IBM z/OS Version 2 Release 4 - Unleashing innovation through an agile, optimized, and resilient platform

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At a glance

Enterprises are turning to digital transformation to address new business challenges, reach new markets, and deliver new value to clients. Addressing new business opportunities demands effective digital transformation through the orchestration of technologies ranging from cloud, analytics, cognitive computing, mobile, and the Internet of Things to enable new internal and external client experiences.

IBM's approach is to unleash the rich application development talent that clients possess by enabling new application development processes and optimizing their existing application investment in new and innovative ways, while providing the application-level resiliency and security that clients have come to expect from IBM Z$^{(R)}$.

Business success will be predicated on embracing agility, optimization, and resiliency:

- Agility in the adoption of new technologies in DevOps, microservices, and consumption models that are delivered as a service to accelerate their time to value
- Optimization through the ability to run computing workloads in the most efficient environment
- Resiliency to deliver continuity of business services through exploitation of attributes such as encryption and high availability

These factors provide the ability to deliver results on demand and without interruption, which is critical to creating and maintaining a highly satisfying client experience.

With the IBM$^{(R)}$ z/OS$^{(R)}$ V2.4 operating system, IBM intends to unleash innovation through an agile, optimized, and resilient platform that helps clients to build applications and services based on a highly scalable and secure infrastructure that delivers the performance and availability for on-premises or provisioned as-a-service workloads that enable businesses to digitally transform.

Overview

z/OS is designed to support clients with workload efficiency, scalability, improved analytics capabilities, and resiliency to deliver capabilities to enhance availability and performance as well as improved security and data protection.

To support the capabilities that provide agility, optimization, and resiliency, z/OS V2.4 is designed to deliver the following:

- z/OS V2.4 introduces an exciting new capability, IBM z/OS Container Extensions, to enable the ability to run almost any Linux[(R)] on IBM Z Docker container in z/OS alongside existing z/OS applications and data without a separate provisioned Linux server. This extends the strategic software stack on z/OS as developers can build new, containerized apps, using Docker and Linux skills and patterns, and deploy them on z/OS, without requiring any z/OS skills. Data centers can, in turn, operate popular open source packages, Linux applications, IBM software, and third-party software together with z/OS applications and data, leveraging industry standard skills. Clients can optimize developing and running their applications in their most efficient environment with faster time to value as business demands grow, thereby protecting existing infrastructure investment.
- IBM delivers capability that enables businesses to integrate z/OS more easily into their private and multicloud environments with improvements that deliver a more robust and highly available IBM Cloud[TM] Provisioning and Management for z/OS and Cloud Storage Access for z/OS Data.
- z/OS V2.4 continues to simplify and modernize the z/OS environment for a better user experience and improved productivity by reducing the level of IBM Z specific skills that are required to maintain z/OS, eliminating and automating various activities with the z/OS Management Facility (z/OSMF) and improving usability and capability of SDSF. Various DFSORT enhancements provide more flexibility and functionality when sorting, merging, or filtering records within DFSORT jobs.
- IBM continues with the industry-wide simplification improvement to help clients install and configure software using a common and modern method. These installation improvements range from the packaging of software through the configuration so that faster time to value can be realized throughout the enterprise.
- IBM Open Data Analytics for z/OS is providing enhancements to simplify data analysis by combining open source run times and libraries with analysis of z/OS data at its source, reducing data movement and increasing the value of insights gained from leveraging current data. These improvements further enhance the data analytics ecosystem in IBM Z and leverage industry standard skills and tools to quickly develop insights for improved time to value.
- z/OS V2.4 is enhancing security and data protection on the system, with an upgraded level of OpenSSH, namely OpenSSH 7.6p1, which provides support for new industry cryptography. z/OS continues to drive pervasive encryption by giving users the ability to encrypt data without application changes and simplify the task of compliance. A new RACF[(R)] capability improves management of access and privileges.
- Transactional VSAM (TVS) delivers an auto-commit function that provides improved system availability without the need to make costly source code changes to batch applications to enable TVS.
- z/OS V2.4 supports enhancements to the NFS file sharing protocol as the DFS/SMB protocol is no longer shipped. The new function for NFS is available on previous levels of z/OS to help DFS/SMB clients migrate and use NFS to share data with the Microsoft[TM] Windows[TM] environment.
- DFSMSrmm enhancements provide improved usability and flexibility of functions and commands and provide support for GDPR legislation. Also, various DFSMS enhancements provide improved usability and flexibility of functions and commands.

Key requirements

z/OS V2.4 runs on these IBM Z family servers:

- IBM z14[TM] Models M01-M05
- IBM z14 Model ZR1
- IBM z13[(R)]
- IBM z13s[(R)]

- IBM zEnterprise(R) EC12 (zEC12)
- IBM zEnterprise BC12 (zBC12)

If you will be running z/OS V2.4 on IBM z/VM(R), the z/VM release must be z/VM V6.4, or later.

For a complete description of z/OS V2.4 hardware requirements, see *z/OS V2R4 Planning for Installation* (GA32-0890), when available, in IBM Knowledge Center.

Planned availability date

September 30, 2019

Description

Improving and simplifying application development

IBM z/OS Container Extensions

IBM is delivering IBM z/OS Container Extensions (zCX) with the announcement of z/OS V2.4. By leveraging open source componentry, clients will gain access to a wide variety of existing Linux on IBM Z applications with a standard packaging approach that is consistent with the latest technology available. With zCX, these applications can be deployed and colocated within a z/OS address space, enabling significant workload modernization as well as improved and simplified application development.

In addition to open source packages available on Dockerhub, IBM is also announcing a new open source project with the Open Mainframe Project (OMP), which enables collaboration across the mainframe community to develop shared tool sets and resources. This new project, hosted under the OMP, is centered on curated open source Docker packages for both Linux on Z and z/OS. This helps traditional z/OS clients by providing a level of governance around maintenance for open source software. Clients still need to consider service contracts where they feel that is needed.

Along with popular open source packages, IBM plans to have third-party software available. In addition, IBM software such as IBM Service Management Unit (SMU), the time-saving user interface for IBM Service Management Suite for z/OS (5698-AAF) and IBM Z Service Automation Suite (5698-SA1), already ship Docker images that are compatible and can run on a zIIP processor inside a zCX container.

Although developed on Linux, applications and services in zCX will directly leverage z/OS Qualities of Service (QoS). Workloads in zCX will benefit from high availability and disaster recovery planning with features like IBM HyperSwap(R), storage replication, and IBM Geographically Dispersed Parallel Sysplex(R) (GDPS(R)) as well as to leverage z/OS workload management capabilities for capacity planning and tuning.

zCXs are designed to be maintained by clients' existing z/OS operations staff reusing their existing z/OS environment QoS outlined above, and application developers with relatively little z/OS skill will be able to use standard Docker commands to manage their packages.

IBM intends to enable ISVs to take advantage of zCX through a vendor enablement program. See the Open Z Systems Exchange GitHub to learn more about enabling your product to use IBM z/OS Container Extensions.

This initial release of IBM z/OS Container Extensions for IBM z/OS V2.4 provides Docker Swarm as support for Docker cluster management.

IBM's future plans intend to leverage Kubernetes clustering for the orchestration, scalability, and management of zCXs with compatible cloud platforms. See the Statements of direction section in this announcement.

zCX workloads are zIIP eligible and will run with IBM z14 servers.

For the chosen server platform, clients must order and install the Container Hosting Foundation (feature code 0104). This feature code provides entitlement and support for the Secure Service Container hosting foundation and can be ordered using e-config.

C header file support

In z/OS V2.4, IBM offers C header files to provide mappings for several commonly used SMF records and system data areas and control blocks to provide ease of use for referencing these control block fields from programs written in the C language, rather than assembler.

Transactional Execution enforcement

z/OS V2.4 provides enforcement to the effect that hardware Transactional Execution, available on IBM Z servers since zEC12, is always available to programs running on z/OS V2.4 so that programs in such an environment can unconditionally assume and make use of Transactional Execution.

Program object compatibility and transportability

A new suboption for the existing binder option of COMPAT is added to enable users to specify the PO level when building the program objects. This new function is especially useful for software vendors or anybody building and distributing programs to other customers, sites, or locations where valuable information needs to be preserved in the program object (problem determination attributes, compression, and so on). Prior to this enhancement, users may have encountered various problems related to the compatibility level of the binder when building program objects.

DFSORT functional enhancements

DFSORT is enhanced to provide additional record filtering capabilities by using regular expressions in DFSORT INCLUDE and OMIT control statements. Regular expressions contain a series of characters that define a pattern of text to be matched, which allows for more robust filtering capabilities, including using wildcards as search strings.

In z/OS V2.3, DFSORT provided the flexibility to SORT and MERGE Unicode data according to specific collation rules in the same manner as EBCDIC and ASCII data. With z/OS V2.4, DFSORT enhances this support to include the ability to provide Unicode data formats UTF-8, UTF-16, UTF-32 on INCLUDE, and OMIT control statements to filter Unicode data.

DFSORT supports ASCII Free format of numeric data for SORT, MERGE, INCLUDE, or OMIT control statements for enhanced sorting and filtering capabilities.

DFSORT is enhanced to support encrypted PDSE data sets without application changes. Users encrypting or decrypting during DFSORT processing must have authority to the key label.

Simplify and modernize the user experience to enhance productivity

z/OSMF and other simplification enhancements

z/OSMF continues to implement browser-based user interface capability. Sysplex management, workflow improvements, and software management are all aimed at reducing complexity.

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z/OSMF delivers on sysplex management stage 2 with the enhanced sysplex management application. It gives a system programmer a detailed view of their sysplex, and it provides the capability to change the configuration (new for stage 2), such as eliminating a single point of failure by enabling CF structure duplexing or adding an alternate couple data set. Commands are aggregated for sysplex operations in one command log so that two or more colleagues can see what the other has done. The application provides both graphical and table-based views of the data for both viewing and modification.

