IBM XL C/C++ for Linux , V12.1 delivers additional support for programming standards and industry specifications

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At a glance

IBM® XL C/C++ for Linux™ is a standards-based, high performance C and C++ compiler with advanced optimizing features. XL C/C++ for Linux, V12.1 delivers a number of new features and enhancements:

- Compliance to ISO programming language standards including C99 and C++2003, emerging support for C11 and addition support for C++11, the latest standards for the C and C++ programming languages
- Support for the OpenMP 3.1 industry specification
- Compile time performance and scalability improvements
- Enhancements to the diagnostic reports that can help you identify opportunities to improve the performance of your applications
- Additional capability for debugging optimized code
- New and enhanced built-in functions, compiler options and pragma directives

Overview

IBM XL compilers, such as XL C/C++ for Linux, are designed to:

- Optimize and tune your applications for execution on IBM Power® platforms.
- Help unleash the full power of your IT investment.
- Create and maintain critical business and scientific applications.
- Maximize application performance.
- Improve developer productivity.

The performance gain from years of compiler optimization experience is seen in the continuous release-to-release compiler improvements that support the POWER4 processor through to the POWER5, POWER6®, and POWER7® processors.

As a standards-based compiler, the XL C compiler in XL C/C++ for Linux, V12.1, is designed to be fully compliant with ISO/IEC 9899:1999, the C99 programming language standard. With this release, adds initial support for ISO/IEC 9899:2011, the C11 (formerly C1X) programming standard. The XL C++ compiler in XL C/C++ for Linux, V12.1, is fully compliant with ISO/IEC 14882:2003, the C++ 2003 programming standard. It includes additional support for ISO/IEC 14882:2011,

the C++11 (formerly C++0X) programming standard. The XL C++ compiler also includes partial support for C99 and C11.

With this release, XL C/C++ for Linux delivers full support for the OpenMP V3.1 industry specification.

IBM has a long history of delivering innovative, high-quality compiler products to the marketplace. Over the course of multiple releases, XL C/C++ for Linux has offered new functions, enhancements, and standards conformance to provide the tools needed to develop and maintain smarter applications to meet critical business needs.

Enhancements in this compiler release include:

- Full support for the OpenMP 3.1 industry standard to allow further exploitation of parallel programming
- Emerging support for C11 and additional support for C++11, the latest standards for the C and C++ programming languages, to deliver additional functionality and to allow for maximum portability of your source code
- Compile time and scalability improvements, especially for large applications
- Enhancements to compiler diagnostics and profiling reports to further help improve the performance of your C and C++ applications
- Additional capability for debugging optimized code.
- New built-in functions, and new and enhanced compiler options and pragma directives, to give even more flexibility

For ordering, contact Your IBM representative or an IBM Business Partner. For more information contact the Americas Call Centers at 800-IBM-CALL (426-2255). Reference: RE001

Key prerequisites

Systems -- IBM Power System servers supported by

- SUSE Linux Enterprise Server 10 Service Pack 4 (SLES 10 SP4)
- SUSE Linux Enterprise Server 11 Service Pack 2 (SLES 11 SP2)
- Red Hat Enterprise Linux 5.7 (RHEL 5.7)
- Red Hat Enterprise Linux 6.2 (RHEL 6.2)

Required hard disk space -- 200 MB

Planned availability date

- May 11, 2012: Electronic software delivery
- May 18, 2012: Physical software delivery on Passport Advantage® by part number
- June 8, 2012: Physical software delivery on Advanced Administrative System by product ID

Description

IBM XL C/C++ for Linux continues to deliver additional functionality and enhancements, including additional support for C++11 - the latest C++ programming language, emerging support for C11 - the latest C programming language standard, support for the latest OpenMP 3.1 industry specification, performance and optimization improvements, new diagnostics report capability, new built-in functions, and new and enhanced compiler options and pragma directives. Support of programming language standards not only provides significant

functionality but also allows for maximum portability of your source code among a variety of compiler implementations.

C++11 programming standard

C++11 (formerly C++0x) is the latest standard for the C++ programming language, published as ISO/IEC 14882:2011. With XL C/C++ for Linux, V12.1, development and implementation of the features of C++11 continues with the following additional features available in Version 12.1:

