IBM z/OS V2.5: Enabling innovative development to support hybrid cloud and AI business applications

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At a glance

Adaptive business and operating models, driven by accelerated disruptions, are shaping the future of enterprises today. Enterprises are embracing the next normal with an accelerated and strategic focus on application modernization, cloud-native processes, and artificial intelligence (AI), all in an effort to ensure timely and resilient business use cases and enhanced business applications for a continuous and positive user experience.

The IBM(R) hybrid cloud approach is at the core of the plan to provide a solution for this swift and massive transformation. It provides a consistent, standards-based approach to development, security, and operations. In a hybrid cloud architecture, IBM Z(R) provides the privacy and security clients need with the common cloud experience they want to accrue the following benefits:

- Create better experiences for users through application modernization
- Fuel business growth with a standard cloud-native approach
- Innovate with integrity with cyber solutions to address evolving threats and new regulations
- Build competitive advantage with a cyber-resilient infrastructure that predicts, responds, and recovers

By leveraging the strengths of the IBM Z platform's computing power and resources, IBM z/OS(R) plays an important role in providing a secure, scalable environment for the underlying transformation process in which organizations are embarking to deliver swift innovation.

IBM z/OS V2.5 is designed to enable and drive innovative development to support hybrid cloud and AI business applications. This is accomplished by enabling next-generation systems operators and developers to have easy access and a simplified experience with IBM z/OS, all while relying on the most optimal usage of computing power and resources of IBM Z servers for scale, security, and business continuity.

Overview

z/OS V2.5 brings added value for primary users. Whether they are running Linux(R) applications on z/OS or extending existing COBOL applications with Java™ programs, an application development team can leverage z/OS V2.5 to achieve rapid application development and provisioning for their hybrid cloud deployment.

z/OS V2.5 supports the scale and simultaneous deployment of agile business use cases for hybrid cloud and AI capabilities and delivers the following values, features, and capabilities to help organizations succeed in their modernization efforts:

- Performance and ease-of-use enhancements for z/OS Container Extensions (zCX). Initially released as part of z/OS V2.4, zCX provides IT solutions architects with colocation agility and access to z/OS qualities of service for Linux applications by integrating Linux applications and utilities into z/OS.
- Enterprise modernization with more seamless COBOL-Java interoperability. This gives application developers full application transparency by extending application programming models.
- Capabilities added to IBM z/OS Cloud storage through DFSMS transparent cloud tiering (TCT) and the Object Access Method (OAM) cloud tier support. TCT, and separately OAM, enable z/OS to utilize hybrid cloud as an additional storage tier for structured and unstructured data. z/OS use of cloud storage is designed to reduce capital and operating expenses with data transfer to hybrid cloud storage environments for simplified data archiving and data protection on IBM Z.
- Exploitation of IBM Integrated Accelerator for Z Sort. This hardware-accelerated approach to sorting using a new CPU coprocessor on the IBM z15™ can reduce CPU usage and improve elapsed time for eligible in-memory sort workloads.
- Enablement for the use of AI in mission-critical applications by utilizing z/OS Container Extensions to broadly expand choices of AI tools, frameworks, or libraries.
- Real Storage Manager (RSM) support for more than 4 TB of real memory. This enables new workloads that require vast amounts of memory to be created and run on the platform.
- Shared Memory Communications Version 2 (SMCv2). This provides the performance advantages of SMC without being constrained to a single IP subnet.

z/OS V2.5 is intended to be the basis for future support of an OCI container runtime and Kubernetes container orchestration for IBM z/OS applications and workloads. This is intended to enable clients to adopt a container-based cloud-native strategy for mission-critical z/OS applications.

z/OS system programmers, including early-tenure system programmers, can independently and confidently deploy, maintain, and manage z/OS (and stack) software functions using guided and customized instructions and workflows. Functions such as z/OS Management Facility (z/OSMF) provide an intuitive user interface as well as automated instructions. This simplified and modern experience is designed to enable easier installation, management, and use of z/OS by programmers and administrators of all levels, with no special skills required for increased agility.

z/OS V2.5 delivers the following capabilities:

- ServerPac for z/OS V2.5 as a portable software instance. This delivery format enables an efficient and accelerated installation path using a common, simple, and guided process within z/OSMF without requiring extensive z/OS systems skills. z/OS V2.5 joins the list of the IBM z/OS subsystems and program products that are already available as portable software instances.
- A new z/OSMF task in z/OSMF Software Management called Software Update. The graphical user interface in Software Update provides a simplified and guided process to install any SMP/E-packaged PTF, regardless of the software vendor. With use cases for installing corrective, recommended, and functional updates to a client's system, Software Update with z/OSMF achieves the same results as does the traditional method, while requiring less time and experience to perform. To support installing z/OS V2.5 using z/OSMF, additional enhancements were added in z/OSMF Software Management to define a new master catalog.
- New functions and an enhanced user experience with IBM Cloud(R) Provisioning and Management for z/OS to offer a robust software provisioning platform on z/OS. Enhancements are designed to simplify provisioning, resource management, and security to help administrators efficiently manage templates and instances and to support expanded resource pools.

- New capabilities and enhancements to drive the effort of automating traditional tasks and simplifying areas of system management to help reduce the level of expertise needed for managing a system. IBM z/OSMF provides a framework for managing various aspects of a z/OS system through a task-oriented web browser interface. Most notable are the following:
  - The z/OSMF browser-based desktop provides a basic facility for organizing and managing information about z/OS. Improvements have been made for searching, browsing, and editing files and data sets as well as managing frequently referenced files or data sets into folders. Simpler manipulation of jobs and spool files is enabled, along with the capability to control access to functions from a browser.
  - The z/OSMF Security Configuration Assistant is extended to enable use by any third party or clients who need to provide security configuration help. This is designed to help ease the complex task of introducing new capability securely on z/OS.
  - z/OSMF Sysplex Management now supports a Coupling Facility Resource Management (CFRM) policy editor that can be viewed, updated, and activated in a graphic interface. This reduces the learning curve required and improves efficiency to edit CFRM policy definitions.
  - Support for a z/OSMF plug-in is provided in DFSMSrmm to simplify the management of Removable Media Manager (RMM).
- Continued reduction of the requirement for assembler skills by extending the IBM Job Entry Subsystem 2 (JES2) policy-based customization facility that was introduced in z/OS V2.4. New phases of processing and new attributes aid system management, and memory usage enhancements are also delivered. This facility reduces the need for clients to code installation exits in JES2, which should reduce the effort to apply service or upgrade to a new release.
- Continued System Display and Search Facility (SDSF) enhancements. Functions such as new primary displays and secondary panels further enhance the information that SDSF can show and enable system programmers to better manage their z/OS environment.
- Enhancements to the z/OS Workload Interaction Correlator, a priced feature that provides infrastructure to z/OS and middleware exploiters for generating additional data in a synchronized, standardized, context-rich way with a focus on low CPU cost.
- Enhanced Tailored Fit Pricing (TFP) for IBM Z ease of use. A new system parameter automatically reports and applies the TFP solution to the system. This improvement is designed to be an easier and less error-prone alternative to defining TFP solutions with Sub-Capacity Reporting Tool (SCRT) control statements.
- Enhancements to the priced feature Resource Measurement Facility (RMF), including optimization when gathering Coupling Facility (CF) hardware statistics. A new, separately priced feature for V2.5, Advanced Data Gatherer (ADG), provides the function of gathering performance data in raw form. The RMF priced feature includes entitlement to the ADG priced feature.

z/OS V2.5 continues to strengthen the security, integrity, and privacy of data. Architecture teams can leverage cyber security system hardening and analytics to provide a new level of cyber resiliency for the enterprise. Enhanced resiliency capabilities provide heightened application availability, modernized tools, and automated detection and mitigation procedures, enabling teams to protect against the impact of cyber attacks and help maintain exceptionally resilient environments with reduced skill requirements. z/OS V2.5 delivers the following:

- An anomaly mitigation solution leveraging Predictive Failure Analysis (PFA), Runtime Diagnostics, Workload Manager (WLM), and JES2 that further enables clients to detect anomalous behavior in near real-time so they can proactively address potential problems before an availability impacting event can develop.
- Updated RACF(R) PassTicket capabilities to support a stronger cryptographic algorithm with additional controls for a configurable validity period and an optionally expanded character set. The new enhancements offer additional client support and include improved error diagnostics and additional information logged in IBM System Management Facility (SMF).

- Enhanced System Recovery Boost for IBM z15 servers. This capability enables clients to leverage a class of boost that can be applied to a range of z/OS sysplex recovery processes, including sysplex partitioning, CF structure recovery, CF data-sharing member recovery, and IBM HyperSwap(R).
- Additional support for Data Privacy for Diagnostics, a z/OS security function that is available on IBM z15 to help clients maintain control when working with third-party vendors by redacting data tagged as sensitive and creating a redacted diagnostic dump that can be shared externally. z/OS Diagnostics Analyzer, a new enhancement for Data Privacy for Diagnostics, is generally available and enhances sensitive data tagging and redaction in system dumps by enabling clients to customize sensitive data patterns that are unique to their organization. Data Privacy for Diagnostics helps clients improve their capability to address compliance challenges in the area of diagnostic data without compromising on serviceability.
- Pervasive Encryption simplification. Most notable is the support for additional z/OS data set types, including sequential basic format and large format System Managed Storage (SMS)-managed data sets. In most instances, clients are able to encrypt data without application changes and simplify the task of compliance. Applications using Execute Channel Program (EXCP) are supported with an access method encryption macro designed to enable programmers to change EXCP programs to read and write data sets that are compatible with encryption by IBM Basic Sequential Access Method (BSAM) and IBM Queued Sequential Access Method (QSAM). Encryption of basic and large format data sets, whether by an access method or EXCP, is designed to enable the installation to specify data sets to be encrypted through a policy such as IBM System Authorization Facility (SAF) or SMS, or manually. The data remains encrypted during administrative functions such as backup and restore, migration and recall, and replication.
- z/OS Encryption Readiness Technology (zERT) is enhanced to provide policy-based enforcement of local network cryptography requirements. When TCP connections match user-defined zERT enforcement rules, you can obtain immediate notification of questionable or unacceptable network cryptographic protection through messages, SMF audit records, and even automatic termination of connections.
- Support for an optional priced feature called z/OS Authorized Code Scanner, which dynamically scans a client's authorized code and provides diagnostic information for subsequent investigation to help support clients in their effort to strengthen the security posture of the z/OS development and test pipeline.

IBM continues to invest in z/OS foundation enhancements to support the performance and optimization of new hardware and to support new data management, scalability, integration of industry standards, and open functionality.

Key requirements

z/OS V2.5 operates on the following IBM Z servers:

- IBM z15 Models T01 and T02
- IBM z14(R) Models M01-M05
- IBM z14 Model ZR1
- IBM z13(R)
- IBM z13s(R)

If you run z/OS V2.5 as a guest of IBM z/VM(R) , z/VM must be at a supported level.

For a complete description of z/OS V2.5 hardware requirements, see *z/OS V2.5 Planning for Installation* (GA32-0890), in IBM Documentation on September 30, 2021.

Planned availability date

Description

Capabilities delivered in IBM z/OS V2.5 include the following. Many of these items are also available in prior releases with continuous delivery (CD) and are noted as such.

Application development

Applications are at the heart of transactional and batch workloads running on z/OS. Fundamentally, developing new applications while modernizing existing applications is part of the digital transformation journey occurring in many enterprises. z/OS V2.5 delivers enhancements to enable application developers to use new hash utilities to maintain data integrity in files, new TLS support when using the z/OS client Web Enablement Toolkit, new memory-map service support, BCPii enhancements to better control the operations of Z hardware, and transparent interoperability between high-level languages when running in different addressing modes.

zCX

zCX provides the capability to run Linux on IBM Z software directly in z/OS. This capability enables Linux on Z application code to run on z/OS unmodified. Software available includes open source, client-written, IBM product, and third-party-vendor software. A project at the Open Mainframe Project™ called Ambitus is available to assist in creating a community around Linux on Z software.

Some of the IBM product use cases include products such as Application Connect Enterprise V11 introduction, Service Management Unite, and MQ Client Concentrator at IBM Integration Community.

Improvements are made in the following areas.

- Performance updates:
  - Increased disk capacity:
    - -- The number of data and swap disks per appliance is increased to as many as 245. This enables a single zCX to address more data at one time. With the PTF for APAR OA60303, this enhancement is also available on z/OS V2.4.
    - -- Each disk can now be up to 1024 GB in size. This is also available with PTF for APAR OA60920.
- With the PTFs for APAR OA59865, APAR OA59111, and APAR OA59943, these performance enhancements are also available on z/OS V2.4:
  - Updates to support single instruction multiple data (SIMD) processes. Some applications are compiled with SIMD instructions and require SIMD enablement. zCX supports hardware SIMD. Applications that take advantage of SIMD can deliver improved performance.
  - zCX can support 1 MB and 2 GB pages. This can improve the efficiency of zCX workloads.
  - The maximum number of containers supported is raised to 1000 per zCX server. The practical limit might be lower depending on available resources.
  - The amount of each zCX guest's memory can be configured up to 1 TB. Given zCX use of fixed memory and z/OS memory layout, the practical limit is lower.
- Inbound Workload Queueing (IWQ) support for IBM z/OS Container Extensions. In support of zCX, z/OS Communication Server's OSA-Express Inbound Workload Queueing (IWQ) support is enhanced to add a new input queue for zCX network traffic. The OSA-Express IWQ separation of the zCX traffic from native z/OS traffic provides an optimal Communications Server processing environment for zCX traffic. When IWQ is enabled, the z/OS TCP/IP inbound processing for

zCX traffic becomes zIIP eligible. OSA-Express directs zCX traffic for protocols TCP and User Datagram Protocol (UDP) to the zCX input queue. The z/OS IWQ zCX solution is planned to be made available on OSA-Express6S and beyond. With the PTFs for APARs PH16581 and OA58300, these enhancements are also available on z/OS V2.4.

- Capabilities for monitoring and alerting include:
  - Support to monitor and log zCX resource usage of the root disk, guest memory, swap disk, and data disks in the server's job log. An enhanced operator command option can display the version and service information about any zCX server and all the relevant components used to provision and run it. This can reduce the effort required and improve the accuracy of service communications. The zCX instance root disk is able to be enlarged when using the software upgrade workflow of the zCX appliance. With the PTFs for APAR OA59835 and APAR OA60303, this enhancement is also available on z/OS V2.4.
  - zCX resource shortage z/OS alerts are proactive alerts that are sent to the z/OS system log (SYSLOG) or operations log (OPERLOG) to improve monitoring and automated operations. The server monitors used memory, root disk space, user data disk space, and swap space in the zCX instance periodically and issues messages to the zCX joblog and operator console when the usage rises to 50%, 70%, and 85% utilization. When returning to below 50%, an information message is issued. With the PTF for APAR OA60303, this enhancement is also available on z/OS V2.4.
- A 90-day trial for zCX is available. Clients can try zCX for up to 90 days without having to purchase the hardware feature code FC 0104 or IBM Container Hosting Foundation for z/OS 1.0 (5655-HZ1), announced in Software Announcement AP21-0119, dated June 1, 2021.When the 90-day trial period has ended, zCX instances will no longer function unless either the hardware feature code or the software program have been purchased. With PTF for APAR OA58969, this enhancement is also available on z/OS V2.4. The 90-day trial is no-charge and is subject to normal hardware and software consumption when adding a workload to z/OS.
- Support is added to zCX for IPv6. This enables a zCX server to fully participate in an IPv6 network on z/OS systems and networks that are IPv6-enabled. IPv6 enablement can be an important prerequisite in some client configurations. With the PTF for APAR OA59508, this enhancement is also available on z/OS V2.4.
- The IBM License Metric Tool is enhanced to support the zCX environment. Utilization of the IBM License Metric Tool is required for sub-capacity pricing for licensing of IBM Linux on Z software programs procured through Passport Advantage(R). Additional information about IBM License Metric Tool enablement in zCX, including the required PTFs, can be found in IBM Documentation.

