IBM z/OS Version 2 Release 1 delivers the foundation for Smarter Computing

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At a glance

z/OS® V2.1. Get ready to innovate with Smarter Computing. z/OS V2.1 helps you get tomorrow-ready today.

The new version of z/OS , z/OS Version 2 Release 1, marks a new era of z/OS . Version 2 sets the groundwork for the next tier of mainframe computing, enabling you to pursue the innovation to drive highly scalable workloads -- including private clouds, support for mobile and social applications, and more. Its unrivaled security infrastructure is designed to help secure vast amounts of data; its highly optimized availability can help you deliver new data analytics solutions, and its continued improvements in management are targeted to help automate the operations of IBM® zEnterprise™ systems. With support for and exploitation of the new IBM zEnterprise EC12 (zEC12) and zEnterprise BC12 (zBC12) systems, z/OS V2.1 is designed to offer unmatched availability, scalability, and security to meet the emerging business challenges of cloud, data analytics, and the security demands of mobile and social applications. Through its unique design and qualities of service, z/OS delivers the foundation you need to support demanding workloads such as operational analytics and clouds alongside your traditional mission-critical applications.

With enhancements to management and operations, z/OS V2.1 and z/OS Management Facility V2.1 (z/OSMF V2.1) improve ease of configuration and software service level management to help reduce the cost and improve the quality of your configuration and management processes. z/OS and z/OSMF together can help your systems administrators and other personnel handle configuration tasks with ease.

Enhancements for z/OS V2.1 are designed to help you achieve the scale and availability needed for cloud, deliver a superior data serving environment, and secure your mission-critical assets. For instance, z/OS V2.1 is designed to help you:

- Provide support for zEDC, designed to compress data with low CPU overhead and at low latency.
- Support for Shared Memory Communications-Remote Direct Memory Access (SMC-R), can help you move data quickly between z/OS images on the same CPC or a different CPC, and is designed to work without requiring changes to applications.
- Further optimize data placement with significant enhancements to policy-based storage tiering.
- Support designed to help you make batch DB2® updates with less performance impact in a Parallel Sysplex® when DB2 data is cached in a coupling facility.

- Provide a top-down perspective on performance and capacity planning efforts across zEnterprise ensembles with RMF™ support for new SMF records for the Linux™ on System z® , and for the Linux on System x® and AIX® operating systems running on zBX blades. RMF V2.1 also adds support for Windows™ Server running on zBX blades.
- Extend existing batch runtime environment support for COBOL-based applications to interoperate with PL/I programs in addition to Java™ programs, all with shared DB2 with transactional integrity, and extended support to encompass DFSMStvs processing for VSAM record-level sharing data sets. These enhancements are intended to provide flexibility in application development and provide modern programming models to help you extend business applications.
- Reduce batch run times by having DFSMShsm-migrated data sets allocated by batch jobs recalled in parallel, in order to reduce overall elapsed recall times.
- Simplify I/O configuration tasks with improvements for z/OS FICON® Discovery and Auto Configuration (zDAC), which provides improved support for installations with less-complex I/O configurations.
- Provide for RACF® , PKI, and SSL in EP11 mode to support secure key PKCS #11 standard in addition to CCA and accelerator modes of operation.
- Improve interoperability, with support for Japanese Industrial Standards for Extended UNIX™ Code and programming services that meet the Unicode 6.0 standard, among others, better enabling you to serve new customers.
- Exploit available fonts, with fonts included as a new base element of z/OS to give you capabilities you need for print in a global marketplace.

z/OSMF V2.1 introduces capabilities designed to help you manage your z/OS environment more effectively and in a more consistent manner, helping you improve overall quality:

- Reduce resource requirements with use of the Liberty profile in IBM WebSphere® Application Server for z/OS , V8.5 in z/OSMF V2.1
- Manage your software service levels with new reporting and display capabilities, to help you determine the currency of your installed system software portfolio at a glance
- Use a new workflow application infrastructure along with roles-based notifications intended to help with simplification of configuration tasks
- Manage On/Off Capacity on Demand in a more intuitive way

These select highlights of z/OS V2.1 contribute to the foundation of a highly secure, available, and scalable enterprise infrastructure for efficiently running business-critical applications. Some new IBM solutions well suited for this environment include:

- IBM Smarter Analytics Anti-Fraud Infrastructure to help banking, insurance, healthcare, and other customers deploy real-time, prepayment fraud-detection capabilities solutions and integrate these functions into operational systems
- IBM Smarter Infrastructure for Social Services, to provide a leading and highly flexible solution for end-to-end social program service delivery, ensuring privacy with a single source of secure data.
- IBM Enterprise Key Management Foundation, a comprehensive highly secure key management system, which is ideal for banks and payment card processors that must comply with industry standards and manage keys and certificates.

For ordering, contact your IBM representative, an IBM Business Partner, or IBM Americas Call Centers at 800-IBM-CALL (Reference: LE001).

Overview

Organizations around the world are recognizing the increasing role that technology plays in driving change as they shift investments from infrastructure maintenance toward new projects that drive business innovation. The explosive growth of new mobile devices, big data, cloud, and social media represents a clear opportunity

to reshape business models, create competitive advantage, and help to deliver significant business value. In order to capitalize on these emerging opportunities, IBM recognizes there is a need to respond with increased agility to deliver new services, while addressing cost, complexity, and risk. This requires an optimized infrastructure that is integrated, flexible, and secure.

The IBM zEnterprise System with z/OS is a modern mainframe environment that is uniquely suited to deliver industry-leading innovation and value. It allows your organization to exploit new technologies to help improve efficiency and speed time-to-market. It is designed to unlock the power of big data with the integration of business intelligence and transactional processing to help deliver competitive advantages through actionable insights gained from real-time analytics.

IBM's z/OS V2.1 operating system in conjunction with zEC12 and zBC12 systems is a platform that can catalyze innovation with new solutions to support core business-critical and next-generation applications. Exploitation of new SMC-R for low-overhead communications, zEDC data compression for managing active data, Transactional Execution for improved throughput, large pages for superior performance, 100-way SMP support for scale, and crypto as a service for remote encryption allow you to drive business-critical work alongside new applications -- all with the outstanding qualities of service you need. Finally, with its world-class security, and cryptography, you can trust z/OS and the IBM zEnterprise System to help protect your most valuable information, helping you to develop innovative applications while reducing operational risk.

For cloud qualities of service, z/OS V2.1 helps you minimize opportunities for downtime and achieve superior performance and availability. New enhancements around the coupling facility are designed to boost performance and drive even higher throughput. SMC-R supports application-transparent, efficient networking for the fast exchange of information across systems. Enhancements planned for Flash Express allow Coupling Facilities to be used to strengthen the resiliency of IBM WebSphere MQ for z/OS Version 7 for managing messaging spikes. To support extraordinary qualities of service, z/OS V2.1 extends platform capabilities such as VSAM record-level sharing (RLS) for improved catalog performance and higher availability.

With a focus on data management, z/OS data tiering offers enhanced intelligent policy-based data movement designed to help you better meet service goals. And z/OS along with zEnterprise Data Compression (zEDC) offers CPU-efficient and low latency compression, designed to help your enterprise support data-intensive applications with ease.

z/OS V2.1 can help you deploy the mainframe as your secured enterprise service delivery hub and, now, as an enterprise cryptographic hub. The new crypto-as-a-service is designed to be available for Linux clients and is intended to make z/OS-based secure key encryption accessible to Linux applications while providing hardware protection for keys. The security fabric of z/OS helps you improve audit readiness, helps secure data and IP, and supports current standards to help you address evolving industry requirements.

z/OSMF V2.1, the new face of z/OS , also offers capabilities designed to help you achieve more standardized management processes and improved quality using a single user interface supporting multiple tasks. A new workflow application is designed for exploiters to help you structure and sequence your work in a repeatable way to improve process quality and reduce errors.

An extended software management application provides reporting capabilities to help you manage software currency at a glance, simply and efficiently. z/OSMF itself is designed for efficiency using the reduced resource requirements of the Liberty profile in WebSphere Application Server for z/OS , V8.5.

Getting to the next tier of computing to support new mobile and social applications, globally connected 24x7 systems, and increasing volumes of data can be a challenging journey. Let z/OS V2.1 help you easily get the infrastructure you need to get there, today.

Key prerequisites

z/OS V2.1 runs on these IBM System z servers:

- IBM zEnterprise EC12 (zEC12)
- IBM zEnterprise BC12 (zBC12)
- IBM zEnterprise 196 (z196)
- IBM zEnterprise 114 (z114)
- IBM System z10® (z10™ EC, z10 BC)
- IBM System z9® (z9® EC, z9 BC)

Planned availability date

September 30, 2013

Description

Cloud-ready qualities of service

z/OS V2.1 is a platform designed to dynamically respond and scale to workload change with enhancements to scalability and performance that cover operations, I/O, virtual storage constraint relief, memory management, and more. These enhancements are suitable for organizations that would like to catalyze a journey to highly scalable virtualized solutions like cloud.

IBM delivers improved scalability and performance for outstanding throughput and service within your existing environment. Smarter scalability can better prepare you to handle growth and spikes in workloads while maintaining the qualities of service and balanced design that customers have come to expect of the IBM mainframe.

As customers consider all the components of downtime, the true costs can be surprising, which is why superior availability continues to remain a key factor in platform selection. With z/OS V2.1, IBM introduces new capabilities designed to improve upon the already legendary z/OS system availability. The industry-leading resiliency and high availability of System z remain key reasons why organizations keep their most critical processing on System z . With its attention to outage reduction, the availability of System z and z/OS is well recognized in the industry. In z/OS V2.1, IBM continues enhancements that improve critical IT systems availability, helping you achieve an even higher level of service for your customers.

Updates for z/OS V2.1 include:

- Support for Shared Memory Communications-RDMA (SMC-R), for low latency, application transparent communications to help you move data quickly between z/OS images on the same CPC or between CPCs.
- RMF offers enhancements to help with performance and capacity reporting, including a new CIM-based collector for Microsoft™ Windows Server 2008 in addition to the collectors for Linux on System z , AIX , and Linux on System z . This is designed to provide a more consistent monitoring solution for operating environments across the zEnterprise environment.
- z/OS V2.1 running on zEC12 or zBC12 systems with CFLEVEL 19 is planned to support Flash Express for certain coupling facility list structures, such as IBM WebSphere MQ for z/OS , V7 (5655-R36), in order to strengthen resiliency for enterprise messaging workload spikes. For more information, refer to the Statements of direction section.
- In z/OS V2.1 with CFLEVEL 19 on zEC12 or zBC12 systems, shared engine coupling facilities can be used in many production environments, for improved

economics by offering a high level of performance without requiring the use of dedicated CF engines.

- New RMF XP support for Windows Server 2008 running on zBX blades, including SMF 104 records. This complements the prior support provided for the Linux on System z , Linux on System x , and AIX operating systems running on zBX blades.
- EXCP support for System z High-Performance FICON (zHPF) is designed to help you improve I/O start rates and improve bandwidth for more workloads on your existing hardware and fabric.
- Usability and performance improvements for z/OS FICON Discovery and Auto Configuration (zDAC), including discovery of directly attached devices.
- Serial Coupling Facility structure rebuild processing, designed to help improve performance and availability by rebuilding coupling facility structures more quickly and in priority order.
- JES2 and SDSF support for over four billion (4,000,000,000) spin data sets, to help improve availability for long-running address spaces and not face limits that would require these systems to be taken down.

Additional function, descriptions, and details in support of scalability and performance enhancements for z/OS V2.1 include:

z/OS V2.1 delivers 100-way symmetric multiprocessing (SMP) support in a single LPAR on IBM zEC12 or zBC12 systems. z/OS V1.12 and z/OS V1.13 (5694-A01) with PTFs running on IBM zEnterprise EC12 or BC12 (zEC12 or zBC12) systems also support up to 100 processors configured in a single LPAR. z/OS supports combinations of general-purpose processors (CPs), zIIPs, and zAAPs. z/OS design supports an architectural limit of 4 TB of real memory per LPAR. On z196 and zEC12 systems, z/OS supports up to 1 TB of real memory per LPAR. On zBC12 and z114 systems, z/OS supports up to the maximum amount of real memory that can be installed in a single LPAR.

In z/OS V2.1, support for 2 GB pages is provided on zEC12 and zBC12 systems. This is designed to reduce memory management overhead and improve overall system performance by enabling middleware to use 2 GB pages. These improvements are expected due to improved effective translation lookaside buffer (TLB) coverage and a reduction in the number of steps the system must perform to translate a 2 GB page virtual address. This z/OS V2.1 function is exploited by the IBM 31-bit SDK for z/OS , Java Technology Edition, V7.0.0 (5655-W43) and SDK IBM 64-bit SDK for z/OS , Java Technology Edition, V7.0.0 (5655-W44). This support is also available for z/OS V1.13 with the z/OS V1R13 RSM Enablement Offering web deliverable and the PTF for APAR OA40967.

z/OS V2.1 running on zEC12 or zBC12 systems is designed to support the use of hardware transactional memory in additional production environments. The capability to use the Transactional Execution Facility for IBM 31-bit and 64-bit SDK for z/OS Java Technology Edition, Version 7 (5655-W43 and 5655-W44) was introduced for z/OS V1.13 with PTFs on zEC12 systems, and is also available on zBC12 systems. The capability to write and test applications using XL C/C++ compiler using hardware built-in functions to enable applications to use the Transactional Execution Facility was also provided with a PTF for z/OS V1.13. The z/OS V1.13 XL C/C++ support is intended to be used for development and testing. In z/OS V2.1, support for the use of transactional memory by applications written in XL C/C++ and High Level Assembler (HLASM) is intended for production use as well.

In z/OS V2.1, JES2 and SDSF is designed to support over 4 billion spin data sets (up to 4,294,967,296) an increase from the prior limit of almost 10 million (9,999,999). This is intended to help improve availability for long-running address spaces by enabling them to create more output data sets on spool before having to stop and restart them. This support is also available on z/OS V1.13 with the PTFs for APARs OA38944 and PM59496, and toleration support is available for z/OS V1.12 with the PTFs for APARs OA38944 and PM59496.

In z/OS V2.1, Capacity Provisioning is designed to provide support for manual and policy-based management of Defined Capacity and Group Capacity. This is intended to broaden the range of automatic, policy-based responses available to help you

manage capacity shortage conditions when WLM cannot meet your workload policy goals. Also, the Capacity Provisioning commands and reports are enhanced for support of IFL, ICF, and SAP processors to provide a consistent method to handle zEnterprise processor capacity from within z/OS . Further z/OS 2.1 Capacity Provisioning allows managing manually activated On/Off CoD capacity to let the Provisioning Manager deactivate that capacity when no longer needed according to its policy. Information about the managed On/Off CoD record is available through an additional Provisioning Manager report. Also, z/OS V2.1 supports the use of IBM 31-bit SDK for z/OS , Java Technology Edition, V7.0.0 (5655-W43) by the Provisioning Manager.

In z/OS V2.1, DFSORT improves its memory resource management to better balance the memory requirements of multiple large concurrent sort operations and other workloads. A new TUNE option is designed to allow you to specify that DFSORT obtain storage incrementally and check on storage availability before allocating additional storage. This is intended to better balance utilization for sort operations and other workloads initiated within a short time. Also, DFSORT is updated to increase the memory object work space maximum from 64 GB to 1 TB, allowing you to sort larger amounts of data in memory object work files.

z/OS V2.1 supports specifying job classes up to eight characters in length. This new support is available for both JES2 and JES3 when the class is specified on the JCL JOB statement. SDSF supports these longer job classes, which is stored in SMF Type 24 records on JES2 systems and Type 26 records on JES3 systems.

In z/OS V2.1, a new MODIFY VLF command enables you to specify that the contents of a COFVLFxx parmlib member be used to update VLF classes, update their associated major names, and change the values of MaxVirt and AlertAge for existing VLF classes. This is designed to improve system performance when making these changes to VLF by making it unnecessary to restart VLF.

z/OS V2.1 is designed to support non-SMS-managed VSAM linear data sets larger than 4 GB, including zFS file system data sets. This support for extended addressability is intended to make it easier to migrate file system data sets from HFS to zFS, particularly for system software file systems including the z/OS version root file system. Coexistence support for z/OS V1.12 and z/OS V1.13, to allow non-SMS-managed linear data sets defined on z/OS V2.1 using extended addressability to be processed, is provided with the PTFs for APAR OA39618.

VSAM supports the use of system-managed buffering (SMB) for VSAM data sets. In prior releases, SMB access bias (ACCBIAS) specifications could be made in JCL, and some were also supported as SMS data class specifications. In z/OS V2.1, DFSMS is designed to support specification of all SMB Record Access Bias values for VSAM data sets that can be specified in JCL in data classes. Also, the system is designed to enable you to override the ACB RMODE31 parameter with SMS data class specifications. The new support is intended to help you make changes for a large number of VSAM data sets without having to make a correspondingly large number of JCL changes.

In z/OS V1.8, System Logger design was enhanced to support separate task structures for managing test and production log streams. In z/OS V2.1, System Logger provides task separation between coupling facility-based and DASD-only log streams as well. This is intended to support higher rates of log stream offload data set allocations, reduce primary storage full conditions, and support higher overall concurrent log stream offload rates. This function is also available for z/OS V1.13 with the PTF for APAR OA38613.

These performance-related z/OS V2.1 SMF enhancements are included:

- In z/OS V1.13, the SMF log stream dump program (IFASMFDL) was updated with a new SMARTENDPOINT keyword. In z/OS V2.1, SMF supports similar processing in the SMF log stream subsystem exit (IFASEXIT) to avoid reading until the end of the log stream for all requests. This is intended to improve performance for IFASEXIT.
- In z/OS V2.1, SMF enables you to specify the buffer size for SMF logging to log streams in a way similar to using the BUFSIZMAX specification for SYS1.MAN

data sets. This support is designed to enable you to specify the size of each individual SMF log stream buffer using a new DSPSIZMAX parameter in an SMFPRMxx member of parmlib and change it dynamically using either a SET SMF command or a SETSMF command. Support for DSPSIZMAX to be set when SMF is initialized was also made available for z/OS V1.12 and V1.13 with the PTF for APAR OA35175.

- SMF also supports the use of data compression on zEC12 and zBC12 systems with the zEDC Express feature and the zEnterprise Data Compression (zEDC) feature for z/OS V2.1. For more information, refer to the z/OS support for zEnterprise EC12 (zEC12) and BC12 (zBC12) systems section and the Statements of direction section.

In z/OS V2.1, NFS Server is designed to use multi-tasking for the RPCSEC_GSS authentication type of the Remote Procedure Call (RPC) protocol, which is supported by z/OS NFS server for NFS V4 workloads. This is expected to improve performance for workloads using RPCSEC_GSS.

In z/OS V2.1, the IDCAMS utility supports REPRO and PRINT operations for data sets on tape with block sizes up to 256 KB (262,144 bytes). Also, when processing z/OS UNIX files with REPRO, the maximum block size supported on the JCL DD statement is 64 KB (65,535 bytes), up from the previous limit of 32,760 bytes. This is intended to allow IDCAMs to support data sets that were created using the large block interface (LBI).

The initial support for System z High-Performance FICON zHPF in z/OS V1.11 was for data sets accessed using the media manager component of DFSMS, including VSAM data sets. z/OS V1.13 added support for QSAM, BSAM, and BPAM and allowed EXCPVR callers to use zHPF channel programs. With z/OS V2.1, EXCP is supported. This function is also available for z/OS V1.12 and V1.13 with the PTF for OA38185. This is intended to provide function that programmers can use to achieve significant I/O performance improvements for programs using EXCP.

Availability

IBM zEC12 Flash Express exploitation was provided with z/OS V1.13 in 2012 with the z/OS V1R13 RSM Enablement Offering web deliverable. This function is integrated in z/OS V2.1. With this support, z/OS is designed to help improve system availability and responsiveness by using Flash Express across transitional workload events such as market openings, and diagnostic data collection. z/OS is also designed to help improve processor performance by supporting middleware such as IMS™ , with its exploitation of pageable large (1 MB) pages. Exploitation is provided for:

- z/OS V1.13 and z/OS V2.1 Language Environment® when used with a runtime option.
- Java , with the IBM 31-bit SDK for z/OS , Java Technology Edition, V7.0.0 (5655-W43) and IBM 64-bit SDK for z/OS , Java Technology Edition, V7.0.0 (5655-W44).
- The IMS Common Queue Server, which is designed to use pageable large pages for selected buffers when running IMS 12 (5635-A03) on zEC12 or zBC12 systems with the PTF for APAR PM66866.

With this support, z/OS is also designed to make the pageable link pack area (PLPA) and common page data sets optional. When Flash Express is used for PLPA and common pages, the system is designed not to require PLPA or common page data sets for cold start (CLPA) IPLs. They remain required to perform quick start (CVIO) IPLs and warm start (neither CLPA nor CVIO) IPLs. Additionally, the system is now designed to allow PLPA and common pages to be written to local page data sets, if necessary. This is intended to improve system availability.

Also, z/OS V2.1 is designed to support concurrent update for Flash Express on IBM zEC12 or zBC12 systems. This function is designed to allow concurrent updates of Flash Express licensed internal code without interrupting system operation. This support is also available on z/OS V1.13 with the z/OS V1R13 RSM Enablement Offering web deliverable.

In z/OS V1.13, JES3 support for dynamically adding a spool volume was introduced. In z/OS V2.1, new support allows JES3 to remove a spool volume dynamically. Also, new support allows JES3 to display spool information for individual jobs, display which jobs have data on a particular spool data set, and dump the spool data associated with jobs having data on a particular spool volume to make it easier to remove a spool volume from the JES3 configuration dynamically. In combination, these functions are intended to enable you to discontinue the use of a JES3 spool volume using either a *MODIFY operator command or during a JES3 hot start with Refresh, removing the existing requirement for a JES3 complex-wide IPL when removing spool volumes. In addition, subsystem interface (SSI80) support provides track group usage for an individual job.

z/OS V2.1 is designed to support a new function that allows components of FICON switches to be taken offline and brought back online. When a FICON switch provides certain supporting functions defined by the SMI-S standard, z/OS is designed to detect whether serviceable switch components such as ports and port cards are in use on any system, and enable you to specify that they be taken offline if they are not in use. Corresponding functions can allow you to specify that they be brought back online. This is intended to allow you to perform concurrent service activities for switches and other fabric components more easily. This function is also available for z/OS V1.12 and z/OS V1.13 with the PTFs for APARs OA38145 and OA38303.

In z/OS V2.1, the z/OS I/O Supervisor (IOS) is designed to detect common points of failure for virtualized FICON switches. This is intended to detect common hardware components within a single physical switch that has been defined as multiple virtual switches, and support these virtualized switches in the IOS single point of failure (SPOF) service and in Dynamic Channel Path Management (DCM) for FICON . This support requires a switch that supports the Read Port Availability Information function. This function is also available for z/OS V1.12 and z/OS V1.13 with the PTF for APAR OA40876.

In z/OS V2.1, the system is designed to enable you to specify that RRS attempt to recover by quiescing its processing, updating its logs, and resuming its processing without restarting RRS. This is expected to help improve RRS availability in certain recovery situations.

z/OS V2.1 is designed to enable you to add and remove MCS consoles dynamically when they are being used in distributed mode. SET CON command processing is designed to process a CONSOLxx parmlib member and add new consoles, up to the system and sysplex limits for the maximum number of consoles, while the SETCON command is designed to enable you to specify a console to be removed. This is intended to help you improve availability by removing another reason for system and sysplex-wide IPLs.

In z/OS V2.1, NFS Server exploits 64-bit addressing to support larger sequential data sets, PDS members, and PDSE members. This new function is designed to support processing for files as large as 4 TB, up from the prior limit of 800 MB, and is intended to help improve application performance for random access.

In z/OS V2.1, the RPCBIND and NFS Servers are designed to allow the NFS Server to re-register with RPCBIND when RPCBIND is restarted, without an NFS Server restart. This is designed to help preserve existing connections to the NFS Server and to allow new mounts when RPCBIND is restarted and intended to help improve availability by eliminating a reason for NFS Server restarts.

z/OS V2.1 Infoprint Server includes two enhancements. First, Infoprint Server is designed to enable you to change most configuration options without a restart. Second, Infoprint Server is designed to support the use of System Logger for the common message log, rather than files in the z/OS UNIX System Services file system. Using System Logger is intended to enable you to use a single, merged log for multiple instances of Infoprint Server.