The z/OSMF configuration process is restructured to provide more flexibility. The new configuration process helps users to configure a minimum z/OSMF setup. When users are satisfied with the minimum z/OSMF setup, they can choose to configure most z/OSMF functions separately by their own needs. This new structure of the z/OSMF configuration helps users quickly roll out z/OSMF.

A new task, Security Configuration Assistant, is introduced to simplify z/OSMF security setup and troubleshooting. z/OSMF Security Configuration Assistant can automatically check if the required security configuration for z/OSMF is satisfied. With graphic interface and functions such as filter, a user can easily check z/OSMF security configuration status at any time. This can help with both z/OSMF security planning and z/OSMF security configuration troubleshooting.

z/OSMF diagnostic data can be generated with one click. A new task, Diagnostic Assistant, is introduced to enable a user to collect z/OSMF diagnostics with one click from z/OSMF.

The workflow engine is improved with support for array variables, parallel step execution, and improved job management. Many of the added features support product installation and upgrade, including the ability to generate a PDF of a workflow.

Finally, cloud provisioning and management delivers a set of improved capabilities to handle provisioning of software in a sysplex, including a cluster of servers and their networking needs. Along with the enhancements to the workflow engine, Workflow Editor is enhanced to support new workflow features. In addition to provisioning z/OS software using the z/OSMF user interface, IBM Cloud Private with IBM z/OS Cloud Broker can be used to provision z/OS software with the click of a button.

Assembler exits remediation

JES2 is enhanced with a new infrastructure designed to allow customization of JES2 with less of a requirement to code assembler exits. The new approach allows the specification of policies that take actions at various points in processing based on conditions being met. For example, set the job's system affinity based on a program that is specified in the JCL. These policies are release-independent, which helps simplify upgrade to new releases. This release provides the infrastructure for policies with support for basic conditions and actions. The existing exit infrastructure is being augmented by the new policies, not replaced.

SMFLIMxx assembler exits support

In z/OS V2.4, SMF enhances existing support by allowing greater customization and filtering to reduce the need for coding tailored assembler exits. In particular, new support adds additional filters for SAF checking, overriding JCL specifications of REGION and MEMLIMIT, as well as the ability to control dataspaces and control over messages that are generated.

System Display and Search Facility (SDSF) enhancements

System Display and Search Facility (SDSF) for z/OS V2.4 continues to add significant new function to SDSF with 16 tables of new information, 31 new columns on existing displays, and 24 new actions on displays, as well as general usability and functional improvements. These improvements span the ISPF-based user interface, the z/OSMF browser-based user interface, and SDSF REXX support. New tables include:

- Extended Operator Console Display

- OMVS options
- Link pack directory
- Coupling (XCF) members and groups
- JES subsystems
- JES2 resource monitor alerts
- Enqueue by data sets
- Workload Manager policy information
- Workload Manager service classes
- Workload Manager report classes
- Workload Manager resource groups
- Workload Manager workloads
- Job memory objects
- Job DD names
- JES3 Job-class members
- JES2 Checkpoint information

SDSF has added new general usability enhancements in the area of ISPF view support wherever ISPF browse was previously supported, along with the ability to hide columns on any table, the ability to better control point and shoot field highlighting, and improvements to the z/OSMF browser-based user interface.

z/OS V2.4 includes several enhancements such as support for JES2 Spool Encryption and JES2 Spool Throttling as well as efficiency improvements for data collection.

IBM Open Data Analytics for z/OS

IBM Open Data Analytics for z/OS integrates key open source analytics technologies with advanced data access and abstraction services. It was originally announced in Software Announcement AP17-0225, dated July 17, 2017.

See the IBM Open Data Analytics for z/OS topic in IBM Knowledge Center for more information.

This solution is designed to simplify data analysis. It combines open source run times and libraries with analysis of z/OS data at its source, reducing data movement and increasing the value of insights gained from leveraging current data.

Since the original release, Open Data Analytics for z/OS has made several improvements.

For Spark, the following improvements have been released since Open Data Analytics for z/OS was made generally available:

- Support for Workload Manager integration, allowing the ability to differentiate Spark users based on business priority and resource restrictions.
- Enhanced security with End-User Authentication and Encryption with the ability to authenticate users deploying to Spark as well as ensuring encryption of all data flowing between connections.
- System programmers can now utilize new z/OSMF workflows to simplify configuration, new configuration checkers, and scheduling support for easier tuning of memory and CPU.
- Spark can now leverage more z/OS infrastructure to allow enhanced auditing and support to associate users with their applications to allow tracking of resource usage as well as to leverage started tasks that enable the Spark master and worker to run on z/OS, consistent with running other MVS™ batch jobs, job steps, or started tasks.

For Mainframe Data Service (MDS), the following improvements have been released to support usability, performance, and security:

- MDS now supports real-time SMF data streaming and better performance for accessing IBM Db2$^{(R)}$ data with enhancements to the IBM Db2 Direct subcomponent in MDS.
- Security administrators can leverage new security enhancements as well with DRDA Authentication support, and userID encoding support between driver and Data Service server.

For Anaconda, the following improvements have been made:

- New Apache Maven support for better build automation.
- New XGBoost utilizes the implementation of gradient boosted decision trees designed for speed and performance.

For the latest updates, see the IBM Open Data Analytics for z/OS topic in IBM Knowledge Center.

Enhanced security and data protection

Security standards

z/OS V2.4 includes a port of OpenSSH 7.6p1 with platform-specific enhancements. Significant new features found with this level of OpenSSH include:

- Support for new key exchange (KEX) algorithms, including:
  - diffie-hellman-group14-sha256
  - diffie-hellman-group16-sha512
  - diffie-hellman-group18-sha512
  - curve25519-sha256
- Support for new ssh-ed25519 and ssh-ed25519-cert-v01 key algorithms.
- Support for the new chacha20-ploy1305 cipher.
- Enhancements to the SMF Type 119 subtype 94 and 95 (ssh/sshd connection started) records now include a section that identifies the IP addresses and ports for the connection.
- Elliptic-curve DSA (ECDSA) keys are now supported in key rings and in FIPS mode.
- Key ring keys now use System SSL for signature creation and verification.
- A new ssh-proxyc command is added, which can be used by the ssh client to connect through SOCKS5 proxy servers.

Pervasive encryption

z/OS V2.4 continues to drive pervasive encryption efforts within an enterprise with support for additional z/OS data set types, including PDSE and sequential basic format and large format SMS-managed data sets, and to provide JES2 encryption of JES-managed data sets on SPOOL. These enhancements give users the ability to encrypt data without application changes and simplify the task of compliance.

Encrypted PDSEs are allocated as an extended format V2 PDSE with all user data and metadata, including PDSE directory and member generations, stored as encrypted. However, program objects cannot reside in encrypted PDSEs. Encrypted PDSEs may be larger due to the 32-byte extended format suffix, which is appended to each physical block.

New support for sequential basic format and large format SMS-managed data sets enables applications using standard BSAM and QSAM APIs to encrypt data with no, or minimal, changes, and applications using EXCP to encrypt data with the use of a new access method encryption callable service. Support for sequential basic format and large format SMS-managed data sets is planned as a post-GA deliverable in third quarter 2020 with the PTFs for APAR OA56622.

As with other supported data set types, this support is designed to allow the installation to specify data sets to be encrypted through a policy such as SAF or

SMS, or manually. The data remains encrypted during administrative functions such as backup/restore, migration/recall, and replication.

JES2 is enhanced with PTFs for APAR OA57466 to support the encryption of instream and SYSOUT data sets on SPOOL. Key labels can be specified for individual data sets using the security product or through JCL. RACF is correspondingly enhanced by providing a new JES segment on the RACF general resource profile. This segment contains the name of the key label used to encrypt data covered by the JESJOBS class profile in which the key label is contained. These enhancements give users the ability to encrypt data without application changes and simplify the task of compliance. This support will be available in second quarter 2020.

RACF is providing a mechanism to dynamically relocate its RACF Remote Sharing Facility (RRSF) checkpoint data sets without requiring a subsystem restart and without losing any in-flight work. This new capability allows consolidation into consistent naming conventions and allows the pervasive encryption function to be applied to the newly allocated RRSF checkpoint data sets.

Additional RACF enhancements

RACF authentication processing is enhanced to support generation and validation of Identity Tokens. The Identity Token contains various claims that contain authentication state information and is in the format of a JSON Web Token (JWT). This Identity Token support allows z/OS applications and RACF to link together multiple authentication API calls and to replay proof of authentication. This capability is exploited by TSO/E to improve the user experience for certain IBM Z Multi-Factor Authentication logon flows.

A PassTicket is a one-time-use password substitute based on a shared secret key between the application generating the PassTicket and RACF, which evaluates the PassTicket when a user is logged on. It allows software such as session managers to authenticate a user once and then log the user on automatically to z/OS applications. RACF is providing new functions to improve usability and to encourage the use of ICSF for PassTicket keys for stronger security:

- Command and programming interfaces (RLIST, R_admin, IRRXUTIL, IRRDBU00) to report on the method of protection for PassTicket keys, and, for encrypted keys, the ICSF key label name
- A function to convert masked keys to encrypted keys without changing the key value
- The ability to use pre-existing keys in ICSF for application PassTickets, enabling you to consolidate key management functions using ICSF interfaces, using your own key naming conventions
- Diagnostic enhancements to help debug PassTicket generation and evaluation errors
- Removal of a setup requirement to copy certain ICSF modules to LPA
- Support during PassTicket evaluation in RACROUTE REQUEST=VERIFY for the CHECKAUTH(YES) configuration option in ICSF, which enforces SAF checks even for authorized callers
- Documentation enhancements to better understand PassTickets and implement them more securely

The RLIST, conversion, and ICSF key label enhancements are available on version 2.3 with the PTF for APAR OA56831.