To learn more about z/OS Container Extensions, including helpful instructions about how to get started, see the zCX Content Solution web page.

z/OS UNIX(R) and POSIX memory-map 64-bit support

Applications using the z/OS UNIX or POSIX memory-map service can now use 64-bit storage and map files of lengths greater than 2 GB. This enhancement helps alleviate below-the-bar memory constraints by enabling applications to use above-the-bar storage for large memory-mapped files. In addition, this new support is designed to improve performance and simplify data access by facilitating access to large amounts of data at once. With the PTFs for APARs OA60306 and PH32235, this support is available for z/OS V2.4.

COBOL-Java interoperability

z/OS Language Environment(R) (LE) introduces support to manage parallel 31-bit and 64-bit LE addressing mode (AMODE) enclaves within the same address space and enables transparent traversal between the two AMODE enclaves. This interoperability support enables clients to modernize their existing high-level language applications. Along with the enhancements made to the IBM Java 8 SDK, 31-bit COBOL applications can now be extended by calling 64-bit Java programs

(or vice versa) directly, in the same application context and process. Other features of this support include coordinated condition handling and easier serviceability because both enclaves are automatically part of the same dump. While the primary focus is for COBOL-Java interoperability, the LE support is designed to work for any combination of high-level languages interoperating between 31-bit and 64-bit addressing modes. This support is available with the PTF for APAR PH28966 for z/OS V2.3 and later.

BCPii

z/OS BCPii provides a powerful way for z/OS applications to automate and control the operations of Z hardware in multiple languages, including REXX. A new z/OS BCPii API named HWIREST is introduced for the z15 that enables applications to access many previously unavailable attributes of the z15, including central processor complex (CPC) storage, storage allocated for an LPAR, CPC environmentals such as exhaust air temperature and dew points, and detailed information about processors and their assignments to an LPAR. BCPii HWIREST is an interface designed to act more as a passthrough interface to the z15 hardware APIs and machine information. As such, it is intended to surface future attributes that might become available in a new hardware firmware level or machine, without requiring a corresponding z/OS BCPii software update. This new interface is in addition to the existing BCPii services and requires exploiting software to explicitly request the new function. With the PTF for APAR OA60351, this enhancement is available for z/OS V2.4 and later. It requires a z15, SE 2.15.0 with MCL P46598.370, Bundle S38 or higher, and HMC 2.15.0 with MCL P46686.001, Bundle H25 or higher.

Web Enablement Toolkit

Enhancements to the HTTP/HTTPS Enabler portion of the z/OS client Web Enablement Toolkit include support for new PATCH and new OPTIONS methods, inclusion of Server Name Indication (SNI) when System SSL usage is specified, and enhanced tracing to help with debugging of complex situations with the capability to turn on verbose debug information using environment variables. With the PTF for APAR OA58707, this enhancement is also available on z/OS V2.3 and later.

In addition, the HTTP/HTTPS Enabler portion of the z/OS client Web Enablement Toolkit is enhanced to provide TLS 1.3 support when System SSL usage is specified. With the PTF for APAR OA58708, this enhancement is also available on z/OS V2.4.

Unicode Standard

The programming interfaces provided by z/OS V2.5 Unicode Services are designed to meet the Unicode 12.0 standard.

Systems management, usability, and skills

Efficient management and maintenance of z/OS has always been a focus. Whether in the form of improved backup and recovery or exploitation of object-based storage, z/OS has many features to help. Looking to the future, IBM intends to move to a browser-based management model. To that end, many functions are delivered in z/OS as part of the z/OSMF. The new functions aim to simplify and improve the processes to help manage z/OS. Historically, much of z/OS relied on assembler-written exits, in some cases for actions that are purely administrative. Reducing requirements for assembler skills continues to be a focus area.

z/OSMF

z/OSMF, the modernization platform of z/OS management, continues to deliver a number of significant new functions with z/OS V2.5. Together, they enable higher efficiency, lower skill requirements, and more industry-popular interfaces to drive z/OS operations. The following z/OSMF enhancements are delivered in z/OS V2.5:

- z/OSMF desktop UI provides higher efficiency and modernized operations to work with data sets, z/OS UNIX System Services files, and jobs. Users can submit a data set or UNIX file as JCL from the z/OSMF desktop search window or editor window. A new task named "Job Output" is introduced so that users can check

job status and retrieve job output directly from the z/OSMF desktop UI. With the PTF for APAR PH16076, this enhancement is available on z/OS V2.4.

  - Users can create a new physical sequential or partitioned data set based on an existing data set, a predefined template, or fully specified attributes, directly from z/OSMF desktop UI. With the PTF for APAR PH30398, this enhancement is also available on z/OS V2.3 and later.
  - The search function on z/OSMF desktop is enhanced to provide type-ahead capability for searching data sets, z/OS UNIX System Services files, and z/OS UNIX System Services directories. With the PTF for APAR PH28692, this enhancement is also available on z/OS V2.3 and later.
  - Every z/OSMF user can create links on their z/OSMF desktop or folder. With the PTF for APAR PH24527, this enhancement is also available on z/OS V2.3 and later.
  - Syntax highlighting is supported when browsing or editing for JCL, XML, REXX, and HTML types in the z/OSMF Desktop Editor. With the PTF for APAR PH24527, this enhancement is also available on z/OS V2.3 and later.
  - The z/OSMF desktop editor is enhanced to highlight data set names and zFS file paths as hot-linkable URLs. A user can open the referenced data set or zFS file from the z/OSMF desktop editor simply by clicking on the link. With the PTF for APAR PH34912, this enhancement is also available on z/OS V2.4.
- z/OSMF Incident Log supports the viewing of diagnostic data using the z/OSMF desktop editor application, unifying the user experience with a more familiar browser look and feel. Previously, viewing the diagnostic data was done only using the z/OSMF ISPF application. This capability is also delivered with the PTF for APAR PH34912 on z/OS V2.4.
- z/OSMF Sysplex Management provides graphical interface and operations for z/OS Sysplex Management. In V2.5, Sysplex Management makes great strides to support editing CFRM policy definitions. The CFRM policy definitions can be viewed, updated, and activated in a graphical interface, reducing the learning curve required to edit CFRM policy definitions via the JCL utility. Best practices and error checking are also built into the graphical interface to reduce human error. The CF structure definitions can be updated in groups to improve efficiency.
- z/OSMF Web ISPF application adds a global settings configuration. This improves the user experience by providing system-wide defaults for the ISPF application settings rather than requiring each user to configure those values themselves. The setting values of the z/OSMF ISPF application can also be captured in a file and used by the administrator to set up other systems' global configurations. This support is available with the PTF for APAR PH34102 on V2.3 and later.
- z/OS Operator Consoles plug-in provides a modernized interface for console operations support to set console properties programmatically or from the z/OSMF UI. This simplifies the configuration previously required for setting up console properties. With the PTF for APAR PH24072, this enhancement is also available on z/OS V2.3 and later.
  - Enable WTOR messages to be displayed in a separate larger window. With the PTF for APAR PH30881, this enhancement is also available on z/OS V2.3 and later.
- Enhancements to z/OSMF Workflow provide a better auditability and workflow management experience as well as support for saving job output in a specified z/OS UNIX directory. With the PTF for APAR PH21919, this enhancement is also available on z/OS V2.3 and later.
  - Support for auto-deletion after a workflow is completed. This reduces clutter in the z/OSMF file system from workflows that clients do not want to save. The workflow administrator enables users to delete multiple workflow instances at a time. With the PTF for APAR PH24190, this enhancement is also available on z/OS V2.3 and later.
  - Clients can execute a workflow on a remote sysplex. A single sign-on among z/OSMF instances is no longer strictly required. In the absence of a single sign-on, the request prompts for a user and password, if necessary. With the PTF for APAR PH28532, this enhancement is also available on z/OS V2.3 and later.
  - Exploit the "type-ahead" search for the workflow definition and workflow properties files in the "create new workflow instance" dialog. This eliminates

the need to provide the full data set name or path name. With the PTF for APAR PH28532, this enhancement is available on z/OS V2.3 and later.
  - Search keywords in the content of a workflow step. Keyword search extended to the content of a workflow step can help users quickly locate corresponding steps. With the PTF for APAR PH27725, this enhancement is also available on z/OS V2.3 and later.
  - Workflow REST API step retrieves the completion status of asynchronous REST API using polling capability. This enhancement enables users to specify polling attributes that will direct the workflow engine to poll the REST API end point with intermittent wait and determine completion condition. With the PTF for APAR PH38975, this enhancement is also available on z/OS V2.3 and later.
- While enhancing the z/OSMF Workflow Engine, the Workflow Editor task is enhanced to simplify workflow creation. With the PTF for APAR PH28532, these enhancements are available on z/OS V2.3 and later.
  - A new "Test" action enables users to open the Workflows task directly from the Workflows Editor. This provides a way to quickly create and run workflow instances using a client's workflow definition.
  - A path selector option is added to some input fields to assist clients with locating workflow files and templates on their system.
  - Workflow Editor supports the REST API polling feature introduced in workflow. With this enhancement, users can create a REST API step in a workflow and specify the polling attributes, e.g., poll count, wait time, etc., when a REST API end point needs to be polled to obtain completion status. With the PTF for APAR PH38975, this enhancement is also available on z/OS V2.3 and later.
  - A raw text option for Workflow Editor. By selecting this option, the Workflow Editor opens the workflow definition in a simple text editor. Consider using the text editor when it is needed to quickly correct a syntax error that prevents the file from opening in the Workflow Editor UI. The flat text editor also can help quickly locate where a specific variable is used.
  - An Expand option is added to the Instructions tab on the Step Details page and the Template contents field for template steps. The use of this option is to expand the input area to full-screen width for a larger text entry area.
  - The Edit Workflow Definition dialog saves the location of the files that clients edit. On subsequent uses, you can select the file location from the pull-down menu, rather than having to enter the full path and file name manually, as was previously necessary.
  - The goal is to enable users to use the VS code editor, already included in z/OSMF, when working with large amounts of text. The VS code editor provides a large area to perform editing as well as standard editor support such as find and replace string, line numbers, and the file overview.
- z/OSMF REST APIs provide more job functions and data set functions and enable users to drive z/OS operations locally or remotely from any platform and language that supports invoking HTTP service. REST Jobs API supports the returning of execution data, such as the system name and timestamp at which a job was submitted. With the PTF for APAR PH23046, this enhancement is also available on z/OS V2.3 and later.
  - REST data set and file APIs support an additional option called "Allocate Like" for creating a z/OS data set by copying the attributes from another data set. In many cases, this avoids the need to exhaustively specify every allocation parameter. With the PTF for APAR PH22030, this enhancement is also available on z/OS V2.3 and later.
  - Reductions in the response time of retrieving content from large data sets or z/OS UNIX files is accomplished by compressing the HTTP stream. With the PTF for APAR PH22030, this enhancement is also available on z/OS V2.3 and later.
  - REST data set and file service support queueing concurrent requests from the same user when the number of Time Sharing Option (TSO) address spaces are exhausted. This can improve the processing when a large number of requests are sent to z/OSMF. With the PTF for APAR PH29745, this enhancement is also available on z/OS V2.3 and later.
  - A new REST API is added to support retrieving OPERLOG by time and direction. With APAR PH35930, this function is also available on z/OS V2.4.

  - z/OSMF adds new REST APIs to manage z/OS Storage Management resources, starting with retrieving information about Storage Group and Volumes.
- z/OSMF configuration, diagnostic, and startup performance are improved:
  - z/OSMF startup time and resource consumption during startup is improved. Actual results can vary, depending on the client's configuration. With the PTFs for APARs PH28921, PH28920, PH28971, PH28990, PH28451, PH29230, PH29243, PH28832, and PH28872, this enhancement is also available on z/OS V2.3 and later.
  - A simple UI enables administrators to enable or disable most z/OSMF services. This provides more flexibility and better usability for administrators to tailor a minimum z/OSMF runtime. In addition to using the UI, systems programmers can tailor z/OSMF runtime by uploading a simple JavaScript Object Notation (JSON) file to the z/OSMF configuration directory. This is designed to simplify settings deployment across multiple z/OSMF instances. With the PTF for APAR PH24527, this enhancement is also available on z/OS V2.3 and later.
  - SETIZU and SET IZU commands are added so that clients can dynamically change z/OSMF parmlib options without having to restart z/OSMF. With the PTF for APAR PH24088, this enhancement is also available on z/OS V2.3 and later.
  - z/OSMF Diagnostic Assistant task is enhanced to support setup of z/OSMF logging level and displaying of. z/OSMF data file system utilization on the z/OSMF desktop taskbar. It supports automatic cleanup of z/OSMF diagnostic data based on a predefined policy. This is designed to help maintain the health of the z/OSMF data file system. With the PTF for APAR PH25691, this enhancement is also available on z/OS V2.3 and later.
  - z/OSMF Security Configuration Assistant is enhanced to support variables so that more security configuration checking can be validated automatically. This is designed to reduce the number of manual actions reported by the assistant. With the PTF for APAR PH17871, this enhancement is also available on z/OS V2.3 and later.
- The z/OSMF Security Configuration Assistant (SCA) plug-in is enhanced to support z/OS components, features, and products. Previously, the SCA was only able to give detailed information to a system programmer about the missing security rules for the z/OSMF component.
  - In z/OS V2.5, this capability is extended to any piece of software.
  - An easy-to-create JSON file can be provided by the exploiting software that defines the security requirements. A properly permitted system programmer or the security administrator can run this plug-in and see in one list all the security rules that are missing and what that might mean.
  - The SCA is designed to help system programmers to understand security requirements of specific functions and to quickly identify the function failure that would be caused by the incorrect security setup. Used as a vehicle to communicate between system programmers and security administrators, this information can improve the time to value for software on z/OS. Several of the z/OS V2.5 DFSMS features are among the first exploiters of this function because they provide security JSON descriptor files that can be imported to SCA. With the PTF for APAR PH29907, this enhancement is available on z/OS V2.3 and later.
- IBM z/OSMF Ansible(R) Collection "ibm_zosmf" enables Ansible users to drive z/OSMF REST API-based capability. It starts with providing Ansible roles and modules to drive z/OSMF Workflow operations as well as Cloud Provisioning and Management for z/OS (CP&M) function. It is available in Ansible Galaxy and Red Hat(R) Ansible Automation Hub as part of the Red Hat Ansible Certified Content for IBM Z.
- To help IBM improve the z/OSMF user experience, z/OSMF V2.5 provides a panel to collect user feedback and task usage of z/OSMF. z/OSMF "General Settings" task can be used to customize the scope of this feedback collection. Users need to opt-in before they can provide any feedback to IBM.

To learn more about z/OSMF and what it can do for your business, see the IBM z/OS Management Facility web page.

