



# IBM z/OS Version 2 Release 2 -- Fueling the digital enterprise

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## At a glance

New market pressures are transforming virtually every industry, requiring businesses to devise new ways to customize and personalize products and services to reach the new demographic--the market of one. Businesses that are able to harness the power of cloud, analytics, and mobile computing while supporting outstanding qualities of service are more likely to succeed in this new market economy. A smooth transition requires a highly aligned platform infrastructure that provides agile information processing and analytics capabilities along with leading-edge security to protect business transactions and customer data.

The transformation to digital business is changing how companies access, consume, and leverage information from multiple sources by analyzing content in new ways to deliver additional value to customers. The digital economy will require you to quickly consume, manipulate, and deliver huge volumes of information, extracting business value while leveraging the new delivery models like cloud. Your information must be securely managed, processed, and delivered to mobile customers around the globe at any time. This processing shift calls for a highly responsive and reliable foundation that can support dramatically different workloads alongside existing ones, without compromising service levels.

IBM's z/OS<sup>®</sup> V2.2 operating system and the IBM z13<sup>™</sup> server work together to deliver innovations designed to help you build the next-generation infrastructure you need. Together, they offer the capacity, scale, availability, and throughput required to improve business performance, meet response time objectives, protect sensitive data and transactions, and deliver an exceptional customer experience. New economic efficiencies enable the z13<sup>™</sup> with z/OS V2.2 to offer more throughput and capabilities with less impact to the IT budget.

This z/OS V2.2 announcement describes many capabilities designed to support:

- Exceptional service levels with:
  - Simultaneous multithreading on zIIP specialty engines on z13 processors for higher overall throughput and more consistent capacity
  - Scalability, with up to 141 configurable processors or up to 128 processors per LPAR on z13 processors when running in SMT mode
  - Improved autonomics for health-based workload routing in a Parallel Sysplex<sup>®</sup> to help improve availability
- Analytics enablement with information management, storage, and delivery capabilities:

- Support for up to 4 TB of RAIM memory per LPAR to improve performance of IBM<sup>(R)</sup> DB2<sup>(R)</sup> and other memory-intensive workloads
- Fabric I/O Priority, extending Workload Management into the SAN fabric to prioritize your most important workloads and help improve service levels
- 16 Gb FICON<sup>(R)</sup> links to help reduce I/O latency to help meet response time goals
- A new IBM zHyperWrite<sup>TM</sup> capability to help you attain better DB2 log write performance and keep up with high transaction rates when using Metro Mirror (PPRC) in a HyperSwap-managed environment
- A trusted and resilient system of record:
  - Faster data encryption to handle increased transaction volume with both a new Crypto Express5S cryptographic adapter and significantly faster on-chip cryptography using CPACF
  - Digitally signed SMF records designed to provide a more trusted audit repository
  - Improvements to secure communications, additional support for ciphers, RACF<sup>(R)</sup> enhancements, and more
- Capturing the potential of the mobile enterprise:
  - System SSL OCSP enhancements help reduce risk by checking certificate revocation status over the network in near real time.
  - Mobile Workload Pricing programs help you reduce software costs during periods of peak mobile transaction workloads.
  - z/OS Connect software helps you easily integrate z/OS systems with your mobile computing environment.

z/OS V2.2 and z13 deliver innovation that can help you support your current workloads while capturing value from the new marketplace, the marketplace of one.

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

Reference: LE001

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## Overview

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Enterprises are transforming their businesses to access and synthesize data to more effectively compete in today's economy. Companies are creating new solutions to capture value from data in real time to serve their mobile stakeholders, while requiring the highest levels of security and resiliency. Companies are also changing the way they assimilate, process, and deliver information to maximize value from information. To meet these needs, an enterprise must harvest huge volumes of data to extract and deliver business insight from raw data and perform "information gymnastics" to uncover and act quickly on competitive advantages. These insights, based on rapid and effective transformation of data, can be used to enable informed decision making on everything from product pipelines to next best actions at points of sale.

The computing environment typically needed for this processing comprises a scalable infrastructure that must be highly secured and accessible on demand, to serve a global market. The environment must be prepared to meet audit and regulatory requirements rendered even more complex in today's borderless economy. Mobile and social computing are the new norms for customer engagement and have created unprecedented requirements for availability, speed, and security.

Throughout the journey to the new digital enterprise, companies must also support exceptional qualities of service while using innovative mobile applications to mine data or capture data to surface new business opportunities. This demand for agility, framed against a backdrop of stringent business requirements, calls for a platform armed with autonomics to drive innovation while minimizing risk. It also requires a platform that is much easier to use. z/OS V2.2 can help you take full advantage

of this new transformational opportunity with a scalable, highly available, and trusted infrastructure. In addition, some aspects of z/OS administration have been dramatically simplified with the inclusion of an updated z/OSMF to help you improve process quality, simplify management, and automate work.

Together, the IBM z/OS V2.2 operating system and the z13 server deliver innovations designed to help you build the next-generation infrastructure you need to power your new workloads. They team to help you improve business performance, meet response time requirements, protect sensitive data, and minimize operational risk while delivering an exceptional customer experience. The combination of z/OS V2.2 and the z13 server are designed together to provide the qualities of service you need to extend your workloads to meet the demands of a global and mobile customer base.

To support the need for real-time information insight, z/OS V2.2 coupled with z13 hardware innovations such as larger memory, new simultaneous multithreading chip design, enhanced vector processing with new SIMD instructions, and enhanced cryptographic capabilities deliver an outstanding solution to support your computing needs.

### **Exceptional service levels for scalable environments and clouds**

z/OS enhancements leverage the new z13 chip multithreading design, vector processing, and huge amounts of memory to help with throughput, performance, and latency:

- Any company considering implementing a private cloud on z/OS on z13 will appreciate the speed and scale of z Systems™, and its support for up to 85 LPARs to accommodate many concurrent workloads. In addition, the z13 supports up to 141 configurable processing cores, approximately 40% more than the zEC12.
- Simultaneous multithreading (SMT) support for zIIP processors is designed to offer throughput improvements you can use to address the growing volume of zIIP-eligible work, such as Java-based IBM WebSphere® Application Server and CICS® Transaction Server Java-based transactions, and more.
- Enhanced WLM and XCF infrastructure designed to help optimize workload routing.
- Infrastructure as a service (IaaS) REST-based z/OS interfaces to help you build and deploy services like file management services and z/OS batch services for new browser-based client-facing applications.
- New RMF™ measurement data for Storage Class Memory to help you more easily manage Storage Class Memory utilization, which is helpful as you deploy storage-class memory to help improve availability.

### **Enable analytics with information management, storage, and delivery**

Data serving is promoted to a new level with new I/O capabilities designed for throughput and autonomies, enhanced vector processing support, and memory scalability designed to improve performance:

- New types of analytics applications are made possible through large memory-- up to 4 TB per z/OS image on z13--to unleash the power of data in memory and also improve performance of many workloads.
- Enhancements to vector processing can be used for analytics acceleration, using new SIMD facilities.
- 16 Gb FICON support can help reduce I/O latency.
- Fabric I/O Priority can help ensure that your most important work is read or written first to help you meet your most critical service levels.
- A new zHyperWrite capability helps you achieve better DB2 log write performance when using Metro Mirror (PPRC) in a HyperSwap-managed environment.

### **Deliver a trusted and resilient system of record**

With its legendary security and support for the most highly regulated industries, z/OS V2.2 is designed to help you build public key infrastructure services, serves as your secured data vault, helps you meet regulatory requirements, and can help reduce operational risk:

- SMF record signing is intended to make your SMF-based auditing data a more highly trusted repository
- A new RACF read-only auditor capability for stronger separation of duties between security auditors and security administrators
- Increased protection against attacks with a variety of strengthened security capabilities in RACF and other system components
- Faster data encryption to handle increased transaction volume with the new Crypto Express5S cryptographic adapter and improved performance for on-chip cryptographic coprocessors; also, virtualization of the cryptographic adapter across up to 85 domains, over a fivefold increase, for improved economics
- Enhancements to help you audit changes to the APF authorized library list

### **Capture the potential of the mobile enterprise**

With new capabilities on near real time, you can understand customer sentiment, analyze information for more targeted insight, conduct transactions with a mobile device, and serve customers across the globe:

- Enhancements to communications can help you reduce the time to respond, even more critical in the new mobile landscape. For instance, the enhanced Communications Server support for RDMA over converged Ethernet (RoCE), which is designed to reduce communications latency and lower CPU cost for many workloads, now can deliver improved economics with as many as 31 z/OS images sharing each adapter.
- z/OS uses improved CPACF on-chip encryption functions on the z13 to help you to effectively double the encryption rate, ideal for mobile banking.
- z/OS V2.2 System SSL enhancements support the online certificate status protocol (OCSP) to help detect revoked certificates in near real time.
- Enhanced vector facilities and support for large memory make it possible to incorporate real-time analytics processing in transactions for retail, healthcare, financial, and more.
- IBM's Mobile Workload Pricing strategy can help you address the cost of mobile workloads during peak processing periods.
- The WebSphere Liberty z/OS Connect function enables z/OS-based systems such as those built using CICS and IMS™ to easily participate in mobile computing environments.

### **Summary**

Enterprises must synthesize knowledge from data and analytics, leveraging memory at scale to help you deliver information to mobile clients, partners, and employees across the globe. Powerful enhancements to z/OS V2.2 and simplification through entitled z/OSMF can help you achieve your business vision and more easily evolve your solutions to meet new computing challenges. Unleash new possibilities with z/OS V2.2 -- fuel for digital business.

The z13 processor, as announced in Hardware Announcement [115-001](#), dated January 14, 2015, is supported by z/OS V1.13 (5694-A01) and z/OS Version 2. Continued tight integration between hardware and software technologies has become increasingly important to meeting the capacity and performance demands of mission-critical workloads. Accordingly, z/OS exploits many of the new functions and features of z13, including SMT support, large memory, SIMD, and more. Refer to the "z/OS support for z Systems servers" topic in the [Description](#) section for details.

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## **Key prerequisites**

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z/OS V2.2 runs on these IBM z Systems™ servers:

- IBM z13
- IBM zEnterprise<sup>(R)</sup> EC12 (zEC12)
- IBM zEnterprise BC12 (zBC12)
- IBM zEnterprise 196 (z196)<sup>1</sup>
- IBM zEnterprise 114 (z114)<sup>1</sup>
- IBM System z10<sup>(R)</sup> (z10<sup>TM</sup> EC, z10 BC)<sup>1</sup>

<sup>1</sup> These products are withdrawn from marketing.

In addition, z/OS V2.2 supports these and later IBM storage control units:

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

For a complete description of z/OS V2.2 software prerequisites, refer to *z/OS V2R2 Planning for Installation* (GA32-0890).

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## Planned availability date

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September 30, 2015

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## Description

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### Availability

Availability is a cornerstone for the z platform, and z/OS continues to make strides in finding and reducing opportunities for downtime.

z/OS Workload Manager (WLM) provides routing recommendations for Parallel Sysplex workload balancers such as the Communications Server Sysplex Distributor based on a number of factors, including application server health. An extended z/OS V2.2 WLM Health service is designed to accept server health adjustments from other authorized participants in a Parallel Sysplex. Also, cross-system coupling facility (XCF) and cross-system extended services (XES) processing are designed to provide server health adjustment factors to WLM, lowering or raising the health factors as circumstances warrant. This new function is intended to help workload balancers that use WLM services to route work to servers that are working well and away from those that are not, helping improve application and Parallel Sysplex availability. z/OS Runtime Diagnostics (RTD) identifies servers having health values that fall below the maximum (100), to help you identify server health issues that might be causing system problems.

In addition, z/OS V2.2 XCF is designed to improve resiliency by delaying, and, if necessary, rejecting messages sent to group members that are not effectively processing their signals. This support is intended to better isolate XCF groups so that problems with signal delivery for one group are less likely to impact signal delivery for other groups.

z/OS V2.2 JES2 is designed to enable you to dynamically increase the JES2 checkpoint size in place if there is sufficient space to support expansion. This supplements other methods of increasing checkpoint space, such as using the checkpoint reconfiguration dialog to move the checkpoint or add another checkpoint device. Combined with the existing dynamic volume expansion capabilities of IBM System Storage<sup>(R)</sup> DS8000<sup>(R)</sup> family devices, this new function is designed to enable

you to increase volume size and then expand a checkpoint data set when necessary, all without disrupting system operation.

z/OS V2.2 supports the Multi-Target Peer-to-Peer Remote Copy (MT-PPRC) capability for IBM System Storage DS8000 series with a minimum MCL, announced in Hardware Announcement [114-171](#), dated October 6, 2014, and Hardware Announcement [114-172](#), dated October 6, 2014.