RACF provides a new capability to detect changes made to a user's security environment by authorized software after that environment was originally established. When a change that elevates the user's privilege is made, RACF can optionally issue a new message to the security console.

RACF is enhanced to enable clients to add their own custom fields to RACF general resource and DATASET class profiles in a consistent manner with the existing ability for user and group profiles. For all profile types, the ability to validate the value of

a field using a System Rexx program is provided, removing the need to code the existing IRRVAF01 exit, which is also supported for all profile types, in assembler.

RACF is enhanced to allow the retrieval of DATASET class profile fields using the R_admin callable service (IRRSEQ00) and the IRRXUTIL rexx interface. This enhancement completes the existing functionality, which currently supports the other RACF profile types, along with system options (SETROPTS) and RACF subsystem and remote sharing configuration data. This capability allows for extensive scripting of security administrator functions using the Rexx programming language.

The RACF IRRXUTIL rexx interface is enhanced to allow the retrieval of a general resource class definition from either the static or dynamic Class Descriptor Table (CDT). There is a corresponding "next" function that enables a caller to iterate through CDT entries. The current SETROPTS settings for the class can be optionally requested in the same call. This capability enhances the RACF scripting ability mentioned above.

RACF provides enhanced conditional access list permissions, allowing certain resources to only be accessed when using a certain service. This capability is exploited by ICSF to restrict access to cryptographic keys only when being used by specific ICSF services. This function is available on version 2.3 with the PTF for APAR OA54350.

z/OS NAS and PKI enhancements

z/OS Network Authentication Services (NAS) is enhanced to support Flexible Authentication Secure Tunneling (FAST) through two updated Kerberos user commands and a new Kerberos API, enabling z/OS clients to be interoperable with other platforms supporting the FAST protocol and minimizing the need for password management in Kerberos authentication.

In support of RFC 8009, z/OS NAS is enhanced to support AES encryption with HMAC-SHA2, where Kerberos 5 defines two encryption types and checksum types using 128-bit and 256-bit keys, which provide more secure encryption, integrity protection, and checksums for all Kerberos operations.

z/OS Public Key Infrastructure (PKI) is enhanced to support the Enrollment over Secure Transport (EST) protocol, standardized by RFC7030, to provision certificates in a more robust manner and to enable clients with a large number of certain third-party hardware vendors' routers to obtain RSA and ECC certificates automatically to simplify administration.

z/OS PKI is also enhanced with the ability to request certificates synchronously through the PKI Services web interface, eliminating the wait from the PKI daemon's certificate creation timer.

Removal of user key common storage

User key common storage is memory that can be updated by any unauthorized program. z/OS V2.4 no longer supports unrestricted user key common storage, thereby improving application isolation and security. PTFs for APARs OA53355 and OA56180 are available at lower releases to assist in migration and identification of programs accessing user key common storage.

Removal of support of YES setting for VSM ALLOWUSERKEYCSA DIAGxx parmlib parameter: z/OS V2.3 will be the last release of z/OS to support the YES setting for the VSM ALLOWUSERKEYCSA DIAGxx parmlib parameter. If you run any software that requires the setting of this parameter to YES, the software will need to be changed to no longer require the setting of this parameter to YES or the optional priced RUCSA feature will be required.

All IBM provided software should not require this setting. If you have any other non-IBM provided software that requires this setting, contact the owner of the software regarding this usage.

Removal of support for obtaining user key CSA/ECSA storage: z/OS V2.4 does not support the usage of the GETMAIN, CPOOL, and STORAGE OBTAIN interfaces to obtain user key (8 - 15) CSA/ECSA storage. If you have any software that obtains user key CSA/ECSA storage, the software will need to be changed to no longer require this capability or the optional priced RUCSA feature will be required.

Removal of support of DISABLE setting for NUCLABEL IARXLUK2 DIAGxx parmlib parameter, which was introduced in z/OS V2.3: z/OS V2.4 ignores the setting for the NUCLABEL IARXLUK2 DIAGxx parmlib parameter. When NUCLABEL DISABLE(IARXLUK2) is in effect, usage of the CHANGKEY interface to change Common ESQA (Subpool 247-248) storage to user key (8 - 15) is supported. If you run any software that requires the setting of this parameter to DISABLE, the software will need to be changed to no longer require the setting of this parameter to DISABLE. All IBM provided software should not require this setting. If you have any other non-IBM provided software that requires this setting, contact the owner of the software regarding this usage.

Removal of support for changing Common ESQA (Subpool 247-248) storage to user key: z/OS V2.4 does not support the usage of the CHANGKEY interface to change Common ESQA (Subpool 247-248) storage to user key (8 - 15). If you have any software that changes Common ESQA (Subpool 247-248) storage to user key, the software will need to be changed to no longer require this capability.

Removal of support of YES setting for ALLOWUSERKEYCADS DIAGxx parmlib parameter: z/OS V2.4 does not support the YES setting for the ALLOWUSERKEYCADS DIAGxx parmlib parameter. On prior releases, when ALLOWUSERKEYCADS(YES) is in effect, usage of the DSPSERV CREATE interface to create a SCOPE=COMMON data space in user key (8 - 15) is supported. If you run any software that requires the setting of this parameter to YES, the software will need to be changed to no longer require the setting of this parameter to YES. All IBM provided software should not require this setting. If you have any other non-IBM provided software that requires this setting, contact the owner of the software regarding this usage.

Removal of support for creating SCOPE=COMMON data spaces in user key: z/OS V2.4 does not support the usage of the DSPSERV CREATE interface to create a SCOPE=COMMON data space in user key (8 - 15). If you have any software that creates a SCOPE=COMMON data space in user key, the software will need to be changed to no longer require this capability.

Restricted Use Common Service Area (RUCSA) feature

A new optional priced feature, RUCSA, is offered to enable clients to define a restricted use CSA (RUCSA) and manage it through SAF security protection. While avoiding user key common storage entirely is recommended, this feature enables clients who cannot update their applications that allocate user key CSA to gain enhanced protection without the need for application changes. Additionally, new health checks and instrumentation are added to track usage of this area. PTFs for APARs OA53355 and OA56180 are available at lower releases to assist in migration and identification of programs accessing user key common.

TLS V1.3 protocol support in System SSL and AT-TLS

z/OS supports TLS V1.3 within its System SSL component as stated in the z/OS V2.4 preview announcement from first quarter 2019. z/OS V2.4 delivers basic services support in System SSL as well as AT-TLS for TLS V1.3. Both RACF and PKI correspondingly support the provisioning of digital certificates with the signature type required by TLS V1.3. Check with any respective component or product that directly utilizes System SSL functionality or leverages AT-TLS to determine if their support is available.

The System SSL component of z/OS Cryptographic Services is updated to support TLS V1.3 handshakes with and without client authentication, TLS V1.3 session resumption, and updating of session keys used to encrypt application data after

a completed TLS V1.3 handshake, as described in RFC 8446. This support gives exploiters the ability to start using TLS V1.3 in their client and server applications.

The Application Transparent TLS feature of z/OS Communications Server is updated to support the new TLS 1.3 protocol as provided by System SSL in z/OS V2.4.

Enhancing availability, scalability, and performance

Dynamic activation of I/O configurations for stand-alone Coupling Facilities

Coupling Facilities (CFs) provide locking, caching, and list services between coupling-capable z/OS processors. They are a significant component of highly available Parallel Sysplex configurations. Stand-alone CFs, which are, by definition, Coupling Facility images that reside on a server without a co-resident z/OS image, are now able to participate in dynamic I/O configuration changes that affect the stand-alone CF and no longer require the server to be restarted to activate such changes. In the past, a restart would have caused disruption for the Parallel Sysplex that is using the stand-alone CF, as the CF image contents had to be relocated to other CF images.

With this announcement, stand-alone CF servers can seamlessly make hardware-only dynamic I/O configuration changes on behalf of the CF partitions that reside there without requiring a disruptive reset. This capability both improves client workload availability and minimizes the risks associated with relocation of CF structures. This enhancement requires z14 GA2 firmware support for the stand-alone CF server, and it requires that an IML or POR action be performed on the stand-alone CF server after the z14 GA2 firmware is present to enable subsequent use of this support. This enhancement also requires z14 GA2 enhanced firmware support on the connected server where the driving HCD system resides, though there is no requirement for an enabling IML or POR action on any server other than the stand-alone CF server.

Note that stand-alone CFs generally do not have any external connectivity other than the coupling links used for Parallel Sysplex CF request traffic. This enhancement does not place any additional connectivity requirements on the stand-alone CF server.

Reduce the impact of first failure data capture (FFDC) on a system

SVC dump processing in z/OS is enhanced to improve overall dump capture times in an unconstrained environment. When sufficient system resources are available, dump processing utilizes more parallelism to reduce the amount of time it takes to capture the requested dump. Clients, over time, have tuned their production systems to ensure that no paging I/O is required. Using that same concept, clients that ensure ample memory is available during dump requests will allow the system to take a dump using an enhanced memory-to-memory capture paradigm and increased parallelism to drastically reduce the amount of time it takes to capture the dump. This enhancement is enabled using the CHNGDUMP SDUMP,OPTIMIZE=YES command.

This enhancement also provides a serviceability improvement by increasing the current maximum dump size limitation beyond 200 GB. Today's production systems are ever-increasing in size, with applications using address spaces that may be larger than the current dump size limitation, which is around 200 GB. While both the system and application serviceability targets should limit the amount of diagnostic data collected to be that which is required to directly provide information to locate and correct issues, in some situations massive amounts of data must still be captured into a dump.

Clients have always been able to set a limit to the maximum amount of virtual memory that DUMPSRV could use for capturing dump data with the MAXSPACE parameter of the CHNGDUMP command; but prior to this support, maximum settings greater than 200 GB for any single dump were actually capped at around that size. With ample system resources available, the 200 GB limit may be exceeded.