JES2 policy enhancements

Reducing the requirement for assembler skills to manage the system is a goal for JES2. In z/OS V2.4, JES2 introduced the initial code for using simple rule-based definitions (JES2 policies) at the end of the job conversion phase. With the PTF for APAR OA58190, JES2 added multisystem support for JES2 policy-based exits. For z/OS V2.5, JES2 adds two new policy types to aid system management. The PreConversion policy type enables filtering on job default attributes (such as CompletionCode, JobClass, and SrvClass) and also modification of job default attributes (such as JESLOG and MsgClass) prior to entering the job conversion phase. The SYSOUTGroup policy type enables filtering on certain SYSOUT data set attributes (such as DDName and JobClass) and also modification of certain SYSOUT data set attributes (such as DSClass and DSDest) prior to exit 40 processing and creation of job output groups. Additional job attributes and policy functions for all policy types are added for z/OS V2.5. One new policy function that is available to all policy types is AuthorityCheck, which performs an SAF authority check based on parameters supplied on the function request. The goal of JES2 policies is to reduce the need to code and maintain JES2 installation exits in assembler to implement company-specific customizations. Having fewer assembler modifications is aimed at reducing the need to assemble or rework code, which can make applying service simpler and speed up the release upgrade process. The policy enhancements can be developed using an editor and can be dynamically added and removed without requiring a JES2 restart of any kind.

Infoprint Central enhancements

Infoprint Central enhancements for z/OS V2.5 include the following:

- A redesign to use responsive design, which can improve the user experience for large and small screens
- Performance improvements to enable faster load of results and enhance the sorting performance for columns
- Updates to use XML Toolkit 1.11
- Support for the use of the Google Chrome browser

Infoprint Server has added support to work with new JES Blank truncation options. With the PTF for OA61026, this support is available in z/OS V2.4.

SDSF

SDSF continues delivering new functions that are most asked for by system programmers. New functions include the following:

- There are eight new primary displays to show information such as address space diagnostics, couple data sets, system IPL parameters, and SVC/PC routines. One new function is address space memory that enables permitted users to view the contents of any address space.
- There are four new secondary panels for job common storage and storage subpools, private storage, and memory structure map.
- There are more than 15 new viewable fields added to various displays, including total space used for a filesystem, used space for storage groups and storage volumes, and timezone offset information.
- There is a new help facility in SDSF that replaces the ISPF tutorial panels with SDSF-based dynamic panels. The capability to search help information, view available commands and actions unique to a panel, and get field unique help are all provided.
- For general usability, there is the capability to use "point and shoot" for memory addresses, wide-screen support for operator command entry, and log positioning to show WTORs and action messages.
- The browser-based UI is reimplemented and is more responsive and covers more functions than prior releases. The graphics and tables are cleaner and display more functions than prior releases.
- As previously announced, SDSF requires configuration with SAF security. To that end, a new security migration guide is provided along with a REXX exec ISFACR to assist in migration to SAF security.

- SDSF is enhanced to display information about the use of system recovery boost. With the PTF for APAR PH26552, this enhancement is available on z/OS V2.3 and later.

TFP ease of use

To reduce the effort of reporting on TFP solutions, a new system parameter named **SOLUT=** is added to the system parameter member **IEASYSxx** . Clients can indicate in the z/OS configuration of a system that it is running with a qualified TFP solution. z/OS reports this information in SMF 89 records. When used with SCRT 28.2.0, clients are no longer required to specify the TFP solution ID in SCRT CONTAINER control statements. Instead, SCRT captures the solution ID from the SMF data and automatically applies it to the system. This is designed to be an easier and less error-prone alternative to defining TFP solutions with SCRT control statements. With the PTF for APAR OA60198, this function is available for z/OS V2.3 and later. SCRT 28.2.0, or later, is required to exploit the information provided by the new system parameter and is available with the PTF for APAR OA60919 for z/OS V2.3 and later.

To learn more about TFP, including helpful instructions about how to get started, see the Tailored Fit Pricing for IBM Z content solution web page.

DFSMShsm recover UNIX files to a new directory

DFSMShsm adds the capability to recover UNIX files to a directory other than the original directory from the time of the backup. This function enables users to recover files to a temporary location to verify that the recovered version is the desired level of the file. It also enables files to be recovered to a different directory and accessed directly from the new location. With the PTF for APAR OA58612, this enhancement is also available on z/OS V2.3 and later.

DFSMShsm UNIX file-level backup and recovery with EXCLUDE criteria

DFSMShsm UNIX file-level backup is enhanced to support an **EXCLUDE** keyword on backup and recovery commands. This keyword accepts a comma-separated list of either filename patterns or directory names that should be excluded from processing. With the PTF for APAR OA57868, this enhancement is also available on z/OS V2.3 and later.

DFSMShsm file mode hosts

A FILEMODE for DFSMShsm enables a separate HSMplex to exclusively process UNIX files within a sysplex that has an existing DFSMShsm HSMplex. Any DFSMShsm requests for UNIX files are automatically directed to the DFSMShsm hosts configured with FILEMODE. This support enables clients with very large existing DFSMShsm environments to add DFSMShsm UNIX data set backup processing without impacting their classic volume and data set environment. With the PTF for APAR OA58870, this enhancement is also available on z/OS V2.3 and later.

New graphical interface for DFSMSrmm

A new user interface for DFSMSrmm (removable media manager) was provided in z/OS V.2.4 as a plug-in for z/OSMF with the PTF for APAR OA59499. After the initial support, several new features were added with the PTF for APAR OA59727, also on z/OS V2.4. The new user interface complements the existing TSO and ISPF dialog support with a graphical interface designed for ease of use and aimed at simplifying the management of DFSMSrmm. Features of the new graphical interface include the capability to display status and settings within DFSMSrmm as well as the capability to display a list of volumes and data sets. Also provided is the capability to export the data being displayed into a CSV formatted file.

OAM support for IBM Db2(R) stored procedures

Db2 stored procedures enable clients to develop modular programs through which a set of common code can be invoked in a Db2 environment across applications. DFSMSdfp OAM provided a sample, CBROSRSP, available in SYS1.SAMPLIB, that

illustrates how a user application can invoke the OAM OSREQ API in a Db2 stored-procedure environment, and also how to manage multiple Db2 connections within a single stored procedure. This is designed to provide flexibility for manipulating data between different databases without having to create multiple programs. With the PTF for APAR OA57837, this enhancement is also available on z/OS V2.2 and later.

OAM address space Db2 connection management enhancements

z/OS V2.5 enhances Db2 connection management characteristics for OAM object users by enabling OAM to be more tolerant of Db2 connection issues and Db2 maintenance cycles and to improve OAM availability by providing the capability to dynamically switch between object and SMS-tape configurations without the need to reactivate the Source Control Data Set (SCDS) or re-IPL.

OAM cloud and additional backup enhancements

With the PTF for APAR OA55700 for z/OS V2.3 and later, a cloud tier is added to the existing OAM storage hierarchy. With the OAM cloud tier support, the primary copy of an OAM object can be managed and stored as an object to a public, private, or hybrid cloud infrastructure that supports the S3 API. However, with the initial cloud support, OAM-managed backup copies were not supported in the cloud. Now, with the PTF for APAR OA59615 for z/OS V2.3 and later, an OAM-managed backup copy of a primary object is additionally supported in the cloud and in a file system (zFS or Network File System [NFS]). OAM continues to support up to two backup copies of an OAM object.

Better administration capabilities for zFS

System administrators can now use a wildcard character in the aggregate name on the **zfsadm chaggr** command. This enhancement enables an administrator to change attributes of multiple zFS instances with a single command rather than issuing several individual commands. For example, this added wildcard support could be used to assign the high-availability (HA) attribute to all mounted file systems. This enhancement can reduce the time required for reconfiguring zFS environments while maintaining their availability. With the PTF for APAR OA59435, this enhancement is available on z/OS V2.3 and later.

Enhanced support for NFS

The z/OS NFS Server is enhanced with a customizable Microsoft™ Windows™-specific attribute, known as *Windows prefix*, to help identify connections from a Windows 10 NFS client. This enables the z/OS NFS Server to tailor responses for a better experience when accessing z/OS UNIX directories. This support is designed to help clients migrate to the z/OS NFS Server because the Server Message Block (SMB) server is no longer available in z/OS V2.4. With the PTF for APAR OA57493, this enhancement is also available on z/OS V2.2 and later.

In addition, the z/OS NFS Server has been enhanced to support Microsoft Windows clients. This enhancement no longer requires Windows clients to unmount and remount the NFS drives after the NFS Server has been restarted. This support helps clients who are migrating from Server Message Block (SMB) to z/OS NFS. With the PTF for APAR OA59310, this enhancement is available on z/OS V2.3 and later.

The z/OS NFS client supports IBM Spectrum® Scale as an NFS Server using both the NFS V3 and V4 protocols and can operate with or without Kerberos authentication. This client/server combination is supported on z/OS V2.3 and later.

The z/OS NFS server has been enhanced with additional function to support Kerberos authentication with unique application-instance DVIPA. This support is designed to help clients preserve data security while enabling easier movement of the z/OS NFS server between LPARs. With the PTF for APAR OA58912 this enhancement is available on z/OS V2.3 and later.

Tape device fencing using SMStape and Storage Management Subsystem (SMS) policies

In z/OS V1.11, support was provided for Demand Allocation with System-Managed Tape. Prior to that, SMStape would always ignore what was specified on the **UNIT** parameter and would instead allocate using the assigned SMS constructs. There was not an easy way to limit the devices that SMStape considered eligible or to select a particular device. To address that, a keyword (**SMSHONOR**) was added to the **UNIT** parameter on the DD statement. z/OS allocation would then honor what was specified as long as there was an intersection between what SMStape considered eligible and what was specified on the **UNIT** parameter. Clients also wanted the capability to select what devices could be used through SMS constructs (policies). Now, **SMSHONOR** can be enabled through the SMS tape storage group construct. This broadens the original **SMSHONOR** support and makes it easier for clients (through SMS policies) to reserve a set of devices for critical applications by limiting the devices used by their less critical applications. If the JES3 subsystem is active, specification of **SMSHONOR** through the tape storage group construct is ignored. With the PTF for APAR OA59161, this enhancement is also available on z/OS V2.3 and later.

Availability of the z/OS V2.5 ServerPac as a portable software instance

With an installation strategy that was developed in collaboration with leading industry software vendors, IBM continues to make great strides in delivering z/OS software. Today, CICS®, IMS, Db2, and the related licensed programs can be ordered as a ServerPac in a portable software instance format and installed with z/OSMF Software Management. Clients are able to order z/OS V2.5 as a ServerPac in a portable software instance format, to be installed with z/OSMF Software Management. Because the removal of the ServerPac CustomPac Dialog format is intended for January 2022, clients should immediately prepare their driving system so that it is ready to install a ServerPac delivered in the z/OSMF format.

For the driving system requirements for installing ServerPac with z/OSMF Software Management and the steps to follow, see the ServerPac Installation using z/OSMF content solution. Here, clients can find a sample portable software instance that can be used to verify that their z/OS driving system is operational for installing a CICS, IMS, Db2, or z/OS ServerPac.

Although it is planned that z/OSMF will become a driving system requirement, it would only be required for the system in a client's enterprise from which software installation activities are performed. However, clients might find that using z/OSMF throughout their enterprise offers tremendous benefits. For clients that cannot meet the z/OSMF driving system requirements for ServerPac, the Customized Offerings Driver (5751-COD) is available on Shopz. With the availability of z/OS V2.5, the Customized Offerings Driver has z/OSMF enabled so it can be used to install a z/OS ServerPac portable software instance.

Upgrade Workflow

IBM is making continual enhancements for assistance with z/OS upgrades. For z/OS V2.5, z/OS Upgrade Workflow provides the steps for upgrading to this new release of z/OS. As in previous releases, two z/OSMF workflows are provided. Depending on whether you are upgrading from z/OS V2.4 or z/OS V2.3, select the workflow that applies to your upgrade path and open it in z/OSMF to begin the upgrade process. Within the workflow, discovery functions run automatically to further streamline the upgrade process. Only the upgrade actions that apply to your particular system are identified in the z/OSMF UI.

Starting in z/OS V2.5, IBM is shipping z/OS V2.5 Upgrade Workflow and z/OS z15 Upgrade Workflow as part of the z/OS product deliverable, including IBM service and support. Any updates and fixes for the Upgrade Workflows are delivered through the standard z/OS service process. By including these two Upgrade Workflows into the z/OS product and with the PTFs for APAR OA60711 supporting z/OS V2.4 and V2.3, the acquisition of these important technical upgrade materials is faster and more convenient than supplying them in a different location.

Prior levels of the z/OS Upgrade Workflows for z/OS V2.2, V2.3, V2.4, and z14 are available on the IBM z/OS z14 Workflow web page. z/OS z15 Upgrade Workflow is

provided and maintained in the z/OS APAR OA60711 information and on the IBM z/OS z15 Workflow web page.

z/OS Software Update enhancement

Because performing updates to z/OS software can be a complicated and time-consuming task, a z/OSMF task has been made available in z/OSMF Software Management called Software Update for z/OS V2.5. SMP/E HOLDDATA contained in updates can be difficult to manage, but the Software Update enables clients to review and track this information in an orderly fashion. All installation output is saved so it can be reviewed at any time.

The Software Update task is used to install updates associated with three different use cases:

- Corrective. Install individual software updates to fix a problem. Clients can identify the updates to be installed by name.
- Recommended. Install all software updates that are recommended by a software vendor. The IBM recommendations are those designated as IBM Recommended Service Upgrade (RSU) fixes.
- Functional. Install software updates to support new hardware, software, or functions. Software Update identifies the fix categories associated with available updates, and clients can select fix categories to install all updates associated with those categories.

Clients can continue to use their existing methods to install SMP/E-packaged software updates, such as with batch jobs, but they might find a simpler experience requiring lesser SMP/E skills by using z/OSMF Software Update instead.

To learn more about z/OSMF Software Update, including helpful instructions about how to get started, see the Software Update with z/OSMF content solution.

With the PTF for APAR PH28412, this enhancement is also available on z/OS V2.3 and later, and satisfied the statement of direction made in Software Announcement AP20-0097, dated March 17, 2020.

z/OSMF Software Management master catalog support

To support installing z/OS V2.5 using z/OSMF, additional support was necessary in z/OSMF Software Management to define a new master catalog. This support enables z/OS to be installed with a new master catalog similar to the support that was used within the CustomPac Installation Dialog for previous z/OS releases. This capability is valuable because many clients wish to define and deploy a new master catalog with new user catalogs when upgrading to a new z/OS release level. With the delivery of PTFs for APARs PH35208 and PH33827 available on z/OS V2.3 and higher, this support is provided and is required on the driving system for installing a z/OS portable software instance.

IBM Cloud Provisioning and Management

Cloud Provisioning and Management for z/OS delivers many new functions and an improved user experience with z/OS V2.5. The following features are included to expand Cloud Provisioning and Management capabilities and offer a robust software provisioning platform on z/OS V2.5.

Cloud Provisioning and Management for z/OS introduces the capability to provision a new z/OS system from scratch. Traditionally, the process of deploying a new z/OS system in an IBM Z LPAR has been a complex and arduous process that requires the skill of an experienced system programmer. As a result, some clients might delay creating new z/OS systems, which can impact their DevOps agility and processes. In z/OS V2.5, Cloud Provisioning and Management provides a set of templates designed for ease of use in provisioning and deprovisioning z/OS systems. By selecting a z/OS provisioning template from the Cloud Provisioning software services catalog, an early tenure system programmer can provision a new instance of z/OS in

a monoplex configuration in less than one hour, compared with the days or weeks it has taken to do so.