- The explicit conversion operators feature supports the **explicit** function specifier applied to the definition of a user-defined conversion function. This function can be used to inhibit implicit conversions from being applied where they might be unintended, and thus allowing you to program more robust classes with fewer ambiguity errors.
- The generalized constant expressions feature extends the expressions permitted within constant expressions. Constant expressions can be evaluated at compile time instead of at run time, providing performance benefits.
- With the reference collapsing feature, you can form a reference to a reference type using one of the following contexts:
  - A **decltype** specifier
  - A **typedef** name
  - A template type parameter
- For the right angle bracket support, in the C++ language, two consecutive closing angle brackets (>) must be separated with a white space, because they are otherwise parsed as the bitwise right-shift operator (>>). The right-angle bracket feature removes the white space requirement for consecutive right-angle brackets, thus making programming more convenient.
- With the rvalue references feature, you can overload functions based on the value categories of arguments and similarly have lvalueness detected by template argument deduction. You can also have an rvalue bound to an rvalue reference and modify the rvalue through the reference. This enables a programming technique with which you can reuse the resources of expiring objects and therefore improve the performance of your libraries, especially if you use generic code with class types, for example, template data structures. Additionally, the value category can be considered when writing a forwarding function.
- With the scoped enumeration feature, you can get the following benefits:
  - The ability to declare a scoped enumeration type, whose enumerators are declared in the scope of the enumeration.
  - The ability to declare an enumeration without providing the enumerators. The declaration of an enumeration without providing the enumerators is referred to as forward declaration.
  - The ability to specify explicitly the underlying type of an enumeration.
  - Improved type safety with no conversions from the value of an enumerator (or an object of an enumeration type) to an integer.
- The trailing return type feature is useful when declaring the following types of templates and functions:
  - Function templates or member functions of class templates with return types that depend on the types of the function arguments
  - Functions or member functions of classes with complicated return types
  - Perfect forwarding functions

The **-qlanglvl=extended0x** option can be used to enable most of the C++ features and all the currently supported C++11 features in XL C/C++ for Linux, V12.1.

C11 programming standard

C11 (formerly C1X) is the latest standard for the C programming language, published as ISO/IEC 9899:2011. With XL C/C++ for Linux, V12.1, support for the latest C11 standard begins with the implementation of selected features including:

- Anonymous structures to allow all members of the anonymous structure to behave as if they were members of the parent structure, for easier grouping
- Complex type initialization to enable the initialization of complex types under the **extc1x** language level
- New language level **extc1x** to enable C11 features that are currently supported by XL C/C++ for Linux, V12.1
- **_Noreturn** function specifier to produce better performing code by self documenting that the functions will not return for library or other interfaces
- Static assertions that can be declared to check important program invariants, to allow libraries to detect and diagnose common usage errors at compile time

OpenMP 3.1

The OpenMP API supports multi-platform shared-memory parallel programming in Fortran, C, and C++ on many architectures including UNIX™ and Microsoft™ Windows™ platforms. OpenMP is a portable, scalable programming model that provides parallel programmers a simple and flexible, standard interface for developing parallel applications for platforms ranging from the desktop to the supercomputer. The specification is defined by the OpenMP organization, a group of computer hardware and software vendors, including IBM. You can find more information about OpenMP specifications at

  http://www.openmp.org

In the previous release, XL C/C++ for Linux, V11.1 supported the full OpenMP 3.0 industry specification. In Version 12.1, full support for the latest OpenMP 3.1 is available. OpenMP V3.1 includes the following updates to OpenMP V3.0:

- Adds **final** and **mergeable** clauses to the **task** construct to support optimization.
- Adds the **taskyield** construct to allow users to specify where in the program, task switching can be performed.
- Adds the **omp_in_final** runtime library routine to support specialization of final task regions.
- Extends the **atomic** construct to include **read**, **write**, and **capture** forms, and adds the **update** clause to apply the existing form of the **atomic** construct.
- Adds two reduction operators: **min** and **max.**
- Allows const-qualified types to be specified on the **firstprivate** clause.
- Adds the **OMP_PROC_BIND** environment variable to control whether OpenMP threads are allowed to move between processors.
- Extends the **OMP_NUM_THREADS** environment variable to specify the number of threads to use for nested parallel regions.

New diagnostic reports

The new diagnostic reports can help identify opportunities to improve the performance of your code. You can use this information to change your code so that the compiler can take advantage of additional optimizations for improving performance.

With this release, a number of enhancements are made to the reports:

- Compiler reports are now available in HTML format as well as XML format. These reports provide information about the optimizations that the compiler was able to perform and also which optimization opportunities were missed. This information

can be used to reduce programming effort for tuning applications, especially high-performance applications.
- Enhancements to profiling reports: New sections are added to your listing file to help you analyze your programs including:
  - Relevance of profiling data - this section shows the more relevant the profiling data is to the source code, the higher the performance gain that can be achieved by using the profiling data.
  - Missing profiling data - this section might include a warning message about missing profiling data.
  - Outdated profiling data - this section might include a warning message about outdated profiling data.
- Enhancements to **showpdf** reports: In addition to block-counter and call-counter profiling information currently provided, you can also use the **showpdf** utility to view cache-miss profiling and value profiling information.