This enhancement is delivered on z/OS V2.3 with PTFs for APARs OA57153 and OA57146.

Logger support for single-system logger

In z/OS V2.4, System Logger provides support for single-system scope Couple Data Sets (LOGRY and LOGRZ CDSes) to provide clients with an isolated set of logger CDSes, intended for use only on the GDPS k-system, isolating its logger functionality from the rest of the sysplex. This allows, for example, for the OPERLOG, LOGREC, and other log-based functions to be isolated for the k-system, relative to the remainder of the systems in the sysplex, while preserving the ability for the k-system to make use of these pervasive sysplex functions, and allowing the k-system to continue to make use of the same tools and technologies used throughout the sysplex to extract and process log data. This support allows improved isolation for the GDPS k-system from problems that may affect the remainder of the sysplex.

On releases prior to z/OS V2.4, with toleration PTFs for Logger APAR OA54815 applied, or by using the STEPLIB to reference an up-level library, the Cross-System Coupling Facility (XCF) couple data set format utility, IXCL1DSU, can be used to create single-system scope system logger couple data sets. However, these pre-z/OS V2.4 release level systems will not be able to make use of a single-system scope couple data set type (LOGRY or LOGRZ) for any system logger log stream processing. The pre-z/OS V2.4 release level systems will continue to only be able to use the sysplex scope LOGR couple data set type for any system logger log stream processing.

Application transparency for unplanned outages affecting zFS file systems shared in a sysplex environment

A new mount option for zFS file systems allows applications that are running in a sysplex environment and sharing read-write mounted zFS file systems to no longer be affected by unplanned outages. Previously during an unplanned outage, applications that are accessing read-write mounted zFS file systems will encounter I/O errors that many clients address by simply restarting the application. With this new support, unplanned outages are transparent to the application and no longer result in zFS file system I/O errors.

This new mount option can be specified on individual mount statements to affected individual zFS file systems, can be specified globally to enable this support for all read-write mounted zFS file systems, or can be specified dynamically to change already mounted zFS file systems. Applications that use zFS file systems in a single system environment will not benefit from this option because it is only applicable to file systems being shared in a sysplex environment. This support is enabled through PTFs for APAR OA57508 on both z/OS V2.3 and V2.4, available by December 31, 2019, and all systems in the sysplex must have this support installed before it can be enabled for shared zFS file systems.

Migration facility for zFS file systems

The file system migration facility BPXWMIGF now allows for the migration of data from one zFS file system to another zFS file system, without requiring the source file system to be unmounted. This new function is useful when migrating a zFS file system from one disk storage volume to another disk storage volume. Files that are in use by the application during the migration process are automatically and transparently moved to the target file system without affecting the application. Prior to this, BPXWMIGF only supported application transparent migration of data from HFS file systems to zFS file systems.

zFS file-level backup and restore capability

The ability to back up and restore individual z/OS UNIX[(R)] files residing in zFS file systems is now available using the z/OS DFSMShsm and DFSMSdss capability. Backing up and restoring individual z/OS UNIX files provides a more granular approach to storage management. By integrating this capability into the existing DFSMShsm and DFSMSdss framework, clients can centralize data management

across the z/OS platform. The DFSMShsm and DFSMSdss backup and restore support subsumes the capabilities formerly provided by IBM Tivoli(R) Storage Manager z/OS UNIX System Services Backup-Archive Client. It will not back up or restore individual z/OS UNIX files found in Hierarchical File System (HFS) data sets because HFS functionality has been stabilized with the impending withdrawal of HFS in a future release of the operating system. This support is also available on z/OS V2.3. See Software Announcement AP19-0098, dated April 23, 2019, for APAR numbers.

New support in NFS to help clients migrate from DFS/SMB

As announced in Software Announcement AP18-0225, dated May 15, 2018, z/OS V2.3 was the last release of the operating system to support the DFS/SMB (Distributed File System / Server Message Block) file-sharing protocol. As such, clients using DFS/SMB must migrate to use the NFS (Network File System) file-sharing technology, to share data with Windows environments, prior to migrating to z/OS V2.4. IBM has delivered new function on z/OS V2.2 and z/OS V2.3 to help clients shift to use NFS. To help clients:

- Identify their usage of DFS/SMB, a new migration health check is provided through the PTF for APAR OA56251. This health check alerts the client if DFS/SMB is active on their system.
- Set up the z/OS NFS Server, the PTF for APAR OA56186 delivers a z/OSMF (documentation only) workflow, providing clients step-by-step instructions to configure an NFS Server, which is especially useful for the first-time user.
- Operationally, the z/OS NFS client utilities MVSLOGIN and MVSLOGOUT that allow a non-z/OS client to manage SAF authentication to a z/OS host and SHOWATTR that displays the z/OS NFS server attributes are now delivered for the Windows 10 NFS client through the PTF for APAR OA56187.
- Control access to NFS network shares, Kerberos support has been provided for NFS V3 through the PTF for APAR OA56224, the level of protocol supported by Windows 10. This support also allows for integration with the Active Directory for UID/GID specification. The z/OS NFS Server already provides Kerberos support for NFS V4. By providing Kerberos-based authentication, the client can enable end-to-end encryption between z/OS and Windows environments.
- Segregate existing DFS/SMB workloads to their own NFS Server rather than their existing applications using the NFS Server, the PTF for APAR OA57577, available by December 31, 2019, enables clients to start multiple NFS Servers in a single LPAR. For existing NFS clients, this new capability can be used to provide improved availability of applications using the NFS Server on z/OS.

System exploitation of 64-bit memory

z/OS V2.4 provides internal changes to utilize 64-bit memory, thus reducing the pressure on 31-bit memory areas. This includes:

- 64-bit obtains (IARV64) now support explicit addresses with the INORIGIN keyword reducing the amount of ESQA used by the system and increasing the number of share views previously supported.
- Continuing the RMF 64-bit roadmap more RMF Monitor I and II control blocks and data areas were moved from common storage below the bar to common storage above the bar.

Transactional VSAM (TVS) Auto-commit

TVS enables batch jobs and CICS(R) transactions to concurrently update shared recoverable VSAM data sets, reducing the batch window for CICS and other VSAM applications and allowing 24/7 access to VSAM recoverable data. With TVS, multiple batch jobs and CICS transactions can process with the same recoverable VSAM data sets, and data integrity is ensured for both CICS and concurrent batch updates. Today, to fully exploit TVS, batch applications must be examined to determine the commit frequency and then modified to use RRS to issue sync point commits and potentially backouts to avoid elongated CICS response times.

New enhancements to TVS provide an auto-commit function that enables TVS to issue sync point commits on behalf of eligible batch applications based on specified parameters. A new optional parameter TVSAMCOM can be specified in the job step JCL to indicate the minimum and maximum number of update requests that need to be performed before TVS issues an automatic commit. The same information can be provided at the system level with the TVSAMCOM parameter in the IGDSMSxx PARMLIB member. Support is available on z/OS V2.3 through PTFs for APAR OA55176.

DFSMSrmm enhancements

With z/OS V2.3, DFSMSrmm enhanced retention management by extending usage of SMS Management Class (MC) with new attributes for retention and volume set management. With z/OS V2.4, the DFSMSrmm utility EDGUTIL, used to verify and repair the integrity of the DFSMSrmm control data set (CDS), is enhanced to include additional checks pertaining to expiration dates of tape volumes and tape data sets, the retention method, and fields related to retention of tape data by catalog status and last reference time. These checks help to ensure CDS integrity and to prevent data loss for tape data.

With z/OS V2.3, DFSMSrmm introduced the Default Table as a replacement for the UXTABLE to make it easier to assign retention policies to newly written tape data sets and volumes. The existing UXTABLE is difficult to understand and manage and requires manual compilation and understanding of RMM exits. To help facilitate migration from the UXTABLE to the Default Table, new keywords were added to the Default Table with z/OS V2.4. These keywords are designed to extend the usage and flexibility of the Default Table.

Tape data sets that are expired and no longer retained by DFSMSrmm but reside on a volume that has not yet been returned to scratch status are still accessible. To help provide support for new GDPR legislation, DFSMSrmm is being enhanced to provide a mechanism to block access to tape data sets based on their expiration and retention status, and to manually block and uncatalog selected data sets. The function is also available using the DFSMSrmm ISPF dialog. Support is available on z/OS V2.3 and V2.2 with the PTFs for APARs OA56204 and OA55827.

With z/OS V2.4, DFSMSrmm provides several RAS enhancements, including the following:

- Issue warning messages when DFSMSrmm control data set (CDS) reaches a specified threshold to avoid potential unplanned outages to increase the size of the CDS.
- Issue warning messages for tape operations when the DFSMSrmm subsystem interface is not initialized to avoid potential data loss.
- New SEARCHVOLUME operands for External Data Manager (EDM) to provide extended searching capability for EDM functionality introduced with z/OS V2.3.
- ONLYIF support in DFSMSrmm PARMLIB member EDGRMMxx to allow for easier management of multiple DFSMSrmm systems using a single PARMLIB member.

DFSMS enhancements

With z/OS V2.4, DFSMS provides several RAS enhancements, including the following:

- SMS provides new Automatic Class Selection (ACS) read-only variables to give more information for users to code their ACS routine logic and have more flexibility and control in programming the ACS routines to derive SMS constructs more appropriately and efficiently.
- DFSMSdss adds a new MINCYLS keyword to the SPACEREL command to enable users to control the size of free space extents that are released to run a more targeted space release in a shorter window of time to reduce the amount of time a volume is unavailable to applications. Support on z/OS V2.3 is available with the PTFs for APAR OA55666.