Cloud Provisioning and Management for z/OS is enhanced to include predefined pools of LPARs. System engineers can create partition definitions using Hardware Management Console (HMC) and add these fully configured LPAR definitions to the Cloud Provisioning LPAR resource pool. During the provisioning process, an available LPAR entry is obtained from the pool automatically. The provisioning process uses the properties that are already associated with the selected LPAR entry, such as volume names, unit addresses, TCP/IP addresses, OSA definitions, and so on, to create and configure a new z/OS instance. Later, when the z/OS instance is deprovisioned, the LPAR entry is returned to the pool so that it can be reused when a new z/OS system is provisioned. With the PTF for APAR PH37859, this enhancement is also available on z/OS V2.3 and later.

- Domain shared resource pool:

  The concept of a shared resource pool is expanded to include sharing resources across an entire domain. Previously, clients were limited to sharing a resource pool within a single tenant. This support enables clients to simplify resource management in a cloud provisioning environment by enabling multiple tenants within a domain to share a resource pool. Administrators can create a domain shared resource pool once and then enable resources from the pool to be shared across multiple tenants. In contrast, if an organization's z/OS environment requires resource isolation across tenants and templates, an optimal approach is to define a tenant-specific shared resource pool or a dedicated resource pool.

  No changes are required in the middleware provisioning template to use this function because cloud provisioning orchestration dynamically detects that the template is associated with a domain shared resource pool and subsequently routes REST APIs to obtain resources from that pool.

  With the PTFs for APAR PH29813, this enhancement is available on z/OS V2.3 and later.

- Security simplification:

  The default domain supports manual security mode for creating templates and tenants. This option is intended for provisioning environments that do not use an automatic security mode. Previously, clients were required to create a new domain if their environment did not support an automatic security mode. When the default domain is created at z/OSMF startup time, it is placed in manual security mode if the **CLOUD_SEC_ADMIN** parameter is not specified in IZUPRMxx parmlib member.

  Cloud Provisioning and Management security definition sample IZUPRSEC is enhanced to configure a user ID that is not RACF SPECIAL for a cloud security administrator role. System programmers can specify a user ID that is not RACF SPECIAL for the **CLOUD_SEC_ADMIN** parameter.

  With the PTFs for APAR PH29813, this enhancement is also available on z/OS V2.3 and later.

- Template and instance management:

  Numerous enhancements are provided to help administrators efficiently manage templates and instances, including:

  - When a template is created, the domain administrator is able to identify that instances can be automatically deleted after they are deprovisioned. With this enhancement, domain administrators are no longer required to manually delete deprovisioned instances, which reduces instance management overhead.
  - When creating a template, the domain administrator is able to select an option to automatically archive provisioning workflows after the template is provisioned successfully. This can help the domain administrator to

automatically manage the number of active workflows, which are limited to 200.

- Domain administrators are able to:
  - -- Modify the published template and change the description of the template and other properties, such as workflow and instance disposition.
  - -- Set a maximum time limit for a provisioned software instance, such as 7 days, 30 days, or unlimited. When consumers provision the template, they can select the time duration for their provisioned instance. When a provisioned instance exceeds its time limit, it is marked as expired, and the consumer who provisioned the instance and domain administrators are notified. Consumers can then deprovision the instance. This enhancement can help the domain administrator to clean up stale, expired instances in a timely manner and keep the provisioning environment in good health.

With the PTFs for APAR PH29813, this enhancement is also available on z/OS V2.3 and later.

- Resource management enhancements:

  The following enhancements are provided in the Cloud Provisioning resource management function:

  - Enhancements to support modification to the software service instance name prefix. If the naming convention for the provisioned instance is not properly established when resource pools are defined, the domain administrator is able to specify a different general name prefix or switch to using the SNA application ID as the prefix.
  - Externalization of APIs so they can be programmatically invoked.

With the PTFs for APAR PH29813, this enhancement is also available on z/OS V2.3 and later.

- Support for multiple sysplexes:

  This enhancement improves the scalability and speed of z/OS middleware provisioning. By provisioning instances across multiple sysplexes using a primary z/OSMF system, an application programmer can scale the cloud provisioning environment beyond the scope of a single sysplex. Clients have access to a larger resource pool of z/OS systems. With this configuration, system and application programmers no longer have to individually define and provision middleware templates and instances using different z/OSMF access points for each sysplex in their domain.

  No changes are required in the middleware provisioning template to leverage this function. With this support, an external cloud management platform, such as Red Hat OpenShift(R), can provision z/OS middleware on any z/OS system in a private cloud infrastructure by communicating with a single z/OSMF instance using Cloud Provisioning and Management REST APIs.

  With the PTFs for APAR PH16513, this enhancement is also available on z/OS V2.3 and later.

- DASD and storage resource pool:

  With this new capability, Cloud Provisioning and Management expands resource pools of managed resources to include direct access storage device (DASD) and storage resources. Collaborating with the storage administrator, a z/OS system programmer can partition the storage resources for z/OS middleware provisioning with tenant-level isolation and limits. By isolating storage resources of specific teams, z/OS system programmers can prevent starvation, such as when teams sharing a resource deplete available space, and provide policy-based resource allocation.

  z/OS V2.5 enables a storage administrator to create storage resources with dedicated attributes and settings defined using data classes, storage classes, and management classes, such as encryption or performance objectives. The z/OS

system programmer can define a DASD and storage resource pool for specific teams and templates, enabling greater customization and quality of service tailored to tenant and template needs. Simplified and automated allocation of storage during provisioning through the use of templates in z/OSMF can enable less time to be spent on storage resource orchestration.

To dynamically obtain data set allocation attributes, the middleware provisioning templates need to be updated to invoke the resource pool services REST API, which is described in the *IBM z/OS Management Facility Programming Guide* SC27-8420-40).

With the PTFs for APAR PH16513, this enhancement is also available on z/OS V2.3 and later.

- Support SAF group name for administrator:

  z/OS 2.5 enables clients to specify SAF groups for various administrator roles when domains are created, modified, or viewed. Clients can specify an SAF group for template approvers when a template is created or modified. Previously, it was necessary to specify individual user IDs for these roles. Clients might find that using groups to represent administrators can help to simplify the management of cloud provisioning resources.

  With the PTFs for APAR PH16513, this enhancement is also available on z/OS V2.3 and later.

  To learn more about Cloud Provisioning and Management, including helpful instructions about how to get started, see the Cloud Provisioning and Management for z/OS content solution web page.

WLM batch initiator enhancements

WLM for z/OS V2.5 further improves the management of batch workloads. To meet performance goals, WLM no longer considers only available capacity on standard CPs when starting new batch initiators. Batch jobs that primarily execute on IBM z Integrated Information Processors (zIIPs) cause WLM initiators to be started preferentially on systems with available zIIP capacity. WLM manages initiators most efficiently when clients use separate service classes for batch jobs that primarily execute on standard CPs and those that primarily execute on zIIPs.

RMF and ADG

In z/OS V2.5, the priced feature, RMF, continues to provide the same functional capability that clients have come to expect. The function of RMF is delivered in two parts, the RMF and z/OS ADG. The RMF feature continues to provide performance reports, which are based on the metrics from the ADG feature, and is designed to be entitled to all clients of the RMF priced feature. The ADG is a new, separately priced feature of z/OS that provides the function of gathering performance data in raw form. The RMF priced feature includes entitlement to the ADG priced feature. No action is required of RMF clients as a result of this change.

RMF and ADG have also been enhanced to:

- Gather information on the performance of hardware using callable services, such as Integrated Cryptographic Service Facility (ICSF) format-preserving encryption and Feistel-based encryption (FFX). With the PTF for APAR OA59330, this enhancement is also available on z/OS V2.3 and later.
- Provide the capability to analyze additional ICSF data with the RMF Postprocessor Crypto hardware report. With the PTF for APAR OA60202, this enhancement is also available on z/OS V2.3 and later.
- Provide the capability to display information about System Recovery Boost when running on suitable hardware. The Boost Class in the Postprocessor CPU Report REPORTS (CPU) will indicate Recovery for the new sysplex recovery process boosts in addition to the already supported IPL, Shutdown, or None values for Boost Class. With the PTFs for APARs OA59852 and OA59321, this enhancement is also available on z/OS V2.3 and later.

- Support the CF monopolization avoidance enhancements of z/OS. With the PTF for APAR OA58726, this enhancement is also available on z/OS V2.3 and later.
- Report about storage class memory (SCM) busy percentage on a z15. RMF adds input/output processor (IOP) utilization SCM busy percentage for all IOPs in the I/O Queuing Activity (IOQ) report. With the PTF for APAR OA58727, this enhancement is also available on z/OS V2.3 and later.

RMF and ADG optimizes CF data collection:

- In z/OS V2.5, a new RMF control session option provides optimization when gathering CF hardware statistics. When the optimization mode is turned on, the ADG limits the requests to each of the data-sharing members in a sysplex by electing one system to collect the data, rather than collecting duplicate data on every system. This can significantly reduce the amount of overhead, contention, and processing for each CF. RMF CF Postprocessor reports support this enhancement.

Additional RMF enhancements include improved Postprocessor Reports by enhancing the Transport Class in the Cross-System Coupling Facility (XCF) Signaling Report to include additional XCF performance statistics. With the PTF for APAR OA60873, this enhancement is available on z/OS V2.4.

IBM z/OS Workload Interaction Correlator

The IBM z/OS Workload Interaction Correlator, announced in Software Announcement AP20-0030, dated January 21, 2020, is a z/OS priced feature that provides infrastructure to z/OS and middleware exploiters to generate synchronized, standardized, context-rich data with a focus on low CPU cost. This data enables products such as the IBM z/OS Workload Interaction Navigator, announced in Software Announcement AP20-0095, dated February 25, 2020, to dynamically identify, temporally correlate, and visualize significant deviations from normal across z/OS and its middleware silos. Together, these technologies can help a subject matter expert implicate and exonerate workload components and their activities and can reduce the time and skill required to diagnose the root cause of a z/OS workload performance problem.

z/OS Supervisor correlator data generation enhancements for products such as the z/OS Workload Interaction Navigator perform the following functions:

- Identify interdependent activities to ease switching analysis among related activities
- Define key activities with anomalies that warrant further attention
- Enable sysplex-wide analysis to dynamically identify, temporally correlate, and visualize disparate client-specific anomalies with worst offending jobs, across all sysplex members, across the z/OS stack, and on a single pane of glass, with no predefined policy

With the PTFs for APAR OA57165 and OA60372, these enhancements are available on z/OS V2.3 and later.

z/OS UNIX System Services

z/OS UNIX System Services continues to be enhanced with new functions, intended to address numerous client requirements. The following z/OS UNIX enhancements are delivered in z/OS V2.5:

- To improve monitoring the status of z/OS UNIX system limits, the default value for **LIMMSG** keyword in the z/OS UNIX PARMLIB member (BPXPRMxx) is changed, enabling warning console messages to appear whenever a system limit is reached by a given process.
- Usability enhancement to the **df** utility provide the file system size in megabyte increments, instead of bytes, optionally.
- The **BPXCOPY** utility is enhanced to enable file tagging where the target z/OS UNIX file can be tagged with a Coded Character Set Identifier (CCSID).

- A new **OVIEW** utility is provided to give users ISPF view-like capability for z/OS UNIX files. This new utility complements the already existing **OEDIT** and **OBROWSE** utilities that give users the ISPF edit-like and browse-like capabilities for z/OS UNIX files, respectively.
- Usability enhancement to the **rm** utility with new options protect from recursively deleting files when crossing file systems and preserve the root directory, protecting an authorized user from accidentally removing directories and files under the system root. With the PTF for APAR OA60001, this enhancement is available on z/OS V2.3 and later.
- The **BPXBATCH** facility has been enhanced with two new keywords, **PGMRC** and **SHRC** , which enable users to get the proper return code for the submitted job.
- The **BPXPRMXX** syntax checker has been updated to validate ZFS parameters on the ROOT and MOUNT statements, giving system programmers improved functional validation prior to re-IPLing the system.
- The z/OS UNIX component trace (**SYSOMVS CTRACE**) buffer size limit has increased from a maximum of 64 M to 2047 M for improved serviceability.
- The z/OS UNIX SMF recording function (**__smf_record()**) has been enhanced to provide extended SMF record support, enabling callers to pass in either a standard or extended SMF record number and get a proper SMF record written. With the PTF for APAR OA61192, this enhancement is available on z/OS V2.3 and later.

Cyber security

In the current world environment, there is a clear need for enterprises to further strengthen their overall cyber-security posture. Compliance regulations correspondingly continue to emerge that help clarify new risk use cases and demand functionality to mitigate them. z/OS V2.5 is uniquely positioned to address the need and includes a broad spectrum of enhancements in the areas of authentication, authorization, logging, system integrity, system and data availability, encryption for data in flight and at rest, and overall data privacy.

zERT policy-based enforcement

In z/OS V2.5, Communications Server extends zERT to provide enforcement of your network encryption standards through policy-based rules that describe different levels of cryptographic protection along with actions to take when TCP connections match those rules. zERT rules and actions are processed by the Communications Server Policy Agent and are enforced by the TCP/IP stack. This feature enables immediate notification through messages, auditing through SMF records, and even automatic termination of connections when questionable or unacceptable cryptographic protection is used. With APAR PH35304, z/OS network security administrators can create and manage zERT rules and actions through a new zERT perspective in the z/OSMF Network Configuration Assistant. This support, including the PTF for APAR PH35304, satisfies the statement of direction made in Software Announcement AP21-0051, dated March 2, 2021.

Data set encryption

z/OS V2.5 continues to drive pervasive encryption efforts within an enterprise with support for additional z/OS data set types, including sequential basic format and large format SMS-managed data sets, providing users with the capability to encrypt data without application changes and to simplify the task of compliance. This new data set support enables applications using standard BSAM and QSAM APIs to encrypt data with no, or minimal, changes. Restrictions should apply and investigation might be needed to identify eligible data sets. Applications using EXCP must change to encrypt data with the use of a new access method encryption macro. As with other supported data set types, this support enables 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 and restore, migration and recall, and replication. With the PTF for APAR OA56622, this enhancement is also available on z/OS V2.3 and later.

To learn more about Pervasive Encryption, including helpful instructions about how to get started, see the IBM Z Pervasive Encryption content solution web page.

Authorized code scanner

z/OS V2.5 provides, as an optional priced feature, an authorized code scanner of Program Call (PC) and Supervisor Call (SVC) routines for development and test environments. This scanner is designed to prevent unauthorized callers from being incorrectly granted an authorized state by detecting potential vulnerabilities in these routines with diagnostic information for remediation, as needed.

With the PTFs for APAR OA59702 and APAR OA60166, this enhancement is available on z/OS V2.4 and satisfies the statement of direction made in Software Announcement AP19-0199, dated December 10, 2019.

Resource Access Control Facility (RACF) enhanced PassTicket support

RACF PassTicket capabilities support a stronger cryptographic algorithm with additional controls for a configurable validity period and an optionally expanded character set. To aid in conversion, RACF PassTickets are able to be concurrently configured with the original PassTicket algorithm and the enhanced PassTicket algorithm, using existing profiles in the PTKTDATA class. The support includes improved error diagnostics and additional information logged in SMF. With the PTF for RACF APAR OA59196 and SAF APAR OA59197, these enhancements are available on z/OS V2.3 and later.