Compile time performance and scalability improvements

Internal improvements to the compiler (for example alias analysis) are made to speed up the gathering of information that is passed between the components within the compiler. This can help speed up compile time, notably for large applications.

The amount of memory required for internal compiler functions such as pointer analysis and aliasing is reduced, helping to improve the efficiency of the compiler and to subsequently improve the usage of your machine resources.

Header files, which are repeatly used in your application, are cached within the compiler to speed up overall processing during compile time.

Additional internal compiler components, including the optimizer, make use of the greater addressability of 64-bit. This helps improve compile time and allows significantly larger programs to be optimized.

Debugging optimized code improvements

Debugging information is generated by the compiler for use by a symbolic debugger and makes the program state available to the debugging session at selected source locations. The program state refers to the values of user variables at certain points during the execution of a program.

In this release of the compiler, the **-g** compiler option is extended to improve the debugging of optimized programs. The different **-g** levels allow you to choose the balance between debug capability and compiler performance. Higher **-g** levels provide a more comprehensive debug support, but at the cost of run time and compile time performance. Lower **-g** levels provide higher run time performance, but at the cost of reduced capability in the debugging session.

Full control of the debug capability is available at the **-O2** optimization level. When an optimization level higher than **-O2** is in effect, the debug capability is limited.

New compiler built-ins

New XL C built-in functions for atomic memory access, where behavior corresponds to that provided by GNU Compiler Collection (GCC), are added in this release. In a program with multiple threads, you can use these functions to atomically and safely modify data in one thread without interference from another thread.

New or changed compiler options and directives for more flexibility

Compiler options can be specified on the command line or through directives embedded in your application source files. The following additional new or changed compiler options and new pragma directives are available with this release of the compiler:

New or changed compiler options

- The **-g** option is extended to improve the debugging of optimized programs.

- The **-qhaltonmsg** option is now supported by XL C/C++ for Linux, V12.1 to stop the compilation before producing any object files, executable files, or assembler source files if a specified error message is generated.

- The negative form **-qnoinclude** is added to ignore the previously specified **-qinclude** option.

- The **-qinfo=all** now enables all diagnostic messages for all groups except **als** and **ppt**.

- The **-qinitauto** is enhanced to be able to perform word initialization for automatic variables.

- The **-qkeyword** includes the new suboption **-q(no)keyword=constexpr** to enable or disable the **constexpr** keyword.

- The following **-qlanglvl** suboptions are added or updated:

  - The **-qlanglvl=autotypededuction** suboption can now enable the trailing return type feature in addition to the auto type deduction feature.

  - The **-qlanglvl=c1xnoreturn** suboption enables support for the _Noreturn function specifier.

  - The **-qlanglvl=complexinit** suboption controls whether to enable the initialization of complex types.

  - The **-qlanglvl=compatrvaluebinding** suboption instructs the compiler to allow a non-const lvalue reference to bind to an rvalue of a user-defined type where an initializer is not required.

  - The **qlanglvl=constexpr** suboption enables the generalized constant expressions feature, which extends the expressions permitted within constant expressions. In XL C/C++ for Linux, V12.1, this feature is a partial implementation of what is defined in the C11 standard.

  - The **-qlanglvl=explicitconversionoperators** suboption enables the explicit conversion operators feature, which allows you to inhibit unintended implicit conversions through the user-defined conversion function.

  - The **-qlanglvl=extc1x** suboption enables all the currently supported C11 features and other implementation-specific language extensions.

  - The **-qlanglvl=referencecollapsing** suboption enables the reference collapsing feature, with which you can form a reference to a reference type using a decltype specifier, a typedef name, or a template type parameter.

  - The **-qlanglvl=rightanglebracket** suboption enables the right angle bracket feature, which removes the white space requirement for consecutive right angle brackets.

  - The **-qlanglvl=rvaluereferences** suboption enables the rvalue references feature.

  - The **-qlanglvl=scopedenum** suboption enables the scoped enumeration feature, with which you can declare a scoped enumeration type or an enumeration without providing the enumerators.

  - The **-qlanglvl=tempsaslocals** suboption extends the lifetime of temporaries to reduce migration difficulties.

  - The **-qlanglvl=textafterendif** suboption suppresses the warning message that is emitted when you are porting code from a compiler that allows extra text after **#endif** or **#else** to the XL C/C++ for Linux compiler.

- The **-qlistfmt** option is enhanced to generate HTML reports as well as XML reports, containing information about optimizations performed by the compiler and missed optimization opportunities.

- For the **-qnamemangling** option, the **v12** namemangling scheme is added. **v12** preserves the cv-qualifiers, so the function parameters that are cv-qualified and not cv-qualified are handled differently.

- The new option **-qoptfile** specifies a file containing a list of additional command line options to be used for the compilation.

- For the **-qpic** option, **-qpic=large** now enables large Table of Contents (TOC) access and prevents TOC overflow conditions when the Table of Contents is larger than 64 KB.