In z/OS V2.1, System Data Mover (SDM) is designed to allow z/OS Global Mirror (z/GM, also known as XRC) primary volumes to be offline when the XSTART and XADDPAIR commands are issued to start or restart mirroring for existing volumes.

This is intended to improve availability by eliminating the need to wait for all devices to be varied online.

In z/OS V2.1, a new operand is available for the FORCE operator command, to enable you to specify the TCB address of a particular task for the system to terminate. This function is intended to be used to preserve system availability when a task holds resources required by other critical functions and there seems to be no other alternative to IPL.

In z/OS V2.1, two enhancements are available for Synchronous WTOR processing, also called the disabled consoles communication facility (DCCF). The first is designed to extend the Timed Auto Reply function introduced in z/OS V1.12 to allow it to respond to WTORs displayed through DCCF. The second is intended to notify all locally attached MCS consoles about the current destination of a WTOR displayed by DCCF, in order to make it easier and faster to locate the console on which the response may be entered. These changes are expected to make it easier to automate responses to critical WTORs and to help you respond to unautomated WTORs displayed through DCCF more quickly.

In z/OS V2.1, Basic HyperSwap® is enhanced to reduce the number of "false freezes" by detecting common reasons for PPRC link suspensions that do not require a volume to be frozen when you specify a new configuration option. Also, while IBM System Storage® DS8700 and DS8800 series storage controllers are designed for high availability, certain recovery processing operations can cause delayed responses to I/O requests. Basic HyperSwap is designed to use notifications issued by these storage controllers, when installed with a minimum microcode level, to detect these long-running recovery processes and initiate a swap when appropriate. This is intended to allow application processing to continue with minimal disruption during storage subsystem recovery processing. This function is also available for z/OS V1.12 and z/OS V1.13 with the PTFs for APAR OA37632.

In z/OS V2.1, enhancements to the System Logger component are intended to help you avoid log stream primary storage full conditions that can lead to performance degradation and outages. New function is designed to enable you to specify that warning messages be issued based on thresholds for log stream primary storage consumption above the HIGHOFFLOAD value.

z/OS V2.1 supports updating the values of system symbols dynamically. A new keyword on the SETLOAD operator command enables you to specify that the values of local static system symbols be updated using the values from an IEASYMxx member of parmlib.

XCF improvements in z/OS V2.1 include:

- Coupling facility (CF) rebuild processing and the way structures are processed when CF duplexing is initiated is changed. The new design is intended to improve performance and availability when a large number of structures are rebuilt by enabling you to specify which structures should be rebuilt or duplexed first, and processing them in priority order to rebuild the most important structures for your workloads ahead of other, less critical, structures.
- XCF is designed to perform additional validation of certain CF cache requests, collect diagnostic information when validation fails, and terminate affected connectors to avoid CF cache corruption. This new function is also available with the PTF for APAR OA40966 on z/OS V1.12 and later on IBM zEC12 or zBC12 systems.

z/OS V1.12 DFSMSdfp added support for a catalog contention display command. In z/OS V2.1, additional information is made available to make it easier to determine the causes of serialization contention problems that affect catalog address space (CAS) processing. Detection was added for SYSZTIOT resource contention in z/OS V1.12. In z/OS V2.1, support is added to detect resource contention for SYSIGGV2 and SYSZVVDS resources, and for the CAS allocation lock.

Networking-related enhancements

A number of networking-related enhancements are available in z/OS V2.1 Communications Server:

- z/OS V2.1 and zEC12 and zBC12 systems with the 10GbE RoCE Express feature are designed to support a new communications protocol, Shared Memory Communications-RDMA (SMC-R) to provide a significant performance benefit in transferring data as compared to standard TCP/IP communications over the Open Systems Adapter (OSA).
- System resolver enhancements allow the resolver to start even if errors are detected with statements in the resolver setup file. This allows TCP/IP stacks and other applications dependent on resolver processing to continue their initialization despite any resolver setup file errors.
- Implementation of RFC 2018 and RFC 3517 provides support for selective acknowledgment (SACK) and selective packet retransmission based on SACKs. This is intended to help improve performance when multiple packets are lost in a single TCP window.
- Supported socket APIs are now designed to use fast path sockets processing automatically, without system programmer or application enablement. Fast path sockets processing can provide a significant reduction in CPU utilization, especially for interactive workloads.
- Support for specifying QDIOACCELERATOR in a TCP/IP profile with IPSECURITY enabled. Existing QDIOACCELERATOR function is designed to improve performance by allowing packets to be directly routed between HiperSockets™ and OSA QDIO connections. This enhancement is designed to provide that support under certain conditions for those TCP/IP stacks that have IPSECURITY enabled.
- The ability for an application-instance dynamic VIPA to be created with an affinity for a particular address space is included. This ensures the correct routing of application traffic destined for one of multiple applications bound to the unspecified address (inaddr_any or in6addr_any) and listening on a common port.
- Trace processing is enhanced so that the coupling facility services (CFS) component always traces connection-related activities and other important information in the mini-trace table for the coupling facility structures ISTGENERIC, EZBDVIPA, and EZBEPORT. Also, Communications Server enhances the APPN route selection trace to provide additional trace entries to diagnose the selection of incorrect routes through the APPN network. These enhancements are intended to reduce problem diagnostic time and to reduce the likelihood of problem re-creates for additional documentation.
- Enhancements to the INTERFACE statement in the TCP/IP profile support configuration of IPv4 interfaces for HiperSockets and static virtual IP addresses (VIPAs). This enhancement provides a simpler method for configuring IPv4 HiperSockets interfaces and static VIPAs than using DEVICE/LINK/HOME statements.
- New TCP/IP profile configuration statements enable you to specify the range of ephemeral ports to be assigned to UDP and TCP sockets. This is intended to help simplify firewall configuration rules.
- Support is added for two new FTP subcommands, MVSPut and MVSGet. These commands are designed to simplify the transfer of sequential and partitioned (PDS and PDSE) data sets between z/OS systems.

These z/OS V2.1 UNIX System Services enhancements are included:

- In z/OS V1.13, support was added to z/OS UNIX System Services for the vi and ex editors to enable you to edit untagged text files and have them treated as if they contained ASCII-encoded text data. In z/OS V2.1, this support is added for a number of additional commands, including cat, cmp, comm, cut, diff, dircmp, ed, egrep, expand, fgrep, file, grep, head, more, paste, tail, sed, strings, unexpand, uniq, and wc. In addition, for the above commands, z/OS V2.1 supports code pages other than IBM-819, including Unicode code pages.

This new function is intended to make it easier to work with text files when using z/OS UNIX .

- In z/OS V2.1, z/OS UNIX System Services supports a significantly greater number of threads that can be active on the system.
- In z/OS V2.1, z/OS UNIX System Services increases the number of mutexes (mutual exclusions) and condition variables the system supports for authorized programs from 131,072 to 16,777,215, and increases the overall system limit to 4,294,967,295. This is intended to make it easier to port applications that require a large number of mutexes and condition variables to z/OS UNIX .
- In z/OS V2.1, the z/OS UNIX System Services automount facility is enhanced to support setting permission bits other than the default for file systems it creates, the use of static system symbols in the master file, and other usability improvements.

Data ready

The strength of System z and z/OS V2.1 in delivering huge volumes of data has long established the IBM mainframe as the ideal platform for data-centric applications. Businesses running transactional and batch applications on z/OS value traditional high availability, scale, and security, while enjoying the freedom to run z/OS seamlessly alongside new workloads. The ability to run new z/OS applications gives you the business agility you need while providing integration with your existing core applications. z/OS V2.1 features many capabilities to enable you to harness the value of your transactional and operational data by:

- Strengthening efficiencies and capabilities of batch processing
- Providing a robust and highly performing I/O infrastructure
- Including enhancements to file systems, paging, and access methods

Enhancements to data and file functions are designed to further improve foundational capabilities to support the scale and performance needed for future analytics and other data applications.

Updates for z/OS V2.1 include:

- In z/OS V2.1, the z/OS I/O Supervisor (IOS) is designed to detect common points of failure for virtualized FICON switches. This support requires a switch that supports the Read Port Availability Information function.
- An updated z/OS Batch Runtime Environment designed to allow COBOL, Java , and now PL/I programs to interoperate using shared DB2 for z/OS , along with support for DFSMStvs as a resource manager, intended to provide increased flexibility in leveraging existing application assets.
- Automatic policy-based movement of SMS-managed data within the primary DFSMShsm storage hierarchy, designed to provide better management of storage resources.
- A new zFS file system version designed to significantly improve performance for file systems with large directories, and a larger maximum file system size of 16 TB for greater scalability.
- Improvements to batch processing of DFSMShsm-migrated data sets intended to reduce elapsed time and improve throughput.
- New support for VSAM record-level sharing (RLS) in a sysplex, intended to improve catalog sharing, reduce contention, and improve coupling facility caching in a Parallel Sysplex to deliver high throughput and improved performance.
- Global Resource Serialization support designed to allow programs to synchronously change an exclusive enqueue to a shared enqueue to help reduce contention, in addition to existing support for changing an enqueue from shared to exclusive.
- z/OS V2.1 DFSMS is planned to provide support for a new PDSE Version 2 format, intended to better utilize space and improve performance, and to recover prior levels of a PDSE member after deletion or modification.
- Hardware support intended to help drive data serving:
  - Support for 2 GB large fixed pages and pageable 1 MB large pages

– Hardware transactional memory support

Additional function, descriptions, and details in support of application integration for z/OS V2.1 include:

In z/OS V2.1 with CFLEVEL 19 on zEC12 and zBC12 systems, XCF and XES are designed to allow the use of shared engine coupling facilities in many production environments with improved performance. This is intended to allow Parallel Sysplex to be implemented at lower cost in many environments by reducing the number of environments for which dedicated coupling facility (CF) engines are needed to achieve good performance. In addition, a new set of interrupts provided on zEC12 and zBC12 systems with a minimum MCL is designed to be used by z/OS to help reduce XCF and XES processing overhead and improve performance when processing asynchronous coupling facility operations and recognizing certain CF events. This support is also available on z/OS V1.12 and V1.13 with the PTFs for APARs OA38734 and OA38781.

z/OS V2.1 running on zEC12 and zBC12 systems with CFLEVEL 19 is planned to support the use of Flash Express for certain coupling facility list structures. For more information, see the Statements of direction section.

In z/OS V2.1, DFSMShsm is designed to provide policy-based movement of SMS-managed data within the primary (Level 0) storage hierarchy. This support is intended to enable DFSMShsm to use existing storage class and storage group constructs to recognize devices with different characteristics within the primary storage hierarchy and apply management class policies to move the data from one class of device to another. For example, you might specify that the primary storage hierarchy is to span tiers that include IBM System Storage DS8700 and DS8800 series devices based on solid-state device (SSD) drives, traditional hard disk drives (HDD), Serial Advanced Technology Attachment drives (SATA), or a mix of these devices, which can include Easy Tier™ devices. Support is provided for policy-based management based on age and the elapsed time since last reference. DFSMShsm continues to support Migration Levels 1 and 2 (ML1 and ML2) in addition to support of the primary storage hierarchy to help you manage data residency to meet your business goals and data management policies.

Also, a number of small enhancements are available for DFSMShsm. They are designed to provide storage constraint relief, improve recycle processing, and automate DFSMShsm recovery from SMSVSAM restarts.

In z/OS V2.1, Catalog support for VSAM record-level sharing (RLS) is provided for user and volume catalogs in a Parallel Sysplex . This new design is intended to substantially reduce catalog contention and improve performance. Additional catalog enhancements are designed to suspend catalog requests for a specified catalog across a sysplex to enable you to minimize application disruption during catalog maintenance. Also, new support enables you to preserve user catalog connector alias entries when you temporarily delete a user catalog so they need not be redefined when the catalog is reallocated, and prevent new catalog entries using those aliases from being defined until the new catalog is available. This is intended to simplify the reallocation of user catalogs.

Additional RLS-related enhancements include:

• Support for directory-only caching. This enhancement is intended to enable you to optionally bypass caching all RLS data for files, including the index component, when the cost of caching any data in the coupling facility outweighs the benefits, such as in limited-sharing environments.
• Movement of a number of RLS buffer-related control blocks from the SMSVSAM data space into 64-bit storage. This is intended to increase the amount of available SMSVSAM data space storage and is expected to help you improve performance when processing a large amount of VSAM RLS data.
• IDCAMS is enhanced to access VSAM data sets in RLS mode. This support is for IDCAMS PRINT, REPRO, IMPORT, and EXPORT functions.

In z/OS V2.1, Allocation support enables you to specify that DFSMShsm-migrated data sets that are to be allocated by a batch job be recalled in parallel, before each job step starts. This new function is designed to speed batch processing by reducing overall data set recall wait time.

In z/OS V2.1, zFS is designed to significantly improve performance for file systems with large directories. A new file system version is designed to store directories in a tree for faster processing, particularly for large directories. A number of conversion options give you the ability to convert existing file systems to the new format. Also, this new version is designed to remove explicit limits on the number of names that can be stored in zFS directories, including the prior limit of 65,535 subdirectories, and to increase the maximum file system size to 16 TB from 4 TB. This new support is intended to give you the ability to migrate HFS file systems that contain directories with a large number of files to zFS.

z/OS V2.1 DFSMS is enhanced as follows:

- In z/OS V2.1, PDSE processing is enhanced with a new format, PDSE Version 2. PDSE Version 2 is designed to allow all unused space to be released, consolidate directory pages when possible, improve read performance, and reduce virtual storage utilization for PDSE processing. Also, the PDSE API is designed to support much larger members for PDSE data sets. The new limit on PDSE member size is over 125 times larger than the previous limit in many circumstances, and substantially larger than the maximum supported size of a PDS member. These enhancements are intended to provide additional scalability and usability benefits of using PDSEs in place of PDSs, make it feasible to use PDSEs instead of multiple large sequential data sets, and help reduce the space required for PDSEs while improving performance for most PDSE read operations. z/OS V1.12 and z/OS V1.13 tolerate the new PDSE format.

  In addition, PDSE Version 2 is designed to provide the capability to recover prior levels of a PDSE member after deleting or modifying a member. ISPF is designed to provide corresponding support for allocating PDSEs in the new format. ISPF also supports programming services, including ISPF programming services, and ISPF Edit support for recovering prior levels of a PDSE member. Support for recovering prior levels of a PDSE member is planned to be made available with a PTF for APAR OA42358 in the first quarter of 2014.

- A new type of Extended Format data set, Version 2, is supported. DFSMSdss is designed to support the use of FlashCopy® for Version 2 Extended Format sequential data sets when copying nonstriped multivolume Extended Format data sets, in addition to the existing support for other Extended Format data sets. IDCAMS REPRO processing is enhanced to support CI mode processing for nonstriped multivolume Extended Format sequential data sets.
- DFSMSdfp is designed to improve tape performance by processing consecutive files without reading each prior tape file's trailer labels when DISP=PASS is coded on the DD statement. This is expected to be most noticeable when reading a large number of small consecutive tape files.
- In z/OS V2.1 DFSMS, processing of catalog aliases is improved. For data set aliases with symbolic-related names, the system is designed to reorient the search with the master catalog or the appropriate user catalog. Also, creation dates are stored for alias entries and listed by the IDCAMS utility.
- In z/OS V1.11, support was introduced for data set name masking in the IDCAMS DELETE command, and in z/OS V1.12, support was introduced for deleting all members of a PDS or PDSE. In z/OS V2.1, support for the DELETE command is extended to give you the ability to specify a mask for deleting members from PDS and PDSE data sets. This is intended to improve the usability of the DELETE command.
- The IDCAMS utility is designed to enable you to use the ALTER command to nullify the management class for an SMS-managed data set. Also, IDCAMS DIAGNOSE processing for generation data groups (GDGs) is enhanced to detect additional problems. This is intended to help you find the causes of GDG processing errors.
- IEBCOPY supports the COPYGROUP function, a superset of the existing COPYGRP function. COPYGRP is designed to copy all aliases when source or destination

data sets are PDSEs. COPYGROUP is designed to copy all aliases for any combination of PDS and PDSE data sets. IEBCOPY is extended to accept special characters on SELECT statements that identify patterns of member names to be copied by the COPYGROUP command. This function is designed to use percent signs (%) and asterisks (*) to determine whether one or more characters match the desired pattern of member names to be copied.

- DFSMS is designed to better align the allocation of SMS-managed data sets with the cluster and extent pool boundaries on IBM System Storage DS8000® series devices. This enhanced function is designed to improve data set Fast Replication operations and more uniform performance for striped data sets by changing SMS volume selection to attempt to allocate multi-volume data sets and extensions within a cluster or Storage Facility Image (SFI) based on storage class attributes and to allocate striped data sets and their extensions across different extent pools when possible.

- Under some circumstances, such as changing a volume's size on a sharing system that is not part of the SMS configuration for another system, the volume space information stored by SMS can become out of date. A new VARY SMS command operand enables you to refresh volume space information stored by SMS so that the output of commands such as ISMF LISTSYS reflects up-to-date information.

- In z/OS , setting Dynamic Volume Count (DVC) along with the Space Constraint Relief attribute in the SMS data class used for a data set can be used to determine the maximum number of volumes it will be allowed to span, to increase the original volume count specified for data sets in JCL or when using Dynamic Allocation. This enables the data set to be extended later should it run out of space on the volumes on which it was originally allocated, and is intended to help you prevent space-related abends. Support for Dynamic Volume Count is extended to support VSAM RLS data sets in z/OS V2.1. This is intended to help prevent space-related abends when data sets grow during VSAM RLS processing.

- DFSMS automatically changes the VSAM SHAREOPTIONS attributes of the active configuration data set (ACDS) and communications data set (COMMDS) if they have been defined with incorrect sharing options. Also, with a new IGDSMSxx parmlib member parameter and SETSMS command operand, you can specify that partitioned data sets be unconditionally allocated as PDSE when DSNTYPE=LIBRARY is specified, whether or not directory space is also specified in JCL.

- A new variable for automatic class selection (ACS) routines indicates whether data sets are eligible to reside in the extended addressing space (EAS) on extended address volumes (EAVs). This is intended to enable you to code ACS routines that direct data sets to appropriate storage groups and set appropriate data set space allocation values.

- Space can be released for an SMS-managed multi-volume sequential data set on disk storage using the RLSE JCL parameter or equivalent function in dynamic allocation. In z/OS V2.1, the system is designed to release unused space for such a data set on the current volume and on all subsequent volumes on which the data set resides. Also, when a tape data set is extended to a new volume and a new JFCB extension (JFCBX) is required for it, the system creates one automatically rather than issuing abend 837 with reason code 08. Finally, comments are now allowed in parmlib member IEAAPP00, which can be used to define authorized I/O appendage routines.

- DFSMSdss supports a new RESET keyword on the RESTORE command used for physical (full-volume and track-based) restore operations, enabling you to specify whether data set changed indicators should be reset for the data sets on the restored volume. Corresponding support is available for DFSMShsm when full volumes are restored under DFSMShsm control. This function is intended to make policy-based storage management more effective for recently restored volumes.

z/OS V2.1 Global Resource Serialization (GRS) supports synchronously changing an exclusive enqueue to a shared enqueue, in addition to the existing support for changing an enqueue from shared to exclusive. Corresponding support is available in JCL for a new JOB statement keyword to enable you to specify that access to data sets can transition from exclusive to shared after the last step in which they are allocated with a disposition of OLD, NEW, or MOD. Also, support is available for

a JES2 initialization statement to specify whether this function should be allowed, and whether it should be used by default if not specified in JCL. This function is intended to permit more parallelism in resource processing by allowing resources to be available for read access before the process that originally requested exclusive use ends in single-system and GRS Star environments.

z/OS V2.1 with IBM DB2 11 for z/OS (5615-DB2) running on zEC12 or zBC12, or later, systems with CFLEVEL 18 is planned to exploit new function to allow batched updates to be written directly to disk without being cached in the coupling facility in a Parallel Sysplex. This is designed to keep the data in the cache that is used by online transactions more current, which is expected to help improve performance during batch update periods. Also, this can help avoid application stalls that might sometimes occur during large concurrent batch updates. The z/OS support for this function is also available on IBM zEnterprise 196 (z196) and zEnterprise 114 (z114) servers with CFLEVEL 17 and an MCL, and on z/OS V1.12 and z/OS V1.13 with the PTF for APAR OA40966.

Security ready

Security of critical information assets remains a top priority for organizations, especially in light of today's sophisticated attacks and new threats. You must defend against increasingly creative attacks and deliver secured information to maintain customer privacy. With corporate data accessed through mobile applications, social networks, and new cloud environments, the challenges around data privacy and custody are even more critical. New z/OS V2.1 capabilities are intended to assist you to further reduce risk, improve compliance, and manage data security in your z/OS environment.

Today, z/OS offers a huge breadth of security capabilities built into the fabric of the operating system. Many z/OS security functions, such as data encryption, key management, PKI infrastructure, and password synchronization can be deployed to harden the overall security level of your computing environment. Security is built into both the technology and design processes as well as middleware for z/OS , fortifying the enterprise infrastructure stack. In addition, enhancements are designed to further support compliance to new emerging regulations and standards in banking, public sector, and other business areas.

Security for z/OS V2.1 offers additional enhancements:

- In z/OS V2.1, IBM TDS (LDAP) is designed to allow applications, such as those running on Linux clients, to send data to z/OS to be processed by ICSF, leveraging the CryptoExpress4S cards available on zEnterprise servers. This support is designed to allow applications to request secure key cryptographic services from z/OS without exposing the keys in memory. Exploitation of these services is planned to be made available for Linux clients.
- New ICSF functions are designed to help banking and finance sector clients provide improved security, such as those functions that support emerging standards.
- New Communications Server capabilities to support security exits for z/OS FTP clients you can use to help secure file transfers.
- The RACF database unload utility is designed to unload additional information about digital certificates to help you more easily perform auditing activities on certificates stored in RACF databases.
- z/OS UNIX System Services enables you to specify whether a user should be logged off after a period of inactivity.
- JES2 and JES3 support for access controls on job classes, which you can use to remove the need for exits.
- New health checks on expiration of trusted certificates, and increased resources checked in sensitive resource class.

System z Security Portal

IBM urges all z/OS users to get registered for the System z Security Portal and to keep current with security and system integrity fixes.

Many security experts agree that in today's world, it is more important than ever that you track and install critical security and system integrity fixes as part of your overall enterprise security policy to mitigate risk in an environment of heightened cybersecurity concerns. IBM recommends that users of the z/OS operating system validate the currency of security and system integrity service and take prompt action to install all security and integrity PTFs. Security and system integrity fixes are included in Recommended Service Upgrades (RSUs), and maintaining RSU currency can help you minimize exposure to security and integrity issues.

The System z Security Portal is intended to help you stay current with security and system integrity fixes by providing current SMP/E HOLDDATA you can use to identify security and system integrity fixes that you might not have installed on your z/OS systems before they are marked RSU. The System z Security Portal now also provides Associated Common Vulnerability Scoring System (CVSS) V2 ratings for new APARs.[1] Because widespread specifics about a vulnerability could increase the likelihood that an attacker could successfully exploit it, and in response to many customer requests to maintain the confidentiality of any vulnerability information reported to IBM , this information is available only to registered z/OS customers who agree not to distribute it to others. IBM recommends that you visit the System z Security Portal site to get the information you need to be registered as an authorized user of this information. Visit

http://www-03.ibm.com/systems/z/advantages/security/integrity_zos.html

Also, questions can be directed to: syszsec@us.ibm.com

[1]

According to the Forum of Incident Response and Security Teams (FIRST), the Common Vulnerability Scoring System (CVSS) is an "industry open standard designed to convey vulnerability severity and help to determine urgency and priority of response." IBM PROVIDES THE CVSS SCORES "AS IS" WITHOUT WARRANTY OF ANY KIND, INCLUDING THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. CUSTOMERS ARE RESPONSIBLE FOR ASSESSING THE IMPACT OF ANY ACTUAL OR POTENTIAL SECURITY VULNERABILITY IN THEIR SPECIFIC ENVIRONMENT.