RACF disallowed profile management for users with ALTER access

RACF provides a mechanism to restrict profile management capabilities from users with ALTER access to a discrete profile. The existing behavior, at the installations request, is preserved on a class-wide basis for specific users or groups. This enhancement separates access rights to a resource from management rights of the profile, thus protecting the resource in a manner that assists with compliance reporting.

RACF health checks

RACF has added a number of new health checks to help clients implement stronger security controls by adding a check to confirm that:

- All data sets are protected by RACF by implementing the SETROPTS PROTECTALL(FAILURES) option
- Residual information is erased when data sets are deleted by implementing the SETROPTS ERASE(ALL) option
- PassTicket keys are encrypted and stored in ICSF
- The RACF subsystem address space is active
- Either RACF sysplex communication mode or RACF data-sharing mode is active

Certificate fingerprint support

z/OS V2.5 provides support to display the certificate fingerprint in the RACF **RACDCERT** command and store them in SMF records that handle certificates, as well as display and search for the certificate fingerprint through PKI Services web pages and store them in SMF records that handle certificates.

The certificate fingerprint support helps to improve security policy management and implementation using certificates.

IBM z/OS Encryption Readiness Technology (zERT) Network Analyzer database administration enhancements

z/OS V2.5 enhances flexibility in the zERT Network Analyzer Db2 for z/OS database schema definitions and reduces the access privileges required by the zERT Network Analyzer's database user ID through the use of Db2 partitioned tables. The supplied database schema tooling adds support for customizing the database schema name,

index names, and table names, along with many other operational parameters that were already configurable. With the PTFs for APAR PH24492 and APAR PH24494, this enhancement is also available on z/OS V2.3 and z/OS V2.4, respectively.

IBM zERT aggregation recording interval

z/OS V2.5 provides the capability to specify a recording interval for zERT aggregation SMF records that is not bound to the system's SMF recording interval. With this support, you can configure a zERT aggregation recording interval of up to 24 hours. The use of a custom aggregation recording interval can significantly reduce the number of SMF type 119 subtype 12 "zERT Summary" records that are written to SMF. This reduction also can improve the performance of the zERT Network Analyzer. With the PTFs for APAR PH25049 and APAR PH24543, this enhancement is also available on z/OS V2.3 and later.

Cryptographic hash utilities

Cryptographic hash utilities are provided in z/OS UNIX, including md5, rmd160, sha1, sha224, sha256, sha384, and sha512. These utilities use the Integrated Cryptographic Service Facility (ICSF) One-Way Hash Generate callable service to generate a cryptographic hash for input files respectively. The utilities can check cryptographic hashes read from input files. These utilities are provided with the PTF for OA59201 on z/OS V2.3, or later.

Improved auditability and serviceability for password syscall

Support is added to the password syscall to include the caller's Port of Entry IP address when calling the SAF to authenticate the user. The security product includes this IP address in SMF Type 80 records. This improves the logging and auditing capability of users by system security administrators. Also, this additional information in SMF is helpful in determining network setup issues. With the PTF for APAR OA59444, this enhancement is also available on z/OS V2.3 and later.

z/OS Diagnostics Analyzer

IBM Z Data Privacy for Diagnostics is designed to tag and redact sensitive user data in diagnostic dumps after they are captured on an IBM z15. The base capability has been generally available and provides z/OS APIs to tag known locations of sensitive user data as "sensitive = yes" or metadata as "sensitive = no."z/OS Diagnostics Analyzer, a new enhancement for Data Privacy for Diagnostics, is generally available and uses built-in and custom identifiers to tag additional sensitive data in previously untagged pages. Data determined to be sensitive is fully redacted and a new dump is created that can be shared with third-party vendors for root cause analysis. Data Privacy for Diagnostics also gives the user the capability to keep the complete original dump and maintain First Failure Data Capture. z/OS 2.5 supports SYSMDUMP and TDUMP and to use the z/OS APIs and the z/OS Diagnostics Analyzer as post-processing steps without impacting the dump capture time. See fix category **IBM.Function.DataPrivacyForDiagnostics** and keyword "DPFD/K" to include all of the support.

See the IBM Support portal for the following APAR information:

- Available with CD for z/OS V2.3 and later:
  - Storage manager API support: PTF for APARs OA57633 and OA58289
  - Service aids support: PTF for APAR OA57570
  - z/OS Diagnostics Analyzer support: PTF for OA58114
  - Db2 support: PTF for APAR PH15940
  - IMS support: PTF for APAR PH14059
  - VSAM support: PTF for APAR OA58730

FIPS compliance support for platform interoperability

z/OS V2.5 provides FIPS compliance support for platform interoperability by completing the FIPS enablement to the UNIX-file-based Kerberos database, following the same support provided by the RACF Kerberos database in the last release.

IPsec certificate reporting enhancements

The **ipsec -k** display command, the IPsec network management interface (NMI), and SMF type 119 subtype 73 and 74 records are enhanced to simplify the process of validating IPsec-related X.509 certificate configurations. The enhancements provide information about the X.509 certificates used during Internet Key Exchange (IKE) negotiations by the local and remote IKE peers, including certificate expiration information, certificate serial number, and subject and issuer distinguished names.

System SSL, AT-TLS, and IPsec certificate diagnostics

z/OS Cryptographic Services System Secure Sockets Layer (SSL) is enhanced to provide the capability for applications to obtain diagnostic details about the digital certificates used to authenticate a remote peer. z/OS Communications Server Application Transparent Transport Layer Security (AT-TLS) and IPsec services are enhanced to use the new certificate data for diagnosing failed negotiations. The enhancements are designed to simplify certificate-related problem determination in many common error scenarios by making critical diagnostic information easier to access and understand. The diagnostic information is written to syslogd when AT-TLS handshakes fail while validating a remote peer's certificate or when IKE negotiations fail while validating a remote IKE peer's certificate. The System SSL enhancements are available to any System SSL application for similar diagnostic improvements.

IBM z/OSMF support for JSON Web Token (JWT)

z/OSMF supports JWT by optionally returning a JWT token during authentication and accepting a JWT token for authentication of z/OSMF services. With the PTF for APAR PH12143, this enhancement is also available on z/OS V2.3 and later.

ICSF enhancements

With z/OS V2.5, ICSF no longer provides new downloadable web deliverables. The current web deliverables will be available until they reach end of service. New cryptographic hardware support is made available with APARs with appropriate SMP/E FIXCAT tags to enable clients to obtain cryptographic updates along with all the other z/OS hardware updates. ICSF unique installation is not required. New ICSF functions, not related to hardware support, are delivered as z/OS updates as per all base z/OS components. Clients requiring new cryptographic hardware exploitation on z/OS V2.3 and z/OS V2.4 need to install ICSF FMID HCR77D1 to get the SMP/E FIXCAT updates.

In z/OS V2.5, ICSF supports the following:

- Updates to the key data sets to enable storage of larger keys, such as the Dilithium algorithm asymmetric keys
- Improved capability to audit the age and key rotation policies associated with CEX master keys
- New SAF protections for elliptic-curve cryptography (ECC) keys
- The capability to limit the use of archived keys to decryption operations
- Additional hardware exploitation for certain SSL/TLS ciphers
- Crypto Express 7 coprocessors. With HCR77D1, this support also is available on z/OS V2.4.

With the PTFs for APAR OA58880, the following enhancements also are available on z/OS V2.4:

- New Edwards curves, Ed448 and Ed25519, for digital signatures
- New lattice-based algorithm for digital signatures

- CP Assist for Cryptographic Function (CPACF) protected key support for ECC Edwards and a subset of National Institute of Standards and Technology (NIST) curves
- TR-31 support for Hash-based Message Authentication Code (HMAC) keys
- Enhancements to Advanced Encryption Standard (AES) PIN(R) functions
- Additional options on TR-31 export services
- Europay, MasterCard, and Visa (EMV) service updates in support of CVN-18

With the PTF for APAR OA60317, the following enhancement is also available on z/OS V2.4:

- Enablement of clear keys to be used for generating and verifying message authentication codes (MAC) using the HMAC algorithm. CSNBMGN2, CSNBMVR2, CSNBHMG, and CSNBHMV enable the input key identifier to be a clear key token. When a clear key is provided as input to these services, ICSF exploits CPACF functions to perform the cryptographic operations to generate or verify the MAC. In addition, the PKCS#11 services CSFPHMG and CSFPHMV exploit CPACF functions when the key object is a clear key and the hashing algorithm is SHA-1 or SHA-2.

With the PTFs for APAR OA59593 for the z15 and OA60355 for the z14, the following enhancements are available on z/OS V2.4:

- The capability to use AES keys in Derive Unique Key Per Transaction (DUKPT) services. Key derivation, especially the DUKPT derivation process, is critical for financial transactions, and with the expansion to include AES derivation keys, enterprises have additional capability to migrate their applications to a more secure AES-based cryptography.
- Enhancements to AES-based ISO-4 PIN block processing. Building on prior efforts, APAR OA59593 completes the support for ISO-4 PIN blocks that enable financial institutions to exploit stronger AES cryptography.
- Format Preserving Encryption (FPE) algorithms. FPE algorithms enable data to be encrypted in such a way that it retains the original form of data. For example, a 16-byte account number when encrypted with an FPE algorithm results in ciphertext that is 16 numeric digits. The addition of callable services introduces FPE algorithms FF1, FF2, and FF2.1, which include:
  - FPE Encipher (CSNBFFXE)
  - FPE Decipher (CSNBFFXD)
  - FPE Translate (CSNBFFXT)
- A new curve for ECC, *secp256k1*, often referred to as a Koblitz Curve.
- Updated warn mode processing that includes services that use AES and RSA keys. The warn mode option enables clients to identify changes to their applications required to exploit a coprocessor configured in PCI HSM compliance mode.

With the PTF for ICSF APAR OA60318, these capabilities are available for V2.2 and later:

- A new method for encrypting a DES secure key token is introduced. This is the first proprietary Triple DES (TDES) key token (also known as a key block) to be independently reviewed and confirmed to be compliant with Payment Card Industry (PCI) Security Standard Council (SSC) PIN Security key block requirements as updated September 30, 2020. The new key block is backward compatible with existing applications, can be stored in the Cryptographic Key Data Set (CKDS), and introduces a new wrapping method called WRAPENH3. The wrapping method controls the cryptographic algorithms used to encrypt the clear-key material within the boundary of the coprocessor, resulting in what is known as a "secure key" from an ICSF perspective.
- ICSF offers a utility that can be used to migrate all existing TDES secure keys in a CKDS to the new wrapping method, or it can be done on a key-by-key basis using updated callable services. In addition, a new SAF resource provides a way to override existing applications such that wherever a wrapping method

is specified or defaulted, the wrapping method is automatically updated to WRAPENH3.

Resiliency

Resiliency and high availability are traditional strengths of the Z and z/OS platforms, with mature and well-established support for Parallel Sysplex(R) clustering to provide redundancy and recovery mechanisms to avoid many planned and unplanned outages that can affect single systems, as well as robust recovery mechanisms to mitigate many single-system events. z/OS V2.5 builds on these strengths with improvements to data resiliency through improved cloud tiering and backup and restore of data to mitigate against data loss or corruption. New System Recovery Boost support provides additional capacity to power you through sysplex recovery activities. New enhancements also help quickly identify anomalous behavior as it occurs and provide information to expedite root-cause analysis and corrective actions to be taken. Additional improvements provide an even higher level of availability, serviceability, and disaster recovery capabilities for z/OS workloads.

z/OS anomaly mitigation

z/OS V2.5 delivers a solution leveraging PFA, Runtime Diagnostics, WLM, and JES2 that further enables clients to detect anomalous behavior in near real-time, so potential problems can be proactively addressed before an availability-impacting event can develop. This solution utilizes new PFA checks to predict a wider range of anomalous behavior, including above-the-bar private storage exhaustion, JES2 resource exhaustion, and performance degradation using WLM velocity of address spaces. When a prediction of anomalous behavior occurs, PFA issues a report containing diagnostic data including Runtime Diagnostics analysis in many scenarios and recommended operator actions to mitigate the problem. The capability to create a visual depiction of resource usage leading to resource exhaustion is also available. These new capabilities enhance the capability to quickly identify anomalous behavior, expedite root-cause analysis, and take appropriate action to address the issue.

Data resiliency through data backup and recovery

A critical aspect of a robust cyber resiliency plan is the management of frequent backup copies to provide the capability to recover from accidental or malicious data corruption and destruction events. To address the significant resources that the creation of these backup copies consume, z/OS DFSMS delivers additional solutions based on the IBM DS8000(R) transparent cloud tiering architecture. Transparent cloud tiering enables z/OS DFSMS to direct all data movement for data set and full-volume operations to be performed by the DS8000 storage controller, consuming virtually no MIPS for the actual data movement to and from cloud object storage or an IBM TS7700 DS8000 object store. IBM z/OS 2.5 delivers the following enhancements:

- DFSMSdss full-volume dump support for transparent cloud tiering from a standard production volume, FlashCopy(R) target, or Safeguarded Copy recovery volume. DS8900 transparent cloud tiering can reduce CPU utilization by up to 98% for z/OS DFSMSdss full-volume dump-and-restore operations of Mod54 or larger volumes by performing all of the data movement directly between the DS8900 and a TS7700 DS8000 object store or cloud object storage.[1] Off-premises, cloud object storage copies can enable air-gapped point-in-time copies of an entire enterprise, enabling a high level of resiliency from a malicious data destruction event and assisting with regulatory compliance. With the PTF for APAR OA57526, this enhancement is also available on z/OS V2.3 and later.

  [1] The results are based on internal IBM measurements running z/OS V2R4 with PTFs for APAR OA60146. Full-volume dumps and restores of MOD54 volumes on a DS8900 were performed on a z15 configured with Crypto Express7S cards. Results can vary based on workload, configuration, software level, and the quantity and size of disk volumes.

- Compression support for transparent cloud tiering with TS7700 as an object store. Data is compressed within an IBM DS8900F prior to being transferred

over TCPIP to a TS7700 configured as an object store. This enables clients to store more data in the same physical space within the TS7700, which can reduce the cost per GB and bandwidth requirements with no impact on IOPS performance, and maximize system resources by avoiding compression of data already compressed or encrypted by IBM Z. With the PTFs for APARs OA59465 and OA59466, these enhancements are available on z/OS V2.3 and later.

These cyber-resiliency solutions demonstrate the continued IBM commitment for z/OS to leverage leading-edge hardware solutions for data management, such as the z15 security capabilities of pervasive data set encryption, z15 data compression, z15 sort accelerator, and transparent cloud tiering solutions.

CF monopolization avoidance

When CF requests directed to a single structure consume a disproportionate share of CF resources, workloads targeting other structures can be constrained and unable to achieve acceptable service times and throughput. The degradation can affect critical system components and middleware applications across the entire sysplex. Enhancements exploit a new function introduced by CF control code level (CFLEVEL) 24 on z15 servers to prevent a runaway sysplex application from monopolizing a disproportionate share of CF resources. With the PTF for APAR OA56774, this enhancement is also available on z/OS V2.3 and later.

ISPF usability enhancements

Enhancements for ISPF provide improved messages when editing, browsing, and viewing members enabled for PDSE v2 member generations. Additionally, the **ISPF SUBMIT** command is enhanced to include support for the **SUBSYS** parameter for specification of an alternate JES. This would be exploited in cases in which directing a submit to the JES2 emergency subsystem is required.

