults for with CEE3CTY callable service 20, 122
table of defaults for a given country_code 419
DECIMAL-OVERFLOW condition 180, 181
dump
CEE3ABD callable service and
abend with clean-up can generate Language
Environment dump 113, 117
abend without clean-up generates only system
dump 113, 117
Language Environment dump, requesting
CEE3DUMP default dump file 129, 132
examples of 135
syntax description 129, 133
TEST compile-time option and 131
TERMTHDACT runtime option and 74
dynamic storage
allocating
additional heap, setting size of 197
initial heap, setting size of 32, 44
callable services for
CEE3RPH—set report heading 177, 179
CEE3RHP—create new additional heap 197, 200
CEE3CNT—reallocate heap storage 202
CEE3DSP—discard heap 228, 230
CEE3RTS—free heap storage 250, 253
CEE3TST—get heap storage 276, 280
Quick Reference Tables 99
initializing (STORAGE runtime option) 70
DYNDUMP runtime option 23
e
eablement
condition handling step
TRAP runtime option and 86
enabling exceptions
CEE3SPM callable service and 180, 183
CEE3GL callable service and 365
XU3FLOW runtime option and 92
enclave
return code of
obtaining current value of 136, 143, 146
setting new value of 143, 146, 185
termination with abend
using CEE3ABD for 113, 116, 151
enclave return code 136, 143, 146
ENV runtime option
syntax 26
ENVAR runtime option
overriding 27
POSIX runtime option and 27
syntax 27
equal (=) in ENVAR runtime option 26
ERRCOUNT runtime option
CEE3GL and 366
syntax 28
error function compliment math service (CEESxERC) 396
error function math service (CEESxERF) 397
ERRUNIT runtime option 29
ESPIE
TRAP runtime option and 86
ESTAE
TRAP runtime option and 86
examples
CEE3ABD—terminate enclave with an abend 114, 115, 117, 118, 153
CEE3CTY—set default country 124, 125
CEE3DMP—generate dump 135
CEE3GRC—get enclave return code 136, 142
CEE3GRN—get name of routine that incurred condition 143, 146
CEE3LNG—set national language 158, 160
CEE3MCS—get default currency symbol 162, 163
CEE3MDT—get default decimal separator 168, 169
CEE3MTS—get default thousands separator 170
CEE3PRM—query parameter string 173, 174
CEE3RPH—set report heading 178, 179
CEE3SPM—query and modify Language Environment
hardware condition enablement 182, 183
CEE3SRC—set enclave return code 185
CEE3USR—set or query user area fields 187, 189
CEE3MI—store and load message insert data 194, 196
CEE3RPR—create new additional heap 199, 200
CEE3ZST—reallocate (change size of) storage 202, 204
CEE3DATE—convert Lilian date to character format 207
CEE3DATM—convert seconds to character format 212, 214
CEE3CD—decompose a condition token 222, 224
CEE3DSP—discard heap 228, 230
CEE3DYWK—calculate day of week from Lilian date 232
CEE3MDT—get default date and time format 242, 243
CEE3MON—format monetary string 245
CEE3FMTM—get default date and time format 248, 249
CEE3FMTS—free heap storage
with CEEGTST 252, 253
CEE3FDT—format date and time into character string 257
CEEEGMT—get current GMT 260, 261
CEE3GMP—get offset from GMT 264
CEE3PID—retrieve Language Environment version/
platform ID 266, 267
CEEQMDT—get q_data_token 269, 270, 274
CEE3TST—retrieves the value of an exported JCL symbol 276
CEE3TST—get heap storage 278, 280
CEE3HDLR—register user-written condition handler
by itself 281
examples (continued)

CEEHDLR—register user-written condition handler (continued)
with CEE3GRC and CEE3SRC 136, 142
CEEHDLU—unregister user-written condition handler
with CEEHDLR 289, 290
CEESEC—convert integers to seconds 293, 294
CEETOK—return initial condition token 295, 298
CEELCNV—query locale numeric conventions 304
CEEOCT—get current local time 306
CEEMGET—get a message 311
CEEMOUT—dispatch a message with CEEMGET 313
CEEMRCR—move resume cursor with CEEHDLR and CEEHDLU 323, 327
CEEMSG—get, format, and dispatch a message 329, 330
CEENCOD—construct a condition token 332
CEEQCEN—query century window 337
CEEQDTC—query locale, date, and time conventions 339
CEERCDM—record information for an active condition 347
CEESCEN—set century window 349, 350
CEESCOL—compare string collation weight 353
CEESDLG1—calculate logarithm base 10 415
CEESMOD—perform modular arithmetic 384
CEESTXF—transform string characters into collation weights 370
CEETEST—invoke debug tool 375, 377