MT-PPRC is designed to provide the capability to have two PPRC relationships on a single primary volume. With this MT-PPRC, you can add another PPRC target volume to provide additional data protection to act as a backup if failing over to one copy is not possible. HyperSwap<sup>(R)</sup> has been enhanced to exploit MT-PPRC. This support is designed to provide enhanced HyperSwap capabilities, enabling you to configure two HyperSwap targets, a preferred and an alternate. During an unplanned HyperSwap event, HyperSwap will attempt to swap to a preferred target and swap to an alternate target if it cannot swap to the preferred copy. This function is also available on z/OS V1.13 and z/OS V2.1 with the PTFs for APARs OA43661 and OA46683, and works with IBM Tivoli<sup>(R)</sup> Storage Productivity Center for Replication for System z<sup>(R)</sup>, V5.2 (5698-Z11), IBM Tivoli Storage Productivity Center, V5.2 (5608-PC1 or 5725-F93), and the GDPS/Multitarget Metro Mirror function of GDPS<sup>(R)</sup> 3.12.

z/OS V2.2 DFSMS is designed to provide new FlashCopy<sup>(R)</sup> function by supporting up to 12 targets for incremental FlashCopy. Incremental FlashCopy can create copies of a number of volumes more quickly and effectively than repetitive, full-volume FlashCopy operations. This new function is intended to provide more flexibility and resilience for FlashCopy, and to help you better protect application availability and provide improved data protection across physical volume failure events. This function is also available for z/OS V1.13 and z/OS V2.1 with the PTFs for APARs OA45412 and PI22256, and requires an IBM DS8870 Storage Subsystem with the appropriate licensed microcode level.

z/OS V2.2 is designed to enable LOGREC data sets to be deallocated without an IPL. An updated SETLOGRC command is intended to deallocate an in-use LOGREC data set and enable you to specify a new data set name. This can enable you to discontinue the use of a particular LOGREC data set when switching to either a log stream or a different LOGREC data set.

z/OS V2.2 supports new keywords for CFRM policy definition to enable you to specify which sites should be preferred when a structure is duplexed. This is intended to provide more control over the placement of duplexed structures; for example, you might want to specify that a structure only be duplexed within the same site or that it only be duplexed within the same site for performance reasons, or that it only be duplexed between two sites for disaster recovery reasons.

z/OS V2.2 is designed to make two improvements to subsystem initialization (SSI) processing. First, the system is designed to validate that an initialization routine specified in an IEFSSNx parmlib member actually exists before attempting to start a subsystem. This is intended to help avoid IPLs required to recover from missing or incorrectly specified initialization routines. Second, new operands of the SETSSI command enable you to specify that a subsystem be deleted when the only alternative would be to IPL.

z/OS V2.2 IBM Tivoli Directory Server (ITDS, LDAP) supports a new transition mode for a sysplex owning LDAP server. This mode is designed to enable other LDAP servers in a Parallel Sysplex to be shut down and restarted at a new compatibility level, or with additional back ends, without shutting down all LDAP services in the sysplex. This new function is intended to help you improve the availability of applications that require LDAP services.

z/OS V2.2 Predictive Failure Analysis (PFA) is designed to monitor several ranges of private area virtual storage for multiple address spaces and to warn you when one or more of those address spaces exceeds criteria that can indicate eventual private area virtual storage exhaustion. This new function is designed to help you improve system availability by providing information you can use in advance of storage exhaustion, as long as the rate of storage consumption is not too rapid. Also, PFA

provides support to enable you to specify address spaces that should be monitored for a number of checks, including the private area storage check.

z/OS V2.2 system logger provides support for preallocating offload data sets. This new function is designed to enable you to specify that offload data sets be allocated ahead of time for selected log streams. Corresponding support enables you to specify preallocation using Logger policy, a programming interface, and operator commands. Also, new messages are intended to provide a timely warning in the event that problems arise with log stream offload data set preallocation. This new function is intended to help you avoid situations in which delays in log stream offload processing cause system problems and provide more time to react should data set allocation delays occur.

z/OS V2.2 SLIP processing has been changed to enable you to specify operator console commands to be issued when the trap is matched. This new function is intended to provide a simple and flexible way to issue operator commands during problem diagnosis.

## **Scalability and performance**

Scalability and performance are vital to supporting your growing analytics needs and supporting mobile workloads. With increasing volumes of data, z/OS further optimizes processing, moves information to optimize consumption and use, and addresses resilience needs.

I/O priority is set throughout much of the system by the I/O supervisor (IOS) and z/OS Workload Manager (WLM) components and honored by the channel subsystem and IBM System Storage DS8000 series control units. z/OS V2.2 is designed to provide additional prioritization data for the FICON fabric so that the highest priority read and write operations can be done first when the fabric becomes congested. This new function requires support available in z13 processors, an IBM DS8870 Storage Subsystem microcode level, and corresponding support in the FICON switches. This function is also planned to be available on the z/OS V2.2 general availability date for z/OS V1.13 and z/OS V2.1 with the PTFs for APARs OA47297 and OA44431. This is intended to provide end-to-end prioritization according to WLM policy for DASD I/O operations, in addition to existing support for channel and control unit prioritization. For more information about the availability of this function, refer to Hardware Announcement [115-001](#), dated January 14, 2015.

z/OS V2.2 provides support for the new vector extension facility (SIMD) instructions available on z13 servers. This new support, also available for z/OS V2.1 with the PTFs for APARs OA43803 and PI12412, is intended to help enable high-performance analytics processing and is exploited by z/OS XML System Services; IBM 31-bit SDK for z/OS, Java™ Technology Edition, Version 8 (5655-DGG); IBM 64-bit SDK for z/OS, Java Technology Edition, Version 8 (5655-DGH); Enterprise PL/I for z/OS, V4.5 (5655-W67); and Enterprise COBOL for z/OS, V5.2 (5655-W32). WebSphere Application Server for z/OS, V8.5 (5655-W65) workloads running with Java 8 are expected to benefit from SIMD exploitation. You can find more information about Java exploitation in Software Announcement [215-010](#), dated January 14, 2015, and Software Announcement [215-004](#), dated January 14, 2015, about PL/I exploitation in Software Announcement [215-014](#), dated January 14, 2015, and about COBOL exploitation in Software Announcement [215-027](#), dated January 14, 2015.

z/OS V2.2 Global Mirror (XRC) is designed to work with z/OS Workload Manager and IBM System Storage DS8000 with the z/OS Global Mirror feature to automatically throttle low-priority write operations when they would cause significant delays that might affect response time. The system is designed to enable you to specify that appropriate delays be imposed for the write activity for different classes of work, based on their importance as defined in WLM service class definitions. This is intended to make it unnecessary to adjust write pacing settings and monitor data set residency, and improve the system's responsiveness to more important work during periods of high write activity. This function requires the appropriate licensed microcode level for IBM DS8870 Storage Subsystems and is also available for z/OS V1.13 and z/OS V2.1 with the PTFs for APARs OA41906, OA44004, and OA43453.

IBM zHyperWrite is a new technology that combines DS8000 and z/OS enhancements that deliver performance benefits for writing operations to DB2 logs in the Metro Mirror (PPRC) environment. This new technology can help reduce up to 43% of the DB2 log write time.<sup>2</sup> zHyperWrite requires z/OS V2.1 with the PTF for APAR OA44973 or z/OS V2.2, either DB2 10 (5605-DB2) or DB2 11 (5615-DB2) with the PTF for PI25747, and an IBM DS8870 Storage System with a minimum microcode level. zHyperWrite also requires IBM GDPS or IBM Tivoli Storage Productivity Center for Replication HyperSwap technology. This facility is expected to provide improved DB2 transactional response time and log throughput improvements.

<sup>2</sup> Performance improvements are based on internal IBM laboratory tests. Your results will vary.

zEnterprise Data Compression (zEDC) for z/OS, running on z13, IBM zEnterprise EC12 (zEC12), and IBM zEnterprise BC12 (zBC12) servers with the zEDC Express<sup>(R)</sup> adapter is designed to support low-latency data compression and inflation functions. In addition to existing support for SMF and Extended Format BSAM and QSAM data, z/OS V2.2 DFSMSdss and DFSMSHsm are designed to exploit this capability for dumping and restoring data and when DFSMSHsm uses DFSMSdss to move data. This is intended to provide efficient compression with lower CPU overheads than the processor-based and software-based compression methods already available when moving data to disk storage. Together, these functions can 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. These capabilities are also available on z/OS V2.1 with the PTF for APAR OA42243.

z/OS V2.2 Library Lookaside (LLA) is designed to make it more likely that certain program objects, such as those compiled using COBOL Version 5 (5655-W32), can be cached by LLA in VLF. This is intended to help to improve performance for users of such program objects when they are contained within libraries managed by LLA. This support is also available for z/OS V1.13 and z/OS V2.1 with the PTF for APAR OA45127.

z/OS V2.2 XML System Services uses the new vector (SIMD) instructions available on z13 processors. This function, also available on z/OS V2.1 with the PTF for APAR OA44545, is intended to help improve the performance for nonvalidating XML parsing for some documents.

z/OS V2.2 DFSMSdfp VSAM record-level sharing (RLS) processing is designed to use a control area (CA) level lock rather than a data set level lock for operations that affect only a single CA. This is intended to reduce contention and improve performance for many frequently updated VSAM key-sequenced and variable-length relative record (KSDS and VRRDS) data sets.

z/OS V2.2 DFSORT provides support for high-performance FICON (zHPF), when available, for SORTIN, SORTOUT, and OUTFIL data sets. Taking advantage of the higher start rates and bandwidth available with zHPF is expected to provide significant performance benefits on systems where zHPF is available.

z/OS V2.2 JES2 is designed to support a maximum of one million (1,000,000) active jobs, a substantial increase over the prior maximum of 400,000. This is intended to enable more jobs to be stored on the spool at a time, which, in turn, can enable you to run more work over shorter periods and increase spool retention time.

z/OS V2.2 is designed to support up to four subchannel sets on z13 servers. This helps relieve subchannel constraints and can enable you to define larger I/O configurations that support multi-target Metro Mirror (PPRC) along with large numbers of PPRC secondaries and Parallel Access Volume (PAV) aliases. As with the prior support for up to three subchannel sets, you can define base devices, aliases, and secondaries in the first subchannel set (set zero), and define aliases and secondaries in the other subchannel sets. All four subchannel sets support FICON and zHPF protocols. This support is also available on z/OS V1.13 and z/OS V2.1 with the PTF for APAR OA43495.



A number of improvements for z/OS V2.2 zFS are designed to provide significant performance improvements for directory update processing. Also, the zFS kernel supports 64-bit addressing (AMODE64), enabling you to use much larger data and object caches, and to support running zFS in the z/OS UNIX™ (OMVS) address space, which is expected to yield further performance gains for all workloads using zFS file systems.

z/OS V2.2 UNIX System Services is designed to support a substantially increased number of threads. The current limit on the number of threads that can run in the kernel is approximately 32,000. The new expected limit is approximately 10 times the current limit. The actual limit for a particular system or set of applications will depend on the services used and the additional storage those services require.

z/OS V2.2 is designed to support up to 4 TB of real memory in a single LPAR on z13 processors. This is intended to help support more workload per z/OS image and more memory-intensive applications. As an example, large amounts of memory in z/OS and in the coupling facility can be used to increase the size of DB2 local and group buffer pools, keeping larger amounts of data resident in memory and achieving benefits in terms of CPU usage, I/O reduction, and improved response times. This support is also planned to be available for z/OS V2.1 with the PTF for APAR OA47439 at z/OS V2.2 general availability.

Generation data groups (GDGs) are limited to 255 or fewer generations. z/OS V2.2 is designed to support a new type of generation data group, GDGE. When the use of GDGEs has been enabled in an IGGCATxx member of parmlib, you can specify that up to 999 generation data sets be kept concurrently. This new support for a larger number of generations is intended to make it easier to manage data sets that are created frequently. For example, it is possible to specify that all of the generations created every day for a full year be kept. Additionally, IDCAMS and DFSMSdfp processing is enhanced to enable you to specify that unexpired generation data sets be deleted automatically when retaining them would prevent the creation of a new generation.

The z/OS V2.2 NFS Server is designed to help improve performance for many operations, with a number of streamlined functions. These include designs intended to improve performance, with support for server callback, a cache processing enhancement, z/OS UNIX uid and gid caching, and support for persistent file handles.