System Recovery Boost sysplex recovery enhancements

The initial z/OS support for System Recovery Boost for z15 servers provided additional capacity to accelerate image-level recovery (image shutdown and re-IPL/middleware startup) and enabled accelerated processing of workload backlogs that occurred as a result of image-level events following the re-IPL. System Recovery Boost provided additional image-level processing capacity and parallelism for images during the IPL and shutdown boost periods by making use of two underlying z15 technologies:

- Speed Boost that enables sub-capacity general-purpose processors to run at full capacity speed
- zIIP boost that makes general-purpose work eligible to run on zIIP processors.

With enhancements to System Recovery Boost, IBM z/OS V2.5 extends the solution to provide value in scenarios beyond image-level shutdowns and startups. System Recovery Boost offers a new class of short-term recovery process boosts addressing a specific set of z/OS Parallel Sysplex recovery events, utilizing the same underlying boost technologies. These Parallel Sysplex recovery events can cause workload disruption while the sysplex is recovering from a component failure or reconfiguration event, until such time as the recovery processing completes and steady-state sysplex operation is restored. Boosted processor capacity is automatically provided to mitigate these short-term recovery impacts and restore normal sysplex operation as quickly as possible; the boosted processor capacity also can continue for a short time following restoration of steady-state operation. This provides workload catchup following the recovery activity.

The solution automatically provides boosted processor capacity and parallelism for the following specific recovery events:

- Sysplex partitioning. Boosts all surviving systems in the sysplex as they recover and take on additional workload following the planned or unplanned removal of a system from the sysplex.
- CF structure recovery. Boosts all systems participating in CF structure recovery processing, including CF structure rebuild, duplexing failover, and re-duplexing.

- CF data sharing member recovery. Boosts all systems participating in recovery following disconnection of a CF locking data-sharing member, such as a Db2 IRLM instance or an SMSVSAM instance, from a CF lock structure with lock resources held.
- HyperSwap. Boosts all systems participating in a HyperSwap process.

These short-duration recovery process boost periods are a separate class of boosts from the existing image-level IPL and shutdown boost periods. Each participating image receives boosts as follows:

- One IPL boost for image-level startup (60 minutes)
- One shutdown boost for image-level shutdown (30 minutes)
- Several recovery process boosts, each of less than 5 minutes duration, with a total usage of no more than 30 minutes of recovery process boost time within a 24-hour period.

During recovery process boost periods, either Speed Boost, zIIP boost, or both can be applied under the control of the z/OS **BOOST =** system parameter. The use of System Recovery Boost Upgrade temporary capacity record activations for recovery process boosts is not supported. The System Recovery Boost Upgrade temporary capacity is for use only in conjunction with image-level IPL and shutdown boosts.

Use of the recovery process boosts requires a z15 T01 or T02 with new LPAR firmware support for recovery process boosts. This is provided by LPAR machine change level (MCL) P46602.005 and later, for z15 Driver 41C.

For z/OS V2.3 and z/OS V2.4, the PTFs are included in the z/OS FIXCAT for System Recovery Boost support, named IBM.Function.SystemRecoveryBoost **.** This enhancement is also available on z/OS V2.3 and later.

To learn more about System Recovery Boost, including helpful instructions about how to get started, see the IBM Z System Recovery Boost content solution web page.

Automatic Restart Manager (ARM) support for restarting a system task

The XCF ARM previously did not support registering system tasks as restartable ARM elements. This type of started task is common for elements started early during system initialization. Such system tasks cannot register with ARM, leaving them exposed to the possibility that they will fail and not be restarted automatically by ARM. With this enhancement to IXCARM REGISTER support, system tasks (such as ICSF) can register with ARM and be restarted as started tasks in the event they terminate abnormally. This is designed to provide improved availability for the functions those system tasks represent. With the PTF for APAR OA59120, this enhancement is also available on z/OS V2.3 and later.

Catalog and IDCAMS enhancements

The following enhancements are delivered:

- IDCAMS DIAGNOSE function is enhanced to check catalog entries for the rename-in-progress bits, and if they are on, write a message including the entry name and the issue. This alerts the installation to a circumstance that could result in job failures.
- The Catalog Address Space (CAS) RESTART function is enhanced to change the master catalog during a CAS RESTART. Previously, the master catalog could only be changed at IPL.
- The Catalog **MODIFY** command is enhanced to enable comments following the command parameters when preceded by a blank.
- The IDCAMS DELETE MASK function is enhanced to include two new parameters, **TEST** and **EXCLUDE** . The **TEST** parameter is provided to enable DELETE MASK to return all the objects that would have been deleted if the **TEST** parameter had not been specified. The **EXCLUDE** parameter enables a subset of data sets that match the MASK filter to be excluded from those being deleted.

- The **IDCAMS DEFINE MODEL** parameter support is enhanced to model the **KEYLABEL** parameter.
- The **IDCAMS REPRO** support is enhanced to move its I/O buffers above the line. This helps to avoid 878 (insufficient space) abnormal ends (abends).

AI Ecosystem enablement on z/OS

z/OS V2.5 clients can now enable the use of AI in their mission-critical applications to improve business outcomes by utilizing z/OS Container Extensions to broadly expand their choices of AI tools, frameworks, or libraries to deploy colocated with z/OS applications.

AI enablement on z/OS V2.5 includes the following:

- To accelerate the adoption of AI on IBM Z, a client can deploy prebuilt container images for popular machine learning frameworks such as Tensorflow, available through the IBM Z and LinuxONE Container Image Repository.
- Build, deploy, and operationalize machine learning models on IBM z/OS through IBM Watson(R) Machine Learning for z/OS (IBM WMLz) 2.3 has been upgraded with more optimization for z/OS that improves online scoring service performance for various types of machine learning models. In addition, the latest release is designed to easily import deep learning models in ONNX format and deploy them into an optimized scoring service running in zCX-enabling deep learning inferencing workloads with IBM WMLz 2.3 to be zIIP eligible.
- If you are not sure how best to use AI with your z/OS application, you can use the WMLz 2.3 Online Scoring Community Edition function, a lightweight no-charge version of IBM WMLz, to try out the streamlined up-and-running IBM WMLz inferencing in-transaction approach.

To learn more about AI enablement, including how to get started, see the Journey to AI on IBM Z and LinuxONE content solution web page.

Scalability and performance

Clients have come to expect a high degree of scalability from z/OS, whether running a small logical partition (LPAR) for testing or a massive 32-system sysplex. Maintaining and enhancing the scalability and performance of z/OS is one of the key areas of z/OS value. While this includes relieving constraints caused by growth of workloads, it also includes exploiting new hardware capabilities such as Z Sort acceleration.

IBM JES2 memory usage enhancements

JES2 is also delivering enhancements that reduce the below-the-bar private-area memory requirements for certain JES2 checkpoint structures in z/OS V2.5. Infrastructure enhancements enable supporting JES2 checkpoint structures in above-the-bar storage. Additionally, SPOOL track group map checkpoint structures are delivered to move from below-the-bar to above-the-bar storage, reducing JES2 below-the-bar storage usage. This support is also available for z/OS V2.4 with APAR OA61229.

IBM Integrated Accelerator for Z Sort

The z15 provides a hardware-accelerated approach to sorting using a new CPU coprocessor that can be exploited by software using the new **SORTL** instruction. By providing one sort accelerator per core, frequently used functions can be accelerated to help speed up sorting, shorten batch windows, and improve select database functions such as reorganization. Integrated Accelerator for Z Sort, which is standard on the z15, is designed to reduce CPU costs and improve the elapsed time for eligible in-memory sort workloads, which typically occur during client batch windows. **DFSORT** and Db2 for z/OS Utilities Suite exploit the **SORTL** instruction.

Integrated Accelerator for Z Sort is available for the following:

- V2.3 with DFSORT PTFs UI90067 and UI71976

- V2.4 with DFSORT PTFs UI90068 and UI71978
- Db2 12 for z/OS with the PTF UI71668

IBM Z Batch Network Analyzer (zBNA) provides support for Integrated Accelerator for Z Sort in z/OS V2.5, with the application DFSORT Z Sort, which uniquely identifies **DFSORT** -eligible candidates and estimates z15 benefits using data from the current environment without requiring a z15. The new information is integrated with the traditional batch information already available in zBNA. This no-charge tool is available for download from the IBM Techdocs Library web page.

High Performance FICON® for IBM Z (zHPF) volume table of contents (VTOC) I/O performance

zHPF I/O technology has been used for many years to improve the performance of data set I/O for sequential, partitioned, and VSAM data sets. Enhancements in DFSMS extend the use of zHPF to VTOC I/O performed by common VTOC access facility (CVAF) and Fast VTOC/VVDS (FVV) services and are designed to provide significant reduction of connect time for applications that sequentially read the entire VTOC. In addition, updates to the VTOC use zHPF. With the PTFs for APAR OA58111, this enhancement is also available on z/OS V2.3 and later.

zHyperLink write statistics

IBM zHyperLink is a short-distance, mainframe-attached link that provides up to 10 times lower latency than does high-performance Fibre Connection (FICON). Low I/O latencies deliver value through improved workload-elapsed times and faster transactional response times and contribute to lower scaling costs. Enhancements in DFSMS provide a command to enable users to display zHyperLink write statistics for a data set and optionally clear them. In addition, new SMF fields are created in the SMF type 42 subtype 6 record to show more information related to zHyperLink write failures. With the PTFs for APAR OA57718, this enhancement is also available on z/OS V2.2 and later.

Data set open limit relief

z/OS V2.5 delivers enhancements that reduce the below-the-bar private-area memory requirements for each open data set, especially for Media Manager and Db2 open data sets. This provides constraint relief for the number of data sets that can be concurrently opened within a given address space. This can be an important consideration in environments such as a Db2 address space that is using Db2 single-tablespace data sets. Additionally, Db2 enhancements provided by the PTFs for APAR PH09189 and PH33238 complement this z/OS constraint relief by providing improved support to better manage Db2 open data sets against the DSMAX limit for a Db2 address space.

Faster mount of zFS file systems

An improvement to overall IPL time is delivered in the area of zFS file systems. Depending on how zFS file systems are copied or dumped, the system has historically waited (65 seconds) to maintain integrity if used outside of the sysplex. With this enhancement, which needs to be installed on both the copying and the restoring system, the need for the wait time is avoided. With the PTFs for APAR OA59145, this enhancement is also available on z/OS V2.3 and later.

RSM support for more than 4 TB of real memory

z/OS V2.5 enables the creation of new workloads by allowing applications to make use of up to 16 TB of real processor storage as allowed by the IBM Z server. Any storage above 4 TB is available as 2 GB large pages. This enables new workloads that require vast amounts of memory, including analytics and in-memory databases, to be created and run on the platform.

Networking

IBM z/OS Communications Server, a high-availability enterprise transaction and data server, provides common applications, such as FTP, Telnet, and the remote execution

of applications. Built for optimum productivity, it provides a secure platform for developing and sharing mainframe workloads. With z/OS V2.5, Communications Server delivers Shared Memory Communications Version 2 (SMCv2), which provides the performance advantages of SMC without being constrained to a single IP subnet. Additionally, Communications Server provides improved notification of the availability of TCP/IP services after initialization.

Shared Memory Communications (SMC) Version 2 for RDMA - multiple IP subnet support

Last year, IBM introduced Shared Memory Communications Version 2, providing multiple IP subnet support for SMC, initially for SMC-D for z/OS V2.4 and the IBM z15. In z/OS V2.5, IBM introduces the next phase of SMCv2 support with SMC-R along with support for RoCEv2 ("Routable RoCE"). The SMC-Rv2 multiple IP subnet support is an enterprise data center solution that expands the benefits of SMC-R capability to additional z/OS application workloads and to new use cases by extending the reach of SMC-R beyond a single IP subnet. RoCEv2 uses your existing IP routing topology to provide support for updated RoCE industry standards, enabling SMC-Rv2 to cross IP subnets. RoCEv2 support is provided by the IBM RoCE Express2 (10 and 25 GbE) features on z15.

SMTPD compatibility enhancements for Communications Server SMTP (CSSMTP)

The CSSMTP application is enhanced with three configuration parameters to provide better compatibility with SMTPD for migration from SMTPD to CSSMTP. With the PTF for APAR PH18237, this enhancement is also available on z/OS V2.3 and later.

Notification of availability of TCP/IP extended services

When the TCP/IP stack completes initialization, a stack initialization complete message is issued before the TCP/IP extended services are available. For many operational tasks and applications that depend on z/OS TCP/IP communication services, that message is insufficient. TCP/IP also relies on optional extended services, including sysplex dynamic VIPA (DVIPA) initialization, IP security infrastructure initialization, and completion of network policy installation. This enhancement enables automated operations and applications to be notified when required TCP/IP extended services have completed initialization. A new message and event notification facility (ENF) event indicate that extended services have completed initialization. The new ENF event is augmented with a name/token pair. This solution improves z/OS startup for network operations and applications with dependencies on TCP/IP extended services availability.

Statement of direction

z/OSMF Software Management master catalog disconnect support

z/OSMF Software Management support for creating a new master catalog when installing z/OS portable software instances is already available. Follow-on support is planned to enable disconnecting the new master catalogs from the driving system, and other associated removals. These activities are not immediately required for installation of a z/OSMF portable software instance, but are planned to ensure that the removal of the connection of the new master catalog can be done easily with z/OSMF Software Management.

z/OSMF Software Management data set merge support

When installing a new z/OS release, clients have indicated that certain data sets need to be merged during the installation process to simplify their data set and UNIX(R) file system management. This data set merge capability exists within the CustomPac Installation Dialog, but does not currently exist within z/OSMF Software Management. This capability is planned to replace the CustomPac Installation Dialog for installing z/OS software. Therefore, a data set merge capability is planned to be

added to z/OSMF Software Management to help clients continue to manage their z/OS systems.

New file system support to access z/OS data sets

IBM plans to provide a new file system type that will render traditional z/OS data sets accessible by the z/OS UNIX name space. This will enable z/OS UNIX applications, tools, and utilities transparent access to data in these data sets in a secure and consistent manner.

Withdrawal of support for VTAM® Link Station Architecture (LSA) and TCP/IP LAN Channel Station (LCS) devices

As stated in Hardware Announcement AG21-0028, dated May 4, 2021, many IBM Z clients continue to rely on Systems Network Architecture (SNA) applications for mission-critical workloads, and IBM has no plans to discontinue support of the SNA protocol, including the SNA APIs. However, IBM Z support for the SNA protocol being transported natively out of the server using OSA Express 1000BASE-T adapters configured as channel type "OSE" will be eliminated in a future hardware system family. With the support for OSE planned to be discontinued, support for the related VTAM and TCP/IP device drivers is also planned to be discontinued. IBM intends z/OS V2.5 to be the last z/OS release to provide support for LSA (SNA) and LCS (TCP/IP) devices. z/OS systems that have workloads that rely on the SNA protocol and utilize OSE networking channels as the transport should be updated to make use of some form of SNA over IP technology, where possible, such as Enterprise Extender.

Removal of OSA DEVICE/LINK/HOME configuration support

z/OS V2.5 is planned to be the last z/OS release to provide support for the TCP/IP profile statements DEVICE, LINK, and HOME for OSA connectivity. All z/OS users who currently use DEVICE, LINK, or HOME for OSA connectivity should migrate to the INTERFACE statement for defining OSA Express connectivity in their TCP/IP profile.

Improved data access for SMF data

IBM intends to deliver a System Management Facility (SMF) data access toolkit leveraging Python and Jupyter Notebooks. This new capability can help clients access SMF data in an easy and modern way. This can enable data science solutions, IT analytics solutions, or artificial intelligence solutions, helping to bring clients valuable insights into their IT operations without needing unique z/OS skills to access and process the data. IBM further intends to deliver Jupyter Notebook tutorials that will guide users on how to access, process, and visualize the SMF raw data.