- DFSMSdss provides new facility class support to control the use of the PRINT command to prevent users from being able to read unallocated space on a volume to provide improved security.
- DFSMSdss provides support when copying large numbers of data sets to support extended TIOT (XTIOT) and to request allocating control blocks above the bar. These enhancements provide critical virtual storage constraint relief and allow users to avoid redriving DFSMSdss jobs that had previously failed due to dynamic allocation errors.
- Catalog provides various RAS enhancements to avoid errors and extended diagnosis and repair times. These enhancements provide increased system availability, decreased enqueue contention, enhanced usability and serviceability, and decreased diagnostic time.
- Catalog provides support for a new facility class to give users with read access authority to the class the ability to delete data sets within the stated catalog without other authority, and an SMF type 80 record will be written to record the deletion. Any users without read authority will still need alter authority to the data set to delete it. If the facility class is defined, alter authority to the catalog will no longer be enough for data set deletion. If the class is not defined, previous rules apply. This enhancement gives users enhanced control over catalog administration authority and the flexibility to manage catalogs more efficiently.

ITDS remove 4096 entry limit on users/group for SDBM

In z/OS V2.4, ITDS provides enhanced search capabilities on the SDBM backend, including complete search filter support, and the removal of 4096-line output restriction on searching the RACF profiles.

Integrating z/OS into your private and multicloud

IBM Cloud Provisioning and Management for z/OS

- The z/OSMF Cloud Provisioning Resource Management task is enhanced to provide memory metering and capping functions for a tenant. System programmers can view memory consumed by software service instances that are provisioned by a specific tenant and set a cap for memory consumption.
- Clustered composite templates enable you to leverage sysplex capability to provision a continuously available middleware environment. With a single provisioning action, you can provision network-clustered instances of a specific middleware environment in a sysplex. When network resources such as distributed DVIPAs are provisioned for clustered composite templates, the Sysplex Distributor configuration is dynamically updated with new network resources. Similarly, a single deprovision action releases the member instances that are associated with the clustered composite template instance. The clustered composite template capability can be used by IBM Db2 and MQ middleware to support provisioning of a Db2 data sharing group or MQ queue sharing group in a parallel sysplex.
- The Workflow Editor task is enhanced as follows:
  - The Workflow Editor includes a "toolbox" of IBM-supplied steps, which are designed for performing common tasks on z/OS, such as creating a data set or submitting a REST request. You will be able to quickly learn z/OSMF workflow capability and save time by importing an IBM-supplied step from the shared step library and modifying it, rather than creating your own step.
  - The Workflow Editor is enhanced to support definition of a variable of an array type. An array type of variable helps reduce the number of variables because a single variable now can have multiple values.
  - The workflow definition XML file, fragment files, and the variable input file now allow an option to reside in sequential or partitioned data sets. With this enhancement, you will be able to use Workflow Editor to edit your workflow definition directly from the data sets without moving them to z/OS UNIX file system.

IBM z/OS Cloud Broker

IBM z/OS Cloud Broker is the first offering to open access to z/OS services within the IBM Cloud Private ecosystem for consumption by the broader development community. The z/OS Cloud Broker interacts with IBM Cloud Provisioning and Management for z/OS and:

- Provides direct self-service access to z/OS computing resources by cloud application developers, no special IBM Z skills required
- Creates connectivity from an industry standard K8s container run time to z/OS with an emphasis on simplicity, robustness, and portability
- Allows complete control over resources and z/OS software subsystem instances with z/OS configurable cloud security
- Grants access to service catalogs with customized z/OS services that exploit the multitenancy and rapid elasticity of z/OS provided by IBM Cloud Provisioning and Management for z/OS

For more information about z/OS Cloud Broker, see Software Announcement AP19-0035, dated May 14, 2019.

Cloud storage access for z/OS

Data is at the heart of every business, and how that data gets stored and managed is critical. Cloud storage makes it possible to store practically limitless amounts of data, simply and cost effectively, and to access it from anywhere in the world using internet protocols.

- Transparent cloud tiering utilizes hybrid cloud as a new storage tier. Transparent cloud tiering improves business efficiency and flexibility and is designed to reduce capital and operating expenses with direct data transfer from IBM DS8880 to hybrid cloud storage environments for simplified data archiving operations on IBM Z. Archiving the less frequently used data in the cloud can potentially reduce costs while keeping the information available when needed.
- For information on additional z/OS exploitation of cloud storage with OAM's object support, see the OAM Cloud Storage statement of general direction in Software Announcement AP18-0453, dated November 13, 2018.

Effective systems management providing businesses proactive IT guidance and support

z/OS platform software installation improvements

With z/OS V2.4 and PTFs for APAR PH11650, and z/OS V2.3 and V2.2 with PTFs for APARs PH09032 and PH11650, additional capabilities can be incorporated into a software artifact and during deployment to assist with the improved configuration capabilities. To assist with configuration, z/OSMF Software Management automatically provides properties for the data sets and products of a software artifact to any workflows created when the artifact is deployed. In addition, the supplier of that software artifact can add user-defined customized properties for data sets, products, and specific provided configuration workflows. For instance, if the supplier of a z/OSMF software artifact wants to indicate that a specific data set needs unique customization, such as link list inclusion, a data set property can be indicated. By having both automatic Software Management properties and supplier properties accommodated, an enhanced opportunity for configuration is offered to the client.

The z/OSMF Software Management and Workflow functions are critical to the industry-wide installation simplification process. For this reason, clients are strongly encouraged to start using and becoming familiar with these functions to more quickly see the benefits as industry software becomes available that exploits these enhancements.

Customized Offering Driver

The Customized Offering Driver (5751-COD) is an entitled driving system that you can use if you have no existing driving system that is sufficient to install z/OS. You can use this driving system to perform a stand-alone restore of a subset of a z/OS

system and then IPL it to proceed with an installation of z/OS. After your installation of z/OS is complete, you must remove the Customized Offering Driver. Previously, the Customized Offering Driver was available only on DVD. The Customized Offering Driver is planned to be offered for electronic delivery in addition to a physical DVD on Shopz by year-end 2019. This addition of the electronic delivery choice enables clients that cannot use physical media, such as a DVD, to still acquire the Customized Offerings Driver through a network connection and continue with the installation of z/OS.

IBM WebSphere^(R) Application Server enhancements

IBM continues to deliver a WebSphere Application Server Liberty profile with z/OS for use by internal components such as z/OS MF, IBM Knowledge Center for z/OS, and PKI Services. This component continues to contain one year's worth of rolling maintenance. New capabilities such as JSON Web Token support are delivered in this package, and depending on the exploiting components, the package will expose these new capabilities.

IBM Tivoli Directory Server for z/OS

The IBM Tivoli Directory Server for z/OS (LDAP server and client) can exploit the new TLS V1.3 support provided by System SSL in z/OS V2.4.

Sysplex autonomics for IPSec

In z/OS V2.4, Communications Server enhances the sysplex autonomics capability to monitor the health of z/OS IPSec infrastructure relative to sysplex traffic. This is designed to provide improved reliability and availability for installations with IPSec-protected sysplex traffic by ensuring that the IKE daemon and other necessary components are healthy before joining the sysplex. Sysplex autonomics for IPSec is planned to be a post-GA deliverable in first quarter 2020 with the PTF for APAR PH12788.

XCF Transport Classes simplification

Installations can achieve the high level of resiliency, availability, and performance expected of sysplex without having to plan, define, monitor, or tune XCF transport classes to accomplish segregation of XCF signal traffic by size. Existing installations can take advantage of this function without having to change transport class definitions.

BCPii LPAR group control support

In z/OS V2.4, BCPii provides simplified programmatic control over active image, through LPAR Group, and activation image profiles, through Group Profiles, in the same manner that BCPii already provides for other hardware configuration entities.

LPA APF authorization default

In z/OS V2.4, users of Dynamic LPA ADD commands, such as SETPROG, PROGxx statements, can indicate whether APF authorization should be applicable to the specified data sets.

Print enhancements: IBM Infoprint, Font Collection, Transforms

Dynamic configuration is enabled as the default behavior for IBM Infoprint Server. This change in default behavior is mandatory and not reversible. This fulfills the statement of direction previously issued for this change.

Some advantages of enabling dynamic configuration include:

- Authorized administrators can use the Infoprint Server ISPF panels or the Printer Inventory Definition Utility (PIDU) to view and change the dynamic attributes rather than editing the /etc./Printsrv/aopd.conf file.

- If you change an attribute in the system configuration definition, with a few exceptions, you do not need to stop and restart Infoprint Server for the change to take effect.
- You can configure Infoprint Server to start and stop individual daemons.
- You can benefit from new functions in Infoprint Server that require dynamic configuration. For example, you can use the MVS system logger function.

JES3 to JES2 conversion aids

As stated in Software Announcement AP19-0011, dated February 26, 2019, the release following z/OS V2.4 is planned to be the last release of z/OS that will include JES3 as a feature. Clients need to convert from JES3 to JES2. Based on clients' concerns with converting, JES2 has been enhanced to include some key JES3 functions. These are in the area of JCL/JECL processing (support for //*ROUTE XEQ JECL), Network Job Entry (support for multiple jobs in an NJE job stream), and other functions such as the JES3 disk reader. These functions aid in the conversion from JES3 to JES2 and enhance the JES2 capabilities for systems programmers.

Uncaptured Volume I/O Statistics

For z/OS V2.4, SMF type 42 subtype 5 (Volume I/O Statistics) is updated to report system I/O statistics, volume contention, and cloud data transfers. These statistics can help diagnose problems related to system I/O. For example, IBM reports the number of hardware RESERVE commands per volume over a SMF interval. This can assist with identifying device contention. SMF type 42 subtype 6 (Data Set I/O Statistics) is updated to report the Storage Subsystem ID of the device with the highest response time. This can help identify a zHyperWrite device having performance issues.