## **Security**

z/OS continues to provide enhancements to security capabilities to strengthen your security profile, simplify operations, and help you mitigate risk. Further enhancements address audit and compliance needs, which become more complex in today's mobile enterprise.

First issued in 1973, IBM's MVS™ System Integrity Statement, and subsequent statements for OS/390® and z/OS, has stood for over three 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 to IBM, IBM will always take action to resolve it in the specified operating environment for releases that have not reached their announced end of support dates.<sup>3</sup>

IBM's long-term commitment to system integrity is unique in the industry<sup>4</sup> and forms the basis of z/OS 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 z Systems remains the industry's premier data server for mission-critical workloads.

- 3** End of support dates are the last dates on which IBM will deliver standard support services for a given version or release of a product. Information about end of support dates is available at

[http://www.ibm.com/software/support/lifecycle/index\\_z.html](http://www.ibm.com/software/support/lifecycle/index_z.html)

- 4** IBM reserves the right to change, modify, or withdraw its offerings, policies, and practices at any time. All products and support obligations are subject to the terms of the applicable license and services agreements.

z/OS V2.2 is designed to provide digital signatures for SMF records written to log streams. This new function signs blocks of SMF records and chains the blocks' signatures. A signature verification function is designed to help you determine whether SMF records or blocks of SMF records have been altered or removed. This function, which requires the CP Assist For Cryptographic Function (CPACF) feature of a z Systems processor, is intended to help you detect unauthorized alterations to recorded SMF data and provide a more trusted repository for the auditing records created by a number of z/OS system components, including RACF.

These RACF enhancements are available for z/OS V2.2:

- The RACF AUDITOR attribute, when assigned to a user ID, enables a number of RACF commands to be used with options that change the events for which SMF records are written for auditing purposes. In z/OS V2.2, RACF is designed to support a new attribute, ROAUDIT. This attribute, like the AUDITOR attribute, is intended to enable an auditor to list the contents of RACF profiles. However, ROAUDIT is designed not to allow auditors to make changes to RACF auditing options. This is intended to help you provide a better separation of duties between RACF administrators and RACF auditors.
- RACF is designed to provide better protection for offline attacks against encrypted passwords by enabling you to use stronger encryption. Also, this support can enable you to accept additional special characters within passwords, define users enabled to use only password phrases, clean up a user's password history, and set an "expired" status for a user's password without changing it to a new value. This support is also available in z/OS V1.13 and z/OS V2.1 with the PTF for APAR OA43999. Additionally, z/OS V2.2 RACF is designed not to set default passwords when new users are defined, to remove the need for an exit (ICHDEX01) to use password encryption, and to enable the use of a password phrase with the RACLINK DEFINE command.
- The RACF remote sharing facility (RRSF) now supports three new functions. The first is designed to enable you to change the MAIN system in a multisystem node dynamically. This new function is expected to make the overall process of changing MAIN systems much simpler. Also, RRSF is designed to enable you to specify that inbound updates from specific systems be ignored. This function is intended to enable you to have RRSF propagate updates from production systems to test systems without enabling privileged users on test systems to obtain more privileges on production systems. Finally, a new function in the R\_admin callable service and in the IRRXUTIL REXX language interface is designed to return RRSF configuration and operational information.
- Certificates can be used for a number of different services. z/OS V2.2 RACF is designed to enable you to use more granular certificate administration, supporting narrowed spans of administrative control using new profiles in the RDATA LIB class.

z/OS V2.2 SAF and RACF provide two new functions for users of z/OS UNIX System Services. The first is designed to enable a user with access to a new profile in the UNIXPRIV class to perform additional file system-related operations, such as listing files in a directory, without being authorized to alter the files. The second is designed to enable security administrators to prevent programs from being run from

designated file systems. These changes are both intended to help you improve z/OS UNIX security.

In z/OS V2.2, a number of new security health checks are available. They are designed to determine whether recommended controls over ICSF, z/OS UNIX System Services, and RACF remote sharing facility (RRSF) resources exist, and to determine whether recommended password controls and encryption techniques are in use. These checks are intended to help you improve system security.

z/OS V2.2 includes new function that can help you audit changes to the APF authorized library list. z/OS is now designed to write new SMF Type 90 subtype 37 records when SET PROG and SETPROG commands or the CSVAPF programming service are used to add data sets to, or remove data sets from, the current APF list.

z/OS V2.2 provides two console security enhancements. First, the system is designed to enable you to specify timeout values for MCS, SMCS, and HMCS consoles and to automatically log off users from those consoles when the timeout intervals are exceeded without any operator input. Second, a new optional SAF profile is intended to enable you to specify that a user be allowed to log on to multiple consoles concurrently. These functions are intended to help you improve console security.

As with other operator commands, the DFSMSdfp MODIFY CATALOG command can be protected using RACF profiles in the OPERCMDS class. In z/OS V2.2, a new optional OPERCMDS profile can be used by the system to determine whether a specific user is authorized to issue MODIFY CATALOG commands that alter the behavior of the system or to issue only MODIFY CATALOG commands that display information about catalog processing. This is intended to provide more granular security and better operational flexibility.

z/OS V2.2 PKI Services is designed to provide support for:

- Requiring multiple administrators to approve the creation of new certificates. This optional multiple approver process is intended to help you prevent the creation of unauthorized certificates.
- Online certificate status protocol (OCSP) responses to be signed with the client-specified signing algorithm as documented by RFC 6277. This is intended to improve the interoperability of PKI Services and OCSP clients.
- Using the SHA-224 and SHA-256 with DSA encryption algorithms for signing certificates, CRLs, OCSP responses, and verify certificate requests.
- Callers running in 64-bit addressing mode.

z/OS V2.2 System SSL is now designed to provide:

- Support for the online certificate status protocol (OCSP) to retrieve certificate revocation status and certificate revocation lists (CRLs) over HTTP. The OCSP support is designed to retrieve revocation status information for x.509 certificates as described by RFC 2560, and the HTTP CRL support is intended to enable you to specify that System SSL should retrieve CRL information using HTTP as described by RFCs 3280 and 5280. These functions are intended to supplement the existing LDAP CRL processing and help you ensure that valid certificates are used to complete SSL and TLS secure connections. Also, z/OS V2.2 Communications Server supports these functions for application-transparent transport layer security (AT-TLS), to enable their use for applications and middleware.
- Support for PKCS #12 certificate files. This support is designed to enable applications to specify a PKCS #12 file to be used for secure connections within an SSL environment. PKCS #12 certificate key store files can contain multiple certificate authority (CA) and end entity certificates, and more than one certificate chain. This is intended to provide better interoperability for applications that create PKCS #12 key store files, such as Java-based applications. This support is also available for z/OS V1.13 and z/OS V2.1 with the PTF for APAR OA45216.
- Support to take advantage of the secure key support when coprocessors are configured in EP11 mode is available with Crypto Express4S (CEX4S)

cryptographic features available for zEnterprise EC12 (zEC12) and zEnterprise BC12 (zBC12), and the Crypto Express5S (CEX5S) cryptographic features available for IBM z13 processors by supporting the use of secure DSA keys for signing data and for fixed Elliptic Curve Diffie-Hellman (ECDH) key exchanges.

- Support enabling SSL sessions to be reused across different TCP ports. Also, Communications Server provides FTP support to enable new data connections to reuse associated SSL sessions for better compatibility and performance with certain FTP servers and clients. This enhancement, available for System SSL users and for both AT-TLS and native SSL users of FTP, is intended to provide both improved security and performance.

The z/OS V2.2 Network Authentication Service (NAS) is designed to support the use of X.509 certificates for Kerberos-based authentication as described by RFC 4556. This is intended to help make it unnecessary for end users to manage strong passwords for some applications. Also, NAS is now designed to allow you to run the Key Distribution Center's (KDC's) started task without assigning the user ID under which it runs UID(0), which can help you minimize the use of UID(0).

z/OS V2.2 BCpii is designed to write new SMF Type 106 records for HWISET and HWICMD events. This enhancement is intended to enable you to audit operations such as updates to attribute values for CPC processor weights, image profiles, and activation profiles; and, for operations affecting a CPC or image such as image activations.

Additional advances in cryptography available on zEC12, zBC12, and z13 processors for z/OS V2.1 and z/OS V1.13 are available in the Cryptographic Support for z/OS V1R13 - z/OS V2R1 web deliverable, which you can download at

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

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

- 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 requires minimum MCLs for Crypto Express3 and Crypto Express4S coprocessors, or a Crypto Express5S coprocessor.
- Enhanced support in the Remote Key Export callable service to enable you to specify the desired key-wrapping method to be used for key generation and transport. This support requires minimum MCLs for Crypto Express3 and Crypto Express4S coprocessors, or a Crypto Express5S coprocessor.
- 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 a number of frequently used User Defined Extensions (UDX) callable services to CCA firmware, expected to help you reduce costs associated with UDX maintenance. This support, which requires minimum MCLs for Crypto Express3 and Crypto Express4S coprocessors, or a Crypto Express5S coprocessor, is designed to provide these new 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-PINO 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

More ICSF enhancements, also available in the Cryptographic Support for z/OS V1R13 - z/OS V2R1 web deliverable, are designed to provide new functions for public sector customers, including industry standard APIs for IBM z Systems, and

are 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, RSA-PSS algorithms, and Secure DSA Domain Parameter Generation
- Support for Enterprise PKCS #11 applications intended to enable 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 require minimum levels of EP11 firmware and microcode level for the Crypto Express4S coprocessors, or a Crypto Express5S coprocessor.

Furthermore, z/OS V2.2 ICSF includes these enhancements, also available with the Cryptographic Support for z/OS V1R13 - z/OS V2R1 web deliverable, which are designed to enable you to improve the performance of applications that call the One Way Hash and Random Number Generate services, help improve cryptographic processor configuration, provide a new, easier-to-use callable service to retrieve status information about the cryptographic environment, and update key records in Key Data Stores to contain usage information.

Further support for z/OS V2.2 ICSF has been introduced in PTFs:

- z/OS V2.1 ICSF, z/OS V1.13 ICSF, and the Cryptographic Support for z/OS V1R10 - z/OS V1R12 web deliverable with the PTFs for APAR OA45548 ICSF are designed to support exploitation of counter (CTR) mode for the AES-based encryption on z196 and later processors.
- z/OS V2.1 ICSF and the Cryptographic Support for z/OS V1R11 - z/OS V1R13 web deliverable and later, with the PTFs for APAR OA43816 ICSF are designed to support enhanced PKA key translation without the need to use a User Defined Extension (UDX). This support requires minimum MCLs for Crypto Express3 and Crypto Express4S coprocessors on z196 and later processors, or a Crypto Express5S coprocessor.
- z/OS V2.1 ICSF and the Cryptographic Support for z/OS V1R12 - z/OS V1R13 web deliverable and later with the PTFs for APAR OA44444 are designed to provide Common Cryptographic Architecture (CCA) support for new German Banking Industry-defined PIN processing functions. This support requires minimum MCLs for Crypto Express3 and Crypto Express4S coprocessors on z196 and later processors, or a Crypto Express5S coprocessor.

Additional advances in cryptography available on zEC12, zBC12, and z13 servers are now available for z/OS V2.2 ICSF. These new and enhanced functions are also available for z/OS V2.1 and z/OS V1.13 in the Enhanced Cryptographic Support for z/OS V1R13 - z/OS V2R1 web deliverable. It can be downloaded at

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

These new ICSF functions are intended to help banking and finance sector clients meet industry standards and provide better cryptographic security with designs intended to provide support for:

- VISA Format Preserving Encryption (VFPE) algorithms in CCA-based callable services. This support requires Crypto Express5S coprocessors available on z13 processors. The use of this function requires a service agreement with Visa, Inc. For more information, refer to the z/OS Licensed Program Specifications.
- Enhanced Random Number generation exploiting CPACF Deterministic Random Number Generate (DRNG) instruction, intended to be compliant with NIST standard SP 800-131A.
- Allow you to disable the RNG Cache.

Another ICSF enhancement in Enhanced Cryptographic Support for z/OS V1R13 - z/OS V2R1 and now available for z/OS V2.2 ICSF is designed to support sharing cryptographic coprocessors across a maximum of 85 domains. This support requires Crypto Express4S and Crypto Express5S coprocessors and is also available for

Cryptographic Support for z/OS V1R10 - z/OS V1R12 web deliverable and later with the PTFs for APAR OA44910.

z/OS V2.2 ICSF and the Enhanced Cryptographic Support for z/OS V1R13 - z/OS V2R1 web deliverable include enhancements designed to enable you to query reference date information for key tokens and key objects in a key data store (KDS); to mark records in a KDS as "archived," rendering them ineligible for use; to retrieve labels from a KDS that satisfy certain search criteria; to mark records in a KDS with start and end dates; and to provide methods to manage metadata and start and end dates associated with a KDS record, including the abilities to archive and recall keys. z/OS V2.2 RMF support is designed to help you to analyze the performance of Crypto Express5S coprocessors operating in CCA and PKCS #11 modes. This support is also available on z/OS V2.1 and z/OS V1.13 with the PTF for APAR OA43493. In addition, ICSF FPE and ECC/RSA digital signature activity information is included in SMF 70-2 records and in the RMF Postprocessor Crypto Activity report.