G

gamma function math service (CEESxGMA) 399

general callable services
CEE3GRC—get enclave return code 136, 142
CEE3PRM—query parameter string 172, 174
CEE3SRM—set enclave return code 185
CEE3USR—set or query user area fields 186, 189
CEERANO—calculate uniform random numbers 343, 345
CEETEST—invoke debug tool 375, 377

GOBACK statement
RTEREUS runtime option and 66

Greenwich Mean Time (GMT)
as seed parameter of CEERANO callable service 344
going offset to local time from (CEEGMT) examples of 263, 264
return Lilian date and Lilian seconds (CEEGMT) examples of 260, 261
Gregorian character string
returning local time as a (CEELOCT) examples of 306

H

HANDLE ABEND EXEC CICS command
CBLPSHPOP runtime option and 17
handle cursor
moving resume cursor relative to (CEEMRCR)

feedback code
FEEDBACK data type 108
in callable services 108
omitting 108
FILEDEF command for CMS
SYSabEND PRINTER 113, 117
SYSuDUMP PRINTER 113, 117
FILEHIST runtime option 30
FILETAG runtime option 30
fixed-overflow condition, in CEE3SPM 180, 181
floating complex divide math service (CEESxDVD) 395
floating complex multiply math service (CEESxMLT) 404
FLOW runtime option 32
from the command line:
REDIR runtime option
syntax description 62
redirections
of stderr, stdout and stdin output 50, 62
REDIR runtime option and 62
runtime options 3, 6, 9, 11, 13–18, 20, 22, 23, 27–30,
32, 34, 36, 38, 40, 41, 43, 44, 46, 47, 51–53, 55,
57–63, 65–67, 69, 70, 73, 78, 81, 83, 84, 86, 88–92,
177, 225
stderr
REDIR runtime option and 62
redirecting output from 62
stdin
MSGFILE runtime option and 62
REDIR runtime option and 62
stdout
MSGFILE runtime option and 62
REDIR runtime option and 62
redirecting output from 62

F

facility ID
CEENCOD callable service and 332
IGZ severity 0 and 1 conditions and the ERRCOUNT runtime option 28
feedback xviii
handle cursor (continued)
  moving resume cursor relative to (CEEMRCR) (continued)
examples of 323
header files
  leawi.h (C)
  condition token structure and 333
HEAP runtime option
  ALL31 runtime option and 11
  CEECRHP and 198
  different treatment under CICS 34
  STORAGE runtime option and 71
  syntax 32, 44
heap storage
  allocating
    from anywhere heap (ANYHEAP runtime option) 14
    from below heap (BELOWHEAP runtime option) 15, 16
    from initial heap segment (CEEGTST) 277
    of initial heap storage (HEAP runtime option) 32, 44
    thread-level heap storage (THREADHEAP runtime option) 80
AMODE considerations of 12, 34
callable services for
  CEE3RPH—set report heading 177
  CEECRHP—create new additional heap 197
  CEECZST—reallocate heap storage 202
  CEEDSHP—discard heap 228
  CEEFRST—free heap storage 250
  CEEGTST—get heap storage 276
  Quick Reference Tables 99
clearing after freeing, in STORAGE runtime option 71
discarding an entire heap (CEEDSHP) examples of 228
freeing (CEEFRST) 250
getting (CEEGTST) 276
heap element, changing size of (CEECZST) 202
heap ID
  heap ID 0 invalid in CEEDSHP 228
  returned by CEECRHP 198
  using to indicate which heap to discard, in CEEDSHP 228
  using to receive storage from a given heap, in
  CEEGTST 276
  initial heap segment
    determining size of (HEAP runtime option) 32, 44
    reallocating (changing size of) 201
initializing storage
  using options of CEECRHP callable service 198
  using STORAGE runtime option 70
INQPCOPN runtime option 43
insert data
  Language Environment-generated 332
  user-created
    cannot use CEEMOUT callable service to create 312
    storing and loading 193
INSPPREF preference file 79
instance specific information (ISI)
 CEEDCOD callable service and 221
  creating, when building a condition token 332
  insert data is part of 332
  maintaining a number of 51
  overwriting 194
  retrieving q_data_token from (CEEGQDT) examples of 269, 274
  storing address of message insert data in 193
  using CEEGLSL callable service to create examples of 368, 369
integers
  converting Lilian seconds to (CEESECI) examples of 356
  converting to Lilian seconds (CEEISEC) examples of 293, 294
interrupts
  creating, when building a condition token 332
  insert data is part of 332
  maintaining a number of 51
  overwriting 194
  retrieving q_data_token from (CEEGQDT) examples of 269, 274
  storing address of message insert data in 193
  using CEEGLSL callable service to create examples of 368, 369
invoking
  debug tool and 44
  with TEST runtime option 78
  Debug Tool and 44
  with CEETEST callable service 375, 377
IOHEAP runtime option 44
hyperbolic cosine math service (CEESxCSH) 392
hyperbolic sine math service (CEESxSNH) 409
hyperbolic tangent math service (CEESxTNH) 413
I
I/O
  BELOWHEAP runtime option and 15
  IGZ Facility ID
    ERRCOUNT runtime option and 28
    imaginary part of complex math service (CEESxIMG) 399
  IMS (Information Management System)
    PLIST runtime option and 58
    POSIX runtime option and 59, 84
    specifying a C application is running 26
    specifying a C application is running under 26
include statement, in C and PL/I 104
INFOMSGFILTER runtime option 43
Japanese Era 426