As part of this delivery, a significant amount of 31-bit common storage is moved above the 2 GB bar, depending on the number of online DASD devices.

The following APARs provide this function for z/OS V2.2 and V2.3: OA55709, OA55711, and OA55948.

Logger transport affinity for zAware communication stack

z/OS system logger has been enhanced in z/OS V2.4, as well as in z/OS V2.2 and V2.3 through the PTFs for APAR OA53111, to allow the specification of transport affinity in Common INET configurations when establishing communication with an IBM zAware server. This enables clients to be able to specify the transport provider name on the ZAI statement in the IXGCNFxx parmlib member. The name provided is used by system logger to set the affinity when establishing the IBM zAware socket communications. This enables clients to be able to configure their Common INET environment with separate INET stacks and get the benefit of dynamic routing while still maintaining the isolation possible through separate INET stacks.

Q4 relief for job throughput

Enhancements are provided in the management and serialization of tape devices to improve job throughput and minimize the impact to jobs due to device availability.

SMF dump utilities enhancements

The IFASMFDP and IFASMFDL SMF dump utilities are enhanced to optionally report information about the SMF records processed, by record type and subtype, providing finer granularity of information without requiring separate post-processing.

Task Input/Output Table (TIOT) high water mark

SMF type 30 records and the IEFACTRT installation exit are enhanced to include TIOT usage information for jobs, allowing installations to proactively monitor and report TIOT usage.

TSO/E MVSSERV removal

In z/OS V2.4, TSO/E removes support for the Server-Requester Programming Interface (SRPI) in fulfillment of the following statement of direction from February 2017:

z/OS V2.3 will be the last release of z/OS to support the Server-Requester Programming Interface (SRPI). SRPI was introduced in TSO/E in the 1980s to provide a programming interface that enhances the environment of IBM workstations communicating with IBM mainframes running z/OS. Clients with applications using SRPI should start using TCP/IP for z/OS to provide similar function. Documentation for SRPI is available in *TSO/E Guide to the Server-Requester Programming Interface*, SA22-7785, and this publication as well as documentation for SRPI-related functions, such as the MVSSERV command, will be removed.

Continuous delivery capabilities delivered for z/OS V2.3

The capabilities announced for delivery with z/OS V2.4 are the culmination of continuous delivery since z/OS V2.3 GA and new functions that are unique to the z/OS V2.4 delivery. To learn what has been delivered through continuous delivery since the delivery of z/OS V2.3, see:

- Software Announcement AP19-0117, dated March 5, 2019(1Q 2019 z/OS V2.3 enhancements)
- Software Announcement AP18-0453, dated November 13, 2018(4Q 2018 z/OS V2.3 enhancements)
- Software Announcement AP18-0306, dated August 7, 2018(3Q 2018 z/OS V2.3 enhancements)
- Software Announcement AP18-0225, dated May 15, 2018(2Q 2018 z/OS V2.3 enhancements)
- Software Announcement AP18-0109, dated March 6, 2018(1Q 2018 z/OS V2.3 enhancements)
- Software Announcement AP17-0521, dated November 21, 2017(4Q 2017 z/OS V2.3 enhancements)
- Software Announcement AP17-0239, dated July 17, 2017(z/OS V2.3 GA)

Highlights of new capabilities delivered through continuous delivery since z/OS V2.3 General Availability

Resiliency/security

Multiple enhancements have been made for security and protection of the z/OS system.

- User key common storage is memory that can be updated by any unauthorized program. z/OS V2.4 no longer supports unrestricted user key common storage, thereby improving application isolation and security. It also includes instrumentation to detect and identify the location of user key common storage usage. Also, the use of MCS logon passphrases is available through the security policy profile specification, which enables an installation to provide a more consistent, secure system environment and aids in meeting their corporate/industry security requirements.
- z/OS Communications Server enables an optimal processing environment with the OSA-Express6S with separation of the IPSec protected traffic from non-IPSec protected traffic. In addition, the Network Configuration Assistant is enhanced to support TCP/IP profile Alternate Configurations for flexibility and availability. NFS server is enhanced to support z/OS encrypted data.
- OpenSSH performance is improved when using CPACF instructions for symmetric cipher and MAC algorithms without requiring ICSF.
- Improved logging throughput is possible with the IBM HyperWrite data replication support.
- RMF now reports IBM zHyperLink related performance measurements.
- z/OSMF provides stronger focus on availability and flexibility with more functions being sysplex enabled, where the user can run and manage tasks on/from

remote systems, such as workflows, ISPF, REST TSO, default settings, and single sign-on across systems in a sysplex. This is valuable in enabling a resilient and highly available cloud provisioning environment.

- DFSORT exploitation of System zHigh Performance FICON(R) (zHPF) A DFSORT enhancement (APAR PI99290) exploits zHPF for DFSORT sort work files. It may provide elapsed time improvements when zHPF is available and zHPF requirements are satisfied. No application changes are required.
- RACF command and programming interfaces (RLIST, R_admin, IRRXUTIL, IRRDBU00) are enhanced to report on the method of protection for PassTicket keys, and, for encrypted keys, the ICSF key label name.
- A RACF function is added to convert masked keys to encrypted keys without changing the key value.
- RACF provides enhanced conditional access list permissions, allowing certain resources to only be accessed when using a certain service. This capability is exploited by ICSF to restrict access to cryptographic keys only when being used by specific ICSF services.

VSAM exploitation of zHyperLink

Enhancements in VSAM and VSAM RLS allow read requests to use zHyperLink, when enabled, to perform I/O operations and can be used for all types of VSAM access (NSR, LSR, GSR, and RLS), except for NSR sequential reads. The PTFs for APAR OA54872 allow the zHyperLink support to be enabled through SMS StorageClass and VARY SMS commands. VSAM zHyperLink exploitation support is available through PTFs for APARs OA52876 (VSAM RLS) and OA52941 (VSAM). Depending on system conditions, a zHyperLink request can have a much-improved elapsed time, allowing VSAM applications to run faster with less latency.[1]

[1] Based on projections or measurements completed in a controlled environment. Results may vary by client based on individual workload, configuration, and software levels.

Agility with development operations (DevOps), application development, and APIs

In support of DevOps/tooling, the cp (copy) utility of z/OS UNIX System Services can transport binaries across various environments to enable application development growth on z/OS. Clients can get a more complete picture of file usage by z/OS UNIX processes with the enhanced zlsof utility. Also, the web enablement toolkit has new enhancements to better handle JSON data streams for improved time to value for application developers. Additional enhancements include:

- Capability to generate true random numbers, which is especially valuable for OpenSSH users who can use sftp and ssh with no dependency on ICSF. This is applicable only to the IBM z14 family.
- Support for open platform or cross-platform application development and workload with enhancements in code page support to facilitate migration from SMTPD to CSSMTP mail client.
- Support for UTF-8 text conversion of z/OS data across platforms.
- Font collection as a web deliverable.
- Ability to manage data at an unprecedented scale with a new functionality, known as VSAMDB, that provides NoSQL applications with low-cost, high-performing, transparent access to open standards-based data stored in z/OS files, along with indexing to alternate keys for faster queries and analytics, enabling affordable real-time analytics for business growth.
- Transparent cloud tiering to extend the DFSMShsm automatic migration function to support policy-driven migration to cloud object storage.

IBM Cloud Provisioning and Management:

- Improved resource management with support for metering and capping CPU resources
- Ability to relocate dynamically provisioned instances
- Ability to share resources across templates for a tenant

- Simpler to create and manage templates
- Simplified security setup for provisioning middleware in dev/test environment for faster time to value
- Ability for cloud architects to include z/OS cloud provisioning in cross-platform cloud solutions with the new support of Swagger specification on z/OS for REST API

z/OSMF has further simplified and modernized the user experience to enhance productivity:

- z/OSMF has delivered usability enhancements (settings, customization), better serviceability (version control, Liberty upgrade, browser support, updated server, support for latest problem management systems), more robust data set and File Rest APIs, automation of tasks with workflows, and making workflows more consumable and sysplex enabled (work on remote systems).
- z/OSMF also has a new look and feel (user interface) that provides a customizable end-user experience and the ability to optimize the tasks performed.
- A new z/OSMF plug-in called the *zERT Network Analyzer* is now available to visually determine which z/OS TCP and Enterprise Extender traffic is or is not cryptographically protected.

Tailored Fit Pricing

Tailored Fit Pricing for IBM Z provides flexible, simplified, and transparent software pricing for qualified solutions, allowing broader application deployment on Z at a competitive price. For additional information, see Software Announcement AP19-0012, dated May 14, 2019.

Obtaining latest enhancements

When new function APARs are introduced in the IBM service stream for the entire z/OS platform, you can find them collected on the web in a convenient reference format. Review the latest enhancements from IBM at the New Function APARs for the z/OS Platform website to help you determine which of the latest functions you want to implement.

Additionally, several enhancements in z/OS V2.4 support hardware functions announced in Hardware Announcement AG18-0074, dated October 2, 2018, (z14 GA2), and Hardware Announcement AG18-0018, dated April 10, 2018(z14 Model ZR1).

To be notified of future announcements, register at the Subscribe to IBM product announcement newsletter website.

Product positioning

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, 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 V2.4 Communications Server is designed to meet these standards.
- The programming interfaces provided by z/OS V2.4 Unicode Services are designed to meet the Unicode 9.0 standard.
- IBM z/OS V2.2 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. 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. This is intended to help satisfy the need for FIPS 140-2 validated cryptographic functions by various IBM software products and customer applications running on z/OS.

Statements of direction

Kubernetes clustering

IBM intends to leverage Kubernetes clustering in the future for the orchestration and management of z/OS Container Extensions with compatible cloud platforms.