IBM DOES NOT PROVIDE A CVSS ENVIRONMENT SCORE. THE CVSS ENVIRONMENT SCORE IS CUSTOMER ENVIRONMENT SPECIFIC AND WILL IMPACT THE OVERALL CVSS SCORE. CUSTOMERS SHOULD EVALUATE THE IMPACT OF ANY ACTUAL OR POTENTIAL SECURITY VULNERABILITY AND CAN CALCULATE A CVSS ENVIRONMENT SCORE.

Additional security enhancements

In z/OS V2.1, IBM Tivoli® Directory Server (IBM TDS, LDAP) is designed to support new LDAP extended operations intended to form a foundation, enabling applications running on other systems to encrypt data transmitted over the network, and to store and use objects in ICSF. This new "crypto-as-a-service" capability is intended to enable applications to use the secure key storage capabilities of ICSF to provide centralized encryption services, including secure key encryption services while avoiding the need to expose sensitive keys in memory on either z/OS or sending systems. This new function supports a subset of common cryptographic architecture (CCA) and Enterprise PKCS#11 services, and supports CryptoExpress4S coprocessors when they are configured in Enterprise PKCS#11 mode. This is intended to help centralize key material on z/OS in a way that persists across virtual machine instances to support both active and inactive guests. IBM plans to contribute an OpenCryptoki (PKCS#11) remote cryptography provider to the open source community in 2013 that is intended to be included in Linux distributions in order to help make exploitation easier. Also, the Advanced Crypto Service Provider (ACSP) of the IBM Enterprise Key Management Foundation (EKMF) provides a client programming environment for multiple platforms. It supports both the IBM TDS crypto-as-a-service capabilities, and provides an ACSP Server that can be deployed on z/OS V2.1, z/OS V1.13, and z/OS V1.12 as well as other platforms, and makes financial industry services, and a subset of PKCS#11 programming services, available in an easy-to-consume package. For more information on System z Security Solutions, visit

http://www.ibm.com/systems/z/solutions/security.html

SAF control over the use of job classes for both JES2 and JES3 environments using new profiles in the JESJOBS class is supported. This new support is designed to provide more flexibility in job class naming, and to help eliminate the need for JES2 and JES3 user exits used solely to restrict the use of job classes to authorized users.

DB2 for z/OS 11 (5615-DB2) is designed to improve usability and consistency for security administration. z/OS V2.1 RACF , when used with DB2 11, is designed to provide consistency between DB2 and RACF access controls for bind and rebind under an owner's authorization identifier, RACF security exit support for declared global temporary tables (DGTT), and support for automatic authorization statement cache refreshes when RACF profiles are changed. This is intended to make DB2 security administration easier.

The RACF Remote Sharing Facility (RRSF) is enhanced. z/OS V1.13 introduced support for TCP/IP-based RACF Remote Sharing Facility (RRSF) connections using IPv4. In z/OS V2.1, RACF supports RRSF connections over TCP/IP using IPv6. This is intended to enable you to choose between IPv4 and IPv6 addressing when setting up RRSF connections over TCP/IP. Also, RRSF uses Application Transparent Transport Layer Security (AT-TLS) to encrypt data between RRSF nodes. In z/OS V2.1, RRSF supports the use of elliptic curve cryptography (ECC)-based certificates for establishing these AT-TLS sessions. This is intended to enable you to use stronger encryption algorithms to protect the RACF profile data transmitted using RRSF. Additionally, placing comments in RACF parameter library members is supported.

z/OS V2.1 IBM TDS (LDAP) is designed to comply with NIST SP 800-131A and NSA Suite B by supporting the TLS 1.2 protocol; additionally, support has been added for the TLS 1.1 protocol. IBM TDS and TLS 1.2 provide support for the SHA-256 and SHA-384 algorithms for SSL handshakes, and for AES-GCM ciphers. This is intended to provide better security for LDAP, particularly when used as a user registry, and to help you meet industry standards for security protocols.

Currently, z/OS System SSL supports validation of certificates according to RFC 2459 "Internet X.509 Public Key Infrastructure Certificate and CRL Profile" and RFC 3280 "Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile," and is designed to create certificates according to RFC 3280. An additional RFC, RFC 5280, has been created to update standards for certificates. In z/OS V2.1, certificate validation processing is extended to encompass three modes of certificate validation. These modes are intended to enable certificate validation to be performed according to RFC 5280, RFC 3280, or RFC 2459.

In z/OS V2.1, a number of additional digital certificate processing enhancements are available. The system is designed to support:

- The generation of Extended Validation (EV) X.509 digital certificates in PKI Services.
- The IBM HTTP Server based on Apache for serving PKI web pages.
- Improved display certificates for RACF certificates, certificate chains, and key rings.
- RACF is designed to enhance certificate request processing for certificates issued by external Certificate Authorities to help ensure that the private keys associated with the fulfilled certificates are not inadvertently deleted.
- A PKI Services option to issue a message when certificate revocation list (CRL) processing has ended. This can enable you to automate follow-on actions such as CRL archival.
- Optional, more granular administrative authority controls for PKI Services administrative functions.

In z/OS V2.1, z/OS UNIX System Services is designed to support a new BPXPRMxx parmlib member parameter that enables you to specify whether a user who is logged in using rlogin, telnet, or the TSO OMVS command should be logged off the system after a period of inactivity at the user's terminal. This new function is intended to help you improve system security.

In z/OS V2.1, the system is designed to issue a message when you use a Server Timer Protocol Coordinated Timing Network and an External Time Source to obtain standard time, and specify a maximum time variance between Coordinated Universal Time (UTC) and the hardware Time of Day (TOD) clock. This new function is intended to help stock exchange members meet Securities and Exchange Commission (SEC) rules for record timestamps for the Order Audit Trail System (OATS).

RACF health checks

These RACF health checks available in z/OS V2.1 are designed to:

- Check additional resources in the RACF_SENSITIVE_RESOURCE health check, including FACILITY class profiles that control the use of functions that affect the content of the active APF, link, and LPA lists; allow access to system dump data; and allow access to certain z/OS UNIX System Services functions. These additional checks are intended to alert you about potential security exposures on your systems.
- Determine whether RACF databases have been upgraded to application identity mapping (AIM) stage 3 as recommended. This check is also available for z/OS V1.12 and z/OS V1.13 with the PTF for APAR OA37164.
- Determine whether RACF will automatically assign unique z/OS UNIX System Services identities when users without OMVS segments use certain UNIX services. This check is also available for z/OS V1.12 and z/OS V1.13 with the PTF for APAR OA37164.
- Detect that a trusted certificate connected to one or more key rings is due to expire within a time period you specify. This is intended to help alert you of pending certificate expiration in time to enable you to take an action to prevent applications that rely on valid certificates from failing.

In z/OS V2.1, the RACF database unload utility, IRRDBU00, is extended to unload additional information about digital certificates, including the issuer and subject distinguished names (DN) and signature algorithm for each certificate. This is intended to help you more easily perform auditing-related activities for the digital certificates stored in your RACF databases.

z/OS V2.1 RACF is enhanced to enable you to specify &RACUID in the home directory path name of the model user ID used for BPX.UNIQUE.USER to help simplify system administration for z/OS UNIX user IDs. This function is also available for z/OS V1.12 and V1.13 with the PTF for APAR OA42554, to help those using BPX.DEFAULT.USER convert to BPX.UNIQUE.USER before migrating z/OS V2.1.

ICSF and cryptography-related enhancements

Advances in cryptography available on IBM zEnterprise EC12 (zEC12) and zEnterprise BC12 (zBC12) servers available for z/OS V2.1 are also available for z/OS V1.12 and z/OS V1.13 with the Cryptographic Support for z/OS V1R12-V1R13 web deliverable, available at

http://www.ibm.com/systems/z/os/zos/downloads/

ICSF function included in the z/OS V2.1 base

These new ICSF functions included in the z/OS V2.1 base are intended to help banking and finance sector clients meet standards and provide better cryptographic security with:

- Support for Derived Unique Key Per Transaction (DUKPT) for message authentication code (MAC) and data encryption keys. This support is intended to be compliant with the ANSI X9.24 part 1 Retail Financial Services Key Management standard, and intended for the symmetric key management used for financial services such as automated teller machine (ATM) transactions.
- Support for a new Cipher Text Translate CCA function designed to process sensitive data encrypted under one key by re-encrypting under another key within the boundary of the Crypto Express coprocessor. This support is designed

to provide the ability to securely change the encryption key of encrypted data without exposing it in plain text. This is designed to help to improve the security of sensitive data.

- In order to comply with industry cryptographic standards, including ANSI X9.24 Part 1 and PCI-HSM, ICSF now supports enhanced cryptographic key wrapping to help ensure that keys are not wrapped with weaker keys. This support relies on enhanced CCA firmware in the Crypto Express coprocessor and is designed to enhance the security of sensitive keys.
- A new random number cache. This cache is designed to be asynchronously replenished and is intended to improve application performance by decoupling the generation of the random data from application requests.

Similarly, ICSF has enhancements designed to provide new functions for public sector clients, including industry-standard APIs for System z for better interoperability with other platforms to help improve application portability and simplify system setup:

- The Crypto Express4S coprocessors support a new mode where the Crypto Express4S may be configured in Enterprise PKCS #11 mode that provides secure key PKCS #11 services in addition to the CCA and accelerator modes of operation. RACF , z/OS PKI Services, and z/OS System SSL provide support to use this new capability. RACF supports the generation of Elliptic Curve Cryptography (ECC) and RSA secure keys using the Crypto Express4S in EP11 mode through the addition of new keywords to the RACDCERT command. Corresponding PKCS #11 secure key support for PKI Services enables the use of a secure key PKCS #11 CA certificate, and generation of secure key pairs for key generation requests and CMP requests. System SSL enables certificates with secure PKCS #11 ECC and RSA certificates to be used during a subset of the SSL/TLS handshakes and through its Certificate Management APIs supporting the generation of digital signatures. This new function is designed to provide the cryptographic services and assurance needed to meet the European Union's requirements for Qualified Digital Signatures and is used in the secure digital identities.
- ICSF setup for FIPS verification processing at the application level has been simplified. Cryptographic requests for FIPS 140-2 compliant key processing can be issued by applications. A new option has now been added to enable applications to request a random number be generated in a FIPS-compliant fashion as well. Processing these requests no longer requires the ICSF FIPS start option FIPSMODE to be set to YES, or requires it to be set to COMPAT with the corresponding RACF profiles defined in the CRYPTOZ class. This is intended to help simplify setup for individual applications and programs that must run in a FIPS-compliant mode.

ICSF is designed to improve I/O performance for the public key data set (PKDS) and PKCS #11 token key data set (TKDS), and to provide a random number cache to help improve performance for applications that use random number generation functions.

ICSF function available on the web

In addition to the functions above, these new ICSF functions, available in the Cryptographic Support for z/OS V1R13 -- z/OS V2R1 web deliverable, are intended to help banking and finance sector clients meet standards and provide better cryptographic security with designs for:

- Support for emerging standards for American Express , JCB, MasterCard, and Visa payment systems (EMVCo) in CCA-based callable services for key management, generation, transport, and derivation. This support relies on enhanced CCA firmware in the CryptoExpress3 coprocessor with a minimum microcode level and on the CryptoExpress4S coprocessor.
- Enhanced support in the Remote Key Export callable service to allow you to specify the desired key-wrapping method to be used for key generation and transport. This support relies on enhanced CCA firmware available with a minimum microcode level for the CryptoExpress3 and CryptoExpress4S coprocessors.

- Support for AES MAC enhancements to the Symmetric MAC Generate and Symmetric MAC Verify callable services, allowing for key lengths greater than 128 bits for XCBC-MAC processing.
- Support for these frequently used User Defined Extensions (UDX) callable services into the CCA firmware base support expected to help you reduce costs associated with UDX maintenance. This support, which relies on enhanced CCA firmware available with a minimum microcode level for the CryptoExpress3 and CryptoExpress4S coprocessors, is designed to provide these services:
    - Recover PIN From Offset, which can be used to calculate the encrypted customer-entered PIN from a PIN generating key, account information, and an IBM-PIN0 Offset.
    - Symmetric Key Export with Data, which can be used to generate an authentication parameter (AP) and return it encrypted using a supplied key.
    - Authentication Parameter Generate, which can be used to export a symmetric key, along with application-supplied data, encrypted using an RSA key.

Additional ICSF enhancements in Cryptographic Support for z/OS V1R13 - z/OS V2R1 are designed to provide new functions for public sector customers, including industry standard APIs for System z , intended to provide better interoperability with other platforms and help improve application portability and simplify system setup:

- Enhanced Enterprise PKCS #11 mode support designed to add secure key support for the Diffie-Hellman, Elliptic Curve Diffie-Hellman, and RSA-PSS algorithms and Secure DSA Domain Parameter Generation.
- Support for Enterprise PKCS #11 applications, intended to allow them to change a key's compliance mode using the Set Attribute Value function
- Support for ECC keys generated using Brainpool curves while executing in FIPS mode

These enhancements rely on enhanced EP11 firmware available with a minimum microcode level for the CryptoExpress4S coprocessors.

Lastly, Cryptographic Support for z/OS V1R13 - z/OS V2R1 has enhancements designed to optionally allow for improved performance of applications that call the One Way Hash and Random Number Generate services, provide improvement with cryptographic processor configuration, provide improved CTRACE implementation greatly enhancing the ability to debug problems, provide a new callable service to retrieve status information about the cryptographic environment as known to ICSF without requiring SAF authorization or calling any cryptographic processors, and update the key records in the Key Data Stores to contain usage information.

Secured networking

Today's enterprise environment accesses data from many untrusted network sources, such as from mobile devices or from social computing sites. As a result, companies are paying more attention to defending their networks, to protecting their data, and to authenticating users and business partners. Both z/OS Communications Server and z/OS security functions help you meet this security challenge, with layered network defenses that help protect your critical business assets from unauthorized use.

Networking enhancements for z/OS V2.1 are targeted to help strengthen the use of z/OS as a secured networking hub:

z/OS V2.1 and zEC12 and zBC12 systems with the 10 GbE RoCE Express feature are designed to support a new communications protocol, Shared Memory Communications-RDMA (SMC-R). This new protocol is designed to provide low-latency, high-bandwidth cross-server connections for applications by providing RDMA communications to TCP endpoints over RoCE (RDMA over Converged Ethernet) in a manner intended to be transparent to socket applications. This is expected to provide a significant performance benefit compared to standard TCP/IP communications over the Open Systems Adapter (OSA). RMF is designed to collect measurement data for tuning and capacity planning in new SMF 74 subtype 9 records, and display them in a new RMF Postprocessor PCIE Activity report.

System SSL provides support for the TLS V1.2 protocol. TLS V1.2 adds support for exploiters to utilize higher-strength cryptographic ciphers defined in RFCs 5246, 5288, and 5289, which allow for the use of SHA-256 and SHA-384 hashing, and of ciphers utilizing the AES-GCM symmetric algorithm during the TLS handshake and application payload exchange. This support is also available on z/OS V1.13 with the PTF for APAR OA39422.

System SSL provides support for NSA Suite B Profile for Transport Layer Security, as defined by RFC 5430 for TLS V1.2. This is intended to meet US government cryptographic algorithm policy for national security applications.

In z/OS V2.1, Communications Server supports the new cryptography suites implemented in TLS, and used by System SSL, in Application Transparent Transport Layer Security (AT-TLS). This is intended to enable these new cipher suites to be used to encrypt application traffic through system programmer-defined policy without application changes.

In z/OS V2.1, Communications Server supports two new security exits for the z/OS FTP client. This is designed to help provide more control over FTP file transfer activities. An EZAFCCMD exit is designed to enable inspection, modification, and rejection of FTP commands, and the cancellation of FTP client sessions. An EZAFCREP exit is designed to enable inspection of reply message lines from FTP servers and cancellation of FTP client sessions.

Sysplex-wide security associations (SWSA) are intended to enable IPSec-protected traffic to be distributed through a Parallel Sysplex while maintaining end-to-end security to all endpoints within the sysplex. In z/OS V2.1, SWSA is extended to provide support for IPv6. This is intended to preserve the benefits of SWSA when you use IPv6 in a Parallel Sysplex .

In z/OS V2.1, z/OS Communications Server introduces configuration settings to enable control over the level of caching used for network access control checks. A reduction in the level of caching enables more network access control checks to be passed to the System Authorization Facility (SAF), thereby enabling the security manager product to provide more meaningful auditing of access control checks. Additionally, z/OS V2.1 Communications Server adds the IP address the user is attempting to access to the log string provided to the external security manager on each network access control check.

z/OS Communications Server provides a configuration option to limit the number of defensive filter messages written to syslog when defensive filtering is enabled through the Defense Manager Daemon (DMD).

z/OS V2.1 Communications Server is designed to provide enhanced diagnostics for the IKE and NSS daemons as well as the AT-TLS function when FIPS 140 processing is required. New messages indicate ICSF status during IKED and NSSD initialization, and during the installation of AT-TLS policy groups. Furthermore, IKED and NSSD are designed not to initialize when ICSF is not active; and AT-TLS policy groups are designed to be installed but left inactive when ICSF is not active.

Also, in Communications Server, the Intrusion Detection Services fragmentation attack detection algorithm is enhanced to reduce false positives in networks with small packet fragments and also to apply to IPv6 traffic.

System integrity

IBM reaffirms its commitment to z/OS System Integrity for z/OS Version 2.

First issued in 1973, IBM's MVS™ TM System Integrity Statement, and subsequent statements for OS/390® and z/OS , has stood for nearly four decades as a symbol of IBM's confidence in and commitment to the z/OS operating system.

IBM's commitment includes design and development practices intended to prevent unauthorized application programs, subsystems, and users from bypassing z/OS security; that is, to prevent them from gaining access, circumventing, disabling,

altering, or obtaining control of key z/OS system processes and resources unless allowed by the installation. Specifically, z/OS System Integrity is defined as the inability of any program not authorized by a mechanism under the installation's control to circumvent or disable store or fetch protection, access a resource protected by the z/OS Security Server (RACF), or obtain control in an authorized state; that is, in supervisor state, with a protection key less than eight (8), or Authorized Program Facility (APF) authorized. In the event that an IBM System Integrity problem is reported, IBM will always take action to resolve it.

IBM's long-term commitment to System Integrity is unique in the industry, and forms the basis of the z/OS operating system's industry leadership in system security. z/OS is designed to help you protect your system, data, transactions, and applications from accidental or malicious modification. This is one of the many reasons IBM System z remains the industry's premier data server for mission-critical workloads.

Management and usability capabilities

Unlike platforms that are optimized for one type of workload, a key strength of z/OS workload management is the ability to run multiple disparate workloads concurrently, within and across images, even when they have competing resource requirements. z/OS V2.1 is designed to allow System z servers to run at utilization levels as high as 100%. System z and z/OS provide dynamic workload management that helps you achieve your service levels by assigning resources to workloads and workloads to resources automatically. With its ability to intelligently manage workloads, improve performance, and optimize resource allocations, z/OS can help you meet your most demanding processing priorities. These z/OS built-in management capabilities are designed to help bolster efficiency, availability, and throughput while meeting your most demanding application and business processing priorities. In addition, z/OSMF V2.1 enhancements are designed to help with the standardization of common processes, helping improve the quality of your software management activities.

For example, z/OS V2.1 and z/OSMF include the following enhancements:

- z/OSMF V2.1 use of the Liberty profile in WebSphere Application Server for z/OS , V8.5 is intended to provide significant reductions in resource requirements.
- The z/OSMF V2.1 Software Management application is extended to help you better manage your z/OS software inventory and to provide a number of new reporting and display capabilities.
- Support for IBM Batch Programming Model, similar to that of WebSphere Compute Grid, is designed to enable Java Applications to be written to a standard model that helps make them more portable.
- Support for new XL C/C++ instructions and facilities on the IBM zEC12 and zBC12 systems with new ARCH (10) and TUNE (10) options is intended to improve optimization of code on zEC12 and zBC12 systems; also new functions to support transactional execution are intended to deliver increased performance through reduced locking.
- Improved Symbol processing in JCL in JES2 environments is expected to help ease programming efforts.

Additional function, descriptions, and details in support of optimization and management capabilities for z/OS V2.1 include:

Systems management

DFSMShsm Fast Replication is enhanced to add support for consistency groups, data set recovery to different volumes, and data set recovery to differently named data sets. The consistency group support is designed to enable DB2 users to create consistent backups of log copy pools. This is intended to allow you to clone DB2 systems without performing conditional DB2 restarts under most circumstances and make it easier to perform conditional restarts during system restores. The support for recovering data sets to different volumes is intended to avoid out-of-space conditions that can occur during recovery when one or more volumes no

longer have enough space for the data sets being recovered. Support is provided for recovering both VSAM and non-VSAM data sets with different names. Finally, DFSMShsm recovery, including the RECOVER command, is designed to support VSAM data set recovery from full-volume dumps to differently named data sets, in addition to the existing support for logical dumps. This is intended to help improve the usability of recovery commands by removing the need to rename an existing VSAM data set prior to using the commands.

In z/OS V2.1, two DFSMShsm processing improvements are provided. First, DFSMShsm is designed to improve performance when migrating data to both tape and disk devices by increasing the multitasking level when a new SETSYS command is specified. This improvement is expected to be greatest when moving a large number of small data sets to tape. It is intended to reduce the elapsed time required to migrate large numbers of small data sets significantly. Second, DFSMShsm has removed its 40-volume limit for migration and backup, and enables you to use up to 254 tape volumes. This is intended to enable you to migrate and back up larger data sets, particularly when using the typically small tape volume sizes configured for virtual tape subsystems.

In z/OS V2.1, zFS file system processing and DFSMSdss are changed to help reduce unnecessary backups for mounted file system data sets. This function is designed to set an indication that a file system has changed, allow its use in DFSMSdss dump command filtering to back up changed file systems, and reset it after a successful dump.

These Workload Manager (WLM) enhancements are provided for z/OS V2.1:

- WLM supports new types of classification groups and qualifier types, and enhanced qualifier types, that you can use in WLM service definitions. This is intended to enable you to define classification rules for qualifiers such as subsystem parameter (SPM) in a way more consistent with how other classification rules are defined, and help you improve the readability of WLM service definitions.
- WLM supports up to 3,000 application environments, up from the prior limit of 999. This is intended to make it easier to maintain common service definitions for multiple sysplexes and to provide support for the growth of large DB2 environments. Customers with large SAP DB2 environments or who use common WLM service definitions across a number of sysplexes are expected to be able to benefit from the raised limit.

In z/OS V2.1, these RMF enhancements are provided:

- RMF is designed to offload a portion of its processing to zIIP processors, when zIIP processors are installed and configured for a z/OS LPAR that is part of a Parallel Sysplex .
- A new interrupt delay time measurement is available on zEC12 and zBC12 systems. With z/OS V2.1, RMF is designed to report on interrupt delay time to help you determine whether I/O processing delays are occurring. This new measurement is designed to measure the time between when primary status is presented to the channel subsystem and when the operating system clears the primary status to begin processing the interrupt. RMF is also designed to write this information to new fields in SMF type 74 subtype 1 and SMF 79 subtype 9 records, and to display averaged interrupt delay times in the Postprocessor Device Activity report. These functions are also available for z/OS V1.12 and V1.13 with the PTF for APAR OA39993.
- RMF is designed to provide additional information about Global Mirror collisions in RMF Monitor I and in SMF 74 subtype 5 records. A Global Mirror collision happens when a consistency group is in the process of being mirrored and an update to one of the volumes occurs. The update must sometimes wait for the original data to be mirrored, which can cause I/O write delays. This support is also available on z/OS V1.12 and z/OS V1.13 with the PTF for APAR OA40376.
- New RMF function enables the Monitor I Postprocessor Coupling Facility Activity report and the Monitor III CFSYS report to be used to provide additional information about the coupling facility and CF links. This design extends both to

indicate channel path details for each of the Coupling over InfiniBand (CIB) link types, including:

- Indication whether the CHPID is running in a "degraded" status
- Channel path type
- HCA adapter and port number
- Calculated length of each of the links

  This information is intended to help with monitoring and tuning of the Parallel Sysplex . This support is also available on z/OS V1.12 and z/OS V1.13 with the PTF for APAR OA37826.