JCL symbol retrieving value of an exported 275

Keyboard

navigation 429
PF keys 429
shortcut keys 429

Language Environment

hardware interrupts that cannot be enabled 182
summary of changes for V2R2 xix
summary of changes for V2R2 as updated December 2015 xviii
summary of changes for V2R3 xviii
language-specific condition handlers, use with XUFLOW runtime option 90
leawi file, description of 104
LIBHEAP64 (AMODE 64 only) 46
library
stack storage
specifying size of (LIBSTACK runtime option) 47
LIBSTACK runtime option 47

Lilian date

calculate day of week from (CEEDYWK) 231
calculate date to (CEEDAYS) 190, 215
calculate output_seconds to (CEEISEC) 292
calculate to character format (CEEDATE) 304
get current local date or time as a (CEEOCT) 304
get GMT as a (CEEGMT) 259
using as input to CEESECI callable service 353
local time
getting (CEEOCT) 304
locale services

CEEFMON—format monetary string 243
CEEFDTD—format date and time into character string 254
CEELCNV—query locale numeric conventions 299
CEEQDTC—return locale date and time 338
CEEQRYL—query active locale environment 342
CEESCOL—compare string collation weight 350
CEESETL—set locale operating environment 362
CEESTXF—transform string character into collation weight 369
log gamma math service (CEESxLGM) 401
logarithm base 10 math service (CEESxLG1)
examples using 415
logarithm base 2 math service (CEESxLG2) 402
logarithm base e math service (CEESxLOG)
examples using 416
logarithm routines
base 10 (CEESxLG1) 401
base 2 (CEESxLG2) 402
base e (CEESxLOG) 403
log gamma (CEESxLGM) 401

Meiji era 426
message
get, format, and dispatch a message (CEEMSG) 328–330
get, format, and store message in a buffer (CEEMGET) 307, 311
obtaining 307, 328
truncated 308
message file
pre-Language Environment options to Language Environment options 93
relationship to CBLQDA runtime option 17
message handling
nested conditions and 51
quick reference of callable services for 102
MinKow era 426
modular arithmetic math service (CEESxMOD)
examples using 415
MSGFILE runtime option
different treatment under CICS 50
MSGFILE runtime option
RPTOPTS options report and 48
RPTSTG storage report and 48
MSGQ runtime option
relationship to Instance Specific Information (ISIs) 51
MTF (Multitasking Facility)
allocating heap storage under (HEAP runtime option) 34
multithreading
multithreading (continued)

RPTSTG runtime option and 63

N

national language
querying (CEE3LNG) 155
setting (NATLANG runtime option, CEE3LNG) 51, 155

national language support (NLS)
default values for a specified country 419
quick reference of callable services for 100, 102
specifying national language (NATLANG runtime option) 51

NATLANG runtime option
default of 52
syntax 51

natural log math service (CEESxLOG) 403

navigation
keyboard 429

nearest integer math service (CEESxNIN) 406

nearest whole number math service (CEESxNWN) 406

nested condition
getting name of routine that incurred a condition (CEE3GRN) 143
limiting (DEPTHCONDLMT runtime option) 22
MSGQ runtime options and 51