- The default value for **-qshowpdf** is changed from **-qnoshopdf** to **-qshowpdf**.

New pragma directives

- The **#pragma ibm independent_loop** directive is added to explicitly state that the iterations of the chosen loop are independent and that the iterations can be executed in parallel.
- The **#pragma ibm iterations** directive is added to specify the approximate number of loop iterations for the chosen loop.
- The **#pragma ibm max_iterations** directive is added to specify the approximate maximum number of loop iterations for the chosen loop.
- The **#pragma ibm min_iterations** directive is added to specify the approximate minimum number of loop iterations for the chosen loop.
- The **#pragma simd_level** directive is added to control the compiler code generation of vector instructions for individual loops.

Accessibility by people with disabilities

A US Section 508 Voluntary Product Accessibility Template (VPAT) containing details on accessibility compliance can be requested at

   http://www.ibm.com/able/product_accessibility/index.html

Section 508 of the US Rehabilitation Act

IBM XL C/C++ for Linux, V12.1 is capable as of May 11, 2012, when used in accordance with associated IBM documentation, of satisfying the applicable requirements of Section 508 of the Rehabilitation Act, provided that any assistive technology used with the product properly interoperates with it. A US Section 508 Voluntary Product Accessibility Template (VPAT) can be requested on the following website

   http://www.ibm.com/able/product_accessibility/index.html

Product positioning

At a basic level, compilers are a bridge between your applications and the hardware architectures on which you run your business. IBM compilers are designed to unleash the full power of IBM processors, including those for the different architectures shipped in the popular IBM Power Systems™.

IBM compilers are designed to improve programmer productivity. The state-of-the-art compilation technology enables programmers to exploit leading-edge performance of the new hardware without source code changes. Developers only need to focus on the logic of the applications and let the compiler figure out the best way to transform and optimize the code generation for the systems the application will run on.

Harness the power of parallel computing

Parallel programming with IBM XL C/C++ for Linux exploits the advantages of multiprocessor systems, while maintaining full binary compatibility with existing single processor systems. With XL C/C++ you can use any of the following to develop your parallelized applications:

- An extensive range of OpenMP directives and non-OpenMP SMP directives
- Message passing interface (MPI)
- The POSIX threads (Pthreads) library module

For high-bandwidth data processing and algorithmic-intensive applications, XL C/C++ for Linux can leverage VMX and VSX instructions and automatic SIMDization to improve program performance. By processing multiple pieces of data at once, the

speed of executed code can increase, with the added benefit that the source code may not need to be rewritten.

Powerful, no-hassle performance optimization

Well-written and thoroughly debugged code, fully conformant to its language standard, can take maximum advantage of the optimizing technology in XL C/C++ for Linux and may enjoy an increase in performance. The optimization and hardware features in XL C/C++ for Linux help improve developer productivity, the compiler can generate code that exploits the leading-edge performance in existing and new hardware, often with minimal source code changes.

XL C/C++ for Linux supports several levels of increasingly agressive code transformations. Advanced optimization techniques such as inter-procedural analysis (IPA) and profile-directed feedback (PDF), are available only at high levels of optimization but can result in increased performance improvements. IPA analyzes and optimizes your application as a whole, rather than on a file-by-file basis. PDF generates information that instructs the optimizer to focus on trade-offs that favor code that executes more frequently.

Get more performance from the IBM Power platform with minimal or no source code changes. Upgrade to the latest XL C/C++ for Linux compiler, which incorporates the latest advances in optimization and hardware technology support.

Multiple-platform XL C, C++ and Fortran

IBM XL C/C++ for Linux, V12.1 is part of a larger family of IBM XL C, C++, and Fortran compilers which supports multiple platforms such as AIX®, z/OS® (C/C++), z/VM® (C/C++), IBM Power Systems, Linux on Power, Blue Gene/L™, and Blue Gene/P™. The modular structure of these compilers delivers optmizations and functionality on all platforms and to all languages. Further, each product derives from a common code base, so features and optimizations are tested in multiple languages on multiple platforms. A common code base, along with compliance with international standards make source-level portability of applications between IBM platforms easier.

Built on a common architecture XL C, XL C/C++, and XL Fortran compilers promote consistency and reliability on many IBM platforms.

Language influences

Programming language standards

The XL C compiler supports the C standard ISO/IEC 9899:1999, also known as C99. With V12.1, XL C/C++ for Linux makes available emerging support for the latest C standard ISO/IEC 9899:2011, also known as C11.

The XL C++ compiler supports the C++ standard ISO/IEC 14882: 2003, the C++ 2003 programming standard. With V12.1, XL C/C++ for Linux continues to deliver additional support for the latest C++ standard ISO/IEC 14882:2011, also known as C++11.