- With z/OS V1.13 and z/OSMF V1.13 (5655-S28), RMF provided CIM-based performance data gatherers for Linux on System z , Linux on System x , and AIX systems to provide a consistent monitoring solution for zEnterprise ensembles. Along with the Resource Monitoring plug-in for the z/OS Management Facility, first made available with z/OSMF V1.12, this function is intended to display performance metrics from those platforms and combine them with z/OS metrics in common graphic views. In z/OS V2.1, this capability is extended by providing new SMF 104 Records to provide performance-related information about Linux on System z , and also about Linux on System x , AIX , and Windows Server 2008 operating systems running on zBX blades. This is intended to help provide the basis of performance and capacity planning management for these operating systems on zBX blades in addition to the support already provided by z/OS related SMF records. Windows Server support requires the Standards Based Linux Instrumentation for Manageability CIM client API, which is part of the IBM Systems Director Platform Agent for Windows . This function can be downloaded at

  http://www.ibm.com/systems/software/director/downloads/agents.html
- In z/OS V2.1, a number of RMF reporting enhancements are provided for 1 MB pages and Flash Express . The RMF Monitor I Paging Activity and Virtual Storage Activity reports, Monitor I and Monitor II Page Data Set Activity reports, and Monitor III STORM display provide additional information intended to help you manage both fixed and pageable 1 MB pages and Flash Express . This function is also available on z/OS V1.13 with the PTF for OA38660 when the Flash Express feature is installed on IBM zEC12 and zBC12 systems and the z/OS V1R13 RSM Enablement Offering web deliverable is installed.

In z/OS V2.1, several OAM enhancements are intended to improve tape performance by supporting larger block sizes for tape, enable you to remove unneeded backup copies of your objects automatically, enable the OSREQ Store Sequence support on smaller object sizes, improve OAM interoperation with products such as IBM Tivoli Automated Tape Allocation Manager for z/OS (ATAM, 5698-B15), and enable you to tune tape library operations through a new SETTLIB command option in the CBROAMxx PARMLIB member. OAM is designed to:

- Support larger tape block sizes with OAM's object support
- Enable you to specify that backup copies of your objects be deleted automatically when an object is moved to a management class that requires fewer backup copies
- Enable you to specify how long OAM's object support should wait before issuing a message when no tape devices are available
- Reduce the minimum object size required to utilize the OSREQ Store Sequence processing from 256 MB + 1 (268,435,457 bytes) to 50 MB + 1 (52,428,801 bytes)
- Enable you to control the issuance of your tape library cartridge entry messages through the new SETTLIB command option in the CBROAMxx PARMLIB member

z/OS V2.1 supports the use of the Hardware Management Console Integrated 3270 Console on System z and zEnterprise servers as a z/OS console during and after IPL. This capability is intended to add another backup console and to enable z/OS LPARs to be operated without OSA-ICC 3270 connections when necessary.

In z/OS V2.1, a number of usability and performance improvements are provided for the z/OS FICON Discovery and Auto Configuration (zDAC) function. These include improved support for Dynamic Channel Path Management (DCM) for FICON channels, improved processing of device number-constrained configurations and those with constrained unit addresses for specific channels, a new capability to enable you to specify switch and CHPID maps to guide path selection, and improved discovery performance. z/OS V2.1 enhances z/OS FICON Discovery and Auto Configuration (zDAC) to discover directly attached storage devices, in addition to those connected to a switch. This is expected to be especially useful for small I/O configurations that do not require a switch, making z/OS I/O definitions easier in those environments.

z/OS V2.1 supports a new DISPLAY PPT command. This support is designed to enable you to see the currently assigned program properties in use by the system and whether each originated in the system's default program properties table or was the result of an entry in a SCHEDxx member of parmlib.

In z/OS V2.1, Communications Server provides a new command to enable you to validate the syntax of statements in your TCP/IP profile. This is intended to help you find any errors in the profile that might exist before making configuration changes, which can help prevent network problems from occurring.

z/OS V2.1 Communications Server is designed to provide additional flexibility in configuring Enterprise Extender by allowing progressive mode ARB to be configured on the GROUP definition in the switched major node. Additionally, z/OS Communications Server is designed to enhance your ability to configure an IPv6 address for an EE connection by allowing the IPADDR parameter to accept either an IPv6 address or an IPv4 address.

Dynamic channel path management (DCM) for FICON channels was introduced in z/OS V1.11 with support for a single intermediate FICON switch between the channel and control units. In z/OS V2.1, z/OS is designed to enhance DCM to support FICON channel path connections through two intermediate switches. This is intended to make it easier for you to use a smaller number of channels and optic fiber connections for FICON I/O, particularly for multi-site installations.

z/OS V2.1 is designed to detect discrepancies in control unit response time and in I/O rates for different channel paths, and issue messages to help you diagnose problems that might exist in the fabric. Two new health checks are intended to detect these problems by checking periodically. Also, DISPLAY MATRIX command support is designed to help you obtain fabric health-related information so you can diagnose problems more easily. This function is also available on z/OS V1.12 and z/OS V1.13 (5694-A01) with the PTFs for APARs OA40548, OA40037, and OA38303.

z/OS V2.1, with DS8700 control units and a minimum microcode level, is designed to improve first failure data capture for certain errors that result in an unplanned Hyperswap by exploiting a new DS8700 capability for collecting control unit state data nondisruptively. Support is also planned for collecting control unit state data in the SLIP command to provide additional diagnostic capabilities.

In z/OS V2.1, DFSMSrmm adds support enabling you to specify retention periods for tape data sets set using SMS management classes. This support is intended to set the resulting expiration dates automatically. Also, DFSMSrmm is designed to extend EXPDT-based retention management to allow it to be based on volume sets or first files, and to support expiration of tape data sets after a specified period of inactivity based on when they were last used.

In z/OS V2.1, support for the TS7700 Virtualization Engine's device allocation assistance (DAA) and scratch allocation assistance (SAA) functionality is provided for JES3-managed tape devices. This support is designed to enable you to use esoteric names specified in HCD and in JES3 initialization statements to enable JES3 to differentiate between composite and distributed library "clusters" during main device scheduling, and select the most appropriate devices to satisfy tape allocation requests for the TS7700 Virtualization Engine.

The Problem Documentation Upload Utility is enhanced to support partitioned data sets (PDS), partitioned data set extended data sets (PDSE), and undefined record format (RECFM U) data sets. This is intended to improve the usability of the utility when sending large amounts of documentation data to IBM for problem diagnosis.

The CIM Server is upgraded to a newer version of the OpenPegasus CIM Server. Also, the CIM Servers Schema repository is updated to CIM Schema version 2.31, and the CIM Client for Java to version 2.1.10. This is intended to keep the z/OS CIM Server and schema current with the CIM standard from OpenGroup and DMTF, and to allow z/OS management applications to manage z/OS in an enterprise environment.

Application development

z/OS V2.1 XL C/C++ supports new instructions and facilities available on zEC12 systems with new ARCH(10) and TUNE(10) options, designed to optimize code for zEC12 and zBC12 systems. These options support the execution-hint, load-and-trap, miscellaneous-instruction-extension, and transactional-execution facilities. Also, new hardware built-in functions support transactional execution on zEC12 and zBC12 systems. These functions can be used to provide two-phase commit processing for multiple memory updates without using software locking. These functions are also available for prototyping and testing purposes on z/OS V1.13 with the PTFs for APARs PM59592, PM59593, PM59589, and PM59595.

z/OS V2.1 XL C/C++ enhancements include:

- z/OS V2.1 XL C/C++ introduces nine new debug level options, designed to enable you to make different trade-offs between optimization and ease of debugging, making it easier to generate fast code that can still be easily debugged.
- z/OS V2.1 XL C/C++ is designed to support additional features of the C11 standard, including complex type creation, static assertions, and the "does not return" function attribute to indicate that a function does not return under the EXTC1X language level. Additional support for features of the C++11 standard also includes explicit conversion operators, strongly scoped enums, rvalue references, and the right angle brackets function. These C11 and C++11 functions are designed to allow a standardized way to specify optimization choices, make it easier to write C and C++ programs, improve program portability, and help you with debugging.
- z/OS V2.1 XL C/C++ is designed to provide support for a named, non-"main" function to have the same setup as the main function, and for interprocedural analysis (IPA) performance enhancements for code with mixed addressing modes (AMODEs). These enhancements are intended to provide more flexibility for developing Metal C applications and help improve program performance.
- z/OS V2.1 XL C/C++ introduces the INCLUDE compiler option. You can use this option to specify that an include file be inserted at the beginning of every source file compiled. This option is designed to make it simple to customize a program with special environments and library header paths without requiring source code changes.
- The dbx debugger acts on information created by compilers. For the C and C++ languages, the process of optimization transforms the original program in a way that makes progressively less information available for source code level debugging as the optimization level is increased. This can make it difficult to achieve a balance between application serviceability and performance. In z/OS V2.1, the XL C/C++ compiler is designed to provide additional information for the debugger to use to make it easier to perform source code diagnosis. This is intended to allow higher levels of optimization to be used while preserving better levels of application serviceability.

z/OS V2.1 XML System Services provides new control options for the programming interface that you can use to obtain additional information about parsing errors, in addition to the existing return and reason codes. This new information is intended to help you find the source of errors more easily.

In z/OS V2.1, a new base element includes the fonts that are included in the AFP Font Collection for S/390® (5648-B33), in IBM Infoprint Fonts for z/OS , V1.1 (5648-E76), in the Compatibility Fonts feature of IBM Print Services Facility™ V4.4 for z/OS (5655-M32), and the World Type fonts that were not previously available in the z/OS environment but form part of the InfoPrint Font Collection V3.1 available for other operating system platforms, and double-byte Asian fonts. This is intended to eliminate the need to include font products and features in z/OS orders and assure that fonts are always available on z/OS systems.

The following JCL improvements are provided:

- Support for passing parameter lists up to 32,760 bytes in length to a program from JCL. A new PARMDD keyword is supported for the EXEC statement to allow you to pass more than 100 characters of parameter data to any program in JCL. A new LONGPARM binder option allows you to specify that APF-authorized programs may use this new function. No changes are needed for unauthorized programs. This new support is intended to make it easier to pass a large number of parameters to a program without writing intermediate programs.
- Enhancements for symbol processing in JCL in JES2 environments. This new function is designed to make both JCL and system symbols available during job execution. For example, you can specify that symbols be used in instream data sets, such as SYSIN data sets, and that symbols be retrieved from the system using new programming services. This support is intended to make symbols more usable and accessible and to make it easier to use identical copies of JCL in multiple environments.
- Support for the use of exported JCL symbols that are accessible in other contexts, including programmatic access. A corresponding function is available for Language Environment .
- Support for new, JES-independent JCL specifications. New SYSTEM and SYSAFF keywords for the JOB statement enable you to specify z/OS MVS system names, JES2 MAS member names, and JES3 main system names. Both job entry subsystems are designed to direct the job to an appropriate system. As with a number of other recent JCL-related improvements, these changes are intended to make it easier to write JCL that can run unchanged under both primary subsystems, JES2 or JES3, by reducing the need to use JES-specific Job Execution Control Language (JECL) statements.
- JES2 adds support enabling you to specify the JES2 procedure library concatenation to be used for a job with a new PROCLIB keyword for the JCLLIB statement, improve OUTPUT processing with new MERGE and DDNAME keywords you can use to specify job-level and step-level defaults and that an OUTPUT statement be used for multiple SYSOUT data sets, and optional improvements in converter/interpreter processing designed to provide earlier detection of JCL errors.
- JES3 supports in-stream data sets in cataloged procedures and INCLUDE groups. This is intended to enable you to simplify the JCL used in PROCs by using in-stream data sets in place of those pointed to by DD statements that use the DSN keyword.
- z/OS V2.1 JES2 and JES3 support the use of system symbols in JCL for batch jobs. This is intended to make it easier to write JCL that is usable in an unchanged form when run on different systems.

z/OS V2.1 Language Environment enhancements include:

- Support for multiple preinitialized main environments under a single task. This is intended to enable you to call main routines in one preinitialized environment from another, and take advantage of multiple persistent preinitialized environments to improve application performance.
- Support for a new option programmers can use to expose memory overlays that cause heap damage. A new HEAPZONES runtime option is designed to enable you to specify that each storage area requested have a check zone appended to it. This function is designed to enable you to specify that Language Environment either detect that a program has stored data in the check zone to help you find problems that might otherwise be more difficult to identify or that storing data

within check zones be ignored. This new function is intended to help you test your application code that uses Language Environment .

- Support for a new callable service designed to provide programmatic access to the value of a specified JCL symbol. This is intended to provide another way to pass information to running programs from JCL.
- Support for reading, writing, and repositioning of data sets by blocks in the Language Environment C runtime library I/O interfaces. Allowing the program to access data by blocks, rather than by bytes or records, is intended to provide significant performance improvements when there is no need to manipulate data within the blocks.
- Additional file I/O programming interfaces for z/OS UNIX System Services. These interfaces, while not part of a formal UNIX standard, have been implemented on other UNIX platforms, and are provided with a new header, <stdio_ext.h>. This is intended to make it improve the portability for these applications between z/OS and other UNIX platforms.
- Support for new functions to convert multibyte Unicode encoded data to wide character data. Four new conversion services are provided to perform these conversions between data encoded as char16_t and char32_t, and CCSIDs supported by z/OS Unicode.

In z/OS V2.1, memory management services are enhanced. 31-bit large (1 MB) page support is designed to provide additional authorized subpool support, CPOOL support, and dataspace support. Exploitation of this function by certain kinds of memory-intensive applications is expected to help improve system performance by relieving memory management constraints. Also, the real storage manager (RSM) supports requests for 128 KB blocks using the IARST64 service. This can reduce the number of calls to the service for programs that need to obtain a large number of blocks.

In z/OS V2.1, SYSREXX supports additional functions that are available when using REXX under TSO/E. Support for the CONSOLE host command environment enables you to issue system and subsystem commands and monitor message traffic with an extended MCS console session in a SYSREXX exec such as one intended to provide system automation functions.

In z/OS V2.1, BCPii is designed to reduce the time it takes to perform queries significantly when multiple attributes are requested for a CPC, image, capacity record, activation profile, or image user group on IBM System z9 , System 10, and zEnterprise servers. Also, BCPii uses this function when processing calls for the HWILIST service. This is expected to yield performance benefits that are most noticeable for interactive system management applications.

BCPii supports a System REXX (SYSREXX) API. This is intended to make it easier to use BCPii services in system management applications.

In z/OS V2.1, the Program Management Binder supports the exact boundary alignment specified in object modules (GOFF only), control statement, binder APIs, and program objects for all powers of two from byte alignment through 4K page alignment when binding or re-binding program objects and load modules. This is intended to enable programmers to better optimize code and data structures to improve cache alignment, which can help improve performance of customer applications. Also, the binder supports a new SYMTRACE option to provide information about symbol resolution processing. SYMTRACE is intended to provide additional information about a specified symbol, such as where it is defined and referenced, and which data sets and members, objects, and libraries were used. This is expected to help you determine from where a symbol was resolved or why it was not resolved.

In z/OS V2.1, DFSMS provides support for using generation data groups (GDGs) comprising PDSE generation data sets. This support, similar to existing GDG support for PDS data sets, is intended to enable you to extend your use of PDSEs.

Several usability enhancements have been made to DFSORT. DFSORT is designed to support new alphanumeric tests for both compare fields and parse fields, including combinations of alphanumeric character sets (uppercase and lowercase,

and numeric). This support is intended to enable you to specify various sets of characters using a single compare condition or PARSE keyword rather than using compare conditions or PARSE keywords. Also, enhancements are available for symbol processing, allowing symbols to be used for more DFSORT operands. The number of parse fields supported is increased from the prior limit of 100 fields to 1,000 fields. Finally, new support enables you to specify that a string up to 50 characters in length be appended to variable-length output records.

In z/OS V2.1, both JES2 and JES3 provide support to return data in 64-bit storage for SSI 80 (Extended Status) callers.

In z/OS V2.1, support is introduced for the IBM Batch Programming Model, similar to that available for WebSphere Compute Grid. This is designed to enable Java applications to be written to conform to a standard batch programming model, making them portable among the supported environments.

In z/OS V1.13, support was added to a number of z/OS UNIX System Services for many commands to enable you to edit untagged text files and have them treated as if they contained ASCII-encoded text data. This support is extended to additional commands in z/OS V2.1. In addition, z/OS V2.1 supports code pages other than EBCDIC IBM-1047 and ASCII IBM-819, including Unicode code pages, to allow conversion of files tagged with Coded Character Set IDs (CCSIDs) to CCSIDs that can be processed by a program or displayed by a user. This new function is intended to make it easier to work with text files when using z/OS UNIX .

In z/OS V2.1, the Case conversion, Collation, Character Conversion, and Normalization services in z/OS Unicode are designed to meet the Unicode 6.0 standard.

In z/OS V2.1, Unicode support is available for three Japanese Industrial Standards (JIS) for Extended UNIX Code (EUC): JIS X 0201, JIS X 0208, and JIS X 0212. This new support is designed to add three new coded character set identifiers (CCSIDs), 17338, 21434, and 37818, which collectively extend the Japanese Unicode support to include 83 additional NEC characters. Also supported is the new currency symbol used for the rupee used by the Republic of India, with CCSID 5233.

In z/OS V2.1, z/OS UNIX System Services supports a larger number of UNIX pipes. z/OS UNIX is designed to support a system maximum of 15,360 pipes, up from the prior limit of 8,730.

In z/OS V2.1, XCF introduces a new programming interface, IXCNOTE, that allows applications to create and delete "note pads." This is designed to support notes containing up to 1024 bytes of application data, and allow a connected application to create, read, modify, or delete notes in the note pad. XCF is designed to create note pads in a coupling facility list structure. This new programming interface is intended to help improve Parallel Sysplex flexibility and usability for application programmers. It is also available on z/OS V1.13 with the PTF for APAR OA38450.

z/OS V2.1 Communications Server provides these new and enhanced application programming interfaces:

- A new API to allow retrieval of configuration information for the TN3270 server. This is designed to improve the ability of network management applications to verify the best practices compliance of the z/OS CS TN3270 server.
- A new API to allow retrieval of configuration information for the z/OS FTP server and FTP client. This is designed to improve the ability of network management applications to verify the best practices compliance of the z/OS FTP server and client.
- Support for an additional network management interface (NMI) that can allow multiple independent, concurrent TCP/IP traces. This is designed to allow both real-time packet traces and data traces in a single trace data stream. With proper RACF authorization, it is also designed to enable you to include decrypted IPSec and AT-TLS data. These extensions are intended to be used by network management applications to provide additional functions.

- A mechanism that allows a sockets application to issue a synchronous or asynchronous receive socket API call that only completes when a TCP connection is terminated. This provides an application with the ability to improve performance by choosing either an asynchronous or synchronous communication model (whichever is more beneficial for the application) while assuring the ability to respond to connection termination events.
- An option to activate an interface without an IP address. This allows applications that implement a DHCP client, such as IBM Rational® Developer for System z feature (RD&T), to communicate with DHCP servers to dynamically obtain an IP address.

In z/OS V2.1, the Catalog Search Interface (CSI) is enhanced to return additional information about catalog entries. For VSAM data sets, CSI is designed to provide more information about index and data buffers, indexes, the maximum number of concurrent requests allowed, and the number of tracks per volume for VSAM data sets. CSI is designed to return additional information about data set alias entries defined using the SYMBOLICRELATE keyword.

The DFSMSdfp VSAM SHOWCB macro provides information about open VSAM data sets. In z/OS V2.1, SHOWCB is designed to return the number of buffers built and the number of buffers actually used for local shared resources (LSR) and nonshared resources (NSR). This new support is intended to help application programs to, for example, determine whether to change their LSR buffer pool sizes.

In z/OS V2.1, Distributed File Service provides SMB support for Microsoft Windows Server 2008 acting as a domain controller for pass-through authentication.

In z/OS V2.1, DFSORT provides Blockset sorting support for programs running in 64-bit addressing mode. This new function is designed to be available to programs, using new parameter lists for DFSORT applications that use E15, E35, or E32 exits to process 64-bit addressed records. 64-bit addressing support in DFSORT is expected to help relieve storage constraints for programs calling DFSORT to perform certain sort operations.

In z/OS V2.1, a new JES2 Job Modify Subsystem Interface (SSI), patterned after Extended Status, was added to allow programs without APF authorization to cancel, hold, purge, and release jobs, and to change their job classes. New profiles in the RACF JESJOBS class are used to determine whether a user is allowed to use these functions. This is intended to complement the function of the Extended Status SSI by allowing a simple way to manage jobs and to allow additional automation to be done using unauthorized programs.

In z/OS V2.1, JES3 supports ENF 70 events to provide the capability to track jobs, started tasks, and TSO/E users as they are processed by showing that their states have changed. For example, a job can have been selected for processing, completed processing, or been purged. This support is intended to allow programs to monitor job status without using repetitive Subsystem Interface (SSI 80) calls.

In z/OS V2.1, TSO/E provides a number of REXX enhancements to EXECIO, LISTDSI, and STORAGE, and provides a new variable to indicate the level of the operating system. These enhancements are intended to make it easier to retrieve information about data sets in the extended addressing space (EAS) of extended address volumes (EAVs), as well as multi-volume, PDSE, and concatenated data sets; to support I/O to undefined and spanned record format data sets; to improve the usability of EXECIO; and to eliminate unnecessary calls from LISTDSI to an external security manager, such as RACF .

In z/OS V2.1, a new authorized HISSERV service provides Hardware Instrumentation Services (HIS) data gathered from the CPU Measurement Facility available on IBM System z10 and zEnterprise servers to multiple consumers on the same system. It is also designed to provide new software-based counter data. This new service is intended to make it easier to write programs that sample counter data.

Simplification and usability

A number of enhancements are provided for z/OS V2.1 with z/OSMF V2.1:

- z/OSMF is designed to use the Liberty profile in IBM WebSphere Application Server for z/OS , V8.5. This is expected to provide significant reductions in the CPU and memory resource requirements for z/OSMF.

- The Software Management application is extended to help you manage your z/OS software inventory. This new function is designed to provide a number of new reporting and display capabilities you can use. Among them are one intended to cross-check SMP/E inventory information with catalog entries, volume residency, and data set content; another to retrieve and display end of service information about installed products; another to provide a number of reporting functions to help with service level (PTF) management, and one to display the location and content of software instances created using the Software Deployment application. These new functions are designed to help you manage your system software more easily, and are also available on z/OS V1.13 with the PTF for APAR PM73833.

- A new z/OSMF Workflow Application is designed to allow exploiters to provide configuration assistance for functional setup tasks to simplify z/OS configuration. This application is designed to route tasks among a number of defined people assigned to specific roles, such as *system programmer* and *security administrator,* to complete setup tasks.

- The z/OSMF Resource Monitoring application links to the WLM application in context, and the WLM application links to the Resource Monitoring application. This function is also available with z/OS V1.13 and z/OSMF V1.13 with the PTFs for APARs PM74517 and PM74508. The System Status task links to WLM for list entries that represent a z/OS system, such as linking to service definitions and active WLM policies, and the WLM application links to the System Status task. This is intended to simplify performance monitoring and management.

- In z/OSMF V2.1, enhancements for the capacity provisioning application are designed to replace the Microsoft Windows based Capacity Provisioning Control Center (CPCC), which is removed in z/OS V2.1. This function is also available with z/OS V1.13 and z/OSMF V1.13 with the PTF for APAR PM74519. In addition, the z/OSMF Capacity Provisioning application is enhanced to enable you to create, edit, and install domain configurations and policies. Existing reports are extended to support IFL and SAP processors in addition to CP, zIIP, and zAAP processors. These new functions are intended to improve the usability of Capacity Provisioning within z/OSMF and support all the functions available in the Microsoft Windows-based Capacity Provisioning Control Center (CPCC).

- z/OSMF V2.1 running on z/OS V2.1 is updated to provide a number of functions that are provided by z/OS components, with updates to the Workload Management, Resource Monitoring, and Capacity Provisioning applications. Also, z/OS V2.1 Communications Server with z/OSMF V2.1 provides a redesigned version of the IBM Configuration Assistant for z/OS Communications Server that replaces the Microsoft Windows based version. It helps reduce CPU consumption, supports configuration of additional policy-based networking functions, and is more consistent with the look and feel of other z/OSMF functions.