O

OCSTATUS runtime option
syntax 52
offset of condition, getting (CEE3GRO) 147, 186
omitted parameter
how C indicates omission 106

ONCHAR built-in function, in CEE3DMP 132
ONCOUNT built-in function, in CEE3DMP 132
ONFILE built-in function, in CEE3DMP 132
ONKEY built-in function, in CEE3DMP 132
ONSOURCE built-in function, in CEE3DMP 132
options report, generating (RPTOPTS runtime option) 63

osplist macro 172

OSRUN command for CMS
PLIST runtime option and 58
out-of-storage condition 70, 72

P

PAGEFRAMESIZE 53
PAGEFRAMESIZE64 55
parameter
list
querying 172
list format
PLIST runtime option and 58
PC runtime option
syntax 57
perror() function 50
picture string
defaults 419
tables of valid 209, 210
PL/I
built-in functions
DATAFIELD 132

PL/I (continued)
built-in functions (continued)
ONCHAR 132
ONCOUNT 132
ONFILE 132
ONKEY 132
ONSOURCE 132
callable services, invoking from 103, 110, 111
CEE3DMP callable service considerations
built-in function information dumped 132
traceback information 130
variables 130
CEE3RPH callable service equivalent to PLIXHD 178
CEEHDLR callable service not allowed with 282
CEEHDLU callable service not allowed with 282
CEESGL callable service restriction 365
ERRCOUNT runtime option consideration 29
examples
CEE3ABD—terminate enclave with an abend 118, 155
CEE3CTY—set default country 125
CEE3DMP—generate dump 135
CEE3GRC—get enclave return code 142
CEE3GRN—get name of routine that incurred condition 147
CEE3LNG—set national language 160
CEE3MDS—get default decimal separator 168
CEE3MTS—get default thousands separator 170
CEE3PRM—query parameter string 173
CEE3SPM—query and modify Language Environment hardware condition enablement 183
CEE3SRC—set enclave return code 142
CEE3USR—set or query user area fields 190
CEECMI—store and load message insert data 196
CEECZST—reallocate (change size of) storage 204
CEEDATE—convert Lilian date to character format 209
CEEDATM—convert seconds to character timestamp 214
CEEDAYS—convert date to Lilian format 219
CEEDCOD—decompose a condition token 224
CEEDSHP—discard heap 230
CEEFMDA—get default date format 241
CEEFMDT—get default date and time format 243
CEEFMTM—get default time format 249
CEEFRST—free heap storage 253
CEEFTDS—format date and time into character string 258
CEEGMT—get current Greenwich Mean Time 261
CEEGMTO—get offset from Greenwich Mean Time to local time 264
CEEGQDT—get q_data_token 274
CEEGQDT—get heap storage 253
CEESEC—convert integers to seconds 295
CEEGTST—return initial condition token 298
CEEELNV—query locale numeric conventions 304
CEEOCT—get current local time 307
CEEMGET—get a message 311
CEEMOUT—dispatch a message 314
CEEMS—get, format, and dispatch a message 331
CEENCOD—construct a condition token 335
CEEQCEN—query century window 337
CEEQDTC—return locale date and time 341
CEEQRYL—query active locale environment 343
PL/I (continued)
examples (continued)

CEEESECI—convert seconds to integers 356
CEESTXF—transform string characters into collation weights 372
CEESxLOG—calculate log base 10 417
CEESxMOD—perform modular arithmetic 417
CEESCEN—set century window 350
CEESCOL—compare string collation weight 353
CEESCTY—check the current country setting, in CEE3CTY 123
CEELANG—check the current national language, in CEE3LNG 156
CEESPM—check the enablement of hardware conditions, in CEE3SPM 181

Quick Reference Tables 3

Q
q_data_token, in CEESGL creating 366
retrieving from the ISI (CEEGQDT) 268
QUERY function
using to check the current country setting, in CEE3CTY 123
using to check the current national language, in CEE3LNG 156
using to check the enablement of hardware conditions, in CEE3SPM 181