Industry specifications and other language influences

The IBM XL family of compilers is deeply involved in parallel computing and high-performance computing. The XL compilers implement both the OpenMP 3.1 specification and the AltiVec/VMX programming interface for shared memory programming model. With the V12.1 release, XL C/C++ for Linux adds full support for the OpenMP 3.1 industry specification.

IBM is a member of the Standard Performance Evaluation Corporation (SPEC). The mission of SPEC is to identify and maintain standardized benchmarks that will drive high performance computing for many years. SPEC released SPEC CPU2006 in 2006. CPU2006 is a benchmark focused on a system's processor, memory subsystem, and

compiler. IBM continues to participate in the SPECCOMP suite which measures the performance of parallel benchmarks using OpenMP.

Support of programming language standards allows for portability of your source code among a variety of compiler implementations.

IBM Rational Developer for Power Systems Software

Rational® Developer for Power Systems Software™ V8 can be purchased with this program.

Rational Developer for Power Systems Software provides a rich family of development tools integrated into an Eclipse workbench that support the XL C/C++ for Linux compiler. Rational Developer for Power Systems Software offers the capabilities of file management, searching, editing, refactoring, application analysis, build, and debug. XL C/C++ developers will now be able to realize the productivity gains of moving from older, text-based, command line development tools to a rich integrated development environment. Rational Developer for Power Systems Software V8 can be used with XL C/C++ for Linux, V9.0, V10.1, V11.1, or V12.1.

If you license the IBM XL C/C++ for Linux compiler, you might also be interested in acquiring licenses for Rational Developer for Power Systems Software V8.

Program number

```
Program                    Program                         Ordering
number        VRM          name                            channel

5765-J03      12.1         IBM XL C/C++ for Linux          AAS
5725-C73      12.1         IBM XL C/C++ for Linux          PA
```

Product identification number

```
Program                              Program
name                                 number

XL C/C++ for Linux, V12.1            5765-J03

XL C/C++ for Linux                   5648-F62
 SW S&S 1 year after license
    - per Authorized User
    - per Concurrent User

XL C/C++ for Linux                   5648-F60
 SW S&S No Charge Registration/
 1-year Renewal
    - per Authorized User
    - per Concurrent User

XL C/C++ for Linux                   5648-F64
 SW S&S 3-year Registration
    - per Authorized User
    - per Concurrent User

XL C/C++ for Linux                   5648-F61
 SW S&S 3-year Renewal
   - per Authorized User
   - per Concurrent User

XL C/C++ for Linux                   5648-F63
 SW S&S 3 years after license
    - per Authorized User
    - per Concurrent User
```

Business Partner information

If you are a Direct Reseller - System Reseller acquiring products from IBM, you may link directly to Business Partner information for this announcement. A PartnerWorld ID and password are required (use IBM ID).

https://www.ibm.com/partnerworld/mem/sla.jsp?num=212-152

Offering Information

Product information is available via the Offering Information website

http://www.ibm.com/common/ssi

Also, visit the Passport Advantage website

http://www.ibm.com/software/passportadvantage

Publications

No hardcopy publications are shipped with this program.

The IBM Publications Center

http://www.ibm.com/shop/publications/order

The Publications Center is a worldwide central repository for IBM product publications and marketing material with a catalog of 70,000 items. Extensive search facilities are provided. Payment options for orders are via credit card (in the US) or customer number for 20 countries. A large number of publications are available online in various file formats, and they can all be downloaded by all countries, free of charge.

Technical information

Specified operating environment

Hardware requirements
- For XL C/C++ for Linux, V12.1
  - System: IBM Power Systems servers supported by:
    -- SUSE Linux Enterprise Server 10 Service Pack 4 (SLES 10 SP4)
    -- SUSE Linux Enterprise Server 11 Service Pack 2 (SLES 11 SP2)
    -- Red Hat Enterprise Linux 5.7 (RHEL 5.7)
    -- Red Hat Enterprise Linux 6.2 (RHEL 6.2)
  - Disk space: 200 MB

Software requirements
- For XL C/C++ for Linux, V12.1:
  - Supported operating systems
    -- SUSE Linux Enterprise Server 10 Service Pack 4 (SLES 10 SP4)
    -- SUSE Linux Enterprise Server 11 Service Pack 2 (SLES 11 SP2)
    -- Red Hat Enterprise Linux 5.7 (RHEL 5.7)
    -- Red Hat Enterprise Linux 6.2 (RHEL 6.2)
  - Instance of GNU Compiler Collection (GCC) and Perl

Refer to *XL C/C++ for Linux Installation Guide* for required packages.