Finally, additional support for z/OS V2.2 ICSF (HCR77B0) is planned to be introduced in PTFs in third quarter 2015:

- z/OS V2.1 ICSF and the Cryptographic Support for z/OS V1R12 - z/OS V1R13 web deliverable and following levels of ICSF with the PTF for APAR OA46466 are planned to be designed to provide additional Common Cryptographic Architecture (CCA) support for German Banking Industry-defined PIN processing functions. These functions include three types of AES key derivation as well as AES Secure Messaging Keys, which can be used in AES-based EMV transactions. This support requires a minimum microcode level (MCL) for Crypto Express4S and Crypto Express5S coprocessors on EC12 and later processors.
- z/OS V2.1 ICSF and the Cryptographic Support for z/OS V1R12 - z/OS V1R13 web deliverable and later with the PTFs for APAR OA47016 are planned to be designed to provide new ICSF Callable Services intended to simplify EMV payment processing.
- z/OS V2.1 ICSF and the Cryptographic Support for z/OS V1R12 - z/OS V1R13 web deliverable and later with the PTFs for APAR OA47781 are planned to provide additional Common Cryptographic Architecture (CCA) support for generation of a single key for the CIPHER, DATAC, and DATAM key types. Support is also planned for RSA-OAEP block formatting for both SHA-1 and SHA-256 hashing in the PKA Encrypt (CSNDPKE) and PKA Decrypt (CSNDPKD) callable services. ICSF will be designed to format returned data using the RSAES-OAEP encryption/decryption scheme defined in the RSA PKCS #1 v2.0 standard. This support requires a minimum MCL for Crypto Express4S and Crypto Express5S coprocessors on EC12 and later processors.

Additional advances in cryptography available on IBM zEnterprise EC12 (zEC12), IBM zEnterprise BC12 (zBC12), and z13 processors are also planned to be available for z/OS V2.2, z/OS V2.1, and z/OS V1.13 in the Cryptographic Support for z/OS V1R13 - z/OS V2R2 web deliverable. When available, it can be downloaded from

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

These additional new ICSF functions are intended to provide support for:

- Performing certain administrative functions via operator commands with Parallel Sysplex wide scope, if needed. These functions are planned to include activating, deactivating, and restarting cryptographic coprocessors.

### **Simplification and usability**

IBM continues to simplify z/OS administration and management, and to extend the reach of your existing skills. By improving administrative ease, z/OSMF can help your company gain quality and productivity improvements while reducing opportunities for error. z/OS V2.2 z/OSMF offers many enhancements.

z/OSMF, previously a separate product, is now a base element of z/OS, delivered with the operating system. This removes the need to order z/OSMF separately. z/OS V2.2 z/OSMF includes a number of new functions designed to provide:

- New REST APIs for the Software Management plug-in, which are intended to allow you to create, retrieve information about, change, and delete software instances.
- An enhanced File and Data Set REST API to enable you to edit and browse data sets and files intended to support data sets and files up to 8 MB in size.
- Two enhancements for the workflow engine: First, a REST API to enable exploiters to initiate, monitor, and terminate workflows. Second, support for enabling one workflow to call another. These new functions are intended to make the workflow engine's functions easier to integrate seamlessly with other configuration applications and to enable workflows to become reusable building blocks.
- Support for the definition of systems and user-defined groups. These are intended to help enable you to drive actions across appropriate groups, in addition to driving actions for specific members of a group. Also, graphical display support makes it easy to see the topology view.
- Configuration is planned to be simplified in a number of ways. Plug-in configuration is planned to make further use of the workflow engine to help guide and simplify plug-in enablement. This function is planned to be available in fourth quarter 2015 with the PTF for APAR PI42838.
- Support in the Jobs REST API to enable you to retrieve the new step-level completion codes in JES2 environments.
- Support in a number of z/OSMF applications for more-granular RACF profiles in the ZMFAPLA class. This is intended to help you better control access to z/OSMF application functions.

z/OS V2.2 z/OSMF includes the functions available with z/OSMF V2.1 and the PTF for APAR PM98630 designed to provide:

- A new task to support external applications, enabling you to import them into z/OSMF in a way that makes them appear in the z/OSMF navigation tree. An external application that has been imported into z/OSMF, while not part of z/OSMF itself, is designed to be:
  - Presented in the z/OSMF user interface
  - Enabled to use certain z/OSMF services
  - Able to link to other z/OSMF applications
- Improvements to the workflow capability introduced in z/OSMF V2.1 to enable workflow authors additional flexibility, such as support for supplying defaults for a workflow, and enable end users to specify that some workflow steps be performed automatically when appropriate. This is designed to improve the usability of workflows.
- Support in the REST Jobs API to hold and release jobs, and to work with jobs using a secondary JES2 subsystem. These new capabilities provide more flexibility.
- Two new z/OSMF REST services designed to enable you to view lists of data sets and to view lists of z/OS UNIX files and directories. These new interfaces further extend the capabilities for developing web-based applications using data stored on z/OS.
- An enhanced workflow designed to help you configure z/OSMF plug-ins quickly and easily. This can help you complete the steps needed to take advantage of z/OSMF functions more quickly.

Additionally, a number of z/OSMF plug-in enhancements for z/OS V2.2 are also available on z/OSMF V2.1 with the PTF for APAR PM98630 and designed to provide:

- In the Resource Monitoring application, the capability to retrieve and display recent historical performance information. In addition, new function is designed to enable you to export information displayed in the application to a file that can be imported by popular spreadsheet programs.
- The ability to add comments to WLM service definition actions. For example, you might use this to document the reason for changes to WLM policies for later review.

- In the Software Management application:
  - An easier way to add non-SMP/E-managed data sets to a software instance. This is designed to make it easier to associate many data sets that are not managed by SMP/E zones with a software instance.
  - A more convenient way to edit mount points for the z/OS UNIX System Services file system. This capability is designed to make it easier for you to manage z/OS UNIX file system mount points during deployment operations.
- In the ISPF task, support for using the Ctrl key on most PC keyboards as the Enter key. This makes it easier to use the ISPF task by providing better consistency with typical 3270 emulator keyboard layouts.

Other z/OSMF plug-in enhancements for z/OS V2.2 include:

- z/OS V2.2 Communications Server extends the function of the z/OSMF based IBM Configuration Assistant plug-in. It is designed to support creating and storing new configuration profiles for TCP/IP stacks, with integrated help to guide novice users. This new function, which builds on existing capabilities for the policy agent, is intended to make it faster and easier to create and maintain TCP/IP configurations.
- Software management plug-in support designed to enable you to submit and manage the generated jobs from within z/OSMF and use OpenSSH SFTP within your enterprise for software deployment. These functions are also available with z/OSMF V2.1 (5610-A01) with the PTF for APAR PI20151.
- The Incident Log plug-in is now designed to support using OpenSSH SFTP to send diagnostic data to software vendors who support it. This function is also available for z/OSMF V2.1 with the PTF for APAR PI20153. Also, z/OS V2.2 z/OSMF is designed to enable you to obtain an aggregated display of incidents across z/OSMF instances within your enterprise.
- The z/OS V2.2 z/OSMF Capacity Provisioning plug-in is designed to support the provisioning of capacity based on overall CPC-wide utilization.

z/OS V2.2 z/OSMF is designed to support these browsers: Microsoft™ Internet Explorer 9, Internet Explorer 10, and Internet Explorer 11; and Mozilla Firefox ESR 31.

Also, the z/OS V2.2 common event adapter (CEA) supports new CEAPRMxx parmliib specifications designed to enable you to control the limits on the number of TSO/E address spaces available for the z/OSMF ISPF task and the number of concurrent TSO/E address spaces allowed for each ISPF task user. This is intended to help you manage the resources consumed by the web-based z/OSMF ISPF task interface.

z/OS V2.2 ISPF is designed to support a number of new functions, including:

- A new option in the ISPF Configuration Utility panels that reads an active ISPF configuration table load module or a specified load module containing an ISPF configuration table and uses it to create a new keyword file containing the original specifications. The keyword file generated is intended to be used as input to the configuration utility, providing an easy way to recover a missing keyword source file. This function is also available for z/OS V2.1 with the PTF for APAR OA42680.
- Support for browsing data sets and members with more than 99,999,999 records. ISPF browse is now designed to support browsing data sets and members with over 2 billion (2,000,000,000) records. This is intended to make it easier to manage large data sets.

z/OS V2.2 ISPF Browse supports new operands on the DISPLAY primary command designed to allow you to display the record descriptor words (RDWs) for variable-length records.

z/OS V2.2 enhances the TSO/ISPF Gateway to include the Interactive TSO/ISPF Gateway, which allows a client to run commands in a TSO/E address space and is designed to support interactive communication between the client and the TSO/E address space.



z/OS V2.2 ISPF includes a new option to help you manage z/OS UNIX System Services file systems. The new File System option on the z/OS UNIX Directory List Utility panel (option 3.17) is designed to include a new set of Mount Table functions to help you manage attributes, mount points, and mounted file systems.

z/OS V2.2 JES2 and SDSF are designed to support a new way to track job step completion codes. JES2 is designed to create a new machine-readable data set contains job tracking information, including the completion codes for each job step. SDSF is designed to extract and display step-level completion codes for batch jobs; also, the z/OSMF Jobs REST API enables you to retrieve step-level completion codes. This function supports new optional SMF Type 30 information as well, and is intended to make it easier to interpret job output quickly and to provide the capability for later analyses of job step level information.

z/OS V2.2 SMP/E is designed to enhance ZONEMERGE command processing. A new CHECK operand for the ZONEMERGE command is intended to identify conditions that would prevent a successful ZONEMERGE. Also, ZONEMERGE processing is now designed to both enforce and preserve conditional requisites while merging target and distribution zones. This new function, planned to be available first quarter 2016 with the PTF for APAR IO23466, is intended to help you merge SMP/E zones for different products in some cases in order to consolidate product sets and simplify overall software management.

JES3 has long supported capabilities for informal, ad hoc batch scheduling. In JES3, these facilities are called deadline scheduling and dependent job control. z/OS V2.2 JES2 is designed to provide similar functions, with some additional capabilities. A new SCHEDULE JCL statement is available; STARTBY and HOLDUNTIL keywords of SCHEDULE are designed to make it easier for you to submit jobs intended for later execution without the need to log onto a system at the time you want the jobs to run.

A number of additional new JCL statements, including JOBGROUP and GJOB, are designed to enable you to specify ordering and dependency information for groups of jobs, supporting both serial and parallel execution. Corresponding operator command support enables job groups to be held, released, modified, canceled, and purged. SDSF is now designed to provide information about job group status and the status of jobs in a job group, and WLM is designed to support this function with enhancements to Batch Initiator Management. Together, these new capabilities are intended to supplement those of production job scheduling products such as Tivoli Workload Scheduler for z/OS (5698-T08), by helping you simplify the scheduling of batch jobs and job groups that are run only when necessary and need not be added to production job schedules. This function is planned to be available in fourth quarter 2015.

z/OS V2.2 JES3 is now designed to support the specification of output disposition (OUTDISP) parameter of the JCL OUTPUT statement. This is intended to help make it easier to manage output data sets. Also, JES3 is designed to support the PROCLIB keyword for the JCLLIB statement so you can specify the JES3 concatenation to be used for a job, and support the MERGE and DDNAME keywords of the OUTPUT statement.

z/OS V2.2 JES3 provides enhancements for symbol processing. This new function is designed to make 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 system, JCL, and JES symbols more usable and accessible and to make it easier to use identical copies of JCL in multiple environments.

The z/OS UNIX System Services bpxmtext command can be used to retrieve information about return codes from various messages, including z/OS UNIX, Language Environment<sup>(R)</sup>, Communications Server, zFS, and TFS. In z/OS V2.2, support is added for NFS messages. This is intended to make it faster and easier to interpret return codes from NFS messages.

z/OS V2.2 Infoprint Server is designed to support a new TSO/E command intended to enable authorized users to start and stop Infoprint Server PrintWay™ extended mode printers. This new command is intended to support both interactive and batch environments, and to work with printers managed by an instance of Infoprint Server running in the same Parallel Sysplex.