Removal of native TLS/SSL support from TN3270E Telnet server, FTP server, and DCAS

z/OS V2.4 is planned to be the last release in which the z/OS TN3270E Telnet server, FTP server, and Digital Certificate Access Server (DCAS) will support direct invocation of System SSL APIs for TLS/SSL protection. In the future, the only TLS/SSL protection option for these servers will be Application Transparent Transport Layer Security (AT-TLS). The direct System SSL support in each of these components is functionally outdated and only supports TLS protocols up through TLSv1.1. IBM recommends converting your TN3270E Telnet, FTP server, and DCAS configurations to use AT-TLS, which supports the latest System SSL features, including the TLSv1.2 and TLSv1.3 protocols and related cipher suites. Note that while native TLS/SSL support for z/OS FTP client is not being withdrawn at this time, no future enhancements are planned for that support. IBM recommends using AT-TLS to secure FTP client traffic.

WLM removal of service coefficients for BCP WLM

z/OS V2.4 is planned to be the last release of z/OS to allow specifying service coefficients in the Workload Manager (WLM) service definition on the Service Definition Details page. The IBM recommended values are CPU=1, SRB=1, MSO=0, and IOC=0, which will be the default values in a later release. IBM recommends that you adjust your service coefficients before upgrading to a later release.

Withdrawal of EIM, OCSF, OCEP, and PKITP

z/OS V2.4 is planned to be the last release to support EIM (Enterprise Identity Mapping) and OCSF (Open Cryptographic Services Facility), and all of its plug-ins, such as OCEP (Open Cryptographic Enhanced Plug-ins) and PKITP (PKI Services Trust Policy). These components have not been widely utilized nor enhanced for several releases of z/OS. IBM recommends using other applications such as ICSF (Integrated Cryptographic Services Facility) and System SSL for comparable functionality.

Removal of policy data import function from the Network Configuration Assistant

z/OS V2.4 will be the last release that the Network Configuration Assistant (NCA) z/OS MF plug-in supports the policy data import function, which allows you to import existing Policy Agent configuration files into the Network Configuration Assistant. After z/OS V2.4, import of policy configuration files will no longer be supported for AT-TLS, IPSec, PBR, and IDS technologies.

Import of TCP/IP profiles into NCA is not affected.

Removal of Sysplex Distributor support for workload balancing to IBM DataPower^(R) Gateway products

z/OS V2.4 is the last release to support Sysplex Distributor target controlled distribution to DataPower Gateway products. This feature is deprecated in the DataPower Gateway. IBM recommends that you implement another solution for workload balancing that might be through an external load balancer. This removal does not impact any other Sysplex Distributor functions, only configurations that have TARGCONTROLLED specified on the VIPADISTRIBUTE statement.

Hardware and software support services

SmoothStart/installation services

IBM SmoothStart Services and Installation Services are not provided.

Reference information

- Hardware Announcement AG17-0044, dated July 17, 2017(IBM z14)
- Hardware Announcement AG15-0001, dated January 14, 2015(IBM z13)
- Hardware Announcement AG15-0001, dated January 14, 2015(IBM z13s)
- Hardware Announcement AG12-0167, dated August 28, 2012(IBM zEnterprise EC12)
- Hardware Announcement AG13-0134, dated July 23, 2013(IBM zEnterprise BC12)
- Software Announcement AP17-0313, dated July 17, 2017(IBM Enterprise COBOL for z/OS, V6.2)
- Software Announcement AP17-0342, dated July 17, 2017(IBM Enterprise PL/I for z/OS, V5.2)
- Software Announcement AP17-0341, dated July 17, 2017(IBM Enterprise PL/I Value Unit Edition for z/OS)
- Software Announcement AP15-0009, dated January 14, 2015(IBM Ported Tools for z/OS, V1.3.0)
- Software Announcement AP16-0363, dated October 4, 2016(IBM Db2^(R) 12 for z/OS)

Availability of national languages

The z/OS national language support features will become generally available when the executable code becomes available.

Translation information, if available, can be found at the Translation Reports website.

Program number

Program number	VRM	Program name
5650-ZOS	2.4	z/OS

Education support

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

Course code	Course title	Course type
ESC9G	z/OS 2.4 Review and Migration	Classroom
ESZ0G	IBM Z Boot Camp	Digital
ESE0G	BlockChain on z Systems[R]	Classroom
ES05	Introduction to z/OS Environment	Classroom
ES10	Fundamental System Skills for z/OS	Classroom
ES15	z/OS Facilities	Classroom
ES27	z/OS System Operators	Classroom
ES41	z/OS Installation Using ServerPac	Classroom
ES54	Basic z/OS Tuning Using the Workload Manager (WLM)	Classroom
ES19	Basics of z/OS RACF Administration	Classroom
OP05	Introducing z/OS UNIX[R] System Services	Classroom
ES90	Advanced Parallel Sysplex[R] Operations and Recovery	Classroom
ES42	Parallel Sysplex Implementation Workshop	Classroom
ES52	z/OS REXX Programming Workshop	Classroom

IBM training provides education to support many IBM offerings. Descriptions of courses for IT professionals and managers can be found on the IBM Skills Gateway website.

Contact your IBM representative for course information.

Technical information

Specified operating environment

Hardware requirements

z/OS V2.4 runs on these Z servers:

- IBM z14 Models M01-M05
- IBM z14 Model ZR1
- IBM z13
- IBM z13s
- IBM zEnterprise EC12 (zEC12)
- IBM zEnterprise BC12 (zBC12)

For a complete description of z/OS V2.4 hardware prerequisites, see *z/OS V2R4 Planning for Installation* (GA32-0890).

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. See *z/OS V2R4 Planning for Installation* (GA32-0890) for a listing of specific software requirements.

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 V2.4:

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 V2.4, IBM intends to allow you to upgrade from z/OS V2.3 directly to z/OS V2.4 with full coexistence, migration, and fallback support to maximize the value of your investment, and from z/OS V2.2 to z/OS V2.4 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 V2.4

Release	Coexistence-Migration-Fallback supported with release in Column 1
z/OS V2.2	z/OS V1.13, [2] z/OS V2.1, [3] z/OS V2.2
z/OS V2.3	z/OS V2.1, [3] z/OS V2.2, z/OS V2.3
z/OS V2.4	z/OS V2.2, z/OS V2.3, z/OS V2.4

[2] z/OS V1.13 end of service was September 30, 2016.

[3] z/OS V2.1 end of service was September 30, 2018.

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 clients using NALC for z/OS, V1 who are using PSLC for their middleware programs. z/OS V2 clients using AWLC or WLC or AEWLC or EWLC pricing for their middleware programs must migrate from NALC to zNALC pricing.
- All z/OS clients 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.

Planning information

Direct client support

To obtain information on customer eligibility and registration procedures, contact the appropriate support center.

Security, auditability, and control

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

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

Ordering information

Current licensees

Current licensees of IBM z/OS will receive this update from IBM Software Delivery and Fulfillment (SDF) automatically. This shipment of release 4 is scheduled to be completed by October 14, 2019.

New licensees

Orders for new licenses can be placed now.

This product is delivered in ServerPac and CBPDO. You choose the delivery method, physical media or internet, when ordering. See the Customized Offerings section for the available media types. Production of z/OS V2.4 orders will begin on the planned general availability date, September 30, 2019. Ship dates for orders will be based on order sequence, production capability, and the client-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 client until confirmed arrival dates are in ESW.

Registered clients can access IBMLink for ordering information and charges. Shipment will not occur before the availability date, September 30, 2019.

New users of IBM z/OS V2.4 should specify: Type: 5650 Model: ZOS

Basic license

To order a basic license, specify the z/OS V2.4 program number 5650-ZOS. Proceed to select the features listed which are required and then select any optional features.

Parallel Sysplex license charge (PSLC)

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

Entitlement identifier	Description	License option/Pricing metric
S01728X	z/OS V2 BookManager[R] 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
S018G2F	z/OS V2 RUCSA	Basic MLC, PSLC

Advanced Workload License Charges (AWLC)

Advanced Workload License Charges (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 V2.4

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
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

Entitlement identifier	Description	License option/Pricing metric
S01780D	z/OS V2 zEDC	Basic MLC, AWLC
S018G2F	z/OS V2 RUCSA	Basic MLC, AWLC

Advanced Entry Workload License Charges (AEWLC)

Advanced Entry Workload License Charges (AEWLC) basic license

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

Program name: z/OS V2.4

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
S018G2F	z/OS V2 RUCSA	Basic MLC, AEWLC

Country Multiplex License Charges (CMLC)

Country Multiplex License Charges (CMLC) 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 Country Multiplex, the charge for all copies is associated to one license if all the copies are licensed to one client number within the multiplex. If there is more than one client number, the charge for all copies is prorated to one license for each client within the multiplex.

For each license being charged, specify the applicable CMLC license options and the prorated quantity of the Service Units in Millions (MSUs) for each client number within the multiplex. For all other program copies, specify the Workload Registration No-Charge (WLREG NC) Identifier on the licenses.