– Required software for documentation

-- A graphical desktop environment (such as K Desktop Environment or GNOME) that supports web browsers and PDF viewers

-- A frames-capable HTML browser (to access help and other web pages)

-- PDF viewer (to access PDF documentation)

The program's specifications and specified operating environment information may be found in documentation accompanying the program, if available, such as a README file, or other information published by IBM, such as an announcement letter. Documentation and other program content may be supplied only in the English language.

Planning information

Packaging

The IBM XL C/C++ for Linux, V12.1 package contains:

• One CD-ROM containing the XL C/C++ for Linux, V12.1 product

• XL C/C++ for Linux, V12.1 Quickstart Guide

• Passport Advantage customer letter

• Passport Advantage media pack pointer sheet

This program, when downloaded from a website, contains the applicable IBM license agreement and License Information, if appropriate, and will be presented for acceptance at the time of installation of the program. For future reference, the license and License Information will be stored in a directory such as LICENSE.TXT.

Security, auditability, and control

IBM XL C/C++ for Linux, V12.1 uses the security and auditability features of the host hardware or software. The customer is responsible for evaluation, selection, and implementation of security features, administrative procedures, and appropriate controls in application systems and communication facilities.

Software Services

IBM Software Services has the breadth, depth, and reach to manage your services needs. You can leverage the deep technical skills of our lab-based, software services team and the business consulting, project management, and infrastructure expertise of our IBM Global Services team. Also, we extend our IBM Software Services reach through IBM Business Partners to provide an extensive portfolio of capabilities. Together, we provide the global reach, intellectual capital, industry insight, and technology leadership to support a wide range of critical business needs.

To learn more about IBM Software Services or to contact a Software Services sales specialist, visit

http://www.ibm.com/software/sw-services/

Ordering information

Product Group: IBM XL C/C++

Product Identifier Description: IBM XL C/C++

PID: 5765-J03, 5725-C73

Product Category: XL C/C++

Charge metric

```
                           Part number or
Program name               PID number      Charge metric

For build to order
XL C/C++ for Linux, V12.1  5765-J03        Authorized User
                                           Concurrent User


For build to plan
XL C/C++ for Linux, V12.1  5725-C73        Authorized User
                                           Concurrent User


For build to plan
XL C/C++ for Linux, V12.1  BA14EML         Authorized User
                                           Concurrent User
```

This program is licensed and charged based upon either the Authorized User or Concurrent User charge metric.

Authorized User

Authorized User is a unit of measure by which the program can be licensed. An Authorized User is a unique person who is given access to the program. The program may be installed on any number of computers or servers and each Authorized User may have simultaneous access to any number of instances of the program at one time. Licensee must obtain separate, dedicated entitlements for each Authorized User accessing the program in any manner directly or indirectly (for example, via a multiplexing program, device, or application server) through any means. An entitlement for an Authorized User is unique to that Authorized User and may not be shared, nor may it be reassigned other than for the permanent transfer of the Authorized User entitlement to another person.

Note: Some programs may be licensed where devices are considered users. In that case, the following applies. Any computing device that requests the execution of or receives for execution a set of commands, procedures, or applications from the program or that is otherwise managed by the program is considered a separate user of the program and requires an entitlement as if that device were a person.

Concurrent User

Concurrent User is a unit of measure by which the program can be licensed. A Concurrent User is a person who is accessing the program at any particular point in time. Regardless of whether the person is simultaneously accessing the program multiple times, the person counts only as a single Concurrent User. The program may be installed on any number of computers or servers, but licensee must obtain entitlements for the maximum number of Concurrent Users simultaneously accessing the program. Licensee must obtain an entitlement for each simultaneous Concurrent User accessing the program in any manner directly or indirectly (for example, via a multiplexing program, device, or application server) through any means.

Note: Some programs may be licensed where devices are considered users. In that case, the following applies. Any computing device that requests the execution of or receives for execution a set of commands, procedures, or applications from the program or that is otherwise managed by the program is considered a separate user of the program and requires an entitlement as if that device were a person.

Passport Advantage

```
                                                     Part
Program name/Description                             number

XL C/C++ for Linux, V12.1
    Media Package Multilingual                       BA14EML

XL C/C++ for Linux
    Authorized User License + SW S&S 12 Months       D54KXLL

XL C/C++ for Linux
    Authorized User Annual SW S&S Renewal            E01M2LL

XL C/C++ for Linux
    Authorized User SW S&S Reinstatement 12 Months   D54KYLL

XL C/C++ for Linux
    Concurrent User License + SW S&S 12 Months       D043RLL

XL C/C++ for Linux
    Concurrent User Annual SW S&S Renewal            E04U8LL

XL C/C++ for Linux
    Concurrent User SW S&S Reinstatement 12 Months   D043SLL
```

Passport Advantage trade-up

Customers who have originally acquired licenses for Authorized User can trade-up
their Authorized User licenses to an equivalent or appropriate number of Concurrent
User licenses (previously known as Floating User).