Also, the Infoprint Central component of z/OS V2.2 Infoprint Server is designed to enable you to select TSO/E address space-related output data sets (those associated with TSUnnnnn job identifiers) and display them in JES2 environments.

z/OS V2.2 JES3 is designed to use the z/OS Generic Tracker to help you identify uses of a number of JES3 JECL statements. This support is intended to help you write JES-neutral JCL and also help those who want to migrate from JES3 to JES2.

z/OS V2.2 DFSMSdftp is designed to improve the processing for DEVSUPxx parmlib members so that the system:

- Allows a subset of DEVSUPxx parameters to be specified in a member used for a SET command.
- Enables you to specify more than one DEVSUPxx member in a single SET command.
- Continues processing DEVSUPxx keywords after a keyword error is detected during IPL or while processing a SET command.
- Displays additional information about tape-related DEVSUPxx parameters with new support in the DEVSERV command. A new DEVSERV QLIB operand is intended to display settings for TAPEAUTHDSN, TAPEAUTHF1, TAPEAUTHRC4, and TAPEAUTHRC8.

These changes are intended to improve usability.

z/OS V2.2 DFSMSdftp is designed to eliminate abend code A13, reason code 18, by automatically selecting the correct volume during Open processing for multivolume tape data sets.

IBM Knowledge Center is IBM's strategic framework for providing Internet-based product documentation. z/OS V2.2 includes IBM Knowledge Center for z/OS, which is designed to provide enhanced search technology similar to that used for Information Centers. It is also designed to enable you to create your own local repositories and manage the content presented from them. z/OS V2.2 ServerPac orders will be designed to help you complete the necessary setup tasks. Additionally, the Softcopy Librarian is enhanced to make it easier to manage and update content for IBM Knowledge Center for z/OS. You can download Softcopy Librarian, when available, at

<http://www.ibm.com/support/docview.wss?uid=swg27018846>

## **Systems management**

Systems management enhancements help simplify the operations and management experience, with additional autonomies and intelligence built in.

z/OS V2.2 JES2 provides new function that can eliminate the need to tune the checkpoint HOLD and DORMANCY times in a multiaccess spool (MAS) environment. The system is designed to enable you to specify that it automatically react to changes within a MAS and adjust these values dynamically. This is intended to help simplify JES2 management and is expected to yield more consistent performance in a JES2 MAS environment.

z/OS V2.2 supports a number of enhancements for system symbols. The system is designed to allow you to use symbols that are up to 16 characters in length, to enable you to assign values with lengths greater than their symbol names, to support values up to 44 characters long, and to support a larger symbol table intended to accommodate more symbols, or longer symbol names and values. In addition to providing improved usability for system symbols, this is intended to

enable you to fully represent data set names as well as complete IPv4 and IPv6 addresses in system symbols.

In z/OS V2.2, a number of enhancements are related to System-Managed Storage (SMS).

- SMS is designed to enable you to specify up to three symbols in an IGDSMSxx member of parmlib to be used within automatic class selection (ACS) routines. This is intended to make it easier for you to reuse ACS routines on different systems.
- SMS is now designed to enable you to specify a new, optional data class attribute for data sets allocated using Guaranteed Space to indicate whether they are eligible for space reduction. This is intended to help reduce allocation failures when the requested space is not available.
- The DISPLAY SMS,SG command is designed to display the space usage statistics for the specified pool storage group. This is intended to make it easier to see when it might be necessary to change a storage group's space management settings or add volumes to a storage group.
- SMS is designed to enable you to specify storage group space warning thresholds separately from the high allocation thresholds. This is intended to enable you to set a lower threshold for warning messages, which can provide more time to react to storage group space shortage conditions.
- DFSMSdfp supports a new secondary space reduction specification for data classes. This is intended to enable the system to extend data sets by less than their originally specified secondary space allocation amounts when doing so would avoid allocation of space on additional volumes. This function is designed to provide support for SMS-managed nonstriped VSAM data sets and nonstriped non-VSAM data sets, and is intended to help you improve disk space utilization.
- The DADSM preprocessing exit IGGPRE00 is designed to enable you to modify SMS Space parameters. This is intended to improve the flexibility you have available in this exit.

z/OS V2.2 supports a new health check for FICON dynamic routing. This function requires z13 processor function and IBM System Storage DS8000 series devices with a minimum MCL. This health check is designed to check all components of a dynamic routing fabric, the channel subsystem, and disk control units to make sure that dynamic routing requirements are met if dynamic routing has been enabled for one or more FICON switches. This support, also planned to be available for z/OS V1.13 and z/OS V2.1 with the PTF for APAR OA47297 in September 2015, is intended to help you identify misconfiguration errors that can result in data integrity exposures. For more information about the availability of this function, refer to Hardware Announcement [115-001](#), dated January 14, 2015.

In z/OS V2.2, a number of catalog-related enhancements are available. DFSMSdss is designed to enable you to specify that a catalog be restored to any volume with like geometry. A new setting for parmlib member IGGCATxx is designed to enable you to change the scratch default for generation data group (GDG) and generation data group extended (GDGE) base entries. Finally, a new health check is designed to identify catalogs residing on volumes whose devices are defined as shared in the active IODF that might have their SHAREOPTIONS set incorrectly. These new functions are intended to provide additional recovery options, improve usability, and help you prevent catalog data integrity exposures.

z/OS V2.2 DFSMSHsm is designed to support distributed dump processing across multiple LPARs for Fast Replication operations in a Parallel Sysplex. This function is intended to help you reduce elapsed time when processing large DB2 copy pools. Also, DFSMSHsm Fast Replication processing is designed to support stacking multiple copy pools on a single tape and to enable you to specify that it use multitasking to process dump requests even when doing so would use more tapes. Additionally, Fast Replication processing is designed to optionally write messages issued during the operation to a data set. These enhancements are expected to be particularly valuable in DB2 environments.

z/OS V2.2 DFSMSHsm extends its support for storage tiering. These extensions are designed to support command-initiated transitions and data movement. They

are intended to enable you to specify that inactive data sets be moved between storage tiers, moved from one storage group to another, and moved from one volume to another volume within the same storage group. Transition processing is also designed to support FlashCopy and Preserve Mirror, and to process open DB2, CICS, and zFS data sets. Additionally, a new design for command-initiated storage group migration is intended to support concurrent data set migration to tape, which is expected to help improve migrating DB2 image copies to tape.

IBM System Storage Easy Tier<sup>®</sup> is now designed to enable software-defined policy information to be communicated to Easy Tier control units, to help them efficiently deploy storage. This is intended to help steer data placement within Easy Tier volumes to meet application performance objectives. When used by exploiters, this is intended to help guide appropriate tier placement. This new function requires z/OS V1.13 or z/OS V2.1 with the PTF for APAR OA45236 and IBM DS8870 Storage Subsystem with a minimum microcode level. IBM DB2 10 for z/OS (5605-DB2) and DB2 11 for z/OS (5615-DB2) are designed to exploit this capability for the database reorganization utility with the PTF for APAR PI35321.

z/OS V2.2 SDSF is designed to provide a number of new functions:

- SDSF has long had the capability to display summary information about some aspects of system workloads. In z/OS V2.2, SDSF is designed to provide address space level information about virtual memory, and device allocation, and workload delays. Additional new function is designed to provide output disposition support for JES3, and new options for entering commands intended to act on one or more rows for table-oriented displays.
- z/OS V2.2 SDSF is also designed to provide both a powerful new facility for building REXX execs and for running REXX execs as command-line commands while providing improved usability for recalled commands. The first function is designed to capture a set of actions taken within SDSF as REXX exec statements, and to allow a REXX exec to be run against selected jobs and devices. The second is designed to support saving context-sensitive groups, an expanded number of recalled commands, and user-specified notes about specific commands.
- A new set of display functions expected to provide productivity enhancements for system programmers is planned for fourth quarter 2015. z/OS V2.2 SDSF will be designed to provide commands to display data sets from any system within a Parallel Sysplex that are APF-authorized; appear in the system's LPA list, link list, parmlib concatenation; or are page data sets. Another new command will be designed to search listed data sets for members whose names match a specified pattern. Also, a capability to display important information about systems in the same Parallel Sysplex, such as IPL, performance-related, address space and CPU summary, and storage information.
- Additionally, SDSF is now designed to offload a portion of certain kinds of processing to zIIP processors, when available.
- Finally, z/OS V2.2 SDSF is designed to display the user ID associated with an enclave in a new column on the enclave display panel, in addition to in a pop-up window.

These new functions are intended to help improve SDSF economics, usability, and productivity. IBM plans additional SDSF functions for the future. For more information, see the [Statements of direction](#) section.

z/OS V2.2 is designed to support a new IEFOPZxx parmlib member in which you can specify pairs of partitioned (PDS and PDSE) data sets. In each pair, you can specify one that is to be searched ahead of its counterpart data set when programs are fetched. This new function is intended to allow you to insert program libraries ahead of others in the link list, in STEPLIB and JOBLIB concatenations, and for LLA-managed libraries without making JCL changes. A new DISPLAY IEFOPZ command is designed to display information about existing pair definitions, and a SET IEFOPZ command is designed to allow you to add, remove, or change pair definitions dynamically. This is expected to be useful for activities such as converting application program libraries from PDS to PDSE, as is necessary for converting

to COBOL V5 (5655-W32), without requiring JCL changes. Availability of these functions is planned for December 2015 with the PTF for APAR OA47689.

z/OS V2.2 extends z/OS Generic Tracker service (GTZTRACK) design to provide a record of tracked events in new SMF Type 117 records. This is intended to enable you to retrieve historical information about tracked events. Also, a REXX query interface is available, which is intended to make it easier to retrieve tracking facility information.

z/OS V2.2 RMF is designed to support a number of enhancements:

- New RMF Monitor III support for the zEnterprise Data Compression (zEDC) and RDMA over Converged Ethernet (RoCE) features available on zEC12, zBC12, and z13 servers. This new support enables you to specify that data be collected for PCIE-attached zEDC and RoCE features, generate a new RMF Monitor III PCIE Activity Report, and use the RMF Distributed Data Server programming interface to create a PCIE Activity Report in XML format.
- New measurement data for Storage Class Memory. New SMF Type 74 subtype 10 records and a new RMF Monitor III SCM Activity report, with corresponding RMF Distributed Data Server Support, are intended to help you understand the important characteristics of Storage Class Memory utilization.
- Additional information about zFS file systems. Three new RMF Monitor III reports showing zFS-related information are designed to provide Parallel Sysplex wide data, overview, file system, and kernel information to help you manage zFS file system activity. Also, RMF and zFS are designed for better zFS data collection performance.
- A new Monitor III report, the Job USAGE report, to display information about address space resource consumption, including I/O-related, CPU-related, memory-related, and GRS-related information. The new Monitor III Job USAGE report is added to the report list for the RMF Distributed Data Server so that the same information is also returned by the RMF Distributed Data Server (DDS) in XML format when the USAGE report is requested.

z/OS V2.2 Capacity Provisioning Manager and the corresponding z/OSMF plug-in support the provisioning of capacity based on overall CPC-wide utilization. This new function is designed to enable you to specify that when the sum of LPAR busy for all LPARs approaches a particular percentage of the capacity of the entire CPC, more capacity should be added automatically. Finally, capacity provisioning support is now designed to allow for relinquishing capacity once overall CPC utilization has fallen to a specified value. These new capacity provisioning functions are intended to enable you to better automate provisioning and deprovisioning actions across a wider range of circumstances.

z/OS V2.2 Health Checker provides System REXX (SYSREXX) language support intended to enable health checks to store and retrieve persistent data, as is already supported for checks written using High Level Assembler. This new function is intended to make it easier to write health checks.

z/OS V2.2 supports specifying limits on 24-bit, 31-bit, and 64-bit storage in a new SMFLIMxx parmlib member, which offers a number of filtering options. Corresponding command support is designed to allow dynamic changes and provide display capabilities to show which rules are currently active. In addition, a new REGIONX JCL keyword is designed to enable you to specify individual limits for 24-bit storage and 31-bit storage. These new enhancements are intended to enable many installations to discontinue the use of the IEFUSI SMF exit and to help avoid certain kinds of storage-related abends.

The z/OS V2.2 DFSMSrmm tape expiration processing design has been enhanced. New WHILECATALOG support allows you to specify whether data sets should be retained or expired by date when catalog entries for them exist. You can specify the policy separately for generation data groups (GDGs), which is intended to help you keep cataloged generation data sets available until they are uncataloged as new generations are created. In addition, the SEARCHDATASET and SEARCHVOLUME TSO commands are enhanced to allow you to select records by creation time, to help you narrow searches so you can create smaller command lists, which is expected

to improve usability. The SEARCHDATASET and SEARCHVOLUME functions are also available for z/OS V2.1 with the PTF for APAR OA45286.