R
random numbers
generation of (CEERAN0) 343
RDRUNIT runtime option
syntax 61
reason code
CEE3DMP callable service and 132
dumps and 132
RECPAD runtime option
syntax 62
REDIR—specify redirections for C output 62
redirections
of stderr, stdout and stdin output 50, 62
register
save area, as component of dsa_alloc_value 71
report
generating options report (RPTOPTS runtime option) 63
resume
cursor
moving (CEEMMCR) 319
setting resume point (CEE3SRP) 185
reusability of an environment 65
routine that incurred condition, getting (CEE3GRN) 143, 146
RPTOPTS runtime option
relationship to MSGFILE runtime option 63
sample options report generated by 63
syntax 63
RPTSTG runtime option
CEEGTST and 277
storage report generated by
setting heading for 177
RTEREUS runtime option
CICS ignores this option 66
syntax 65
runtime option
INFOMSGFILTER 43
THREADEHP - control the allocation of thread-level heap storage 80
runtime options
ABPERC—percolate an abend 9
AIXBLD—invoke AMS for COBOL 11
ALL31—indicate whether application runs in AMODE(31) 11
ANYHEAP 13
ARGPARSE—specify whether arguments are parsed 14
AUTOTASK—specify whether Fortran MTF is to be used 15
BELOWHEAP—control library heap storage below 16M 15
runtime options (continued)
- CBLOPTS—specify format of COBOL argument
- CBLPSHPOP—control CICS commands
- CBLODA—control COBOL QSAM
- CEEDLYM—suspend processing of the active enclave in milliseconds
- CEEDUMP
- CHECK—detect checking errors
- COUNTRY—specify default date/time formats
- DEBUG—activate COBOL batch debugging
- DEPTHCONDLMT—limit extent of nested conditions
- DYNDUMP
- ENV—specify operating environment for C application
- ENVAR
- ERRCOUNT
- ERRUNIT
- EXECOPS—let runtime options be specified on command line
- FILEHIST
- FILETAG
- FLOW
- HEAP
- HEAP—control allocation of heaps
- HEAP64
- HEAPPOLLS (C/C++ and Enterprise PL/I only)
- HEAPZONES
- INQPCOPN
- INTERRUPT—cause attentions to be recognized by Language Environment
- IOHEAP64
- LIBHEAP64 (AMODE 64 only)
- LIBSTACK
- MSGQ
- NATLANG—specify national language
- OCSTATUS—control checking of file existence and whether file deletion occurs
- PAGEFRAMESIZE
- PAGEFRAMESIZE64
- PC—control whether Fortran status common blocks are shared among load modules
- PLIST—specify format of C arguments
- PLIST—specify format of invocation parameters for C applications
- PLITASKCOUNT—control the maximum number of active tasks
- POSIX
- PROFILE
- PRTUNIT—specifies unit number used for PRINT and WRITE statements
- PUNUNIT—specifies unit number used for PUNCH statements
- Quick Reference Tables
- RDRUNIT—specifies unit number used for READ statements
- RECPAD—specifies whether a formatted input record is padded with blanks
- report of options specified generating heading for
- language report is written in 52, 62, 63
- not generated if application abends
- sample of 63
- RPTOPTS—generate a report of runtime options used
- RTEREUS—initialize a reusable COBOL environment