Containers and Kubernetes orchestration support for IBM z/OS

As stated in Software Announcement AP20-0017, dated June 23, 2020, IBM intends to provide clients with capabilities that will help accelerate their transformation to greater portability and agility in a hybrid cloud environment by delivering containers and Kubernetes orchestration support for IBM z/OS applications and workloads. This move towards greater portability and agility will be supported by taking advantage of architecture-independent standards and technology for container-based development and deployment on z/OS. As this container-based technology is deployed on core systems of record, it will ensure the isolation of environments and other users from the effects of other containers. By providing a container runtime for z/OS, and the orchestration of those containers, users can:

- Increase speed from development to deployment of z/OS-based applications
- Increase predictability and repeatability across the application lifecycle for z/OS applications
- Enhance practices across z/OS development, testing, and operations through a wide ecosystem of open-source application container-based tools

These proposed capabilities for z/OS will reinforce and further strengthen the IBM focus on hybrid cloud to unlock business value and drive growth for clients. This can be achieved by providing technology that incorporates the client's core mission-critical applications and workloads across their z/OS middleware into a container-based cloud-native strategy.

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

Reference information

For information about z/OS V2.5 Preview, see Software Announcement AP21-0051, dated March 2, 2021.

For information about IBM Container Hosting Foundation, see Software Announcement AP21-0119, dated June 1, 2021.

For information about z/OS V2.4 and CD enhancements for z/OS V2.4, see:

- Software Announcement AP21-0206, dated June 22, 2021
- Software Announcement AP21-0094, dated March 16, 2021
- Software Announcement AP20-0469, dated December 8, 2020
- Software Announcement AP20-0455, dated October 13, 2020
- Software Announcement AP20-0362, dated September 22, 2020
- Software Announcement AP20-0211, dated June 16, 2020
- Software Announcement AP20-0097, dated March 17, 2020
- Software Announcement AP19-0199, dated December 10, 2019
- Software Announcement AP19-0326, dated July 23, 2019
- Software Announcement AP19-0011, dated February 26, 2019

For information about z15, see:

- Hardware Announcement AG20-0056, dated August 4, 2020
- Hardware Announcement AG20-0006, dated April 14, 2020
- Hardware Announcement AG20-0013, dated January 14, 2020
- Hardware Announcement AG19-0094, dated November 26, 2019
- Hardware Announcement AG19-0032, dated September 12, 2019

For information about z14 Model ZR1, see:

- Hardware Announcement AG18-0074, dated October 2, 2018
- Hardware Announcement AG18-0018, dated April 10, 2018

For information about z14, see:

- Hardware Announcement AG18-0074, dated October 2, 2018
- Hardware Announcement AG17-0093, dated November 28, 2017
- Hardware Announcement AG17-0044, dated July 17, 2017

For information about z13(R), see:

- Hardware Announcement AG19-0045, dated May 7, 2019
- Hardware Announcement AG19-0017, dated February 12, 2019
- Hardware Announcement AG16-0058, dated June 7, 2016
- Hardware Announcement AG15-0060, dated March 3, 2015
- Hardware Announcement AG15-0001, dated January 14, 2015

For information about z13s(R), see:

- Hardware Announcement AG16-0058, dated June 7, 2016
- Hardware Announcement AG16-0002, dated February 16, 2016

For information about zEnterprise(R) EC12, see Hardware Announcement AG12-0167, dated August 28, 2012.

For information about zEnterprise BC12, see Hardware Announcement AG13-0134, dated July 23, 2013.

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	2.5.0	z/OS

Technical information

Specified operating environment

Hardware requirements

z/OS V2.5 operates on the following IBM Z servers:

- z15 Models T01 and T02
- z14 Models M01-M05
- z14 Model ZR1
- z13
- z13s

For a complete description of z/OS V2.5 hardware requirements, see *z/OS V2.5 Planning for Installation* (GA32-0890), in IBM Documentation on September 30, 2021.

Software requirements

The z/OS base is a system that can be IPLed. There are no software prerequisites to IPL. Specific functions might require additional products not included in the z/OS base or optional features of z/OS. See *z/OS V2.5 Planning for Installation* (GA32-0890) in IBM Documentation on September 30, 2021 for a list of specific software requirements.

If you run z/OS V2.5 as a guest of IBM z/VM , z/VM must be at a supported level.

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

Ordering z/OS through the internet

Shopz provides an easy way to plan and order your z/OS packaged offering. It will analyze your current installation, determine the correct product migration, and present your new configuration based on z/OS. Additional products can also be added to your order. Shopz will determine whether all product requisites are satisfied. Shopz is available in all countries. For more details and availability, go to the Shopz website.

New licensees

Orders for new licenses can be placed now. Registered clients can access IBMLink for ordering information and charges. Shipment will not occur before the availability date. Unless a later date is specified, orders entered before the planned availability date will be assigned a schedule date of one week following availability.

- Orders entered with a scheduled date before the planned availability date will be shipped z/OS V2.4.
- Orders entered with a scheduled ship date after planned availability will be shipped z/OS V2.5. Unless a later date is specified, an order is scheduled for the week following order entry.

Shipment will begin on the planned availability date.

- Orders that ship before the planned availability will receive z/OS V2.4.
- Orders that ship after the planned availability date will receive z/OS V2.5

New users of z/OS V2.5 should specify:

Type: 5650 Model: ZOS

Basic license

To order a basic license, specify the z/OS V2.5 program number 5650-ZOS. Proceed to select the features listed which are required and then select any optional features.

Parallel Sysplex License Charges (PSLC)

Parallel Sysplex(R) license charge (PSLC) basic license

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

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

Entitlement identifier	Description	License option/Pricing metric
S01728S	z/OS V2 Alternate Base	Basic MLC, PSLC
S01728T	z/OS V2 Base	Basic MLC, PSLC
S01728V	z/OS V2 BDT FTF	Basic MLC, PSLC
S01728W	z/OS V2 BDT SNA NJE	Basic MLC, PSLC
S01728X	z/OS V2 BookManager(R) Build	Basic MLC, PSLC
S01728Z	z/OS V2 XL C/C++	Basic MLC, PSLC
S017290	z/OS V2 DFSMSdss	Basic MLC, PSLC
S017291	z/OS V2 DFSMSdsshsm	Basic MLC, PSLC
S017292	z/OS V2 DFSMSrmm	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
S018K16	z/OS V2 Adv Data Gatherer	Basic MLC, PSLC
S018HT1	z/OS V2 Auth Code Scanner	Basic MLC, PSLC
S018H13	z/OS V2 Workload Int Corr	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 V2.5

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 DFSMSdss	Basic MLC, AWLC
S017291	z/OS V2 DFSMSdsshsm	Basic MLC, AWLC
S017292	z/OS V2 DFSMSrmm	Basic MLC, AWLC
S017293	z/OS V2 DFSMStvs	Basic MLC, AWLC
S017294	z/OS V2 DFSORT	Basic MLC, AWLC

Entitlement identifier	Description	License option/Pricing metric
S017295	z/OS V2 GDDM-PGF	Basic MLC, AWLC
S017296	z/OS V2 GDDM-REXX	Basic MLC, AWLC
S017297	z/OS V2 HCM	Basic MLC, AWLC
S017298	z/OS V2 HLASM Toolkit	Basic MLC, AWLC
S017299	z/OS V2 Infoprint Server	Basic MLC, AWLC
S01729B	z/OS V2 JES3	Basic MLC, AWLC
S01729C	z/OS V2 RMF	Basic MLC, AWLC
S01729D	z/OS V2 SDSF	Basic MLC, AWLC
S01729F	z/OS V2 Security Server	Basic MLC, AWLC
S01780D	z/OS V2 zEDC	Basic MLC, AWLC
S018G2F	z/OS V2 RUCSA	Basic MLC, AWLC
S018K16	z/OS V2 Adv Data Gatherer	Basic MLC, AWLC
S018HT1	z/OS V2 Auth Code Scanner	Basic MLC, AWLC
S018H13	z/OS V2 Workload Int Corr	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 V2.5

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 DFSMSdss	Basic MLC, AEWLC
S017291	z/OS V2 DFSMSdsshsm	Basic MLC, AEWLC
S017292	z/OS V2 DFSMSrmm	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
S018K16	z/OS V2 Adv Data Gatherer	Basic MLC, AEWLC
S018HT1	z/OS V2 Auth Code Scanner	Basic MLC, AEWLC
S018H13	z/OS V2 Workload Int Corr	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 V2.5

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 DFSMSdss	Basic MLC, CMLC
S017291	z/OS V2 DFSMSdsshsm	Basic MLC, CMLC
S017292	z/OS V2 DFSMSrmm	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
S018K16	z/OS V2 Adv Data Gatherer	Basic MLC, CMLC
S018HT1	z/OS V2 Auth Code Scanner	Basic MLC, CMLC
S018H13	z/OS V2 Workload Int Corr	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 V2.5

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

Entitlement identifier	Description	License option/Pricing metric
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 DFSMSdss	Basic MLC, MzNALC
S017291	z/OS V2 DFSMSdsshsm	Basic MLC, MzNALC
S017292	z/OS V2 DFSMSrmm	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
S01780D	z/OS V2 zEDC	Basic MLC, MzNALC
S018G2F	z/OS V2 RUCSA	Basic MLC, MzNALC
S018K16	z/OS V2 Adv Data Gatherer	Basic MLC, MzNALC
S018HT1	z/OS V2 Auth Code Scanner	Basic MLC, MzNALC
S018H13	z/OS V2 Workload Int Corr	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 V2.5

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

Entitlement identifier	Description	License option/Pricing metric
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 DFSMSdss	Basic MLC, SCLC
S017291	z/OS V2 DFSMSdsshsm	Basic MLC, SCLC
S017292	z/OS V2 DFSMSrmm	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
S018K16	z/OS V2 Adv Data Gatherer	Basic MLC, SCLC
S018HT1	z/OS V2 Auth Code Scanner	Basic MLC, SCLC
S018H13	z/OS V2 Workload Int Corr	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 DFSMSdss	Basic MLC, VWLC
S017291	z/OS V2 DFSMSdsshsm	Basic MLC, VWLC
S017292	z/OS V2 DFSMSrmm	Basic MLC, VWLC
S017293	z/OS V2 DFSMStvs	Basic MLC, VWLC
S017294	z/OS V2 DFSORT	Basic MLC, VWLC
S017295	z/OS V2 GDDM-PGF	Basic MLC, VWLC
S017296	z/OS V2 GDDM-REXX	Basic MLC, VWLC
S017297	z/OS V2 HCM	Basic MLC, VWLC
S017298	z/OS V2 HLASM Toolkit	Basic MLC, VWLC
S017299	z/OS V2 Infoprint Server	Basic MLC, VWLC
S01729B	z/OS V2 JES3	Basic MLC, VWLC
S01729C	z/OS V2 RMF	Basic MLC, VWLC

Entitlement identifier	Description	License option/Pricing metric
S01729D	z/OS V2 SDSF	Basic MLC, VWLC
S01729F	z/OS V2 Security Server	Basic MLC, VWLC
S01780D	z/OS V2 zEDC	Basic MLC, VWLC
S018G2F	z/OS V2 RUCSA	Basic MLC, VWLC
S018K16	z/OS V2 Adv Data Gatherer	Basic MLC, VWLC
S018HT1	z/OS V2 Auth Code Scanner	Basic MLC, VWLC
S018H13	z/OS V2 Workload Int Corr	Basic MLC, VWLC

Entry Workload License Charges (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 DFSMSdss	Basic MLC, EWLC
S017291	z/OS V2 DFSMSdsshsm	Basic MLC, EWLC
S017292	z/OS V2 DFSMSrmm	Basic MLC, EWLC
S017293	z/OS V2 DFSMStvs	Basic MLC, EWLC
S017294	z/OS V2 DFSORT	Basic MLC, EWLC
S017295	z/OS V2 GDDM-PGF	Basic MLC, EWLC
S017296	z/OS V2 GDDM-REXX	Basic MLC, EWLC
S017297	z/OS V2 HCM	Basic MLC, EWLC
S017298	z/OS V2 HLASM Toolkit	Basic MLC, EWLC
S017299	z/OS V2 Infoprint Server	Basic MLC, EWLC
S01729B	z/OS V2 JES3	Basic MLC, EWLC
S01729C	z/OS V2 RMF	Basic MLC, EWLC
S01729D	z/OS V2 SDSF	Basic MLC, EWLC
S01729F	z/OS V2 Security Server	Basic MLC, EWLC
S01780D	z/OS V2 zEDC	Basic MLC, EWLC
S018G2F	z/OS V2 RUCSA	Basic MLC, EWLC
S018K16	z/OS V2 Adv Data Gatherer	Basic MLC, EWLC
S018HT1	z/OS V2 Auth Code Scanner	Basic MLC, EWLC
S018H13	z/OS V2 Workload Int Corr	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 DFSMSdsshsm	Basic MLC, NALC
S017292	z/OS V2 DFSMSrmm	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

IBM Z 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 DFSMSdss	Basic MLC, zELC
S017291	z/OS V2 DFSMSdsshsm	Basic MLC, zELC
S017292	z/OS V2 DFSMSrmm	Basic MLC, zELC
S017293	z/OS V2 DFSMStvs	Basic MLC, zELC
S017294	z/OS V2 DFSORT	Basic MLC, zELC
S017295	z/OS V2 GDDM-PGF	Basic MLC, zELC
S017296	z/OS V2 GDDM-REXX	Basic MLC, zELC
S017297	z/OS V2 HCM	Basic MLC, zELC
S017298	z/OS V2 HLASM Toolkit	Basic MLC, zELC
S017299	z/OS V2 Infoprint Server	Basic MLC, zELC
S01729B	z/OS V2 JES3	Basic MLC, zELC
S01729C	z/OS V2 RMF	Basic MLC, zELC
S01729D	z/OS V2 SDSF	Basic MLC, zELC
S01729F	z/OS V2 Security Server	Basic MLC, zELC
S01780D	z/OS V2 zEDC	Basic MLC, zELC
S018G2F	z/OS V2 RUCSA	Basic MLC, zELC
S018K16	z/OS V2 Adv Data Gatherer	Basic MLC, zELC
S018HT1	z/OS V2 Auth Code Scanner	Basic MLC, zELC
S018H13	z/OS V2 Workload Int Corr	Basic MLC, zELC

IBM Z 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 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.