- In z/OS V2.1 with z/OSMF V2.1, the z/OS Jobs REST Interface is extended to add support for submitting jobs from data sets and z/OS UNIX files, optional asynchronous notification upon job completion, passing JCL symbols to a job being submitted, and an optional job correlator that is unique across the JES2 spool. These extensions are intended to make it easier to extend z/OS batch services to distributed environments, reuse existing JCL, and detect job completion.

- z/OSMF V2.1 is designed to provide new browser and operating system support for:

  - Firefox ESR 17 on the 32-bit version of the Microsoft Windows XP operating system, and for both 32-bit and 64-bit versions of the Windows 7 operating system

  - Both 32-bit and 64-bit Microsoft Internet Explorer 8 and 9 browsers on the 64-bit version of Microsoft Windows 7 operating system

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- The 32-bit Microsoft Internet Explorer 8 and Internet Explorer 9 browsers on the 32-bit version of Microsoft Windows 7 operating system
- The 32-bit Microsoft Internet Explorer 8 on Microsoft Windows XP operating system

With z/OS V1.13 and z/OSMF V1.13 (5655-S28), RMF provided CIM-based performance data gatherers for Linux on System z , Linux on System x , and AIX systems to provide a consistent monitoring solution for zEnterprise ensembles. Along with the Resource Monitoring plug-in for the z/OS Management Facility, first made available with z/OSMF V1.12, this function is intended to display performance metrics from those platforms and combine them with z/OS metrics in common graphic views. In z/OS V2.1, this capability is extended by providing new SMF 104 Records to provide performance-related information about Linux on System z , and also about Linux on System x , AIX , and Windows Server 2008 operating systems running on zBX blades. This is intended to help provide the basis of performance and capacity planning management for these operating systems on zBX blades in addition to the support already provided by z/OS related SMF records. Windows Server support requires the Standards Based Linux Instrumentation for Manageability CIM client API, which is part of the IBM Systems Director Platform Agent for Windows . This function can be downloaded at

http://www.ibm.com/systems/software/director/downloads/agents.html

Note: The z/OSMF V1.13 level of the ISPF task under z/OS Classic Interfaces is not supported on z/OS V2.1. However, this function is available with z/OSMF V2.1 on z/OS V2.1.

z/OS V2.1 Allocation and TSO/E are designed to provide additional information when an attempt to log on fails for a number of reasons other than user authentication failures. This information is intended to make it easier to identify and resolve the reasons for logon failures.

In z/OS V1.12, the JESXCF component was changed to allow you to log on to multiple systems within a sysplex using the same TSO/E user ID in a JES2 environment. In z/OS V2.1, the system is designed to extend this support to JES3 environments as well.

In z/OS V2.1, TSO/VTAM provides support for translating Extended English characters for the TPUT EDIT macro instruction.

A catalog parmlib member (IGGCATxx) was introduced in z/OS V1.13. In z/OS V2.1, DFSMSdfp is enhanced to add parameters for the remaining Modify Catalog command parameters, and for a number of additional specifications currently made in a SYSCATxx member of the nucleus data set or in a LOADxx member of a SYS1.IPLPARM or SYS1.PARMLIB data set that are not required early during IPL processing. These extensions are intended to make it easier to specify options for catalog processing.

In z/OS V2.1, HCD supports dynamic I/O configuration changes from a single system across all LPARs running z/OS V1.12 and z/VM® V5.4 (5741-A05) and later releases on IBM System z9 , System z10 , and zEnterprise servers that are controlled by the same Hardware Management Console. This extension to the current support that enables you to make dynamic I/O configuration changes for all the LPARs on a server that are within the same Parallel Sysplex is intended to help improve system programmer productivity by reducing the number of systems you must interact with to make these changes.

z/OS V2.1 SDSF is designed to incorporate a number of usability improvements, including support for using system symbols on the SDSF Filter command, improved print support, security access tracing, and the ability to limit sysplex displays to a JES complex's scope. Also, SDSF is designed to provide support for sorting as many as 10 columns in a display.

In z/OS V2.1, Infoprint Server enables you to move a number of customization settings from AOP environment variables to settings stored in the printer inventory, where they can be managed by the Infoprint Server Printer Inventory Manager. This is intended to make it easier to examine and change these settings and to eliminate the need to restart Infoprint Server for the changes to take effect. Also, Infoprint Server replaces most attributes in the aopd.conf file with information stored in the Printer Inventory. This is designed to enable you to use Infoprint Server's ISPF application to perform most System Administrator and Printer Administrator tasks. In z/OS V2.1, Infoprint Server adds job accounting information to SMF Type 6 records. This is intended to make it easier to write job accounting and chargeback programs that process these records.

In z/OS V2.1, SMP/E is designed to allow you to use the SMP/E dialog with multiple ISPF logical screens at a time. This provides support for any number of logical screens for reading CSI data sets and zones concurrently, and for using one logical screen per CSI data set for update. This is intended to improve the usability of the SMP/E ISPF dialog.

In z/OS V2.1, DFSMS extends the function introduced in z/OS V1.13 that enables you to specify that explanatory text for a number of DFSMS abends be included in job output. This makes it easier to determine the reasons for these errors more quickly. This function is also available in z/OS V1.13 with the PTFs for APARs OA37505 and OA37957. Also, open processing for non-SMS-managed data sets using DISP=MOD has been made consistent with the processing for that for SMS-managed data sets.

Enhancements for z/OS V2.1 ISPF are as follows:

- ISPF View and Edit are designed to allow you to view and edit data sets and z/OS UNIX System Services files encoded in Unicode, in addition to the existing support for ASCII and EBCDIC encoding. This is intended to eliminate the need to perform character conversion when operating with Unicode encoded data.
- ISPF Edit supports:
  - Longer data set names to be used with the COMPARE command and for a volume serial to be specified so the data set being edited can be compared to an uncataloged data set. This is designed to improve the usability of Edit Compare.
  - An expandable command field with a length of 255 bytes. This is designed to enable you to use a pop-up panel to enter long editor commands that do not fit in the field on the existing edit panel. In z/OS V2.1, the edit HILITE command is enhanced to highlight the invalid use of lowercase characters in JCL statements.
  - Regular expressions to be specified as arguments to the FIND and CHANGE commands.
  - External data commands designed to enable you to specify the encoding for the external data. This is designed to cause the editor to convert the external data from its original encoding to the specified encoding. For example, you could use the CUT command to have data from a file containing ASCII data stored in the clipboard as EBCDIC data.
- Support for data sets using an extended TIOT (XTIOT), when dynamically allocated and processed by ISPF services including EDIT, BROWSE, LMINIT, and LIBDEF.
- An improved enhanced member list function. When used to enter a TSO/E command, CLIST, or REXX exec to be run for a particular member, this function is designed to support passing additional information to the command, CLIST, or exec. Also, the ISPF directory list display for z/OS UNIX supports a SRCHFOR command similar to that available from member list displays. This command is designed to enable you to search for data strings in all the regular files in the currently displayed directory. Similar function is available for the UDLIST command and DIRLIST service.
- Enhanced flexibility and usability of the SWAPBAR command.

- Support for multiple logical screens to be created when you invoke ISPF. In addition, support enables you to end multiple logical screens simultaneously when exiting ISPF.
- Support for numeric scroll amounts greater than 9,999 lines when scrolling displays for browse, edit, view, member lists, and the data set list.
- The z/OS UNIX Directory List Utility now supports entry of a path name mask, designed to display only those files with a path name that matches the mask. Also, it supports the entry of block line commands in a way similar to the block line command support in the Data Set List Utility. Another enhancement to the utility is designed to save z/OS UNIX commands previously entered in the command field for the directory list so you can easily recall and run previously entered z/OS UNIX commands.
- Enhanced ISPF member list displays to show member count values greater than the current limit of 99,999.
- Support for a new DEFAULT keyword option for the MEMLIST service. This is designed to allow applications calling the MEMLIST service to define a line command to be invoked when the "S" line command is entered by the user.
- Support in the Data Set List Utility "F" line command to free unused space for a multi-volume data set.
- Support in the UDLIST command for lowercase path names. This improves the usability of the command by suppressing automatic capitalization of data entered in the command field and allowing the UDLIST command to process lowercase path names.

In z/OS V2.1, the Health Checker address space is started at IPL time, and support for a new system parameter HZS enables you to specify the HZSPRMxx members, to be used for Health Checker parameters, in an IEASYSxx parmlib member. This is intended to help assure that the information provided by health checks is available and simplifies Health Checker setup. In addition, a number of new health checks are available:

- RACF has several new or enhanced health checks, for which details can be found in the Security ready section:
  - The RACF_SENSITIVE_RESOURCE health check is designed to check additional resources.
  - A new check determines whether RACF databases have been upgraded to application identity mapping (AIM) stage 3 as recommended.
  - A new check determines whether RACF will automatically assign unique z/OS UNIX System Services identities when users without OMVS segments use certain UNIX services.
  - A new check detects that a trusted certificate connected to one or more key rings is due to expire within a time period you specify.
- A health check is designed to determine whether extended task I/O tables (XTIOTs) are enabled for non-VSAM data sets and warn you if they are not. Using XTIOTs is recommended because it provides virtual storage constraint relief (VSCR) below the 16 MB line.
- A health check helps you manage the amount of virtual storage used by the virtual lookaside facility (VLF). This is designed to enable you to specify a minimum age for VLF-cached data and notify you when the time objects that have been cached fall below that minimum. This is intended to help you choose the best settings for the MAXVIRT parameters for each class of objects specified in the COFVLFxx member of parmlib to improve overall system performance.
- Three new health checks help you find diagnostic functions that can cause performance degradation that might have been left enabled. The first is designed to warn you that branch tracing in the system trace table has been active for an extended period of time, the second to provide a similar warning for mode tracing, and the third to warn you about long-running PER SLIP traps. These functions, while sometimes necessary for problem diagnosis, can degrade overall system performance.
- IBM makes specific recommendations about what to specify in global resource serialization resource name lists (GRS RNLs) to prevent catalog-related deadlocks when using shared volumes and catalogs. A catalog health check is designed to

alert you when a deadlock condition might arise due to RNLs that do not follow the recommendations.

In z/OS V2.1, new support for the DISPLAY MATRIX=CONFIG and CONFIG CPU commands enables you to validate that the active processors (CPs, zAAPs, and zIIPs) in a configuration are of the type and number you expect. This is intended to make it easier to detect CPU-related configuration errors.

z/OS V2.1 z/OS DFSMS and Allocation processing are enhanced to enable you to specify that all the members of a generation data group (GDG) be returned in order from oldest to newest when the generation data set (GDS) name is specified without a generation number. A new GDGORDER keyword on the DD statement is intended to enable all the members of a GDG to be processed in chronological order without the records being sorted.

In z/OS V2.1, HCD is designed to use new IOS system services to perform IODF validation when Tivoli System Automation (5698-SA3) I/O Operations is not available. This is intended to provide a minimum level of validation reporting.

In z/OS V2.1, a new tracking facility, with additional function, replaces the Tracking Facility, which has also been referred to as the *Console ID Tracking Facility* and the *EAV migration assistance tracker* . For example, many migration actions require you to determine whether specific system functions are in use. This new facility is intended to enable exploiters to use a simple method to call the tracker from within their code so that you can easily determine whether specific functions are being used on each system. Also, a programming interface enables other programs, such as health checks, to determine whether tracked functions are in use. This new tracker is designed to return more information than the Consoles Tracker (CNZTRKR) when the new programming interface is used. Existing calls using the CNZTRKR interface are automatically routed to this new facility, and an operator command provides tracking information.

z/OS V2.1 Library Server is designed to extend its cross-PDF search capability to PDF documents that are part of a collection, in addition to those that are defined on an extended bookshelf. This is intended to make it easier to define collections of searchable documents. In addition, the Infocenter indexing function has been redesigned to improve performance, both for creating and using indexes, and to support preindexed Infocenters.

z/OS support for zEnterprise EC12 (zEC12) and BC12 (zBC12) systems

z/OS V2.1 provides exploitation of many of the IBM zEC12 and zBC12 features and functions, including Flash Express , hardware transactional memory, improved channel load balancing, a new I/O processing delay measurement, coupling facility write-around support, and 100-way symmetric multiprocessing (SMP) support in a single LPAR. You can use current HOLDDATA and the SMP/E REPORT MISSINGFIX command using the appropriate Fix Categories to help you identify which PTFs are needed on current z/OS systems. Some of this support is also available for z/OS V1.12 and later releases with PTFs, and z/OS V1.10 and z/OS V1.11 with the Lifecycle Extension for z/OS V1.10 (5656-A01) or the Lifecycle Extension for z/OS V1.11 (5657-A01) with PTFs.

Flash Express exploitation on z/OS is designed to help improve system availability and responsiveness by using Flash Express across transitional workload events such as market openings, and diagnostic data collection. z/OS is also designed to help improve processor performance by supporting middleware such as IMS , with its exploitation of pageable large (1 MB) pages. Exploitation is provided for:

- z/OS V1.13 Language Environment when used with the runtime option PAGEFRAMESIZE, and z/OS V2.1 when used with the PAGEFRAMESIZE and PAGEFRAMESIZE64 options.
- Java , with the IBM 31-bit SDK for z/OS , Java Technology Edition, V7.0.0 (5655-W43) and IBM 64-bit SDK for z/OS , Java Technology Edition, V7.0.0 (5655-W44). For more information about Java , see the Statements of direction section.

- The IMS Common Queue Server, which is designed to use pageable large pages for selected buffers when running IMS 12 (5635-A03) with the PTF for APAR PM66866.

Flash Express exploitation is also available with the z/OS V1R13 RSM Enablement Offering web deliverable.

z/OS V2.1 is also designed to help improve processor performance by enabling middleware to use 2 GB pages. Exploitation is provided for the IBM 31-bit SDK for z/OS , Java Technology Edition, V7.0.0 (5655-W43) and IBM 64-bit SDK for z/OS , Java Technology Edition, V7.0.0 (5655-W44). Also, along with that support, z/OS is designed to make the pageable link pack area (PLPA) and common page data sets optional, used only for quick and warm start IPLs. This support is also available for z/OS V1.13 with the z/OS V1R13 RSM Enablement Offering web deliverable and the PTF for APAR OA40967.

zEnterprise Data Compression (zEDC) for z/OS V2.1, a new priced optional feature of z/OS , running on zEC12 and zBC12 systems with the zEDC Express adapter, is designed to support a new data compression function. This facility is designed to provide high-performance, low-latency compression without significant CPU overhead. Initially, z/OS is designed to allow you to specify that SMF data written to log streams be compressed, which is expected to reduce storage requirements for SMF data and reduce SMF and System Logger CPU consumption for writing SMF data. Further support for zEDC is also planned. See the Statements of direction section for planned availability dates. Corresponding support in the SMF dump program IFASMFDL is designed to support both hardware-based and software-based decompression, and software-based decompression support is available on z/OS V1.12 and z/OS V1.13 (5694-A01) with the PTF for APAR OA41156. This new function is expected to allow higher write rates for SMF data when hardware compression is enabled. RMF support for hardware compression includes SMF Type 74 subtype 9 records and a new Monitor I PCIE Activity report intended to provide information about compression activity on the system.

z/OS V2.1 provides the industry-standard zlib library, which provides standard-compliant, cross-platform access for compressing and decompressing data. This version of the library supports the sending of compression and decompression requests to the zEDC Express . The z/OS provided zlib library is provided as a UNIX archive file that can be statically linked into IBM , ISV, or customer applications that currently use zlib, enabling additional exploitation of compression through zEDC Express and expanding potential compression opportunities.

In z/OS V2.1 with CFLEVEL 19 on zEC12 and zBC12 systems, XCF and XES are designed to allow the use of shared engine coupling facilities in many production environments with improved performance. This is intended to allow Parallel Sysplex to be implemented at lower cost in many environments by reducing the number of environments for which dedicated coupling facility (CF) engines are needed to achieve good performance. In addition, a new set of interrupts provided on zEC12 and zBC12 systems with a minimum MCL is designed to be used by z/OS to help reduce XCF and XES processing overhead and improve performance when processing asynchronous coupling facility operations and recognizing certain CF events. This support is also available on z/OS V1.12 and V1.13 with the PTFs for APARs OA38734 and OA38781.

z/OS V2.1 running on zEC12 or zBC12 systems with CFLEVEL 19 is planned to support Flash Express for certain coupling facility list structures, such as IBM WebSphere MQ for z/OS Version 7 (5655-R36), in order to strengthen resiliency for enterprise messaging workload spikes. For more information, refer to the Statements of direction section.

z/OS V2.1 and zEC12 and zBC12 systems with the 10 GbE RoCE Express feature are designed to support a new communications protocol, Shared Memory Communications-RDMA (SMC-R). This new protocol is designed to provide low-latency, high-bandwidth cross-server connections for applications by providing RDMA communications to TCP endpoints over RoCE (RDMA over Converged Ethernet) in a manner intended to be transparent to socket applications. This is expected to provide a significant performance benefit compared to standard TCP/

IP communications over the Open Systems Adapter (OSA). RMF is designed to collect measurement data for tuning and capacity planning in new SMF 74 subtype 9 records, and display them in a new RMF Postprocessor PCIE Activity report.

z/OS V2.1 is designed to provide full support for hardware transactional memory on zEC12 and zBC12 servers in production environments. Initial production-level support was provided for IBM 31-bit and 64-bit SDK for z/OS Java Technology Edition, Version 7 (5655-W43 and 5655-W44), and was introduced for z/OS V1.13 with PTFs on zEC12 and zBC12 servers. XL C/C++ and High Level Assembler (HLASM) support was also introduced on z/OS V1.13 with PTFs for code developing and testing. z/OS V2.1 is designed to support the use of hardware transactional memory for programs developed using Java , XL C/C++, IBM Enterprise COBOL for z/OS , V5.1 (5655-W32), HLASM, and any other exploiters in production environments.

IBM zEnterprise EC12 and BC12 (zEC12 and zBC12) servers incorporate improved channel load balancing algorithms, designed to provide more consistent I/O rates across the channel subsystem and help improve I/O response times, even when abnormal conditions occur. In support of this new function, z/OS V2.1 is designed to provide an updated health check based on an I/O rate-based metric, rather than on initial control unit command response time.

New RMF function enables the Monitor I Postprocessor Coupling Facility Activity report and the Monitor III CFSYS report to be used to provide additional information about the coupling facility and CF links. This design extends both to indicate channel path details for each of the Coupling over InfiniBand (CIB) link types, including:

- Indication whether the CHPID is running in a "degraded" status
- Channel path type
- HCA adapter and port number
- Calculated length of each of the links

A new interrupt delay time measurement available on zEC12 and zBC12 (zEC12 and zBC12) servers is supported by z/OS V2.1 RMF , which is designed to report on interrupt delay time to help you determine whether I/O processing delays are occurring. This new measurement is designed to measure the time between when primary status is presented to the channel subsystem and when the operating system clears the primary status to begin processing the interrupt. RMF is also designed to write this information to new fields in SMF type 74 subtype 1 and SMF 79 subtype 9 records. This support is also available with z/OS V1.12 or z/OS V1.13 and the PTF for APAR OA39993.

z/OS V2.1 provides support planned to allow IBM DB2 11 for z/OS (5615-DB2) running on zEC12 and zBC12 servers with CFLEVEL 18 to exploit new function to allow batched updates to be written directly to disk without being cached in the coupling facility in a Parallel Sysplex. This is designed to keep the data in the cache that is used by online transactions more current, which is expected to help improve performance during batch update periods. Also, this can help avoid application stalls that might sometimes occur during large concurrent batch updates. The z/OS support for this function is also available on IBM zEnterprise 196 (z196) servers with CFLEVEL 17 and an MCL, and is also available for z/OS V1.12 or z/OS V1.13 with the PTF for APAR OA40966.

In z/OS V2.1, XCF is designed to perform additional validation of certain coupling facility cache requests, collect diagnostic information when validation fails, and terminate affected connectors to prevent or limit cache corruption. This new function is also available with the PTF for APAR OA40966 on z/OS V1.12 and later on IBM zEC12 and zBC12 servers.

z/OS V2.1 delivers 100-way symmetric multiprocessing (SMP) support in a single LPAR on IBM zEC12 and zBC12 servers. z/OS V1.12 and z/OS V1.13 (5694-A01) with PTFs running on IBM zEnterprise EC12 and BC12 (zEC12 and zBC12) servers also support up to 100 processors configured in a single LPAR. z/OS supports combinations of general-purpose processors (CPs), zIIPs, and zAAPs. z/OS design

supports an architectural limit of 4 TB of real memory per LPAR. On z196, zEC12, and zBC12 servers, z/OS supports up to 1 TB of real memory per LPAR.

These new ICSF functions, available in the Cryptographic Support for z/OS V1R13 - z/OS V2R1 web deliverable, are intended to help banking and finance sector clients meet standards and provide better cryptographic security with designs for:

- Support for emerging standards for American Express , JCB, MasterCard, and Visa payment systems (EMVCo) in CCA-based callable services for key management, generation, transport, and derivation. This support relies on enhanced CCA firmware in the CryptoExpress3 coprocessor with a minimum microcode level and on the CryptoExpress4S coprocessor.
- Enhanced support in the Remote Key Export callable service to allow you to specify the desired key-wrapping method to be used for key generation and transport. This support relies on enhanced CCA firmware available with a minimum microcode level for the CryptoExpress3 and CryptoExpress4S coprocessors.
- Support for these frequently used User Defined Extensions (UDX) callable services into the CCA firmware base support expected to help you reduce costs associated with UDX maintenance. This support, which relies on enhanced CCA firmware available with a minimum microcode level for the CryptoExpress3 and CryptoExpress4S coprocessors, is designed to provide these services:
  - Recover PIN From Offset, which can be used to calculate the encrypted customer-entered PIN from a PIN generating key, account information, and an IBM-PIN0 Offset.
  - Symmetric Key Export with Data, which can be used to generate an authentication parameter (AP) and return it encrypted using a supplied key.
  - Authentication Parameter Generate, which can be used to export a symmetric key, along with application-supplied data, encrypted using an RSA key.

Additional ICSF enhancements in Cryptographic Support for z/OS V1R13 - z/OS V2R1 are designed to provide new functions for public sector customers, including industry standard APIs for System z , intended to provide better interoperability with other platforms and help improve application portability and simplify system setup:

- Enhanced Enterprise PKCS #11 mode support designed to add secure key support for the Diffie-Hellman, Elliptic Curve Diffie-Hellman, and RSA-PSS algorithms and Secure DSA Domain Parameter Generation.
- Support for Enterprise PKCS #11 applications, intended to allow them to change a key's compliance mode using the Set Attribute Value function
- Support for ECC keys generated using Brainpool curves while executing in FIPS mode

These enhancements rely on enhanced EP11 firmware available with a minimum microcode level for the CryptoExpress4S coprocessors.

These new ICSF functions included in the z/OS V2.1 base are intended to help banking and finance sector clients meet standards and provide better cryptographic security with:

- Support for Derived Unique Key Per Transaction (DUKPT) for message authentication code (MAC) and data encryption keys. This support is intended to be compliant with the ANSI X9.24 part 1 Retail Financial Services Key Management standard, and intended for the symmetric key management used for financial services such as automated teller machine (ATM) transactions.
- Support for a new Cipher Text Translate CCA function designed to process sensitive data encrypted under one key by re-encrypting under another key within the boundary of the Crypto Express coprocessor. This support is designed to provide the ability to securely change the encryption key of encrypted data without exposing it in plain text. This is designed to help to improve the security of sensitive data.
- In order to comply with industry cryptographic standards, including ANSI X9.24 Part 1 and PCI-HSM, ICSF now supports enhanced cryptographic key wrapping to help ensure that keys are not wrapped with weaker keys. This support relies

on enhanced CCA firmware in the Crypto Express coprocessor and is designed to enhance the security of sensitive keys.