Program name: z/OS V2.4

Program PID: 5650-ZOS

Entitlement identifier	Description	License option/Pricing metric
S01728S	z/OS V2 Alternate Base	Basic MLC, CMLC
S01728T	z/OS V2 Base	Basic MLC, CMLC
S01728V	z/OS V2 BDT FTF	Basic MLC, CMLC
S01728W	z/OS V2 BDT SNA NJE	Basic MLC, CMLC
S01728X	z/OS V2 BookManager Build	Basic MLC, CMLC
S01728Z	z/OS V2 XL C/C++	Basic MLC, CMLC
S017290	z/OS V2 DFSMS dss	Basic MLC, CMLC
S017291	z/OS V2 DFSMS dsshsm	Basic MLC, CMLC
S017292	z/OS V2 DFSMS rmm	Basic MLC, CMLC
S017293	z/OS V2 DFSMStvs	Basic MLC, CMLC
S017294	z/OS V2 DFSORT	Basic MLC, CMLC
S017295	z/OS V2 GDDM-PGF	Basic MLC, CMLC
S017296	z/OS V2 GDDM-REXX	Basic MLC, CMLC
S017297	z/OS V2 HCM	Basic MLC, CMLC
S017298	z/OS V2 HLASM Toolkit	Basic MLC, CMLC
S017299	z/OS V2 Infoprint Server	Basic MLC, CMLC
S01729B	z/OS V2 JES3	Basic MLC, CMLC
S01729C	z/OS V2 RMF	Basic MLC, CMLC
S01729D	z/OS V2 SDSF	Basic MLC, CMLC
S01729F	z/OS V2 Security Server	Basic MLC, CMLC
S01780D	z/OS V2 zEDC	Basic MLC, CMLC
S018G2F	z/OS V2 RUCSA	Basic MLC, CMLC

Multiplex System z$^{(R)}$ New Application License Charge (MzNALC) Basic License

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

Program name: z/OS V2.4

Program PID: 5650-ZOS

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

Entitlement identifier	Description	License option/Pricing metric
S01780D	z/OS V2 zEDC	Basic MLC, MzNALC
S018G2F	z/OS V2 RUCSA	Basic MLC, MzNALC

Solution Consumption License Charge (SCLC) basic license

SCLC is a new type of Monthly License Charge (MLC) metric. It delivers a true metered usage model, where the million service units (MSUs) that are consumed are charged at the same per-MSU rate, regardless of hourly peaks and spikes. This can deliver exceptional levels of pricing predictability.

Combined with the extensive monitoring and statistics that are available on the z/OS platform, a per-MSU metric delivers unprecedented levels of price transparency. The cost per MSU can be compared with the processing work done per MSU to directly relate costs to business value.

There are two variations of SCLC for qualified new applications:

- The SCLC pay-as-you-go option offers a low priced, per-MSU model for software programs within the NewApp Solution, with no minimum financial commitment.

- The SCLC-committed MSU option offers a saving of 20% over the pay-as-you-go price points, with a monthly minimum MSU commitment of just 25,000 MSUs.

With SCLC, clients can now launch new applications to their end users with a predictable, transparent cost structure that relates directly to business value.

Program name: z/OS V2.4

Program PID: 5650-ZOS

Entitlement identifier	Description	License option/Pricing metric
S01728S	z/OS V2 Alternate Base	Basic MLC, SCLC
S01728T	z/OS V2 Base	Basic MLC, SCLC
S01728V	z/OS V2 BDT FTF	Basic MLC, SCLC
S01728W	z/OS V2 BDT SNA NJE	Basic MLC, SCLC
S01728X	z/OS V2 BookManager Build	Basic MLC, SCLC
S01728Z	z/OS V2 XL C/C++	Basic MLC, SCLC
S017290	z/OS V2 DFSMS dss	Basic MLC, SCLC
S017291	z/OS V2 DFSMS dsshsm	Basic MLC, SCLC
S017292	z/OS V2 DFSMS rmm	Basic MLC, SCLC
S017293	z/OS V2 DFSMStvs	Basic MLC, SCLC
S017294	z/OS V2 DFSORT	Basic MLC, SCLC
S017295	z/OS V2 GDDM-PGF	Basic MLC, SCLC
S017296	z/OS V2 GDDM-REXX	Basic MLC, SCLC
S017297	z/OS V2 HCM	Basic MLC, SCLC
S017298	z/OS V2 HLASM Toolkit	Basic MLC, SCLC
S017299	z/OS V2 Infoprint Server	Basic MLC, SCLC
S01729B	z/OS V2 JES3	Basic MLC, SCLC
S01729C	z/OS V2 RMF	Basic MLC, SCLC
S01729D	z/OS V2 SDSF	Basic MLC, SCLC
S01729F	z/OS V2 Security Server	Basic MLC, SCLC
S01780D	z/OS V2 zEDC	Basic MLC, SCLC
S018G2F	z/OS V2 RUCSA	Basic MLC, SCLC

Variable Workload License Charge (VWLC)

Workload License Charge (WLC) Basic License

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

Entitlement 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
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
S018G2F	z/OS V2 RUCSA	Basic MLC, VWLC

Entry Workload License Charge (EWLC)

Entry Workload License Charge (EWLC) Basic License

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

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

Entitlement identifier	Description	License option/Pricing metric
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
S018G2F	z/OS V2 RUCSA	Basic MLC, EWLC

New Application License Charge (NALC)

New Application License Charge (NALC) ordering information

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

New Application License Charge

Basic license one-time charge

Entitlement 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
S018G2F	z/OS V2 RUCSA	Basic MLC, NALC

z Systems entry license charge (zELC)

IBM Z Entry License Charge (zELC)

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

Specify the zELC monthly license option.

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
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

Entitlement identifier	Description	License option/Pricing metric
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
S018G2F	z/OS V2 RUCSA	Basic MLC, zELC

z Systems New Application License Charge (zNALC)

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, go to the IBM Z software pricing tools website.

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.

Basic license structure

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
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
S018G2F	z/OS V2 RUCSA	Basic MLC, zNALC

IBM Z New Application License Charge (zNALC) Basic License

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

Basic machine-readable material

The following no-charge features are added to z/OS V2.4 and can be ordered effective September 13, 2019. 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 **Notes** below for details on past announcements for this information.

z/OS V2.4 feature description	z/OS V2.4 orderable supply ID
Base	S018DSM
Alternate Base	S018DSZ

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.

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 machine-readable material

Optional unpriced features -z/OS V2.4

The following optional features, offered at no additional charge, can be ordered effective September 13, 2019.

z/OS V2.4 feature description	z/OS V2.4 orderable supply ID
Communications Server Security Level 3	S018DSF
z/OS Security Level 3	S018DSC

Optional priced features

The following optional no-charge media features can be ordered effective September 13, 2019. These optional no-charge media features have pricing/billing features associated with them. It is those associated pricing/billing features where the charges are listed and not the media features listed below. For more information on the optional priced feature, see the z/OS operating system website.

z/OS V2.4 feature description	z/OS V2.4 orderable supply ID
BDT FTF	S018DSR
BDT SNA NJE	S018DSP
XL C/C++	S018DSL
DFSMS dss	S018DS8
DFSMS dss,hsm	S018DS7
DFSMS rmm	S018DSX
DFSMStvs	S018DT1
DFSORT	S018DS5
GDDM-PGF	S018DSD
GDDM-REXX	S018DSK
HCM	S018DS6
HLASM Toolkit	S018DSS
Infoprint Server	S018DST
JES3	S018DT2
RMF	S018DT3
SDSF	S018DSJ
Security Server	S018DSG
zEDC	S018DSB
RUCSA	S018G2F

Optional unpriced language features

The z/OS V2.4 language features will become generally available on the same date the release becomes available.

z/OS V2.4 provides support in the languages listed below. However, not all elements within z/OS V2.4 are translated into each language. See *z/OS Planning for Installation* (GA32-0890) in the z/OS Internet Library for information about the languages in which z/OS elements and features are available.

The following optional features, offered at no additional charge, are added to z/OS V2.4 and can be ordered effective September 13, 2019.

The language features for z/OS V2.4 are:

z/OS V2.4 feature description	z/OS V2.4 orderable supply ID
JPN Base	S018DS9
JPN XL C/C++	S018DSN
JPN Infoprint Server	S018DSV
JPN RMF	S018DSW
JPN Security Server	S018DSH
JPN ALT Base	S018DT0

Publications

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

To access the unlicensed z/OS product documentation, start at the z/OS Internet Library. It contains direct links to the following repositories and content:

- IBM Knowledge Center sections for z/OS V2.4 and other supported releases
- z/OS V2R4 Library, hosted on Resource Link$^{(R)}$, to download individual or grouped PDFs
- Adobe™ Indexed PDF Collections (SC27-8430) to easily conduct offline searches on the z/OS product documentation
- Downloadable collections of Knowledge Center plug-ins for clients who host their own instances of Knowledge Center for z/OS (KC4z)
- Content Solutions, which provide comprehensive and interactive content such as workflows, videos, and content collections
- IBM Z Publications Library Archive, to obtain as-is content for out-of-service products and releases

PDF collections are provided in the "zip" format that any modern zip utility can process.

Licensed documentation

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

Customized Offerings

Product deliverables are shipped only through CBPDO and ServerPac. These customized offerings are offered for internet delivery from Shopz. For more details on internet delivery, go to the Help section on the Shopz website.

IBM recommends internet delivery. However, if you still require physical media, you can choose DVD.

Many products can be ordered in ServerPac the month following their availability in CBPDO. z/OS can be ordered through 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, go to the Help section on the Shopz website.

Production of software product orders will begin on the planned general availability date.

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

Terms and conditions

The terms for z/OS Version 2 (5650-ZOS), as previously announced in Software Announcement AP13-0290, dated July 23, 2013, licensed under the IBM Customer Agreement(ALP/IAP Software - Japan)are unaffected by this announcement.

Statement of good security practices

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 lawful, comprehensive security approach, which will necessarily involve additional operational procedures, and may require other systems, products, or services to be most effective.

Important: IBM does not warrant that any systems, products, or services are immune from, or will make your enterprise immune from, the malicious or illegal conduct of any party.

Prices

For all local charges, contact your IBM representative.

AP distribution

Country/Region	Announced
AP	
ASEAN *	Yes
India/South Asia **	Yes
Australia	Yes
Hong Kong	Yes
Macao SAR of the PRC	Yes
Mongolia	Yes
New Zealand	Yes
People's Republic of China	Yes
South Korea	Yes
Taiwan	Yes

* Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor-Leste, and Vietnam

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Corrections

(Corrected on October 23, 2019)

Revised Pervasive encryption topic in the Description section.

(Corrected on September 23, 2019)

Revised Pervasive encryption topic in the Description section.