IBM Z New Application License Charge (zNALC) 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, 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 DFSMSdss	Basic MLC, zNALC
S017291	z/OS V2 DFSMSdsshsm	Basic MLC, zNALC
S017292	z/OS V2 DFSMSrmm	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
S018K16	z/OS V2 Adv Data Gatherer	Basic MLC, zNALC
S018HT1	z/OS V2 Auth Code Scanner	Basic MLC, zNALC
S018H13	z/OS V2 Workload Int Corr	Basic MLC, zNALC

Basic machine-readable material

z/OS V2.5 feature description	z/OS V2.5 orderable supply ID
Base	S018JP3
Alternate Base	S018JP5

The following no-charge features are added to z/OS V2.5 and can be ordered effective September 17, 2021. 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 V2.5 feature description	z/OS V2.5 orderable supply ID
Authorized Code Scanner	S018JR2

z/OS V2.5 feature description	z/OS V2.5 orderable supply ID
Workload Int Corr	S018JR3

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 V2.5

The following optional features, offered at no additional charge, can be ordered effective September 17, 2021.

z/OS V2.5 feature description	z/OS V2.5 orderable supply ID
Communications Server Security Level 3	S018JPZ
z/OS Security Level 3	S018JR0

Optional priced features

The following optional no-charge media features can be ordered effective September 17, 2021. 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 V2.5 feature description	z/OS V2.5 orderable supply ID
Alternate Base	S018JP5
Base	S018JP3
BDT FTF	S018JPC
BDT SNA NJE	S018JPD
XL C/C++	S018JPF
DFSMSdss	S018JPH
DFSMSdsshsm	S018JPJ
DFSMSrmm	S018JPK
DFSMStvs	S018JPL
DFSORT	S018JPM
GDDM-PGF	S018JPN
GDDM-REXX	S018JPP
HCM	S018JP7
HLASM Toolkit	S018JPR
Infoprint Server	S018JPS
JES3	S018JP8
RMF	S018JP9
SDSF	S018JPV
Security Server	S018JPW
zEDC	S018JZX
RUCSA	S018JP2
Adv Data Gatherer	S018K11
Auth Code Scanner	S018HT2

z/OS V2.5 feature description	z/OS V2.5 orderable supply ID
Workload Int Corr	S018H14

Optional unpriced language features

The z/OS V2.5 language features will become generally available on the same date the release becomes available.

z/OS V2.5 provides support in the languages listed below. However, not all elements within z/OS V2.5 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 V2.5 and can be ordered effective September 17, 2021.

The language features for z/OS V2.5 are:

z/OS V2.5 feature description	z/OS V2.5 orderable supply ID
JPN ALT Base	S018JP6
JPN Base	S018JP4
JPN XL C/C++	S018JPG
JPN Infoprint Server	S018JPT
JPN RMF	S018JPB
JPN Security Server	S018JPX

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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 Documentation sections for z/OS V2.5 and other supported releases.
- z/OS V2.5 Library, hosted on Resource Link, to download individual or grouped PDFs. An IBMid and password are required.
- Adobe™ Indexed PDF Collections (SC27-8430) to easily conduct offline searches on z/OS product documentation.
- Downloadable collections of IBM Documentation plug-ins for clients who host their own instances of IBM Documentation for z/OS (KC4z).
- IBM Z and LinuxONE 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.

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 on the planned availability date. 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 availability date.

- CBPDO shipments will begin within 3 business days after the planned availability date.
- ServerPac availability and shipments will begin within 3 - 4 weeks after the planned availability date due to additional customization and data input verification.

Terms and conditions

The terms 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

IBM Z entry license charge (zELC)

Entitlement identifier	Description	License option/Pricing metric
S01728S	z/OS V2 Alternate Base	Basic MLC, zELC
S01728T	z/OS V2 Base	Basic MLC, zELC
S01728V	z/OS V2 BDT FTF	Basic MLC, zELC
S01728W	z/OS V2 BDT SNA NJE	Basic MLC, zELC
S01728X	z/OS V2 BookManager Build	Basic MLC, zELC
S01728Z	z/OS V2 XL C/C++	Basic MLC, zELC
S017290	z/OS V2 DFSMSdss	Basic MLC, zELC
S017291	z/OS V2 DFSMSdsshsm	Basic MLC, zELC
S017292	z/OS V2 DFSMSrmm	Basic MLC, zELC
S017293	z/OS V2 DFSMStvs	Basic MLC, zELC

Entitlement identifier	Description	License option/Pricing metric
S017294	z/OS V2 DFSORT	Basic MLC, zELC
S017295	z/OS V2 GDDM-PGF	Basic MLC, zELC
S017296	z/OS V2 GDDM-REXX	Basic MLC, zELC
S017297	z/OS V2 HCM	Basic MLC, zELC
S017298	z/OS V2 HLASM Toolkit	Basic MLC, zELC
S017299	z/OS V2 Infoprint Server	Basic MLC, zELC
S01729B	z/OS V2 JES3	Basic MLC, zELC
S01729C	z/OS V2 RMF	Basic MLC, zELC
S01729D	z/OS V2 SDSF	Basic MLC, zELC
S01729F	z/OS V2 Security Server	Basic MLC, zELC
S01780D	z/OS V2 zEDC	Basic MLC, zELC
S018G2F	z/OS V2 RUCSA	Basic MLC, zELC
S018K16	z/OS V2 Adv Data Gatherer	Basic MLC, zELC
S018HT1	z/OS V2 Auth Code Scanner	Basic MLC, zELC
S018H13	z/OS V2 Workload Int Corr	Basic MLC, zELC

Parallel Sysplex license charge (PSLC) basic license

Entitlement identifier	Description	License option/Pricing metric
S01728S	z/OS V2 Alternate Base	Basic MLC, PSLC
S01728T	z/OS V2 Base	Basic MLC, PSLC
S01728V	z/OS V2 BDT FTF	Basic MLC, PSLC
S01728W	z/OS V2 BDT SNA NJE	Basic MLC, PSLC
S01728X	z/OS V2 BookManager Build	Basic MLC, PSLC
S01728Z	z/OS V2 XL C/C++	Basic MLC, PSLC
S017290	z/OS V2 DFSMSdss	Basic MLC, PSLC
S017291	z/OS V2 DFSMSdsshsm	Basic MLC, PSLC
S017292	z/OS V2 DFSMSrmm	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
S018K16	z/OS V2 Adv Data Gatherer	Basic MLC, PSLC
S018HT1	z/OS V2 Auth Code Scanner	Basic MLC, PSLC
S018H13	z/OS V2 Workload Int Corr	Basic MLC, PSLC

Advanced Workload License Charges (AWLC) basic license

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

Entitlement identifier	Description	License option/Pricing metric
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 DFSMSdss	Basic MLC, AWLC
S017291	z/OS V2 DFSMSdsshsm	Basic MLC, AWLC
S017292	z/OS V2 DFSMSrmm	Basic MLC, AWLC
S017293	z/OS V2 DFSMStvs	Basic MLC, AWLC
S017294	z/OS V2 DFSORT	Basic MLC, AWLC
S017295	z/OS V2 GDDM-PGF	Basic MLC, AWLC
S017296	z/OS V2 GDDM-REXX	Basic MLC, AWLC
S017297	z/OS V2 HCM	Basic MLC, AWLC
S017298	z/OS V2 HLASM Toolkit	Basic MLC, AWLC
S017299	z/OS V2 Infoprint Server	Basic MLC, AWLC
S01729B	z/OS V2 JES3	Basic MLC, AWLC
S01729C	z/OS V2 RMF	Basic MLC, AWLC
S01729D	z/OS V2 SDSF	Basic MLC, AWLC
S01729F	z/OS V2 Security Server	Basic MLC, AWLC
S01780D	z/OS V2 zEDC	Basic MLC, AWLC
S018G2F	z/OS V2 RUCSA	Basic MLC, AWLC
S018K16	z/OS V2 Adv Data Gatherer	Basic MLC, AWLC
S018HT1	z/OS V2 Auth Code Scanner	Basic MLC, AWLC
S018H13	z/OS V2 Workload Int Corr	Basic MLC, AWLC

Advanced Entry Workload License Charges (AEWLC) basic license

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 DFSMSdss	Basic MLC, AEWLC
S017291	z/OS V2 DFSMSdsshsm	Basic MLC, AEWLC
S017292	z/OS V2 DFSMSrmm	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
S018K16	z/OS V2 Adv Data Gatherer	Basic MLC, AEWLC
S018HT1	z/OS V2 Auth Code Scanner	Basic MLC, AEWLC

Entitlement identifier	Description	License option/Pricing metric
S018H13	z/OS V2 Workload Int Corr	Basic MLC, AEWLC

Sub-capacity charges for AWLC, AEWLC, CMLC, zNALC, VWLC, EWLC, and MWLC products

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

Sub-capacity charges terms and conditions

Z software charges at less than full machine capacity for eligible sub-capacity products apply when z/OS, z/TPF, or z/VSE(R) is running in z/Architecture(R) (64-bit) mode on a Z server, no other z/OS- based, TPF-based, or VSE-based operating system respectively is licensed to that server, and the required information is provided by the client in accordance with the applicable terms.

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

- Sign and abide by the terms of one of the following:
  - Attachment for IBM System z Advanced Workload License Charges (Z125-8538)
  - Attachment for IBM System z Advanced Entry Workload License Charges (Z125-8755)
  - Attachment for IBM Country Multiplex Pricing (Z126-6965)
  - Attachment for zNALC License Charges on IBM System z (Z125-7454)
  - Attachment for IBM System z Workload License Charges (Z125-6516
  - Attachment for EWLC, TWLC, zELC, and z/OS.e License Charges (Z125-6587)
  - Attachment for IBM System z Midrange Workload License Charges (Z125-7452)
- Obtain the latest version of the Sub-Capacity Reporting Tool.
- Install any sub-capacity product and IBM z Systems(R) Licensed Internal Code (LIC) service required for sub-capacity charging. Required service will be listed on the IBM Z software pricing help website.
- Collect SMF or SCRT89 data as required by the Sub-Capacity Reporting Tool. Retain the collected data for a period of not less than six months.
- Use the IBM provided Sub-Capacity Reporting Tool to process the collected SMF or SCRT89 data. The Sub-Capacity Report produced by the tool is used to determine required license capacity for the sub-capacity products. Required license capacity is determined based on the largest MSU value of a sub-capacity product running concurrently in all LPARs during the reporting period. IBM reserves the right to request the system data that supports these product-defined capacity values for a period of up to six months after the data was collected.
- Provide an initial Sub-Capacity Report to begin to receive the benefits of less than full machine capacity charges. Sub-capacity charging will follow submission of a Sub-Capacity Report. There will be no retroactive application of sub-capacity charges.
- Submit Sub-Capacity Reports monthly between the 2nd and 9th days of the month after the reporting period.
- Submit Sub-Capacity Reports for all sub-capacity products with complete data for the entire reporting period via the method specified on the IBM Z software pricing help website.

  Sub-Capacity Reports that reflect a changed product defined capacity will be considered to be orders placed by the client without further action on the client's

part, and IBM is authorized to make any resulting billing increase or decrease, including the ordering of any necessary new licenses. To discontinue licenses, move licenses between machines, report a hardware model upgrade, or enable or disable product features, the client must contact IBM or their IBM Business Partner.

- Configure the machine to send weekly Transmit System Availability Data (TSAD) to IBM via the IBM z Systems Remote Support Facility (RSF). If the machine cannot connect via the RSF, provide this TSAD through an alternate means documented in the *SCRT Users Guide* (SG24-6522) on the IBM Z software pricing help website.

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 DFSMSdss	Basic MLC, CMLC
S017291	z/OS V2 DFSMSdsshsm	Basic MLC, CMLC
S017292	z/OS V2 DFSMSrmm	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
S018K16	z/OS V2 Adv Data Gatherer	Basic MLC, CMLC
S018HT1	z/OS V2 Auth Code Scanner	Basic MLC, CMLC
S018H13	z/OS V2 Workload Int Corr	Basic MLC, CMLC

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 DFSMSdss	Basic MLC, MzNALC
S017291	z/OS V2 DFSMSdsshsm	Basic MLC, MzNALC
S017292	z/OS V2 DFSMSrmm	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

Entitlement identifier	Description	License option/Pricing metric
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
S01780D	z/OS V2 zEDC	Basic MLC, MzNALC
S018G2F	z/OS V2 RUCSA	Basic MLC, MzNALC
S018K16	z/OS V2 Adv Data Gatherer	Basic MLC, MzNALC
S018HT1	z/OS V2 Auth Code Scanner	Basic MLC, MzNALC
S018H13	z/OS V2 Workload Int Corr	Basic MLC, MzNALC

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 DFSMSdss	Basic MLC, SCLC
S017291	z/OS V2 DFSMSdsshsm	Basic MLC, SCLC
S017292	z/OS V2 DFSMSrmm	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
S018K16	z/OS V2 Adv Data Gatherer	Basic MLC, SCLC
S018HT1	z/OS V2 Auth Code Scanner	Basic MLC, SCLC
S018H13	z/OS V2 Workload Int Corr	Basic MLC, SCLC

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 DFSMSdss	Basic MLC, VWLC
S017291	z/OS V2 DFSMSdsshsm	Basic MLC, VWLC
S017292	z/OS V2 DFSMSrmm	Basic MLC, VWLC

Entitlement identifier	Description	License option/Pricing metric
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
S018K16	z/OS V2 Adv Data Gatherer	Basic MLC, VWLC
S018HT1	z/OS V2 Auth Code Scanner	Basic MLC, VWLC
S018H13	z/OS V2 Workload Int Corr	Basic MLC, VWLC

Entry Workload License Charge (EWLC):

Entry Workload License Charge (EWLC) Basic License

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 DFSMSdss	Basic MLC, EWLC
S017291	z/OS V2 DFSMSdsshsm	Basic MLC, EWLC
S017292	z/OS V2 DFSMSrmm	Basic MLC, EWLC
S017293	z/OS V2 DFSMStvs	Basic MLC, EWLC
S017294	z/OS V2 DFSORT	Basic MLC, EWLC
S017295	z/OS V2 GDDM-PGF	Basic MLC, EWLC
S017296	z/OS V2 GDDM-REXX	Basic MLC, EWLC
S017297	z/OS V2 HCM	Basic MLC, EWLC
S017298	z/OS V2 HLASM Toolkit	Basic MLC, EWLC
S017299	z/OS V2 Infoprint Server	Basic MLC, EWLC
S01729B	z/OS V2 JES3	Basic MLC, EWLC
S01729C	z/OS V2 RMF	Basic MLC, EWLC
S01729D	z/OS V2 SDSF	Basic MLC, EWLC
S01729F	z/OS V2 Security Server	Basic MLC, EWLC
S01780D	z/OS V2 zEDC	Basic MLC, EWLC
S018G2F	z/OS V2 RUCSA	Basic MLC, EWLC
S018K16	z/OS V2 Adv Data Gatherer	Basic MLC, EWLC
S018HT1	z/OS V2 Auth Code Scanner	Basic MLC, EWLC
S018H13	z/OS V2 Workload Int Corr	Basic MLC, EWLC

New Application License Charge (NALC) charges

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

Entitlement identifier	Description	License option/ Pricing metric
S01728Z	z/OS V2 XL C/C++	Basic MLC, NALC
S017291	z/OS V2 DFSMSdsshsm	Basic MLC, NALC
S017292	z/OS V2 DFSMSrmm	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

IBM Z New Application License Charge (zNALC) Basic License

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 DFSMSdss	Basic MLC, zNALC
S017291	z/OS V2 DFSMSdsshsm	Basic MLC, zNALC
S017292	z/OS V2 DFSMSrmm	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
S018K16	z/OS V2 Adv Data Gatherer	Basic MLC, NALC
S018HT1	z/OS V2 Auth Code Scanner	Basic MLC, NALC
S018H13	z/OS V2 Workload Int Corr	Basic MLC, NALC

For all local charges, contact your IBM representative.

Variable charges:

The applicable processor based one-time charge will be based on the group of the designated machine on which the program is licensed for use. If the program is designated to a processor in a group for which no charge is listed, the charge of the next higher group listed applies. For movement to a machine in a higher group, an upgrade charge equal to the difference in the then-current charges between the two groups will apply. For movement to a machine in a lower group, there will be no adjustment or refund of charges paid.

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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

** Bangladesh, Bhutan, India, Maldives, Nepal, and Sri Lanka

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