Similarly, ICSF has enhancements designed to provide new functions for public sector clients, including industry-standard APIs for System z for better interoperability with other platforms to help improve application portability and simplify system setup:

- The Crypto Express4S coprocessors support a new mode where the Crypto Express4S may be configured in Enterprise PKCS #11 mode that provides secure key PKCS #11 services in addition to the CCA and accelerator modes of operation. RACF , z/OS PKI Services, and z/OS System SSL provide support to use this new capability. RACF supports the generation of Elliptic Curve Cryptography (ECC) and RSA secure keys using the Crypto Express4S in EP11 mode through the addition of new keywords to the RACDCERT command. Corresponding PKCS #11 secure key support for PKI Services enables the use of a secure key PKCS #11 CA certificate, and generation of secure key pairs for key generation requests and CMP requests. System SSL enables certificates with secure PKCS #11 ECC and RSA certificates to be used during a subset of the SSL/TLS handshakes and through its Certificate Management APIs supporting the generation of digital signatures. This new function is designed to provide the cryptographic services and assurance needed to meet the European Union's requirements for Qualified Digital Signatures and is used in the secure digital identities.

- ICSF setup for FIPS verification processing at the application level has been simplified. Cryptographic requests for FIPS 140-2 compliant key processing can be issued by applications. A new option has now been added to enable applications to request a random number be generated in a FIPS-compliant fashion as well. Processing these requests no longer requires the ICSF FIPS start option FIPSMODE to be set to YES, or requires it to be set to COMPAT with the corresponding RACF profiles defined in the CRYPTOZ class. This is intended to help simplify setup for individual applications and programs that must run in a FIPS-compliant mode.

z/OS V2.1 includes support introduced for z/OS V1.13 with a PTF, which adds XL C/C++ compiler support for new instructions and facilities available on zEC12 and zBC12 servers. New ARCH(10) and TUNE(10) compiler options can be used to optimize code that is intended to run on these servers.

IBM continues to support running zAAP workloads on zIIP processors ("zAAP on zIIP"). z/OS V2.1 is designed to remove the restriction that prevents zAAP-eligible workloads from running on zIIP processors when a zAAP is installed on the server. This is intended only to help facilitate migration and testing of zAAP workloads on zIIP processors. This support is also available with the PTF for APAR OA38829 for z/OS V1.12 and z/OS V1.13.

IBM recommends the use of GRS Star in a Parallel Sysplex . For GRS Ring, IBM recommends using XCF communications rather than GRS-managed CTCs. However, IBM zEC12 and zBC12 and later servers will support only FICON channels. In z/OS V2.1, to support those who would find it difficult to migrate to GRS Star or XCF communications, z/OS Global Resource Serialization (GRS) supports FICON channel-to-channel (CTC) connections for GRS Rings. In addition, z/OS V1.12 and V1.13 with the PTF for APAR OA38230, and z/OS V1.10 and z/OS V1.11 with the Lifecycle Extension for z/OS V1.10 (5656-A01) or the Lifecycle Extension for z/OS V1.11 (5657-A01) with the PTF for OA38230, also provide support for FICON channel-to-channel adapter support for GRS Rings. You can migrate your existing ESCON® CTC links to FICON before installing an IBM zEnterprise EC12 or BC12 (zEC12 or zBC12) to help simplify your migration.

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 z/OS V2.1 is capable as of September 30, 2013, when used in accordance with IBM's associated 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 at

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

Product positioning

Standards

z/OS Version 2 is designed to continue to meet a number of important standards. In addition to maintaining previously announced support in z/OS Version 1 for a number of industry standards such as RFCs and PCI-DSS, and adding support for a number of additional standards in z/OS V2.1, these include:

- z/OS V2.1 continues the platform's tradition of rich IPv6 support. z/OS Version 1 has earned the IPv6 Phase 2 Ready logo and USGv6 Profile Version 1.0 (NIST SP500-267) certification. z/OS V2.1 is designed to meet these standards as well.
- The programming interfaces provided by z/OS V2.1 Unicode Services are designed to meet the Unicode 6.0 standard.
- z/OS Version 2 Release 1 is "in evaluation" by Bundesamt fur Sicherheit in der Informationstechnik (BSI) to the Operating System Protection Profile V3.9.
- IBM plans to pursue an evaluation to the Federal Information Processing Standard (FIPS) 140-2 using National Institute of Standards and Technology's (NIST) Cryptographic Module Validation Program (CMVP) for the System SSL component of the Cryptographic Services element of z/OS . The scope of this evaluation will include algorithms provided by the CP Assist for Cryptographic Functions (CPACF) that are utilized by System SSL. This is intended to help satisfy the need for FIPS 140-2 validated cryptographic functions when using z/OS Communications Server capabilities such as AT-TLS and protocols such as TN3270 and FTP when secured using AT-TLS.
- IBM plans to pursue an evaluation to the Federal Information Processing Standard (FIPS) 140-2 using National Institute of Standards and Technology's (NIST) Cryptographic Module Validation Program (CMVP) for the ICSF component of the Cryptographic Services element of z/OS . The scope of this evaluation is planned to include algorithms provided by the CP Assist for Cryptographic Functions (CPACF) and utilize the Crypto Express coprocessors configured as accelerators and Enterprise PKCS #11 coprocessors. This is intended to help satisfy the need for FIPS 140-2 validated cryptographic functions by various IBM software products and customer applications running on z/OS .

Statements of direction

zEnterprise Data Compression (zEDC) for z/OS V2.1, running on zEC12 and zBC12 servers with the zEDC Express adapter, is designed to support a new data compression function designed for low-latency compression. Initially, z/OS is designed to allow you to specify that SMF data written to log streams be compressed. In addition, IBM intends to provide support for the BSAM and QSAM access methods. This function, planned to be made available by the end of the first quarter of 2014, is intended to help you save disk space, improve effective channel and network bandwidth without incurring significant CPU overhead, and improve the efficiency of cross-platform data exchange.

IBM also plans to provide support for DFSMSdss to exploit zEDC by the end of the third quarter 2014. This function is designed to be available for dumping and restoring data, and also when DFSMShsm uses DFSMSdss to move data. This

is intended to provide efficient compression with lower CPU overheads than the processor- and software-based compression methods already available.

IBM plans for future updates of IBM 31-bit and 64-bit SDK for z/OS Java Technology Edition, Version 7 (5655-W43 and 5655-W44) (IBM SDK 7 for z/OS Java) to provide exploitation of the zEDC Express feature and also to provide exploitation of Shared Memory Communications-Remote Direct Memory Access (SMC-R), which is utilized by the 10GbE RoCE Express feature. In addition, improved integration of Java with core z/OS workload management facilities is planned to provide new Java APIs that use the WLM SYSEVENT QRYCONT macro. These programming interfaces are designed to support adaptive concurrent online and batch workloads in Java-based processing environments such as WebSphere Compute Grid.

IBM plans that the IBM Encryption Facility for z/OS (5655-P97) will exploit zEnterprise Data Compression (zEDC) for z/OS V2.1, running on zEC12 and zBC12 servers with the zEDC Express adapter when the Java release supporting zEDC becomes available. This will complement the software compression support that exists today with Encryption Facility OpenPGP support.

IBM intends to provide exploitation of the Flash Express feature on zEC12 and zBC12 servers with CFLEVEL 19 for certain coupling facility list structures in the first half of 2014. This new function is designed to allow list structure data to be migrated to Flash Express memory as needed when the consumers of data do not keep pace with its creators for some reason, and migrate it back to real memory to be processed. When using WebSphere MQ for z/OS Version 7 (5655-R36), this new capability is expected to provide significant buffering against enterprise messaging workload spikes and provide support for storing very large amounts of data in shared queue structures, potentially allowing several hours' data to be stored without causing interruptions in processing. Also, z/OS V2.1 RMF is planned to provide measurement data and reporting capabilities for Flash Express when it is used in conjunction with coupling facilities.

IBM plans a number of changes to z/OS preventive service ordering for third quarter 2014.

- In Shopz, the z/OS "all licensed products" service package type will be removed.
- Also in Shopz, z/OS Internet delivery service subscriptions will be removed.
- ServiceLink z/OS ESO packages will be supported only when used to order service for selected FMIDs.

z/OS preventive service orders will be based on installed products, which is intended to make order content a better reflection of the systems to be serviced.

If you currently order z/OS service based on licensed products, you are encouraged to begin using the other available service options at this time. IBM recommends use of the SMP/E RECEIVE ORDER command, the simplest method of acquiring z/OS service, which enables customers who are able to connect their z/OS host to the Internet fully automate service acquisition using local batch scheduling tools. SMP/E RECEIVE ORDER can be run using scheduled jobs to replace the current Shopz z/OS service subscription capabilities. Also, the ServiceLink z/OS ESO option is an alternative method you can use for ordering z/OS service if you are unable to upload a software inventory (bitmap or CSI) to IBM to identify installed software. Corrective service ordering remains unchanged.

For more information on Shopz service options, visit

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

For more information on ServiceLink service options, visit

  http://www.ibm.com/ibmlink

For more information on the SMP/E RECEIVE ORDER command, see the z/OS SMP/E Users Guide .

z/OS V2.1 is planned to be the last release to include Version 1 of the Standards Based Linux Instrumentation for Manageability (SBLIM) CIM client for Java . Version 1 support for the SourceForge open source project was sunset in 2010. Version 2 of the SBLIM client, which is designed to be a JSR48-compliant implementation, was included in z/OS V1.10 and later and planned to be included in z/OS V2.1. IBM recommends that users of SBLIM Version 1 convert to Version 2.

z/OS V1.13 is planned to be the last release to provide support for Integrated Call Level Interface (ICLI).

The Cryptographic Support for z/OS V1R12-R13 web deliverable is planned to be the last level of ICSF to support IBM eServer™ zSeries® z800 and z900 servers. Future levels of ICSF are planned to require an IBM eServer zSeries z890, z990, or later server.

Note: The Cryptographic Support for z/OS V1R12-R13 web deliverable includes the level of ICSF planned to be incorporated in z/OS V2.1. However, z/OS V2.1 itself is planned to require an IBM System z9 EC, IBM System z9 BC, or later server.

z/OS V2.1 is planned to be the last release to include the IBM HTTP Server Powered by Domino® (IHS powered by Domino). IBM recommends you use the IBM HTTP Server Powered by Apache, which is available in z/OS Ported Tools as a replacement. IHS powered by Apache supports IPv6, 64-bit execution, and includes security authentication and authorization capabilities similar to those provided in IHS powered by Domino . Also, a refresh of IBM HTTP Server powered by Apache is planned later in 2013. IBM plans to provide documentation help with customer migration to IBM HTTP Server Powered by Apache.

z/OS V2.1 is planned to be the last release to support the z/OS BookManager® Build optional feature.

z/OS V2.1 is planned to be the last release to support the SNMP subagent function of Infoprint Server for communication with PSF-managed printers. IBM recommends you use the existing functions in z/OS Infoprint Central component of Infoprint Server to manage these printers instead.

IBM intends for z/OS V2.1 to be the last release to support the GATEWAY configuration statement in the TCP/IP profile. If you are using the GATEWAY statement to define static routes, you should use the BEGINROUTES/ENDROUTES configuration block instead.

IBM's statements regarding its plans, directions, and intent are subject to change or withdrawal without notice at IBM's sole discretion. Information regarding potential future products is intended to outline our general product direction and it should not be relied on in making a purchasing decision. The information mentioned regarding potential future products is not a commitment, promise, or legal obligation to deliver any material, code, or functionality. Information about potential future products may not be incorporated into any contract. The development, release, and timing of any future features or functionality described for our products remains at our sole discretion.

Hardware and software support services

SmoothStart/installation services

IBM SmoothStart Services and Installation Services are not provided.

Program number

Program number	VRM	Program name
5650-ZOS	2.1	z/OS

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=213-292

Installation

In October 2012, ServerPac began to support orders for certain z/OS and DB2 products without requiring that z/OS or DB2 themselves be ordered. Concurrent with z/OS V2.1 availability, Product ServerPac will be designed to support orders for certain products from all ServerPac subsystems without a base product such as IMS , NCP, or CICS® . The triangle icon in the Shopz catalog can help you identify which products are eligible for Product ServerPac. In addition, Product ServerPac will be designed to allow you to use an existing GLOBAL zone for installation.

Starting with z/OS V2.1 orders, ServerPac will support a comparison between saved jobs to define RACF profiles for a prior order and the jobs generated for the current order. This function is designed to help you identify new security definitions that are required for the new products, or levels of products, in new orders. In addition, ServerPac orders that include z/OS with the Security Server RACF feature will provide a RACF database you can use for initial IPL when you do not have an existing security environment.

Concurrent with z/OS V2.1 availability, the Customized Offerings Driver (5751-COD) is planned to be updated to a subset of a z/OS V1.13 system.

Secure z/OS Software Delivery

Previously, IBM announced that support for standard FTP connections used for z/OS software and service delivery would be discontinued October 1, 2013. Based on customer feedback and to allow more time to transition to secured FTP connections, IBM now plans to extend the date before this option is eliminated. You should take steps now to position your enterprise for the required withdrawal of standard FTP connections for z/OS software and service delivery downloads. Secured connections will require use of implementations such as FTPS (FTP using Secure Sockets Layer) or of Download Director with encryption. To aid in this transition, in October 2012, the option to download your order direct to host using FTPS was provided on the Shopz download page. If you plan to use FTPS, IBM recommends that you visit the Connectivity Test website to verify your system setup and start using FTPS to download your order. No change is required for Download Director with encryption; however, you can also verify Download Director with the Connectivity Test. The Connectivity Test can be found at

   https://www14.software.ibm.com/webapp/iwm/web/preLogin.do?&source=cbct

Preventive service ordering changes

IBM plans a number of changes to z/OS preventive service ordering for third quarter of 2014:

- In Shopz, the z/OS "all licensed products" service package type will be removed.
- In Shopz, z/OS Internet delivery service subscriptions will be removed.
- ServiceLink z/OS ESO packages will be supported only when used to order service for selected FMIDs.
- z/OS preventive service orders will be based on installed products, which is intended to make order content a better reflection of the systems to be serviced. If you currently order z/OS service based on licensed products, you are encouraged to begin using the other available service options at this time.

IBM recommends use of the SMP/E RECEIVE ORDER command, the simplest method of acquiring z/OS service, which lets customers who are able to connect their z/OS

host to the Internet fully automate service acquisition using local batch scheduling tools. SMP/E RECEIVE ORDER can be run using scheduled jobs to replace the current Shopz z/OS service subscription capabilities. Also, the ServiceLink z/OS ESO option is an alternative method you can use for ordering z/OS service if you are unable to upload a software inventory (bitmap or CSI) to IBM to identify installed software. Corrective service ordering remains unchanged.

For more information on Shopz service options, visit

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

For more information on ServiceLink service options, visit

   http://www.ibm.com/ibmlink

For more information on the SMP/E RECEIVE ORDER command, see the *z/OS SMP/E Users Guide.*

Related products

IBM z/OS Management Facility (z/OSMF) (5610-A01) can be acquired together with z/OS (5650-ZOS). z/OSMF is the new face for z/OS . More than just a veneer over existing functions, it is designed to streamline and simplify z/OS administration.

Automated tasks can help reduce the learning curve and improve productivity. For example, new users may require only weeks of training to become proficient on z/OSMF system management tasks. In addition, embedded active user assistance, such as wizards, can guide users through tasks and provide simplified operations, for example, reducing hours of tasks down to minutes or minutes worth of tasks down to seconds.

The latest release of z/OSMF V2.1 offers several enhancements designed to allow:

- Management of a variety of systems functions. Many tools are oriented to serve a single IT role; z/OSMF can benefit many staff functions such as operations, administrators, system programmers, help desk, and other systems support roles.
- Users the ability to customize and to augment functions like Workflow to tune the management steps to their environment.
- Interfaces for ISVs to supply additional functions.
- Fluid navigation between different tasks paralleling the various tasks that administrators have to perform.

Refer to Software Announcement 213-308, dated July 23, 2013 , for more information on z/OS Management Facility.

z/OS Management Facility is just one of many companion products that aid in the management, monitoring, securing, and programming in the z/OS environment.

Optional no-charge companion products for z/OS include:

- z/OS Management Facility (5610-A01)
- IBM Ported Tools for z/OS (5655-M23)
- IBM XML Toolkit for z/OS (5655-J51)
- Java support:
  – IBM 31-bit SDK for z/OS , Java Technology Edition, V7.0.0 (5655-W43)
  – IBM 64-bit SDK for z/OS , Java Technology Edition, V7.0.0 (5655-W44)
  – IBM 31-bit SDK for z/OS , Java Technology Edition, V6.0.0 (5655-R31)
  – IBM 64-bit SDK for z/OS , Java Technology Edition, V6.0.0 (5655-R32)
  – IBM 31-bit SDK for z/OS , Java Technology Edition, V6.0.1 (5655-R31)

- IBM 64-bit SDK for z/OS , Java Technology Edition, V6.0.1 (5655-R32)
- IBM 31-bit SDK for z/OS , Java 2 Technology Edition, V5 (5655-N98)
- IBM 64-bit SDK for z/OS , Java 2 Technology Edition, V5 (5655-N99)

- IBM Explorer for z/OS , V2.1 (z/OS Explorer, CSZE), is an Eclipse-based integration platform for z/OS system application users, designed to enable the integration of a variety of offerings from IBM and other software vendors, as well as in-house development plug-ins. z/OS Explorer is extendable through an IBM repository of compatible products to help each user's roles and responsibilities. For example, z/OS Explorer can provide a single Eclipse environment with the ability to administer IBM CICS Transaction Server for z/OS (5655-Y04), IBM DB2 10 for z/OS (5605-DB2), WebSphere MQ for z/OS Version 7 (5655-R36), and IMS 12 (5635-A03) subsystems, and other Eclipse environments targeted at development and problem determination of z/OS applications. For more information, visit

  http://ibm.com/systems/Z/os/zos/explorer

  Also refer to Software Announcement 213-141, dated April 23, 2013 (IBM Explorer for z/OS , V2.1 delivers extensible workstation access to key IBM z/OS functions).

Optional priced companion products for z/OS include:

- Operating System Environment Manager (OS/EM) for z/OS (5799-HAX).
- IBM Tivoli Storage Productivity Center for Replication Basic Edition for System z , V5.1 (5698-Z12) and IBM Tivoli Storage Productivity Center for Replication for System z , V5.1 (5698-Z11).
- IBM Encryption Facility for z/OS (5655-P97).
- Print and output:
  - IBM Print Services Facility for z/OS (5655-M32)
  - Infoprint Coaxial Printer Support for z/OS (5655-N62)
  - IBM Print Transform from AFP to PDF for Infoprint Server for z/OS , V1.1 (5655-TF1)
  - IBM Print Transform from AFP to PCL for Infoprint Server for z/OS , V1.1 (5655-TF2)
  - IBM Print Transform from AFP to PostScript™ for Infoprint Server for z/OS , V1.1 (5655-TF3)
  - Infoprint Transforms to AFP for z/OS (5655-N60)
  - IBM Infoprint XT for z/OS , V3.1 (5655-O15)
- Tivoli NetView® for z/OS (5697-NV6).
- Tivoli System Automation for z/OS (5698-SA3).
- IBM Security zSecure™ Suite of products (formerly known as IBM Tivoli zSecure suite).
- IBM Tivoli Service Availability and Performance Management software products.

Important websites

- z/OS website

  http://www.ibm.com/systems/z/os/zos/
- General literature

  http://www.ibm.com/systems/z/resources/
- Previously announced statements of direction

  http://www.ibm.com/systems/z/os/zos/zos_sods.html
- z/OS Internet Library

  http://www.ibm.com/systems/z/os/zos/bkserv/
- z/OS Basic Skills Information Center

- Descriptions of courses worldwide

  http://www.ibm.com/services/learning
- z/OS downloads

  http://www.ibm.com/systems/z/os/zos/downloads/
- CustomPac

  http://www.ibm.com/services/custompac
- Shopz

  http://www.ibm.com/software/shopzseries
- z/OS Communications Server

  http://www.ibm.com/software/network/commserver/zos/
- z/OS Management Facility

  http://www.ibm.com/systems/z/os/zos/zosmf/

Reference information

Software Announcement 207-339, dated December 11, 2007 (IBM Enterprise COBOL for z/OS V4.1)

Software Announcement 209-244, dated August 25, 2009 (IBM Enterprise COBOL for z/OS V4.2)

Software Announcement 211-341, dated September 27, 2011 (IBM Enterprise PL/I for z/OS V4.2 delivers performance improvements and usability enhancements)

Software Announcement 210-199, dated July 06, 2010 (IBM Ported Tools for z/OS Version 1.2)

Software Announcement 207-041, dated March 06, 2007 (IBM DB2 V9.1 for z/OS)

Software Announcement 210-380, dated October 19, 2010 (IBM DB2 10 for z/OS)

Hardware Announcement 113-119, dated July 23, 2013 (IBM zEnterprise EC12)

Hardware Announcement 113-121, dated July 23, 2013 (IBM zEnterprise BC12)

Notices

Any information contained in this document regarding Specialty Engines ("SEs") and SE eligible workloads provides only general descriptions of the types and portions of workloads that are eligible for execution on Specialty Engines (e.g., zIIPs, zAAPs, and IFLs). IBM authorizes customers to use IBM SE only to execute the processing of Eligible Workloads of specific Programs expressly authorized by IBM as specified in the Authorized Use Table (AUT) for IBM Machines provided at

  http://www.ibm.com/systems/support/machine_warranties/machine_code/aut.html

No other workload processing is authorized for execution on an SE.

IBM offers SEs at a lower price than General Processors/Central Processors because customers are authorized to use SEs only to process certain types and/or amounts of workloads as specified by IBM in the AUT.

Education support

IBM Systems and Technology Group, Skills Enablement, education provides many global education offerings for z/OS .

Visit

  http://www.ibm.com/training/us

Call IBM training at 800-IBM-TEACH (426-8322) for catalogs, schedules, and enrollments.

Here are just a few of the courses available for classroom delivery:

- Introduction to z/OS Environment (ES050)
- Fundamental System Skills for z/OS (ES10A)
- z/OS Facilities (ES155)
- z/OS Operations (ES270)
- z/OS Installation (ES41A)
- Basic z/OS Tuning Using the Workload Manager (WLM) (ES545)
- Basics of z/OS RACF Administration (ES191)
- Introducing z/OS UNIX System Services (OP052)
- Advanced Parallel Sysplex Operations and Recovery (ES902)
- Parallel Sysplex Implementation Workshop (ES420)
- z/OS Management Facility Implementation and Use (ESB10)
- z/OS REXX Programming Workshop (ES52A)
- IBM zEnterprise System: Using zManager to Provision Virtual Servers (ESA10)

Call 1-800-IBM-TEACH (426-8322) to enroll in one or more of these classes. To find other z/OS related courses, visit

  http://www.ibm.com/training/us/catalog/zseries

Technical information

Specified operating environment

Hardware requirements

z/OS V2.1 runs on these IBM System z servers:

- IBM zEnterprise EC12 (zEC12)
- IBM zEnterprise BC12 (zBC12)
- IBM zEnterprise 196 (z196)
- IBM zEnterprise 114 (z114)
- IBM System z10 (z10 EC, z10 BC)[1]
- IBM System z9 (z9 BC, z9 EC)[1]

[1] These products are withdrawn from marketing.

In addition, z/OS V2.1 supports these and later IBM storage control units:

- 3990 Model 3 and 3990 Model 6
- 9393
- 2105
- 2107
- 2421, 2422, 2423, and 2424

The z/OS base is a system that can be IPLed. There are no software prerequisites in order to IPL. Specific functions may require additional products not included in the z/OS base, or in the optional features of z/OS . Refer to *z/OS Planning for Installation*

(GA32-0890) for a listing of specific software requirements. The z/OS books can be found in the z/OS library, at

http://www-03.ibm.com/systems/z/os/zos/bkserv/

Software requirements

The z/OS base is a system that can be IPLed. There are no software prerequisites in order to IPL. Specific functions may require additional products not included in the z/OS base, or in the optional features of z/OS . Refer to *z/OS Planning for Installation* (GA32-0890) for a listing of specific software requirements at

http://publibz.boulder.ibm.com/cgi-bin/bookmgr_OS390/BOOKS/E0Z2B1C0

Coexistence, release migration, and fallback

z/OS gives you compatibility and flexibility as you migrate systems in a multisystem configuration by allowing multiple releases of z/OS to coexist. This includes non-Parallel Sysplex and Parallel Sysplex multisystem configurations. Coexistence allows systems within a multisystem configuration to be upgraded to a new release level of z/OS one system at a time. This is contingent on the fact that the release you are migrating to can coexist with the lowest release running in your multisystem configuration.