runtime options (continued)
- SIMVRD—specify VSAM KSDS for COBOL
- STACK—allocate stack storage
- STORAGE—control storage
- TERMTHDACT—specify type of information generated with unhandled error
- TEST—indicate debug tool to gain control
- THREADSTACK—control the allocation of the thread's stack storage
- THREADSTACK64—control the allocation of the thread's stack storage for AMODE 64 applications
- TRACE—activate Language Environment runtime library
- TRAP—handle abends and program interrupts
- UPSI—set UPSI switches
- USRHDLR—register a user condition handler at stack frame 0
- VCTRSAVE—use vector facility
- XPLINK
- XUFLOW—specify program interrupt due to exponent underflow
stack (continued)
  library, allocating (LIBSTACK runtime option) 47
storage
  ALL31 runtime option and 11
  allocating (STACK runtime option) 67, 69
  initializing (STACK runtime option) 70
  RPTSTG runtime option and 64
  setting initial stack segment (STACK runtime option) 67, 69
  user, allocating (STACK runtime option) 67, 69
STACK runtime option
  syntax 67, 69
  using with RPTSTG to tune the stack 64
stack storage
  allocating
    stack storage (THREADSTACK runtime option) 81
    stack storage (THREADSTACK64 runtime option) 83
STAE
  Options 86
  VS COBOL II options 86
stderr
  MSGFILE runtime option and 50
storage
  additional heaps, creating new (CEECRHP) 197
  discarding an entire heap (CEEDSHP) 228
  freeing
    discarding an entire heap (CEEDSHP) 228, 230
    freeing additional heap (CEEFRST) 250, 253
  getting
    heap storage (CEEGTST) 276
  initializing (STORAGE runtime option) 70
  options for
    BELOWHEAP—control library heap below 16M 15
    HEAP—control initial heap 32, 44
    LIBSTACK 47
    STACK—control thread stack storage 67, 69
  report
    language written in 52, 63
    not generated if application abends 64
    setting heading for 177
    STACK runtime option and 64
  services
    CEE3RPH—set report heading 177
    CEECRHP—create new additional heap 197
    CEECZST—reallocate (change size of) storage 201
    CEEDSHP—discard heap 228
    CEEFRST—free heap storage 251
    CEEGTST—get heap storage 276
  stack storage, controlling (THREADSTACK runtime option) 81
  stack storage, controlling (THREADSTACK64 runtime option) 83
  thread-level heap, controlling (THREADHEAP runtime option) 80
  tuning
    additional heap, setting size of (CEECRHP) 197
    anywhere heap, setting size of (ANYHEAP) 13
    below heap, setting size of (BELOWHEAP) 16
    initial heap, setting size of (HEAP) 32, 44
    initial stack segment, setting size of (STACK) 67, 69
    library stack storage, setting size of (LIBSTACK) 47
    with CEEGTST 276
    with STORAGE runtime option 70

STORAGE runtime option
  CEECZST callable service and 201
  CEEFRST callable service and 251
  syntax 70
  STORAGE—control initial heap or stack 70
  straight double quote (”) initializing storage with 71, 72
  specifying in parameters of TEST runtime option 78, 79
  straight single quote (’) initializing storage with 71, 72
  specifying in parameters of TEST runtime option 78, 79

summary of changes
  Language Environment
    V2R2 xi
    V2R2 as updated December 2015 xviii
    V2R3 xviii
  Summary of changes xix
  symbol
  table, generated by CEE3DMP 131
  syntax diagrams
    how to read xiv
  SYSABEND PRINTER 113, 117
  SYSOUT
    default destinations of MSGFILE runtime option 49
    SYSUDUMP PRINTER 113, 117

T
  Taisho era 426
  Taiwan era 426
tangent math service (CEESxTAN) 412
termination
  enclave
    CEE3ABD and 113, 116, 151
  TERMTHDACT 73
  TERMTHDACT runtime option
    CEE3DMP and 77
  TEST compile-time option 131
  TEST runtime option
    syntax 78
  thousands separator
    obtaining default of (CEE3CTY) 122
    setting defaults for (COUNTRY) 20
  thread
    multiple
      storage report for (RPTSTG runtime option) 64
  THREADHEAP—control the allocation of thread-level heap storage
    syntax 80
  THREADSTACK—control the allocation of the thread's stack storage for both the upward and downward-growing stacks
    syntax 81
  THREADSTACK64—control the allocation of the thread's stack storage for AMODE 64 applications
    syntax 83
  time, getting local (CEELOCT) 304
timestamp 210, 357
  TRACE runtime option
    syntax 84
  trace, generating a 74
  trademarks 436
  transfer of sign math service (CEESxSGN) 407
  TRAP runtime option
TRAP runtime option (continued)
   ABPERC runtime option and 9
   syntax 86
truncation math service (CEESxINT) 400

U
UNDERFLOW condition 92, 180, 181
UPSI runtime option
   syntax 88
UPSI—set UPSI switches 88
USE FOR DEBUGGING declarative 22
user
   area fields 185–187
   heap (initial heap)
      allocating storage from 32, 44, 277
      restrictions against discarding 228
   stack, controlling (STACK runtime option) 65
user interface
   ISPF 429
   TSO/E 429
user-written condition handler
   CEE3SPM callable service and 180
   CEEMRCR callable service and 319
      registering with CEEHDLR callable service 281
      unregistering 288
   VCTRSAVE runtime option and 90
USRHDLR runtime option
   syntax 89

V
valid condition 365
VCTRSAVE runtime option
   syntax 90
vector facility 90
VSAM
   KSDS 11, 66
   RRDS 11

W
WITH DEBUGGING MODE clause for COBOL 22

X
XPLINK runtime option 91
XUFLOW runtime option
   syntax 92