Below is a list of precursor products and their associated Authorized User part
numbers for which you must have already acquired a license, in order to be eligible
to acquire the equivalent Concurrent User licenses using the trade-up part number.

```
Precursor product    Trade-up product    Trade-up part number

XL C/C++ for Linux  XL C/C++ for Linux  D0DEXLL to trade-up from
Authorized User      Concurrent User     Single Authorized User
single entitlement   single entitlement  to Single Concurrent User
```

Consult your IBM representative if you have any questions.

Passport Advantage Customer: Media pack entitlement details

Customers with active Maintenance or Subscription for the products listed below are
entitled to receive the corresponding media pack.

```
Entitled Maintenance Offerings
Description
XL C/C++ for Linux
Media Pack
Description                                          Part number
XL C/C++ for Linux, V12.1 Media Pk Multilingual      BA14EML
```

Basic License: To order the programs described in this announcement for 5765-J03 specify the type-model number and the applicable features from the tables below. The medium feature (CD-ROM) need only be specified as required. To request the media package (CD-ROM), specify media supply features 6656 and 3410.

When placing an ESD order in econfig, specify a billing feature, the media features 6656 and the ESD only feature 3450.

```
                                    One-time
                                    charge        Medium
                         Program    feature       feature
Description              number     number  Medium number

XL C/C++ for Linux, V12.1  5765-J03
OTC with 1 Year SW S&S
   - per Authorized User              0001
   - per Concurrent User              0002

Media Package                               CD-ROM  6656
                                            CD-ROM  3410

Expedite Fee charge to Branch                       3445


Customization features:
 Electronic Delivery                                3450
 Do not ship pubs                                   3470
 Do not ship media                                  3471
```

Electronic Software Update Orders

Entitled Software Update (ESU) is a way for customers to self order their POWER® software release upgrades via the Entitled Software Support (ESS) website without the need to go to their seller to place the upgrade order. Entitled Software Update (ESU) orders for Electronic Software Delivery (ESD), will now be available in all countries. ESU orders for POWER software including IBM XL C/C++ for Linux, V12.1 will be placed on the Entitled Software Support (ESS) website

   http://www.ibm.com/servers/eserver/ess

Customers should generally select electronic delivery when ordering via ESU, but do have the ability to select physical delivery. Programs ordered for ESD will have the same download images provided as provided on the CD media shipped for physical orders.

ESU customers placing ESD software orders will receive an e-mail with software order information. The ESU customer will be able to immediately proceed to the "Downloads" website support for program access, instead of waiting for delivery of a physical package shipped from IBM.

Customers choosing physical delivery will also have the electronic images available for ESD download.

ESD help (instructions on how to use)

   http://www.ibm.com/systems/support/software/delivery/en_US/
   downloadinfo.html

ESD sign-in (must have Customer number & POWER software entitlements to get in)

   http://www.ibm.com/servers/eserver/ess/OpenServlet.wss

List of POWER software products that are available for electronic download

   http://www.ibm.com/systems/support/software/delivery/en_US/

Maintenance Offering Customer: Media supply entitlement dtails

Customers with active Software Maintenance for XL C/C++ for Linux or XL C/C++ Advanced Edition for Linux are entitled to receive the media supply corresponding to XL C/C++ for Linux, V12.1 or a previous level of the program as long as the level of the program continues to be active.

Eligible customers should add the applicable CD-ROM media supply feature number from the following table to their existing maintenance record. To request the media package (CD-ROM), specify the media supply features 6656 and 3410.

When placing an ESD order in econfig, specify a billing feature, the media features 6656 and 3410, and the ESD only feature 3450. Note that these ESD features are also applicable to the compiler products:

- XL C/C++ for Linux, V12.1, (5765-J03)
- XL C/C++ for Linux, V11.1, (5724-X14)
- XL C/C++ for Linux, V10.1, (5724-U83)

```
Entitled maintenance offerings description

XL C/C++ for Linux


                                             Medium
                                             feature
    Description                              number

    XL C/C++ for Linux, V12.1    CD-ROM Media Supply    6656
    for PID 5765-J03             CD-ROM Media Supply    3410

    Expedite fee charge to Branch                       3445

    Customization features:
     Electronic Delivery                                3450
     Do not ship pubs                                   3470
     Do not ship media                                  3471

    XL C/C++ for Linux, V11.1    CD-ROM Media Supply    5809
    for PID 5724-X14             CD-ROM Media Supply    3410


    Expedite fee charge to Branch                       3445

    Customization features:
     Electronic Delivery                                3450
     Do not ship pubs                                   3470
     Do not ship media                                  3471

    XL C/C++ for Linux, V10.1    CD-ROM Media Supply    6036
    for PID 5724-U83             CD-ROM Media Supply    3410


    Expedite fee charge to Branch                       3445

    Customization features:
     Electronic Delivery                                3450
     Do not ship pubs                                   3470
     Do not ship media                                  3471
```

Trade-up from Authorized User to Concurrent User

Customers who have originally acquired licenses for Authorized User can trade-up their Authorized User licenses to an equivalent or appropriate number of Concurrent User licenses.