Note: These statements represent the current intention of IBM . IBM reserves the right to change or alter the Coexistence-Migration-Fallback policy in the future or to exclude certain releases beyond those stated. IBM development plans are subject to change or withdrawal without further notice. Any reliance on this statement of direction is at the relying party's sole risk and does not create any liability or obligation for IBM .

IBM provides the following coexistence, migration, and fallback for z/OS V2.1:

IBM plans to support an n-2 approach, where three consecutive releases are planned to be supported for coexistence, fallback, and migration. For example, where "n" is z/OS V2.1, IBM intends to allow you to upgrade from z/OS V1.12 directly to z/OS V2.1 with full coexistence, migration, and fallback support to maximize the value of your investment, and from z/OS V1.13 to z/OS V2.1 with full coexistence, migration, and fallback support.

Migration forward as well as fallback should be made within the same z/OS releases supported by the coexistence policy.

Table: Coexistence-Migration-Fallback for z/OS V2.1

```
              Coexistence-Migration-Fallback
Release       supported with release in Column 1

z/OS V1.12    z/OS V1.10¹, z/OS V1.11², z/OS V1.12
z/OS V1.13    z/OS V1.11², z/OS V1.12, z/OS V1.13
z/OS V2.1     z/OS V1.12, z/OS V1.13, z/OS V2.1
```

[1]
   z/OS V1.10 end of service was September 30, 2011.

[2]
   z/OS V1.11 end of service was September 30, 2012.

This consistent coexistence, migration, and fallback policy applies to release migrations for all configurations, whether they are:

- Single system configurations
- Individual systems within a multisystem configuration
- Cases where a simultaneous IPL is used to migrate all systems in a multisystem configuration at the same time

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License Metric Change

- z/OS V2 is only offered with NALC pricing for customers using NALC for z/OS V1 who are using PSLC for their middleware programs. z/OS V2 customers using AWLC or WLC or AEWLC or EWLC pricing for their middleware programs must migrate from NALC to zNALC pricing.
- All z/OS customers using NALC pricing are encouraged to migrate to zNALC pricing to obtain the zNALC advantages such as sub-capacity pricing for z/OS with zNALC supported by the SCRT reports, lower prices above 45 MSUs, and aggregated pricing across qualified Parallel Sysplexes.

See Software Announcement 207-006, dated January 09, 2007 (IBM System z New Application License Charges) and Software Announcement 907-245, dated December 04, 2007 (Software withdrawal: Selected IBM System z products Some replacements available).

Planning information

Direct customer support

Direct customer support is provided by IBM Operational Support Services - SoftwareXcel Enterprise Edition or SoftwareXcel Basic Edition. These fee services can enhance your productivity by providing voice and electronic access into the IBM support organization. IBM Operational Support Services - SoftwareXcel Enterprise Edition or SoftwareXcel Basic Edition will help answer questions pertaining to usage, how-to, and suspected software defects for eligible products.

Installation and technical support is provided by IBM Global Services. For more information on services, call 888-426-4343. To obtain information on customer eligibility and registration procedures, contact the appropriate support center.

Security, auditability, and control

Data security and auditability in the z/OS environment are enhanced by the functions available in the optional Security Server for z/OS feature.

The customer is responsible for evaluation, selection, and implementation of security features, administrative procedures, and appropriate controls in application systems and communication facilities.

Ordering information

For a list of the publications available for z/OS , visit the z/OS Internet Library at

http://www.ibm.com/servers/eserver/zseries/zos/bkserv/

Ordering z/OS through the Internet

Shopz provides an easy way to plan and order your z/OS ServerPac or CBPDO. It will analyze your current installation, determine the correct product migration, and present your new configuration based on z/OS . Additional products can also be added to your order (including determination of whether all product requisites are satisfied). Shopz is available in the US, Canada, and several countries in Europe. In countries where Shopz is not available yet, contact your IBM representative (or IBM Business Partner) to handle your order via the traditional IBM ordering process. For more details and availability, visit the Shopz website at

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

Key dates

- **July 23, 2013** : z/OS V2.1 CFSW configurator support for stand-alone path (5650-ZOS) and price proposal support.
- **September 13, 2013** : First date for ordering z/OS V2.1 ServerPac, SystemPac® [1] , CBPDO using CFSW configuration support, or Shopz, the Internet ordering tool. Note that most z/OS media (executable code) is shipped only through Customized Offerings (ServerPac, SystemPac [1] , and CBPDO).
- **September 30, 2013** : z/OS V2.1 planned general availability via ServerPac, CBPDO, and SystemPac [1] .
- **January 17, 2014** : Last date for processing orders for z/OS V1.13 via ServerPac and CBPDO.
- **January 31, 2014:** End of Marketing for z/OS V1.13 (5694-A01) (See Software withdrawal 913-103, dated June 04, 2013 .
- **March 17, 2015:** Recommended last date for processing orders for z/OS V1.13 (5694-A01) via the fee Customized Offering, SystemPac.
- **March 31, 2015:** End of Marketing for z/OS V1.13 (5694-A01) via the fee Customized Offering, SystemPac.

ServerPac, CBPDO, and SystemPac [1] are offered for electronic delivery, where Shopz product ordering is available. For more details on electronic delivery, refer to the Shopz help information.

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

Refer to the Shopz website for product catalogs for the Customized Offerings:

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

If a product catalog for your country is not available in Shopz, use one of the following countries, United States or Germany, and select English language for the most complete product catalogs for the Customized Offerings.

[1]
   EMEA only

New licensees

Orders for new licenses can be placed now.

This product is delivered in ServerPac and CBPDO. You choose the delivery method, physical media or Internet, when ordering. See the Customized offerings section for the available media types. Production of z/OS V2.1 orders will begin on the planned general availability date, September 30, 2013. Ship dates for orders will be based on order sequence, production capability, and the customer-requested arrival date. Due to the amount of customization of ServerPac orders, shipments will begin approximately two weeks after general availability. For CBPDO orders, shipments will begin one week after general availability. In all cases, no delivery commitments are to be made to the customer until confirmed arrival dates are in ESW.

Registered customers can access IBMLink for ordering information and charges.

Shipment will not occur before the availability date, September 30, 2013.

New users of IBM z/OS V2.1 should specify:

Type: 5650 Model: ZOS

Basic license

To order a basic license, specify the z/OS V2.1 program number 5650-ZOS. Proceed to select the features listed which are required and then select any optional features.

Parallel Sysplex license charge (PSLC) basic license

To order a basic license, specify the program number and quantity of MSU.

If there is more than one program copy in a Parallel Sysplex , the charge for all
copies is associated to one license by specifying the applicable PSLC license options
and quantity represented by the sum of the Service Units in Millions (MSUs) in
your Parallel Sysplex . For all other program copies, specify the System Usage
Registration No-Charge (SYSUSGREG NC) Identifier on the licenses.

```
Entitlement                              License option/
identifier      Description              Pricing metric

S01728S         z/OS V2 Alternate Base   Basic MLC, PSLC
S01728T         z/OS V2 Base             Basic MLC, PSLC
S01728V         z/OS V2 BDT FTF          Basic MLC, PSLC
S01728W         z/OS V2 BDT SNA NJE      Basic MLC, PSLC
S01728X         z/OS V2 BookManager Build  Basic MLC, PSLC
S01728Z         z/OS V2 XL C/C++         Basic MLC, PSLC
S017290         z/OS V2 DFSMS dss        Basic MLC, PSLC
S017291         z/OS V2 DFSMS dsshsm     Basic MLC, PSLC
S017292         z/OS V2 DFSMS rmm        Basic MLC, PSLC
S017293         z/OS V2 DFSMStvs         Basic MLC, PSLC
S017294         z/OS V2 DFSORT           Basic MLC, PSLC
S017295         z/OS V2 GDDM-PGF         Basic MLC, PSLC
S017296         z/OS V2 GDDM-REXX        Basic MLC, PSLC
S017297         z/OS V2 HCM              Basic MLC, PSLC
S017298         z/OS V2 HLASM Toolkit    Basic MLC, PSLC
S017299         z/OS V2 Infoprint Server Basic MLC, PSLC
S01729B         z/OS V2 JES3             Basic MLC, PSLC
S01729C         z/OS V2 RMF              Basic MLC, PSLC
S01729D         z/OS V2 SDSF             Basic MLC, PSLC
S01729F         z/OS V2 Security Server  Basic MLC, PSLC
S01780D         z/OS V2 zEDC             Basic MLC, PSLC
```

Advanced Workload license charge (AWLC) basic license

To order a basic license, specify the program number and quantity of MSUs. If there
is more than one program copy in a Parallel Sysplex , the charge for all copies
is associated to one license by specifying the applicable AWLC license options
and quantity represented by the sum of the Service Units in Millions (MSUs) in
your Parallel Sysplex . For all other program copies, specify the System Usage
Registration No-Charge (SYSUSGREG NC) Identifier on the licenses.

```
Program name: z/OS V2.1

Program PID: 5650-ZOS

Entitlement                              License option/
identifier      Description              Pricing metric

S01728S         z/OS V2 Alternate Base   Basic MLC, AWLC
S01728T         z/OS V2 Base             Basic MLC, AWLC
S01728V         z/OS V2 BDT FTF          Basic MLC, AWLC
S01728W         z/OS V2 BDT SNA NJE      Basic MLC, AWLC
S01728X         z/OS V2 BookManager Build  Basic MLC, AWLC
S01728Z         z/OS V2 XL C/C++         Basic MLC, AWLC
S017290         z/OS V2 DFSMS dss        Basic MLC, AWLC
S017291         z/OS V2 DFSMS dsshsm     Basic MLC, AWLC
S017292         z/OS V2 DFSMS rmm        Basic MLC, AWLC
S017293         z/OS V2 DFSMStvs         Basic MLC, AWLC
S017294         z/OS V2 DFSORT           Basic MLC, AWLC
S017295         z/OS V2 GDDM-PGF         Basic MLC, AWLC
S017296         z/OS V2 GDDM-REXX        Basic MLC, AWLC
S017297         z/OS V2 HCM              Basic MLC, AWLC
S017298         z/OS V2 HLASM Toolkit    Basic MLC, AWLC
S017299         z/OS V2 Infoprint Server Basic MLC, AWLC
S01729B         z/OS V2 JES3             Basic MLC, AWLC
S01729C         z/OS V2 RMF              Basic MLC, AWLC
S01729D         z/OS V2 SDSF             Basic MLC, AWLC
```

```
S01729F        z/OS V2 Security Server    Basic MLC, AWLC
S01780D        z/OS V2 zEDC               Basic MLC, AWLC
```

Advanced Entry Workload license charge (AEWLC) basic license

To order a basic license, specify the program number and quantity of MSUs.

```
Program name: z/OS V2.1

Program PID: 5650-ZOS

Entitlement                                License option/
identifier     Description                 Pricing metric

S01728S        z/OS V2 Alternate Base      Basic MLC, AEWLC
S01728T        z/OS V2 Base                Basic MLC, AEWLC
S01728V        z/OS V2 BDT FTF             Basic MLC, AEWLC
S01728W        z/OS V2 BDT SNA NJE         Basic MLC, AEWLC
S01728X        z/OS V2 BookManager Build   Basic MLC, AEWLC
S01728Z        z/OS V2 XL C/C++            Basic MLC, AEWLC
S017290        z/OS V2 DFSMS dss           Basic MLC, AEWLC
S017291        z/OS V2 DFSMS dsshsm        Basic MLC, AEWLC
S017292        z/OS V2 DFSMS rmm           Basic MLC, AEWLC
S017293        z/OS V2 DFSMStvs            Basic MLC, AEWLC
S017294        z/OS V2 DFSORT              Basic MLC, AEWLC
S017295        z/OS V2 GDDM-PGF            Basic MLC, AEWLC
S017296        z/OS V2 GDDM-REXX           Basic MLC, AEWLC
S017297        z/OS V2 HCM                 Basic MLC, AEWLC
S017298        z/OS V2 HLASM Toolkit       Basic MLC, AEWLC
S017299        z/OS V2 Infoprint Server    Basic MLC, AEWLC
S01729B        z/OS V2 JES3                Basic MLC, AEWLC
S01729C        z/OS V2 RMF                 Basic MLC, AEWLC
S01729D        z/OS V2 SDSF                Basic MLC, AEWLC
S01729F        z/OS V2 Security Server     Basic MLC, AEWLC
S01780D        z/OS V2 zEDC                Basic MLC, AEWLC
```

Workload license charge (WLC) basic license

If there is more than one program copy in a Parallel Sysplex , the charge for all copies is associated to one license by specifying the applicable WLC license options and quantity represented by the sum of the Service Units in Millions (MSUs) in your Parallel Sysplex . For all other program copies, specify the Workload Registration Variable WLC Identifier on the licenses.

```
Entitlement                                License option/
identifier     Description                 Pricing metric

S01728S        z/OS V2 Alternate Base      Basic MLC, VWLC
S01728T        z/OS V2 Base                Basic MLC, VWLC
S01728V        z/OS V2 BDT FTF             Basic MLC, VWLC
S01728W        z/OS V2 BDT SNA NJE         Basic MLC, VWLC
S01728X        z/OS V2 BookManager Build   Basic MLC, VWLC
S01728Z        z/OS V2 XL C/C++            Basic MLC, VWLC
S017290        z/OS V2 DFSMS dss           Basic MLC, VWLC
S017291        z/OS V2 DFSMS dsshsm        Basic MLC, VWLC
S017292        z/OS V2 DFSMS rmm           Basic MLC, VWLC
S017293        z/OS V2 DFSMStvs            Basic MLC, VWLC
S017294        z/OS V2 DFSORT              Basic MLC, VWLC
S017295        z/OS V2 GDDM-PGF            Basic MLC, VWLC
S017296        z/OS V2 GDDM-REXX           Basic MLC, VWLC
S017297        z/OS V2 HCM                 Basic MLC, VWLC
S017298        z/OS V2 HLASM Toolkit       Basic MLC, VWLC
S017299        z/OS V2 Infoprint Server    Basic MLC, VWLC
S01729B        z/OS V2 JES3                Basic MLC, VWLC
S01729C        z/OS V2 RMF                 Basic MLC, VWLC
S01729D        z/OS V2 SDSF                Basic MLC, VWLC
S01729F        z/OS V2 Security Server     Basic MLC, VWLC
S01780D        z/OS V2 zEDC                Basic MLC, VWLC
```

Entry Workload license charge (EWLC) basic license

To order a basic license, specify the program number and the quantity of MSUs.

```
Entitlement                              License option/
identifier       Description             Pricing metric

S01728S          z/OS V2 Alternate Base  Basic MLC, EWLC
S01728T          z/OS V2 Base            Basic MLC, EWLC
S01728V          z/OS V2 BDT FTF         Basic MLC, EWLC
S01728W          z/OS V2 BDT SNA NJE     Basic MLC, EWLC
S01728X          z/OS V2 BookManager Build  Basic MLC, EWLC
S01728Z          z/OS V2 XL C/C++        Basic MLC, EWLC
S017290          z/OS V2 DFSMS dss        Basic MLC, EWLC
S017291          z/OS V2 DFSMS dsshsm     Basic MLC, EWLC
S017292          z/OS V2 DFSMS rmm        Basic MLC, EWLC
S017293          z/OS V2 DFSMStvs         Basic MLC, EWLC
S017294          z/OS V2 DFSORT           Basic MLC, EWLC
S017295          z/OS V2 GDDM-PGF         Basic MLC, EWLC
S017296          z/OS V2 GDDM-REXX        Basic MLC, EWLC
S017297          z/OS V2 HCM              Basic MLC, EWLC
S017298          z/OS V2 HLASM Toolkit    Basic MLC, EWLC
S017299          z/OS V2 Infoprint Server Basic MLC, EWLC
S01729B          z/OS V2 JES3             Basic MLC, EWLC
S01729C          z/OS V2 RMF              Basic MLC, EWLC
S01729D          z/OS V2 SDSF             Basic MLC, EWLC
S01729F          z/OS V2 Security Server  Basic MLC, EWLC
S01780D          z/OS V2 zEDC             Basic MLC, EWLC
```

New Application license charge (NALC) ordering information

The NALC price is a price per MSU of the processor to which the software is licensed.
Order the quantity of features equal to the MSU rating of the processor.

```
New Application License Charge
Basic license one-time charge

Entitlement                              License option/
identifier       Description             Pricing metric

S01728T          z/OS V2 Base            Basic MLC, NALC
S01728Z          z/OS V2 XL C/C++        Basic MLC, NALC
S017291          z/OS V2 DFSMS dsshsm     Basic MLC, NALC
S017292          z/OS V2 DFSMS rmm        Basic MLC, NALC
S017293          z/OS V2 DFSMStvs         Basic MLC, NALC
S017294          z/OS V2 DFSORT           Basic MLC, NALC
S01729C          z/OS V2 RMF              Basic MLC, NALC
S01729D          z/OS V2 SDSF             Basic MLC, NALC
S01729F          z/OS V2 Security Server  Basic MLC, NALC
S01780D          z/OS V2 zEDC             Basic MLC, NALC
```

System z entry license charge (zELC)

To order zELC software, specify the program number and z800 model.

```
Specify the zELC monthly license option.

Entitlement                              License option/
identifier       Description             Pricing metric

S01728S          z/OS V2 Alternate Base  Basic MLC, zELC
S01728T          z/OS V2 Base            Basic MLC, zELC
S01728V          z/OS V2 BDT FTF         Basic MLC, zELC
S01728W          z/OS V2 BDT SzE NJE     Basic MLC, zELC
S01728X          z/OS V2 BookManager Build  Basic MLC, zELC
S01728Z          z/OS V2 XL C/C++        Basic MLC, zELC
S017290          z/OS V2 DFSMS dss        Basic MLC, zELC
S017291          z/OS V2 DFSMS dsshsm     Basic MLC, zELC
S017292          z/OS V2 DFSMS rmm        Basic MLC, zELC
```

```
S017293        z/OS V2 DFSMStvs         Basic MLC, zELC
S017294        z/OS V2 DFSORT           Basic MLC, zELC
S017295        z/OS V2 GDDM-PGF         Basic MLC, zELC
S017296        z/OS V2 GDDM-REXX        Basic MLC, zELC
S017297        z/OS V2 HCM              Basic MLC, zELC
S017298        z/OS V2 HLASM Toolkit    Basic MLC, zELC
S017299        z/OS V2 Infoprint Server Basic MLC, zELC
S01729B        z/OS V2 JES3             Basic MLC, zELC
S01729C        z/OS V2 RMF              Basic MLC, zELC
S01729D        z/OS V2 SDSF             Basic MLC, zELC
S01729F        z/OS V2 Security Server  Basic MLC, zELC
S01780D        z/OS V2 zEDC             Basic MLC, zELC
```

Single version charging

To elect single version charging, the customer must notify and identify to IBM the prior program and replacement program and the designated machine the programs are operating on.

Basic machine-readable material

The following no-charge features are added to z/OS V2.1 and can be ordered effective September 13, 2013. These no-charge media features have pricing/billing features associated with them. It is those associated pricing/billing features where the charges are listed and not the media features listed below. See the notes below for details on past announcements for this information.

```
z/OS V2.1                       z/OS V2.1
Feature description             Orderable supply ID

Base                            S01729J
```

Note: This product ships its executable code via Customized Offerings (ServerPac and CBPDO). The media type is chosen during the customized offering ordering procedure. Refer to the Customized offerings section for the media types offered.

Basic publications

A program directory is supplied with the basic machine-readable material.

Basic unlicensed electronic-only publications

```
                                       Order
      Title                            number

 z/OS V2R1 Collection                  SK4T-4949
```

For free, the customer can download the softcopy collection or any z/OS V2.1 documents individually or as product and some topic extended shelves available in electronic-form using the IBM Publications Center at

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

They come as "kitzips," which any modern zip utility can handle.

z/OS Version 2 Release 1 Collection (PDFs)

z/OS Version 2 Release 1 Collection (SK4T-4949) includes softcopy tools and libraries for z/OS Version 2 Release 1 (the element and feature libraries). Only PDF formats, when available, are included on the electronic deliverable.

For creating softcopy repositories, SoftCopy Librarian is the flagship tool for uploading and managing softcopy files on a z/OS host or server and on LANs and workstations. SoftCopy Librarian is a free program that is available on the softcopy tools disc of the collections or the web. Use it to obtain and manage shelves from

IBM or OEM (original equipment manufacturers), CD or DVD collections, or the Internet from the IBM PUBLIB website, as well as from other websites that provide support for the SoftCopy Librarian.

Softcopy Librarian V4.4 is supported on Windows 2000, Windows XP, and Windows Vista.

The latest version of the SoftCopy Librarian can be downloaded at

http://publib.boulder.ibm.com/epubs/df/ebrsclwj.exe

Customization options

Expedite shipments will be processed to receive 72-hour delivery from the time IBM Software Delivery and Fulfillment (SDF) receives the order. SDF will then ship the order via overnight air transportation.

Optional machine-readable material

To order, select the feature number for the desired distribution medium.

Optional unpriced features -- z/OS V2.1

The following optional features, offered at no additional charge, can be ordered effective July 23, 2013.

```
z/OS V2.1                            z/OS V2.1
Feature description                  Orderable supply ID

Communications Server Security Level 3    S0172B0
z/OS Security Level 3                     S01729W
```

Optional priced features

The following optional no-charge features can be ordered effective July 23, 2013. These optional no-charge media features have pricing/billing features associated with them. It is those associated pricing/billing features where the charges are listed and not the media features listed below.

```
z/OS V2.1                    z/OS V2.1
Feature description          Orderable supply ID

BDT FTF                      S01729L
BDT SNA NJE                  S01729G
BookManager Build           S01729P
XL C/C++                    S0172B4
DFSMS dss                   S01729H
DFSMS dss, hsm              S01729K
DFSMS rmm                   S01729M
DFSMStvs                    S01729N
DFSORT                      S01729S
GDDM-PGF                    S0172B2
GDDM-REXX                   S01729Z
HCM                         S0172B6
HLASM Toolkit               S0172B1
Infoprint Server            S01729X
JES3                        S01729V
RMF                         S01729T
SDSF                        S01729R
Security Server             S0172B3
zEDC                        S0178BP
```

Optional unpriced language features

The z/OS V2.1 Language features will become generally available on the same date the release becomes available.

z/OS V2.1 provides support in the languages listed below. However, not all elements within z/OS V2.1 are translated into each language. Refer to *z/OS Planning for Installation* for information on which elements are translated into which languages, by visiting

   http://publibz.boulder.ibm.com/cgi-bin/bookmgr_OS390/BOOKS/E0Z2B11B

The following optional features, offered at no additional charge, are added to z/OS V2.1 and can be ordered effective July 23, 2013.