Certain kinds of GRS queue scan processing used by application programs can cause significant CPU and storage consumption in the GRS address space. SMF Type 87 records and the GRS Monitor function were introduced in z/OS V1.13 and z/OS V2.1 with the PTF for APAR OA42221, and were intended to help you trace such activity. z/OS V2.2 GRS is designed to support a new subtype for SMF Type 87 records to help you identify users of GRS enqueue/dequeue and RESERVE services. z/OS V2.2 is also designed to provide filtering options in a new parmlib member to allow you to limit the GRS requests traced by the GRS Monitor, so you can track only those for particular address spaces or resources.

z/OS V2.2 ISPF provides a new option you can use to completely disable the use of ISPF Edit Pack. This function is designed to enable you to help control CPU utilization for ISPF users by preventing the overhead of software compression and inflation for data sets used in conjunction with ISPF and ISPF services, and assure that newly created and unpacked data sets processed by ISPF can be easily processed by other programs.

The z/OS V2.2 common event adapter (CEA) supports new CEAPRMxx parmlib specifications to enable you to specify limits on the number of TSO/E address spaces available for the z/OSMF ISPF task and the number of concurrent TSO/E address spaces allowed for each ISPF task user. This is intended to help you manage the resources consumed by the web-based z/OSMF ISPF task interface.

z/OS V2.2 ISPF provides new application programming capabilities designed to provide:

- A new ISPF function to allow an application to specify whether ISPF or the application should process left and right scroll commands.
- Support for zSTART to be the default command stack variable when other statement parameters are specified without the OPT parameter.
- Support for mixed-case characters to be used when either the keyword BASIC or an initial command stack variable is specified on the OPT parameter.
- Support for the DTL compiler (ISPDTLC) to pass its return code in a ISPF shared pool variable, ZISPFRC.

A number of z/OS V2.2 DFSMSdfp open, close, and end of volume (OCE) processing exits are designed to support dynamic exits. This is intended to enable you to replace the statically bound exits with dynamic exits and to enable you to implement or change these exits without an IPL.

z/OS V2.2 DFSMSdfp is designed to add job identifiers, such as Jnnnnnnn, to SMF Type 14 and Type 15 (non-VSAM data set activity) records, to make it easier to use them for chargeback and capacity planning.

z/OS V2.2 IBM Tivoli Directory Server (ITDS, LDAP) is designed to enable you to specify that a number of additional events be recorded in the LDAP activity log and in SMF Type 83 records. This data is intended to help you diagnose problems with LDAP servers, help you detect denial of service attacks, and help improve auditability for LDAP-related activities.

z/OS V2.2 is designed to provide additional information when the system is IPLed, by providing the IPL device number, subchannel set, and volume serial number to an operator message. Also, Program Event Recording (PER) SLIP trap processing is enhanced to capture the contents of the Breaking Event Address Register (BEAR). This is intended to help speed diagnosis when the BEAR data is relevant for a problem.

z/OS V2.2 Server Timer Protocol (STP) is designed to issue additional z/OS console messages to notify you of events that can affect sysplex timing. This is intended to enable automation actions to be driven from these events.

z/OS V2.2 Infoprint Server is designed to support converting its daemons to started tasks in both sysplex (monoplex) and Parallel Sysplex environments. This

is intended to make it easier for you to automate startup and recovery actions for these functions using existing z/OS facilities and common system message-based automation tools, and to simplify operations procedures for managing Infoprint Server.

## Networking

As companies prepare for extended platform reach, such as for cloud and mobile environments, they need to strengthen their networking capabilities and further secure them.

z/OS V2.2 Communications Server supports the new virtualization capability for the RDMA over Converged Ethernet (RoCE Express) features on z13 processors. This new support is designed to enable you to fully utilize the ports in the RoCE adapter and to share adapters across up to 31 z/OS images on a z13 processor. Also, z/OS V2.2 Communications Server is now designed to support selecting between TCP/IP and RoCE transport layer protocols automatically based on traffic characteristics, and to support MTU sizes up to 4K for RoCE adapters. The virtualization is available on z/OS V2.1 with the PTF for APARs OA44576 and PI12223 and the corresponding RMF support with the PTF for OA44524. Finally, z/OS V2.2 Communications Server provides a tool designed to monitor TCP workload patterns and show the percentage of TCP traffic that could benefit from the enablement of Shared Memory Communications over RDMA. This monitoring tool is also available on z/OS V1.13 with the PTF for PI27252 and z/OS V2.1 with the PTF for APAR PI29165.

z/OS V2.2 Communications Server supports a number of capabilities intended to make z/OS V2.2 Communications Server meet the requirements of the United States National Institute of Standards and Technology (NIST) Special Publication SP800-131A, with:

- Updates to the z/OS UNIX System Services based Sendmail client and server, with support for TLSv1.2, SHA-2 hashes, and encryption key strengths of 112 bits or more. This capability is also available on z/OS V2.1 with PTF UI13138 for APAR PM96896.
- Updates to the SNMP Agent, the z/OS UNIX System Services SNMP command, and the SNMP manager API to support the Advanced Encryption Standard (AES) 128-bit cipher algorithm. This capability is also available on z/OS V2.1 with PTF UI13140 for APAR PM96901.
- An updated Digital Certificate Access Server (DCAS), with support for TLSv1.1 and TLSv1.2, including a new set of TLSv1.1 and TLSv1.2 2-byte ciphers. This capability is also available on z/OS V2.1 with PTF UI13139 for APAR PM96898.
- Support for centralized policy agent clients to communicate with policy agent servers using both TLSv1.1 and TLSv1.2, including support for a new set of TLSv1.1 and TLSv1.2 2-byte ciphers. This capability is also available on z/OS V2.1 with PTF UI13120 for APAR PM96891.

z/OS V2.2 System SSL and Communications Server are enhanced to provide session reuse capabilities. System SSL is designed to enable SSL sessions to be reused across different TCP ports, and FTP is designed to enable new data connections to reuse associated SSL sessions for better compatibility and performance with certain FTP servers and clients. This enhancement, available for System SSL users and for both AT-TLS and native SSL users of FTP, is intended to provide both improved security and performance.

z/OS V2.2 Communications Server is designed to exploit the new z/OS V2.2 System SSL features for Application Transparent Transport Layer Security (AT-TLS) support. This includes the new System SSL support for OCSP, CRL retrieval over HTTP and LDAP, and certificate validation as described by RFC 5280.

z/OS V2.2 Communications Server is designed to help simplify security configuration for IPsec. This new design no longer requires applications that send and receive IPsec-protected traffic to be granted access to various resources in the RACF CSFSERV class when CHECKAUTH (YES) is specified in the ICSF options data set.

z/OS V2.2 Communications Server is now designed to enable the TCP/IP stack and selected device drivers, including OSA-Express QDIO, HiperSockets™, and RoCE, to run in 64-bit addressing mode (AMODE 64). These enhancements are intended to provide scalability and performance improvements, and to provide virtual storage constraint relief by significantly reducing ECSA use.

z/OS V2.2 Communications Server is designed to support an increased number of application-instance dynamic virtual IP addresses (DVIPAs) for a single TCP/IP stack, raising the previous limit of 1,024 to 4,096. This is intended to improve scalability within a Parallel Sysplex, particularly when the sysplex is operating with a smaller number of systems than usual, as might be the case during planned outages for one or more LPARs.

z/OS V2.2 Communications Server also offers improved scalability for Enterprise Extender connections. This enhancement is designed to support nodes with a very large number of Enterprise Extender connections.

z/OS V2.2 Communications Server is designed to provide increased scalability by improving the Internet Key Exchange daemon's (IKED's) ability to concurrently negotiate IPsec tunnels with a large number of remote IKE peers. This is expected to significantly reduce the amount of time needed to establish a large number of IPsec tunnels, while also reducing CPU utilization.

z/OS V2.2 Communications Server can help improve load balancing on systems where system resolver cache has been implemented by allowing you to specify system-wide round-robin reordering of the IP address lists associated with each cached hostname.

z/OS V2.2 Communications Server enhances its support for VIPAROUTE, which is designed to automatically adjust the maximum segment size for each IPv4 route to prevent fragmentation within the sysplex. This new support is expected to simplify VIPAROUTE configuration and help improve VIPAROUTE performance by eliminating packet fragmentation issues that can arise for some routes.

z/OS V2.2 Communications Server offers new autonomic features intended to provide for smarter self-monitoring and tuning of the TCP/IP stack, with a focus on performance-related functions such as dynamic right sizing (DRS) and delayed acknowledgements (DELAYACKs).

z/OS V2.2 Communications Server enhances the CICS Sockets Listener interface. This support is designed to provide CICS with additional information about local and remote session partners, which is intended to be used by facilities such as the CICS Explorer<sup>(R)</sup> or Session Monitor to provide transaction tracking capabilities. This support requires IBM CICS Transaction Server for z/OS, V4.2 (5655-S97) or CICS Transaction Server for z/OS, V5.1 (5655-Y04), or later.

z/OS Communications Server provides a Trace Resolver function to provide a variety of diagnostic information that can be used by application programmers and network administrators. In z/OS V2.2, z/OS Communications Server provides a new component trace (CTRACE) option that is designed to capture the same information recorded by the Trace Resolver in CTRACE records, and to view formatted trace data using IPCS. This new function is also designed to enable you to dynamically enable and disable tracing without an application restart.

z/OS Communications Server allows you to define a set of limited default IP filters in the TCP/IP Profile to help you protect the TCP/IP stack during initialization, before Policy Agent installs an IPsec policy. z/OS V2.2 Communications Server is designed to allow you to specify additional default filter parameters, including source and destination address ranges, and source and destination port ranges. This is intended to allow greater flexibility in configuring the default filter rules.

In z/OS V2.3, IBM intends to remove some of the Sendmail functions and all of the SMTPD functions of Communications Server (see the [Statements of direction](#) section). To help you plan for migration to CSSMTP functions for sending SMTP mail and to other solutions for receiving SMTP mail, z/OS V2.2 Communications Server



includes migration health checks designed to help you determine whether the mail functions planned to be withdrawn are in use. Also, z/OS V2.2 Communications Server provides a test mode for CSSMTP along with a utility program that copies JES email job output to both CSSMTP and SMTPD, allowing the two daemons to be run simultaneously. When run in this mode, CSSMTP is designed only to log errors while SMTPD continues to serve as the production mail program.

## Application development

Application development improvements revitalize the development environment on z/OS, making it easier to develop software and to enable new applications.

z/OS V2.2 XL C/C++ provides support for the new z13 processor, with ARCH(11) and TUNE(11) parameters designed to take advantage of the new instructions to better optimize your generated code. XL C/C++ is also designed to support the single instruction, multiple data (SIMD) instructions provided with the z13 vector extension facility and corresponding vector programming language extensions, and the IBM MASS (Mathematical Acceleration Subsystem) and ATLAS (Automatically Tuned Linear Algebra Software) libraries. The MASS library is intended for accelerated execution of elementary mathematical functions that serves as a higher-performance alternative to the standard math library that is part of the z/OS XL C/C++ Runtime. The ATLAS library is designed to provide linear algebra function support for BLAS (Basic Linear Algebra Subprograms) and LAPACK (Linear Algebra PACKage) functions routinely used in Business Analytics and Optimization solutions. These two libraries provide a powerful framework for development of new Business Analytics workloads, porting math-intensive workloads from other platforms, and can help accelerate Business Analytics workloads on zEC12, zBC12, and z13 processors. z/OS V2.2 dbx also provides support for debugging C/C++ programs on z/OS UNIX that use vector variables and the SIMD instructions.

Additionally, z/OS V2.2 XL C/C++ delivers a number of usability and performance enhancements:

- Inline assembler statements support is designed to enable you to insert assembler statements inline with XL C and XL C++ code. This support is designed to not require Metal C compilation and to enable you to easily use specialized instructions with your C and C++ objects.
- Runtime architecture blocks are designed to enable you to use a single source file with sections designed to take advantage of various hardware architecture levels and specify that the system select the appropriate path to be run at execution time. This function is designed to enable a single executable to have optimized paths for various hardware levels to help deliver improved performance.