Below is a list of precursor products and their associated Authorized User part numbers for which you must have already acquired a license, in order to be eligible to acquire the equivalent Concurrent User licenses using the trade-up feature code.

```
Precursor product    Trade-up product    Trade-up feature code

XL C/C++ for Linux   XL C/C++ for Linux  Is used to trade-up from
Authorized User      Concurrent User     single Authorized User
single entitlement   single entitlement  to single Concurrent User
```

Consult your IBM representative if you have any questions.

```
                                    One-time
                                    charge
                                    program    Feature
Description                         number     number


XL C/C++ for Linux, V12.1                5765-J03
  - trade up from single Authorized User
    entitlement to single Concurrent User
    entitlement                                0003
```

This software license includes Software Subscription and Technical Support, previously referred to as Software Maintenance.

Extending coverage for a total of three years from date of acquisition may be elected. Order the program number, feature number, and quantity to extend coverage for your software licenses. If maintenance has expired, specify the after license feature number.

Software license includes one-year Software Maintenance.

```
Feature                                            Feature
description                                        number

5765-J03 - IBM XL C/C++ for Linux, V12.1
         Per Authorized User with 1 Year SW S&S    0001
         Per Concurrent User with 1 Year SW S&S    0002

5765-J03 - IBM XL C/C++ for Linux, V12.1           6656
           Multilingual, CD ROM                    3410

5648-F60 - IBM XL C/C++ for Linux
           Per Authorized User SW S&S
             - NoCharge Registration               0001
             - 1-year Renewal                      0002
           Per Concurrent User SW S&S
             - NoCharge Registration               0003
             - 1-year Renewal                      0004

5648-F62 - IBM XL C/C++ for Linux
           Per Authorized User SW S&S 1 year after license  0001
           Per Concurrent User SW S&S 1 year after license  0002

5648-F64 - IBM XL C/C++ for Linux
           Per Authorized User SW S&S 3-year Registration   0001
           Per Concurrent User SW S&S 3-year Registration   0002
```

```
5648-F61 - IBM XL C/C++ for Linux
          Per Authorized User SW S&S 3-year Renewal        0001
          Per Concurrent User SW S&S 3-year Renewal        0002

5648-F63 - IBM XL C/C++ for Linux
          Per Authorized User SW S&S 3 years after license 0001
          Per Concurrent User SW S&S 3 years after license 0002
```

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License Information form number

L-MCHN-8SBPLN

The program's License Information will be available for review on the IBM Software
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Limited warranty

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Volume orders (IVO)

Yes. Contact your IBM representative.

Passport Advantage applies

Yes, and through the Passport Advantage website at

   http://www.ibm.com/software/passportadvantage

Software Subscription and Support applies

Yes. Software Subscription and Support (also referred to as Software Maintenance), is now included in the Passport Advantage Agreement. Installation and technical support for the products announced in this announcement is provided by the Software Subscription and Support offering of the IBM International Passport Advantage Agreement. This fee service enhances customer productivity by providing voice or electronic access into the IBM support organizations.

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Variable charges apply

No

Educational allowance available

Yes. A 15% education allowance applies to qualified education institution customers.

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Information on charges is available at

Choose the option entitled Purchase/upgrade tools.

Description	Program number	One-time charge feature number
XL C/C++ for Linux, V12.1 with 1 Year SW S&S		
- per Authorized User	5765-J03	0001
- per Concurrent User	5765-J03	0002
- trade up from single Authorized User entilement to single Concurrent User entitlement	5765-J03	0003
XL C/C++ for Linux, SW S&S NoCharge Registration		
- per Authorized User	5648-F60	0001
- per Concurrent User	5648-F60	0003
SW S&S 1-year Renewal		
- per Authorized User	5648-F60	0002
- per Concurrent User	5648-F60	0004
XL C/C++ for Linux, SW S&S 1 year after license		
- per Authorized User	5648-F62	0001
- per Concurrent User	5648-F62	0002
XL C/C++ for Linux, SW S&S 3-year Registration		
- per Authorized User	5648-F64	0001
- per Concurrent User	5648-F64	0002
XL C/C++ for Linux, SW S&S 3-year Renewal		
- per Authorized User	5648-F61	0001
- per Concurrent User	5648-F61	0002
XL C/C++ for Linux, SW S&S 3 years after license		
- per Authorized User	5648-F63	0001
- per Concurrent User	5648-F63	0002

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