The Language features for z/OS V2.1 are:

```
z/OS V2.1                          z/OS V2.1
Language feature description       Orderable supply ID

Brazilian Portuguese Base (PTB)    S0173RM
Brazilian Portuguese BookMgr       S0173RT
Build
Canadian French Base (FRC)         S0173S9
Canadian French BookMgr Build      S0173RN
Danish Base (DAN)                  S0173RD
Dutch Base (NLD)                   S0173RK
French Base (FRA)                  S0173R4
French BookMgr Build               S0173RR
German Base (DEU)                  S0173R8
German BookMgr Build               S0173RP
Italian Base (ITA)                 S0173R7
JPN Base                           S0173RF
JPN XL C/C++                       S0173SD
JPN Infoprint Server               S0173SG
JPN RMF                            S0173SH
JPN SDSF                           S0173RV
JPN Security Server                S0173SF
Upper Case English Base (ENP)      S0173RJ
Korean Base (KOR)                  S0173RH
Norwegian Base (NOR)               S0173RG
Spanish Base (ESP)                 S0173R9
Spanish BookMgr Build              S0173RS
Swedish Base (SVE)                 S0173RC
Swiss German Base (DES)            S0173RB
Simplified Chinese Base (CHS)      S0173RL
Traditional Chinese Base (CHT)     S0173R6
```

System z New application license charge (zNALC) ordering information

z/OS (and z/OS priced features) is the only program eligible for zNALC charges. In the IBM enterprise software billing and fulfillment system, IBM uses the term "Basic License" to indicate licenses that are billable. When software is licensed to a stand-alone server, IBM places basic (billable) licenses on that stand-alone server. When software is licensed to multiple machines in a qualified Parallel Sysplex , IBM places basic (billable) licenses on an entity representing the Sysplex and places registration (no-charge) licenses on each licensed machine belonging to the Parallel Sysplex .

z/OS with zNALC charges can aggregate across servers that participate in a fully qualified Parallel Sysplex . For more information on Parallel Sysplex , visit

   http://ibm.com/zseries/swprice/sysplex

In the case that there are multiple servers with z/OS with zNALC charges participating in qualified Parallel Sysplex and you request aggregated pricing, then IBM will apply the zNALC basic license structure to the Sysplex and apply zNALC no-charge registration licenses to each of the individual servers that comprise the Sysplex.

```
System z New Application License Charge (zNALC)

Basic license structure

Entitlement                            License option/
identifier      Description            Pricing metric

S01728S         z/OS V2 Alternate Base    Basic MLC, zNALC
S01728T         z/OS V2 Base              Basic MLC, zNALC
S01728V         z/OS V2 BDT FTF           Basic MLC, zNALC
S01728W         z/OS V2 BDT SNA NJE       Basic MLC, zNALC
S01728X         z/OS V2 BookManager Build Basic MLC, zNALC
S01728Z         z/OS V2 XL C/C++          Basic MLC, zNALC
S017290         z/OS V2 DFSMS dss         Basic MLC, zNALC
S017291         z/OS V2 DFSMS dsshsm      Basic MLC, zNALC
S017292         z/OS V2 DFSMS rmm         Basic MLC, zNALC
S017293         z/OS V2 DFSMStvs          Basic MLC, zNALC
S017294         z/OS V2 DFSORT            Basic MLC, zNALC
S017295         z/OS V2 GDDM-PGF          Basic MLC, zNALC
S017296         z/OS V2 GDDM-REXX         Basic MLC, zNALC
S017297         z/OS V2 HCM               Basic MLC, zNALC
S017298         z/OS V2 HLASM Toolkit     Basic MLC, zNALC
S017299         z/OS V2 Infoprint Server  Basic MLC, zNALC
S01729B         z/OS V2 JES3              Basic MLC, zNALC
S01729C         z/OS V2 RMF               Basic MLC, zNALC
S01729D         z/OS V2 SDSF              Basic MLC, zNALC
S01729F         z/OS V2 Security Server   Basic MLC, zNALC
S01780D         z/OS V2 zEDC              Basic MLC, zNALC
```

System z New Application License Charge (zNALC) Basic License

To order a basic license, specify the program number and the quantity of MSUs.

A program directory and one copy of the following publication is supplied automatically with the basic machine-readable material:

```
                                 Order
        Title                    number

z/OS Hot Topics Newsletter       GA32-0892
```

The z/OS publications are available at

   http://www.ibm.com/systems/z/os/zos/bkserv/

Licensed documentation

Subsequent updates (technical newsletters or revisions between releases) to the publications shipped with the product will be distributed to the user of record for as long as a license for this software remains in effect. A separate publication order or subscription is not needed.

Customized offerings

Product deliverables are shipped only via CBPDO and ServerPac.

CBPDO and ServerPac are offered for Internet delivery in countries where Shopz product ordering is available. Internet delivery reduces software delivery time and allows you to install software without the need to handle tapes. For more details on Internet delivery, refer to the Shopz help information at

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

You choose the delivery method when you order the software. IBM recommends Internet delivery. In addition to Internet and DVD, the supported tape delivery options for CBPDO and ServerPac include:

- 3590
- 3592

Most products can be ordered in ServerPac the month following their availability on CBPDO. z/OS can be ordered via both offerings at general availability. Production of software product orders will begin on the planned general availability date.

- CBPDO shipments will begin one week after general availability.
- ServerPac shipments will begin two weeks after general availability

Terms and conditions

Agreement
IBM Customer Agreement

Designated machine
Not required

Variable charges apply
No

Indexed monthly license charge (IMLC) applies
No

Location license applies
No

Use limitation applies
No

Educational allowance available
Yes, 15% education allowance applies to qualified education institution customers.

Volume orders
Not applicable.

```
 Replaced programs        Replacement programs

 Program     Program      Program      Program
 number      name         number       name

 5645-001    OS/390 V1    5650-ZOS     z/OS V2
 5647-A01    OS/390 V2    5650-ZOS     z/OS V2
 5694-A01    z/OS V1      5650-ZOS     z/OS V2

 z/OS base

 5648-E76    Infoprint    5650-ZOS     z/OS 2.1
             Fonts z/OS
             V1.1
 5648-B33    IBM AFP Font 5650-ZOS     z/OS 2.1
             Collection
             V2.1 for
             S/390

 5650-ZOS    z/OS         To a follow-on if any
 5655-068    MVS/ESA JES2 5650-ZOS     z/OS 2.1
 5695-117    VTAM®        5650-ZOS     z/OS 2.1
```

```
5695-046    BookManager   5650-ZOS      z/OS 2.1
            Read
5655-A20    BookManager   5650-ZOS      z/OS 2.1
            BookServer
5695-DF1    DFSMSdfp      5650-ZOS      z/OS 2.1
5695-DF1    DFSMS/MVS     5650-ZOS      z/OS 2.1
            Network File
            System
5695-167    GDDM®         5650-ZOS      z/OS 2.1
5696-234    HLASM         5650-ZOS      z/OS 2.1
5655-042    ISPF          5650-ZOS      z/OS 2.1
5688-198    Language      5650-ZOS      z/OS 2.1
            Envt./MVS
5655-104    OSA/SF        5650-ZOS      z/OS 2.1
5655-G44    SMP/E         5650-ZOS      z/OS 2.1
5655-HAL    TCP/IP        5650-ZOS      z/OS 2.1
5685-025    TSO/E         5650-ZOS      z/OS 2.1
5685-051    ICSF/MVS      5650-ZOS      z/OS 2.1

5665-264    BDT           5650-ZOS      z/OS 2.1
5665-311    PCFiletrn     5650-ZOS      z/OS 2.1
5655-A29    Communica-    5650-ZOS
            tions Server
5740-XY5    Programmed    5650-ZOS      z/OS 2.1
            Cryptographic
            Facility V1
5771-ABC    Math and      5650-ZOS      z/OS 2.1
            Science
            Font Object
            AFP
5771-ADT    Pi and        5650-ZOS      z/OS 2.1
            Specials
            Fonts Object


z/OS optional features

5665-264    BDT File-to-  5650-ZOS      z/OS 2.1
            File
5665-264    BDT SNA NJE   5650-ZOS      z/OS 2.1
5695-045    BookManager   5650-ZOS      z/OS 2.1
            Build
5655-121    XL C/C++      5650-ZOS      z/OS 2.1
5740-SM1    DFSORT        5650-ZOS      z/OS 2.1
5695-DF1    DFSMSdss      5650-ZOS      z/OS 2.1
5695-DF1    DFSMShsm      5650-ZOS      z/OS 2.1
5695-DF1    DFSMSrmm      5650-ZOS      z/OS 2.1
5694-A01    DFSMStvs      5650-ZOS      z/OS 2.1
5668-812    GDDM-PGF      5650-ZOS      z/OS 2.1
5695-167    GDDM-REXX     5650-ZOS      z/OS 2.1
5697-119    HCM           5650-ZOS      z/OS 2.1
5696-234    HLASM         5650-ZOS      z/OS 2.1
5655-069    MVS/ESA JES3  5650-ZOS      z/OS 2.1
5695-039    RACF          5650-ZOS      z/OS 2.1
5655-084    RMF           5650-ZOS      z/OS 2.1
5665-488    SDSF          5650-ZOS      z/OS 2.1
```

Warranty applies

Yes

Licensed program materials availability

```
Restricted Materials of IBM:     Some
Non-Restricted Source Materials: Some
Object Code Only (OCO):          None
```

IBM Operational Support Services -- SupportLine

Yes

Prices

For additional information and current prices, contact your local IBM representative.

```
Program number      MLC

5650-ZOS            $
```

System z entry license charge (zELC)

```
Entitlement                              License option/
identifier      Description              Pricing metric

S01728S         z/OS V2 Alternate Base   Basic MLC, zELC
S01728T         z/OS V2 Base             Basic MLC, zELC
S01728V         z/OS V2 BDT FTF          Basic MLC, zELC
S01728W         z/OS V2 BDT SzE NJE      Basic MLC, zELC
S01728X         z/OS V2 BookManager Build Basic MLC, zELC
S01728Z         z/OS V2 XL C/C++         Basic MLC, zELC
S017290         z/OS V2 DFSMS dss         Basic MLC, zELC
S017291         z/OS V2 DFSMS dsshsm      Basic MLC, zELC
S017292         z/OS V2 DFSMS rmm         Basic MLC, zELC
S017293         z/OS V2 DFSMStvs          Basic MLC, zELC
S017294         z/OS V2 DFSORT           Basic MLC, zELC
S017295         z/OS V2 GDDM-PGF         Basic MLC, zELC
S017296         z/OS V2 GDDM-REXX        Basic MLC, zELC
S017297         z/OS V2 HCM              Basic MLC, zELC
S017298         z/OS V2 HLASM Toolkit    Basic MLC, zELC
S017299         z/OS V2 Infoprint Server Basic MLC, zELC
S01729B         z/OS V2 JES3             Basic MLC, zELC
S01729C         z/OS V2 RMF              Basic MLC, zELC
S01729D         z/OS V2 SDSF             Basic MLC, zELC
S01729F         z/OS V2 Security Server  Basic MLC, zELC
S01780D         z/OS V2 zEDC             Basic MLC, zELC
```

Parallel Sysplex license charge (PSLC)

```
Entitlement                              License option/
identifier      Description              Pricing metric

S01728S         z/OS V2 Alternate Base   Basic MLC, PSLC
S01728T         z/OS V2 Base             Basic MLC, PSLC
S01728V         z/OS V2 BDT FTF          Basic MLC, PSLC
S01728W         z/OS V2 BDT SzE NJE      Basic MLC, PSLC
S01728X         z/OS V2 BookManager Build Basic MLC, PSLC
S01728Z         z/OS V2 XL C/C++         Basic MLC, PSLC
S017291         z/OS V2 DFSMS dsshsm      Basic MLC, PSLC
S017292         z/OS V2 DFSMS rmm         Basic MLC, PSLC
S017293         z/OS V2 DFSMStvs          Basic MLC, PSLC
S017294         z/OS V2 DFSORT           Basic MLC, PSLC
S017295         z/OS V2 GDDM-PGF         Basic MLC, PSLC
S017296         z/OS V2 GDDM-REXX        Basic MLC, PSLC
S017297         z/OS V2 HCM              Basic MLC, PSLC
S017298         z/OS V2 HLASM Toolkit    Basic MLC, PSLC
S017299         z/OS V2 Infoprint Server Basic MLC, PSLC
S01729B         z/OS V2 JES3             Basic MLC, PSLC
S01729C         z/OS V2 RMF              Basic MLC, PSLC
S01729D         z/OS V2 SDSF             Basic MLC, PSLC
S01729F         z/OS V2 Security Server  Basic MLC, PSLC
S01780D         z/OS V2 zEDC             Basic MLC, PSLC
```

Advanced Workload license charge (AWLC)

Entitlement identifier	Description	License option/ Pricing metric
S01728S	z/OS V2 Alternate Base	Basic MLC, AWLC
S01728T	z/OS V2 Base	Basic MLC, AWLC
S01728V	z/OS V2 BDT FTF	Basic MLC, AWLC
S01728W	z/OS V2 BDT SNA NJE	Basic MLC, AWLC
S01728X	z/OS V2 BookManager Build	Basic MLC, AWLC
S01728Z	z/OS V2 XL C/C++	Basic MLC, AWLC
S017290	z/OS V2 DFSMS dss	Basic MLC, AWLC
S017291	z/OS V2 DFSMS dsshsm	Basic MLC, AWLC
S017292	z/OS V2 DFSMS rmm	Basic MLC, AWLC
S017293	z/OS V2 DFSMStvs	Basic MLC, AWLC
S017294	z/OS V2 DFSORT	Basic MLC, AWLC
S017295	z/OS V2 GDDM-PGF	Basic MLC, AWLC
S017296	z/OS V2 GDDM-REXX	Basic MLC, AWLC
S017297	z/OS V2 HCM	Basic MLC, AWLC
S017298	z/OS V2 HLASM Toolkit	Basic MLC, AWLC
S017299	z/OS V2 Infoprint Server	Basic MLC, AWLC
S01729B	z/OS V2 JES3	Basic MLC, AWLC
S01729C	z/OS V2 RMF	Basic MLC, AWLC
S01729D	z/OS V2 SDSF	Basic MLC, AWLC
S01729F	z/OS V2 Security Server	Basic MLC, AWLC
S01780D	z/OS V2 zEDC	Basic MLC, AWLC

Advanced Entry Workload license charge (AWLC)

Entitlement identifier	Description	License option/ Pricing metric
S01728S	z/OS V2 Alternate Base	Basic MLC, AEWLC
S01728T	z/OS V2 Base	Basic MLC, AEWLC
S01728V	z/OS V2 BDT FTF	Basic MLC, AEWLC
S01728W	z/OS V2 BDT SzE NJE	Basic MLC, AEWLC
S01728X	z/OS V2 BookManager Build	Basic MLC, AEWLC
S01728Z	z/OS V2 XL C/C++	Basic MLC, AEWLC
S017290	z/OS V2 DFSMS dss	Basic MLC, AEWLC
S017291	z/OS V2 DFSMS dsshsm	Basic MLC, AEWLC
S017292	z/OS V2 DFSMS rmm	Basic MLC, AEWLC
S017293	z/OS V2 DFSMStvs	Basic MLC, AEWLC
S017294	z/OS V2 DFSORT	Basic MLC, AEWLC
S017295	z/OS V2 GDDM-PGF	Basic MLC, AEWLC
S017296	z/OS V2 GDDM-REXX	Basic MLC, AEWLC
S017297	z/OS V2 HCM	Basic MLC, AEWLC
S017298	z/OS V2 HLASM Toolkit	Basic MLC, AEWLC
S017299	z/OS V2 Infoprint Server	Basic MLC, AEWLC
S01729B	z/OS V2 JES3	Basic MLC, AEWLC
S01729C	z/OS V2 RMF	Basic MLC, AEWLC
S01729D	z/OS V2 SDSF	Basic MLC, AEWLC
S01729F	z/OS V2 Security Server	Basic MLC, AEWLC
S01780D	z/OS V2 zEDC	Basic MLC, AEWLC

Variable Workload license charge (VWLC)

Entitlement identifier	Description	License option/ Pricing metric
S01728S	z/OS V2 Alternate Base	Basic MLC, VWLC
S01728T	z/OS V2 Base	Basic MLC, VWLC
S01728V	z/OS V2 BDT FTF	Basic MLC, VWLC
S01728W	z/OS V2 BDT SzE NJE	Basic MLC, VWLC
S01728X	z/OS V2 BookManager Build	Basic MLC, VWLC
S01728Z	z/OS V2 XL C/C++	Basic MLC, VWLC
S017290	z/OS V2 DFSMS dss	Basic MLC, VWLC
S017291	z/OS V2 DFSMS dsshsm	Basic MLC, VWLC
S017292	z/OS V2 DFSMS rmm	Basic MLC, VWLC
S017293	z/OS V2 DFSMStvs	Basic MLC, VWLC
S017294	z/OS V2 DFSORT	Basic MLC, VWLC
S017295	z/OS V2 GDDM-PGF	Basic MLC, VWLC
S017296	z/OS V2 GDDM-REXX	Basic MLC, VWLC

```
S017297       z/OS V2 HCM             Basic MLC, VWLC
S017298       z/OS V2 HLASM Toolkit   Basic MLC, VWLC
S017299       z/OS V2 Infoprint Server  Basic MLC, VWLC
S01729B       z/OS V2 JES3            Basic MLC, VWLC
S01729C       z/OS V2 RMF             Basic MLC, VWLC
S01729D       z/OS V2 SDSF            Basic MLC, VWLC
S01729F       z/OS V2 Security Server  Basic MLC, VWLC
S01780D       z/OS V2 zEDC            Basic MLC, VWLC
```

Sub-capacity charges for VWLC products

Sub-capacity charges for VWLC products are based on product LPAR utilization capacity. Product LPAR utilization capacity for a VWLC product is the highest number of MSUs utilized by the combined LPARs in which a VWLC product runs concurrently during a reporting period. The number of MSUs is based on the highest observed rolling 4-hour average utilization used by the combination of the relevant LPARs during the reporting period.

Sub-capacity charges terms and conditions

System z software charges at less than full machine capacity for eligible VWLC products apply when z/OS is running in z/Architecture® (64-bit) mode on an IBM System z 900, no other MVS-based operating system is licensed to that server, and the required information is provided by the customer in accordance with the applicable terms.

Sub-capacity charges for a VWLC product is based on the utilization of the LPARs where/when the product executes. To obtain charges at less than full machine capacity for VWLC products, the customer is required to:

- Sign and abide by the terms of the Attachment for IBM System z Workload License Charges - (Z125-6516).
- Obtain the latest version of the Sub-Capacity Reporting Tool.
- Install any VWLC product and IBM e(logo)server System z 900 Licensed Internal Code (LIC) service required for sub-capacity charging. Required service will be listed on the WLC website

  http://www.ibm.com/zseries/swprice
- Collect SMF data as required by the Sub-Capacity Reporting Tool. Retain the collected SMF data for a period of not less than six months.
- Use the IBM provided Sub-Capacity Reporting Tool to process the collected SMF data. The Sub-Capacity Report produced by the tool is used to determine required license capacity for the VWLC products. Required license capacity is determined based on the largest MSU value of a VWLC product running concurrently in all LPARs during the reporting period. IBM reserves the right to request the system data that supports these product-defined capacity values for a period of up to six months after the data was collected.
- Provide an initial Sub-Capacity Report to begin to receive the benefits of less than full machine capacity charges. Sub-capacity charging will follow submission of a Sub-Capacity Report. There will be no retroactive application of sub-capacity charges.
- Submit Sub-Capacity Reports monthly.
- Submit Sub-Capacity Reports for all VWLC products with complete data for the entire reporting period to the email address and by the date specified in the current IBM System z Workload License Charges Exhibit (Z125-6324) and on the System z Software Pricing website

  http://www.ibm.com/zseries/swprice

  Sub-Capacity Reports that reflect a changed product defined capacity will be considered to be orders placed by the customer without further action on the customer's part, and IBM is authorized to make any resulting billing increase or decrease. To place an order for a new license or to discontinue licenses, move licenses between machines, report a hardware model upgrade, or enable or

disable product features, the customer must contact IBM or their IBM Business Partner.

- Configure the machine to send weekly Transmit System Availability Data (TSAD) to IBM via the IBM System z 900 Remote Support Facility (RSF). If the machine cannot connect via the RSF, provide this TSAD via an alternate means documented in the z/OS publication *Planning for Workload License Charges* at

    http://www.ibm.com/zseries/swprice

Entry Workload license charge (EWLC)

Entitlement identifier	Description	License option/ Pricing Metric
S01728S	z/OS V2 Alternate Base	Basic MLC, EWLC
S01728T	z/OS V2 Base	Basic MLC, EWLC
S01728V	z/OS V2 BDT FTF	Basic MLC, EWLC
S01728W	z/OS V2 BDT SzE NJE	Basic MLC, EWLC
S01728X	z/OS V2 BookManager Build	Basic MLC, EWLC
S01728Z	z/OS V2 XL C/C++	Basic MLC, EWLC
S017290	z/OS V2 DFSMS dss	Basic MLC, EWLC
S017291	z/OS V2 DFSMS dsshsm	Basic MLC, EWLC
S017292	z/OS V2 DFSMS rmm	Basic MLC, EWLC
S017293	z/OS V2 DFSMStvs	Basic MLC, EWLC
S017294	z/OS V2 DFSORT	Basic MLC, EWLC
S017295	z/OS V2 GDDM-PGF	Basic MLC, EWLC
S017296	z/OS V2 GDDM-REXX	Basic MLC, EWLC
S017297	z/OS V2 HCM	Basic MLC, EWLC
S017298	z/OS V2 HLASM Toolkit	Basic MLC, EWLC
S017299	z/OS V2 Infoprint Server	Basic MLC, EWLC
S01729B	z/OS V2 JES3	Basic MLC, EWLC
S01729C	z/OS V2 RMF	Basic MLC, EWLC
S01729D	z/OS V2 SDSF	Basic MLC, EWLC
S01729F	z/OS V2 Security Server	Basic MLC, EWLC
S01780D	z/OS V2 zEDC	Basic MLC, EWLC

New Application license charge (NALC)

Entitlement identifier	Description	License option/ Pricing metric
S01728T	z/OS V2 Base	Basic MLC, NALC
S01728Z	z/OS V2 XL C/C++	Basic MLC, NALC
S017291	z/OS V2 DFSMS dsshsm	Basic MLC, NALC
S017292	z/OS V2 DFSMS rmm	Basic MLC, NALC
S017293	z/OS V2 DFSMStvs	Basic MLC, NALC
S017294	z/OS V2 DFSORT	Basic MLC, NALC
S01729C	z/OS V2 RMF	Basic MLC, NALC
S01729D	z/OS V2 SDSF	Basic MLC, NALC
S01729F	z/OS V2 Security Server	Basic MLC, NALC
S01780D	z/OS V2 zEDC	Basic MLC, NALC

System z New Application license charge

Entitlement identifier	Description	License option/ Pricing metric	zNALC charge
S01728S	z/OS V2 Alternate Base	Basic MLC, zNALC	
S01728T	z/OS V2 Base	Basic MLC, zNALC	
S01728V	z/OS V2 BDT FTF	Basic MLC, zNALC	
S01728W	z/OS V2 BDT SzE NJE	Basic MLC, zNALC	
S01728X	z/OS V2 BookManager Build	Basic MLC, zNALC	
S01728Z	z/OS V2 XL C/C++	Basic MLC, zNALC	
S017290	z/OS V2 DFSMS dss	Basic MLC, zNALC	
S017291	z/OS V2 DFSMS dsshsm	Basic MLC, zNALC	
S017292	z/OS V2 DFSMS rmm	Basic MLC, zNALC	
S017293	z/OS V2 DFSMStvs	Basic MLC, zNALC	
S017294	z/OS V2 DFSORT	Basic MLC, zNALC	
S017295	z/OS V2 GDDM-PGF	Basic MLC, zNALC	
S017296	z/OS V2 GDDM-REXX	Basic MLC, zNALC	

```
S017297        z/OS V2 HCM               Basic MLC, zNALC
S017298        z/OS V2 HLASM Toolkit     Basic MLC, zNALC
S017299        z/OS V2 Infoprint Server  Basic MLC, zNALC
S01729B        z/OS V2 JES3              Basic MLC, zNALC
S01729C        z/OS V2 RMF               Basic MLC, zNALC
S01729D        z/OS V2 SDSF              Basic MLC, zNALC
S01729F        z/OS V2 Security Server   Basic MLC, zNALC
S01780D        z/OS V2 zEDC              Basic MLC, zNALC
```

Order now

To order, contact the Americas Call Centers or your local IBM representative, or your IBM Business Partner.

To identify your local IBM representative or IBM Business Partner, call 800-IBM-4YOU (426-4968).

```
Phone:      800-IBM-CALL (426-2255)
Fax:        800-2IBM-FAX (242-6329)
 For IBM representative: callserv@ca.ibm.com
 For IBM Business Partner: pwswna@us.ibm.com
Mail:       IBM Teleweb Customer Support
            ibm.com® Sales Execution Center, Americas North
            3500 Steeles Ave. East, Tower 3/4
            Markham, Ontario
            Canada
            L3R 2Z1
```

Reference: LE001

The Americas Call Centers, our national direct marketing organization, can add your name to the mailing list for catalogs of IBM products.

Note: Shipments will begin after the planned availability date.

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Corrections

(Corrected on October 29, 2013)

Instances of "XL C/C++ without Debug" were changed to "XL C/C++."

(Corrected on October 1, 2013)

The Key dates section was revised to correct the SystemPac dates.

(Corrected on September 26, 2013)

The Statements of direction, Key dates, and Description sections were revised.