The functions above are available for z/OS V2.1 XL C/C++ with a web deliverable added to the z/OS download site, at

<http://www.ibm.com/systems/z/os/zos/tools/downloads/index.html>

In addition, z/OS V2.2 XL C/C++ includes:

- Automatic conversion of code, designed to take advantage of the vector facility, enable more efficient use of the hardware, and parallelize code for better performing applications.
- Support in the dbgld utility, which is now designed to capture all source and place it into the module level debugging file, allowing you to view or use the nonexecutable code.
- An enhanced Metal C design is enhanced to allow larger reserved DSA fields, if requested, which is intended to allow for easier migration from nonstandard linkages and intended to provide more flexibility.

z/OS V2.2 introduces a new z/OS Client Web Enablement Toolkit, designed to enable applications written in C/C++, COBOL, PL/I, and High Level Assembler to participate more easily as a client in a RESTful web application programming model. The toolkit provides a z/OS JSON parser able to process text coming from any source, to build new JSON text, or add to existing JSON text; and, an HTTP/HTTPS protocol enabler that uses interfaces similar to other industry-standard APIs. These components are

also available for z/OS V2.1. For z/OS V2.1, the PTF for OA46575 includes the z/OS JSON Parser and is available now, and the PTF for OA46622 is planned to provide the z/OS HTTP enabler on the z/OS V2.2 general availability date.

z/OS V2.2 JES2 will be designed to allow you to specify that a number of JES3 job execution control language (JECL) statements be converted to their JES2 equivalents or converted to equivalent JCL statements, when equivalent functions exist. This new function, planned to be available in fourth quarter 2015, is intended to make it possible for some JES3 JECL statements to be processed on JES2 systems, which is expected to make it easier to write JCL (including JECL) that runs the same way on both JES2 and JES3 systems and make it easier to convert from JES3 to JES2.

z/OS V2.2 Infoprint Server provides new function in IP PrintWay extended mode that you can use to specify that personalized text be added to emailed notes that include print output. This is intended to enable you to insert customized text (such as "Dear Ms. Doe,") at the beginning of generated notes that accompany attachments.

z/OS V2.2 Unicode services is designed to provide conversion support between Hong Kong Supplementary Character Set (HKSCS) 2008 and Unicode. This support, also available on z/OS V2.1 with the PTFs for APARs OA43021 and OA44045, is intended to enable you to take advantage of applications using the HKSCS 2008 standard. Additionally, z/OS V2.2 Unicode services are designed to extend support for user-defined conversion tables to the full UTF-32 range. This support enables you to define your own character conversion tables for the full Unicode range.

z/OS V2.2 Unicode collation service is designed to support the European Ordering Rules (EOR / EN 13710 standard) and its German tailoring defined by the European Committee for Standardization (CEN). This standard provides for common character ordering and is used by the European Union, the European Free Trade Association, and parts of Eastern Europe. It provides for consistent ordering for Latin, Greek, and Cyrillic alphabets and a number of special characters. This support is intended to make it easier to sort data encoded in Unicode in a consistent way across all three alphabets.

z/OS V2.2 DFSORT supports two new date functions. A WEEKNUM function is designed to convert input dates to numbers representing corresponding weeks of the year. An AGE function is designed to calculate date duration that specifies the number of years, months, and days between an input date and the current date. These functions are intended to provide additional flexibility in creating reports and to help improve the usability of reports generated with these new functions.

z/OS V1.13 introduced support for user-defined line commands for ISPF Edit and View. In z/OS V2.2, this design is extended to enable you to pass predefined line commands to the Edit and View interface services (EDIF and VIIF) and to enable you to specify a set of line commands in a new global line command table.

z/OS V2.2 includes OpenSSH 6.4p1. This is the same level of OpenSSH included in IBM Ported Tools V1.3.0 (5655-M23), announced in Software Announcement [215-009](#), dated January 14, 2015. OpenSSH is intended to provide encryption for remote login and file transfer. Also, IBM plans to provide future enhancements to the OpenSSH function included in z/OS (see the [Statements of direction](#) section). These enhancements include optional support for FIPS 140-2, which will also be designed to use ICSF and System SSL, and support for Kerberos-based authentication. Support for FIPS 140-2 and Kerberos is planned to be available for fourth quarter 2015 with the PTF for APAR OA48013.

In z/OS V2.2, IBM HTTP Server Powered by Apache replaces IBM HTTP Server powered by Domino<sup>®</sup>. IBM HTTP Server powered by Apache is based on the IBM HTTP Server powered by Apache that is part of WebSphere Application Server and is at a higher level than the IBM HTTP Server 8.5.5 powered by Apache that was previously available as part of IBM Ported Tools (5655-M23).

The z/OS V2.2 Program Management Binder supports a new dynamically linked library (DLL) intended for use by C/C++ language AMODE 64 callers of binder services.

z/OS V2.2 NFS is designed to support being called in 64-bit addressing mode (AMODE 64). This is intended to help support the placement of z/OS UNIX System Services data areas above the 2 GB bar and to reduce the overheads required to switch into and out of AMODE 64. Also, the z/OS V2.2 NFS client is designed to support asynchronous I/O processing, which is intended to improve network performance.

The z/OS V2.2 CIM Server is upgraded to a newer version of the OpenPegasus CIM Server, 2.13. Also, the CIM Servers Schema repository is updated to CIM Schema version 2.36, and the Standards Based Linux™ Instrumentation for Manageability (SBLIM) CIM client for Java is included, version 2.2.5. This is intended to help keep the z/OS CIM Server and schema current with the CIM standards available at development time from OpenGroup and DMTF, and to allow z/OS management applications to manage z/OS in an enterprise environment. Also, version 2.2.5 of the SBLIM CIM client for Java is designed to be a JSR48-compliant implementation.

A number of small enhancements for z/OS V2.2 System REXX (SYSREXX), including support for commands, are designed to enable you to:

- Cancel requests
- Terminate TSO=YES address spaces
- Initiate TSO=NO requests
- Stop the AXR address space

Also, new support enables you to specify the maximum number of TSO=YES address spaces and the maximum time allowed for REXX execs in AXRnn parmlib members, and for issuing console messages requiring a response (WTORs) from execs and receiving the operator responses.

### **z/OS support for z Systems**

The z13 processor, as announced in Hardware Announcement [115-001](#), dated January 14, 2015, is supported by z/OS V1.13 (5694-A01) and z/OS Version 2. Continued tight integration between hardware and software technologies has become increasingly important to meeting the capacity and performance demands of mission-critical workloads. Accordingly, z/OS exploits many of the new functions and features of z13, including:

- z13 provides SMT support for certain specialty engines. z/OS V2.2 supports the use of SMT for zIIP processors. The use of SMT can provide significantly more throughput. To support this new function, z/OS is designed to provide:
  - IPL-time controls to enable SMT and set the SMT mode
  - Post-IPL controls to dynamically switch the SMT mode
  - SMF Type 30 record fields with a normalized value for CPU time spent on a processor running in SMT mode
  - SMF Type 70 records with new SMT-related fields
  - Parallel Sysplex services (XES) use of SMT mode for workloads using zIIPs to help improve physical processor utilization during synchronous CF access requests
  - Hardware Instrumentation Services (HIS) updates to provide measurement data in SMT mode
  - New RMF metrics to help you with capacity planning and performance analysis

This support is also available for z/OS V2.1 with the PTFs for OA43366, OA43622, OA44101, OA44439, and OA44624.

**Note:** To find the complete set of required and recommended PTFs for z13 processors, IBM recommends you use the appropriate FIXCAT category or categories and the SMP/E REPORT MISSINGFIX command.

- z/OS V2.2 is designed to support up to 141-way multiprocessing (SMP) in a single LPAR on IBM z13 systems, or up to 128 physical processors (256 logical

processors) per LPAR in SMT mode. This support is also available for z/OS V2.1 with the PTFs for OA43366, OA43622, OA44101, and OA44439. z/OS V1.13 supports up to 100 processors configured in a single LPAR in non-SMT mode. z/OS supports combinations of general-purpose processors (CPs), zIIPs, and zAAPs on systems that support them.

- z/OS V2.2 supports up to four subchannel sets on z13 servers. This helps relieve subchannel constraints and can enable you to define larger I/O configurations that support multi-target Metro Mirror (PPRC) along with large numbers of PPRC secondaries and Parallel Access Volume (PAV) aliases. As with the prior support for up to three subchannel sets, you can define base devices, aliases, and secondaries in the first subchannel set (subchannel set zero), and define only aliases and secondaries in subchannel sets one, two, and three. All four subchannel sets support FICON and zHPF protocols. This support is also available on z/OS V1.13 and z/OS V2.1 with the PTF for APAR OA43495.
- z/OS V2.2 provides support for the new vector extension facility (SIMD) instructions available on z13 servers. This new support, also available for z/OS V2.1 with the PTFs for APARs OA43803 and PI12412, is intended to help enable high-performance analytics processing and is exploited by z/OS XL C/C++; z/OS XML System Services; IBM 31-bit SDK for z/OS, Java Technology Edition, Version 8 (5655-DGG); IBM 64-bit SDK for z/OS, Java Technology Edition, Version 8 (5655-DGH); Enterprise PL/I for z/OS, V4.5 (5655-W67); and Enterprise COBOL for z/OS, V5.2 (5655-W32).
- WebSphere Application Server for z/OS Liberty Profile V8.5.5.5 (5655-W65) applications using the Liberty profile and running with Java 8 are expected to benefit from SIMD exploitation. You can find more information about Java exploitation in Software Announcement [215-010](#), dated January 14, 2015, and Software Announcement [215-004](#), dated January 14, 2015, about PL/I exploitation in Software Announcement [215-014](#), dated January 14, 2015, and about COBOL exploitation in Software Announcement [215-027](#), dated January 14, 2015.
- z/OS V2.2 XL C/C++ provides support for the new z13 processor, with new ARCH(11) and TUNE(11) parameters designed to take advantage of the new instructions and better optimize the generated code. XL C/C++ is designed to support single instruction, multiple data (SIMD) registers and enhanced string processing built-in functions. This is expected to help you improve the performance of C/C++ code running on z13 processors. This function is also available for z/OS V2.1 XL C/C++ with a web deliverable from the z/OS download site

<http://www.ibm.com/systems/z/os/zos/tools/downloads/index.html>

- z/OS V2.2 is designed to support up to 4 TB of real memory in a single LPAR on z13 processors. This is intended to help support more workload per z/OS image and more memory-intensive applications. This support is also planned to be available for z/OS V2.1 at z/OS V2.2 general availability with the PTF for APAR OA47439.
- z/OS V2.2 XCF is designed to exploit CFCC Level 20 to improve availability for users of large CF cache structures and data sharing performance with larger DB2 Group Buffer Pools (GBP). This support is intended to remove inhibitors to using large CF cache structures, enabling you to appropriately scale to larger DB2 Local Buffer Pools (LBP) and Group Buffer Pools (GBP) in data sharing environments. For more information, refer to Hardware Announcement [115-001](#), dated January 14, 2015.

### **Accessibility by people with disabilities**

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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](http://www.ibm.com/able/product_accessibility/index.html)

### **Section 508 of the US Rehabilitation Act**

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IBM z/OS V2.2 is capable as of September 30, 2015, 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](http://www.ibm.com/able/product_accessibility/index.html)

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## Product positioning

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### Product positioning - Globalization

#### 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 Version 1 earned the IPv6 Phase 2 Ready logo and USGv6 Profile Version 1.0 (NIST SP500-267) certification. z/OS V2.2 Communications Server is designed to meet these standards.
- The programming interfaces provided by z/OS V2.1 Unicode Services are designed to meet the Unicode 6.0 standard.
- IBM z/OS V2.1 has been certified as meeting the requirements of the German Common Criteria Certification Body (BSI) Operating System Protection Profile (OSPP) at EAL 4+.
- 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 also 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<sup>(R)</sup> 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.

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## Statements of direction

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IBM plans to further extend the capabilities of the Configuration Assistant for z/OS Communications Server, a plug-in for z/OSMF, in z/OS V2.2. Additional planned enhancements will be designed to support making dynamic configuration changes to an active TCP/IP configuration, and a function designed to import existing TCP/IP profile data.

IBM intends to deliver a number of additional enhancements to SDSF in the future. These functions are planned to include new commands that will be designed to:

- Help you perform address space level diagnosis, with display support for active task control blocks (TCBs), contents directory entries (CDEs), allocated data sets, and enqueue (ENQ) serialization conflicts
- Display a virtual storage map and common storage utilization, including orphaned common storage

- Display information about catalogs, mounted z/OS UNIX™ file system data sets, and SMF (SYS1.MAN) data sets
- Show ASID-related virtual storage information, including allocated storage by subpool
- Provide information about real, virtual, and auxiliary storage consumption by ASID
- Display information about active subsystems, and identify a number of IBM subsystems such as DB2 and WebSphere MQ

Additional SDSF displays will be intended to provide:

- SMS-related information, including active classes and the volumes in storage groups
- Parallel Sysplex information about XCF structures, groups, and group members
- WLM-related information, including service and reporting classes
- Support for browsing virtual memory contents for a specified address space
- Generic tracker information

Finally, SDSF is planned to provide a new facility that will be designed to help you manage dynamic exits, which will be intended to make it easier to display active exits and to manage activation, deactivation, and replacement of system exits.

z/OS V2.2 is planned to be the last release to include the Trivial File Transfer Protocol Daemon (TFTPD) function in z/OS Communications Server.

z/OS V2.2 is planned to be the last release to include the TCP/IP legacy device drivers for FDDI and Token Ring (LCS with LINKs FDDI and IBMTR), Token Ring (MPCIPA with LINK IPAQTR), and ENet and FDDI (MPCOSA with LINKs OSAENET and OSAFDDI). If you are using any of these devices, IBM recommends you migrate to newer devices such as OSA Express QDIO and Hipersockets. Note that this withdrawal is only for TCP/IP device types, and not for any of the SNA device drivers.

z/OS V2.2 is planned to be the last release to provide support in the Common Information Model (CIM) component for the Java™ Managed Provider Interface (JMPI).

z/OS V2.2 is planned to be the last release to support the DFSMSrmm CIM Provider.

z/OS V2.2 is planned to be the last release to include a number of TSO/E-based System Data Mover (SDM) related commands. Except for the query commands (CQUERY, FCQUERY, RQUERY, XQUERY, XSTATUS), and the XSET command, which will remain, IBM recommends you use the REXX version of these commands instead. For more information about using the REXX commands, see *z/OS DFSMS Advanced Copy Services*.

As previously announced in Hardware Announcement [114-009](#), dated February 24, 2014, the Simple Mail Transport Protocol Network Job Entry (SMTPD NJE) Mail Gateway and Sendmail mail transports are planned to be removed from z/OS. IBM now plans for z/OS V2.2 to be the last release to include these functions. If you use the SMTPD NJE Gateway to send mail, IBM recommends you use the existing CSSMTP SMTP NJE Mail Gateway instead. In that same announcement, IBM announced plans to provide a replacement program for the Sendmail client that would not require programming changes. Those plans have changed, and IBM now plans to provide a compatible subset of functions for Sendmail in the replacement program and to announce those functions in the future. Programming changes or alternative solutions to currently provided Sendmail functions might be required. No replacement function is planned in z/OS Communications Server to support using SMTPD or Sendmail as a (SMTP) server for receiving mail for delivery to local TSO/E or z/OS UNIX System Services user mailboxes, or for forwarding mail to other destinations.

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 remain at our sole discretion.

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## Hardware and software support services

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### SmoothStart/installation services

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IBM SmoothStart Services and Installation Services are not provided.

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## Reference information

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- Hardware Announcement [115-001](#), dated January 14, 2015(IBM z13)
- Software Announcement [215-007](#), dated January 14, 2015(IBM Enterprise COBOL for z/OS V5.2)
- Software Announcement [215-014](#), dated January 14, 2015(IBM Enterprise PL/I for z/OS V4.5 offers new function and improved performance)
- Software Announcement [215-009](#), dated January 14, 2015(IBM Ported Tools for z/OS Version 1.3.0)
- Software Announcement [213-376](#), dated October 1, 2013(IBM DB2 11 for z/OS)

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## Program number

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Program number	VRM	Program name
5650-ZOS	2.2	z/OS

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## Business Partner information

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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<sup>®</sup> ID and password are required (use IBM ID).

[BP Attachment for Announcement Letter 215-267](#)

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## Education support

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IBM Systems and Technology Group, Lab Services and Technical Training supports many IBM offerings. These include both introductory and advanced classes in z/OS, z/VM<sup>®</sup>, Linux<sup>™</sup> on z Systems, and our hardware update classes.

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

Here is a partial list of classroom courses that are currently available and planned for z/OS education:

- z/OS V2.2 Review and Migration (ESC7)<sup>5</sup>
- Introduction to z/OS Environment (ES05)
- Fundamental System Skills for z/OS (ES10)
- z/OS Facilities (ES15)
- z/OS System Operators (ES27)
- z/OS Installation Using ServerPac (ES41)

- Basic z/OS Tuning Using the Workload Manager (WLM) (ES54)
- Basics of z/OS RACF Administration (ES19)
- Introducing z/OS UNIX System Services (OP05)
- Advanced Parallel Sysplex Operations and Recovery (ES90)
- Parallel Sysplex Implementation Workshop (ES42)
- z/OS Management Facility Implementation and Use (ESB1)
- z/OS REXX Programming Workshop (ES52)

<sup>5</sup> This course is planned to be available by the end of 2015.

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## Technical information

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### **Specified operating environment**

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#### ***Hardware requirements***

z/OS V2.2 runs on these IBM z Systems servers:

- IBM z13
- IBM zEnterprise EC12 (zEC12)
- IBM zEnterprise BC12 (zBC12)
- IBM zEnterprise 196 (z196)<sup>6</sup>
- IBM zEnterprise 114 (z114)<sup>6</sup>
- IBM System z10 (z10 EC, z10 BC)<sup>6</sup>

<sup>6</sup> These products are withdrawn from marketing.

In addition, z/OS V2.2 supports these and later IBM storage control units:

- 3990 Model 3 and 3990 Model 6<sup>6</sup>
- 9393<sup>6</sup>
- 2105<sup>6</sup>
- 2107<sup>6</sup>
- 2421, 2422, 2423, and 2424



## 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 V2R2 Planning for Installation* (GA32-0890) for a listing of specific software requirements at

<http://www.ibm.com/systems/z/os/zos/library/bkserv/index.html>

## Compatibility

### 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 V2.2:

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 V2.2, IBM intends to allow you to upgrade from z/OS V1.13 directly to z/OS V2.2 with full coexistence, migration, and fallback support to maximize the value of your investment, and from z/OS V2.1 to z/OS V2.2 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 V2.2**

Release	Coexistence-Migration-Fallback supported with release in Column 1
z/OS V1.13	z/OS V1.11, <sup>7</sup> z/OS V1.12, <sup>8</sup> z/OS V1.13 <sup>9</sup>
z/OS V2.1	z/OS V1.12, <sup>8</sup> z/OS V1.13, <sup>9</sup> z/OS V2.1
z/OS V2.2	z/OS V1.13, <sup>9</sup> z/OS V2.1, z/OS V2.2

<sup>7</sup> z/OS V1.11 end of service was September 30, 2012.

<sup>8</sup> z/OS V1.12 end of service was September 30, 2014.

<sup>9</sup> z/OS V1.13 end of service is planned to be September 30, 2016.

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

## 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 9, 2007(IBM System z<sup>(R)</sup> New Application License Charges) and Software withdrawal [907-245](#), dated December 4, 2007(Software withdrawal: Selected IBM System z products -- Some replacements available).

## Planning information

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### ***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**

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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.

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## Ordering information

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For a list of the publications available for z/OS, visit the z/OS Internet Library at <http://www.ibm.com/systems/z/os/zos/library/bkserv/index.html>

### **New licensees**

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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 V2.2 orders will begin on the planned general availability date, September 30, 2015. 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, 2015.

New users of IBM z/OS V2.2 should specify: Type: 5650 Model: ZOS

### Basic license

To order a basic license, specify the z/OS V2.2 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 identifier	Description	License option/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 <sup>(R)</sup> 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 V2.2

Program PID: 5650-ZOS

Entitlement identifier	Description	License option/Pricing metric
S01728S	z/OS V2 Alternate Base	Basic MLC, AWLC
S01728T	z/OS V2 Base	Basic MLC, AWLC

Entitlement identifier	Description	License option/Pricing metric
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 V2.2

Program PID: 5650-ZOS

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 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.

<b>Entitlement identifier</b>	<b>Description</b>	<b>License option/Pricing metric</b>
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.

<b>Entitlement identifier</b>	<b>Description</b>	<b>License option/Pricing metric</b>
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

<b>Entitlement identifier</b>	<b>Description</b>	<b>License option/Pricing metric</b>
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

### ***z Systems entry license charge (zELC)***

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

Specify the zELC monthly license option.

<b>Entitlement identifier</b>	<b>Description</b>	<b>License option/Pricing metric</b>
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 SNA 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 V2.2 and can be ordered effective September 11, 2015. 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.

<b>z/OS V2.2 Feature description</b>	<b>z/OS V2.2 Orderable supply ID</b>
Base	S017P7T

#### **Notes:**

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

<b>Title</b>	<b>Order number</b>
z/OS V2.2 Collection	SK4T-4949

For free, the customer can download the softcopy collection or any z/OS V2.2 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 2 Collection (PDFs)**

*z/OS Version 2 Release 2 Collection* (SK4T-4949) includes softcopy tools and libraries for z/OS Version 2 Release 2 (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.

The latest version of the SoftCopy Librarian can be downloaded at

<http://www.ibm.com/support/docview.wss?uid=swg27018846>

### **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 V2.2

The following optional features, offered at no additional charge, can be ordered effective July 28, 2015.

<b>z/OS V2.2 Feature description</b>	<b>z/OS V2.2 Orderable supply ID</b>
Communications Server Security Level 3	S017P9C
z/OS Security Level 3	S017P9D
<b>z/OS V2.2 Feature description</b>	<b>z/OS V2.2 Orderable supply ID</b>
Brazilian Portuguese Base (PTB)	S017P90
Canadian French Base (FRC)	S017P7V
Danish Base (DAN)	S017P8R
Dutch Base (NLD)	S017P8X
French Base (FRA)	S017P7H
German Base (DEU)	S017P7F
Italian Base (ITA)	S017P7G
JPN Base	S017P8S
JPN XL C/C++	S017P96
JPN Infoprint Server	S017P8L
JPN RMF	S017P7S
JPN SDSF	S017P94
JPN Security Server	S017P99
Upper Case English Base (ENP)	S017P8W
Korean Base (KOR)	S017P8V
Norwegian Base (NOR)	S017P8T
Spanish Base (ESP)	S017P8M
Swedish Base (SVE)	S017P8P
Swiss German Base (DES)	S017P8N
Simplified Chinese Base (CHS)	S017P8Z
Traditional Chinese Base (CHT)	S017P7X

### **z Systems 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.

### **z Systems New Application License Charge (zNALC)**

Basic license structure

<b>Entitlement identifier</b>	<b>Description</b>	<b>License option/Pricing metric</b>
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



Entitlement identifier	Description	License option/Pricing metric
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

### **z Systems New Application License Charge (zNALC) basic license**

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

#### **Unlicensed documentation**

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

Title	Order 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.

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. These customized offerings 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 include:

- 3590
- 3592

Most products can be ordered in ServerPac the month following their availability in CBPDO. z/OS can be ordered via CBPDO and ServerPac at general availability. Many

products will also be orderable in a Product ServerPac without also having to order the z/OS operating system or subsystem.

Shopz and CFSW will determine the eligibility based on product requisite checking. For more details on the product ServerPac, visit the Help section on the Shopz website at

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

For additional information on the Product ServerPac option, refer to Software Announcement [212-272](#), dated July 31, 2012.

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.

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## Terms and conditions

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The terms for z/OS Version 2 (5650-ZOS), as previously announced in Software Announcement [213-292](#), dated July 23, 2013, licensed under the IBM Customer Agreement, are unaffected by this announcement.

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## Statement of good security practices

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IT system security involves protecting systems and information through prevention, detection, and response to improper access from within and outside your enterprise. Improper access can result in information being altered, destroyed, or misappropriated or can result in misuse of your systems to attack others. Without a comprehensive approach to security, no IT system or product should be considered completely secure and no single product or security measure can be completely effective in preventing improper access. IBM systems and products are designed to be part of a comprehensive security approach, which will necessarily involve additional operational procedures, and may require other systems, products, or services to be most effective. IBM does not warrant that systems and products are immune from the malicious or illegal conduct of any party.

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## Prices

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

### z Systems Entry License Charge (zELC)

Entitlement identifier	Description	License option/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 SNA 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

Entitlement identifier	Description	License option/Pricing metric
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 identifier	Description	License option/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)

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

Entitlement identifier	Description	License option/Pricing metric
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)

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 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

### 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 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

Entitlement identifier	Description	License option/Pricing metric
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<sup>(R)</sup> (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 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)

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

### z Systems New Application License Charge

Entitlement identifier	Description	License option/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

Entitlement identifier	Description	License option/Pricing metric
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

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## **Corrections**

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### **(Corrected on October 19, 2015)**

The Security topic in the Description section was revised.