

z/OS
2.5

Introduction and Release Guide



Note

Before using this information and the product it supports, read the information in [“Notices” on page 103.](#)

This edition applies to Version 2 Release 5 of z/OS® (5650-ZOS) and to all subsequent releases and modifications until otherwise indicated in new editions.

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How to send your comments to IBM

We invite you to submit comments about the z/OS product documentation. Your valuable feedback helps to ensure accurate and high-quality information.

Important: If your comment regards a technical question or problem, see instead [“If you have a technical problem”](#) on page ix.

Submit your feedback by using the appropriate method for your type of comment or question:

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If your comment is about the information that is provided in the z/OS product documentation library, send a detailed email to mhvrcfs@us.ibm.com. We welcome any feedback that you have, including comments on the clarity, accuracy, or completeness of the information.

To help us better process your submission, include the following information:

- Your name, company/university/institution name, and email address
- The following deliverable title and order number: z/OS Introduction and Release Guide, GA32-0887-50
- The section title of the specific information to which your comment relates
- The text of your comment.

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z/OS information

This information explains how z/OS references information in other documents and on the web.

When possible, this information uses cross document links that go directly to the topic in reference using shortened versions of the document title. For complete titles and order numbers of the documents for all products that are part of z/OS, see *z/OS Information Roadmap*.

To find the complete z/OS library, go to [IBM Documentation \(www.ibm.com/docs/en/zos\)](http://www.ibm.com/docs/en/zos).

Summary of changes

This information includes terminology, maintenance, and editorial changes. Technical changes or additions to the text and illustrations for the current edition are indicated by a vertical line to the left of the change.

Note: IBM z/OS policy for the integration of service information into the z/OS product documentation library is documented on the z/OS Internet Library under [IBM z/OS Product Documentation Update Policy \(www-01.ibm.com/servers/resourcelink/svc00100.nsf/pages/ibm-zos-doc-update-policy?OpenDocument\)](http://www-01.ibm.com/servers/resourcelink/svc00100.nsf/pages/ibm-zos-doc-update-policy?OpenDocument).

Summary of changes for z/OS Introduction and Release Guide for Version 2 Release 5 (V2R5)

The following content is new, changed, or no longer included in V2R5.

New

The following content is new.

June 2023 refresh

- z/OS Communications Server has new functions to consider. For details, see [“Communications Server new functions to consider” on page 30](#)
 - [“Support considerations” on page 30](#)
 - ZOSMIGV2R5_NEXT_CS_LSA
 - ZOSMIGV2R5_NEXT_CS_OSADLH
 - [“Hardware support” on page 31](#)
 - OSA-Express Enhanced Inbound Blocking (EIB) with TCP/IP APAR PH44281 and SNA APAR OA62831
 - Communications Server support for RoCE Express3 with TCP/IP APAR PH34117
 - [“Simplification” on page 32](#)
 - Communications Server exploitation of the IBM Function Registry for z/OS with SNA APAR OA63555
 - [“Scalability and performance” on page 33](#)
 - Persistent Pause Support for Sysplex Distributor DVIPAs with APAR PH50408
 - [“Enhancing security” on page 35](#)
 - z/OS UNIX syslogd support for secure logging over TCP with APAR PH47666
 - AT-TLS Currency with System SSL with APAR PH49284
 - AT-TLS support for x25519 and x448 key exchange for TLSv1.2 with APAR PH45902
 - Support for SMF compliance evidence with APAR PH37372
 - FTP server JES access control with APAR PH42618
 - IBM zERT Network Analyzer passphrase and password management support with APAR PH43119

May 2023 refresh

- TIOC is added to the list of base elements. See [“z/OS base elements” on page 1](#).
- z/OS Change Tracker and z/OS Authorized Code Scanner (zACS) are added to the list of optional features. See [“z/OS optional features” on page 2](#).

- A description is added for IBM z/OS Liberty Embedded. See [“IBM z/OS Liberty Embedded”](#) on page 8.
- A description is added for zEnterprise® Data Compression (zEDC) for z/OS. See [“zEnterprise Data Compression \(zEDC\) for z/OS ”](#) on page 21.

March 2023 refresh

- You can specify multiple qualifiers to be represented as a single directory in DSFS. See [“Specifying multiple qualifiers to be represented as a single high-level qualifier directory”](#) on page 51 (APAR OA63218)
- You can determine whether high-level language applications such as COBOL, PL/I, Java™, and so on are running in the 31-bit/64-bit interoperability environment. See [“Determining interoperability environments”](#) on page 71. (APAR PH45216, which applies to 2.5 and 2.4)

June 2022 refresh

- Support for password phrase intervals is added to RACF® with APAR OA61951, which applies to z/OS 2.5. See [“RACF Password Phrase Interval Support”](#) on page 86.
- The auditing capability is added to the **su** command. See [“Auditing capability for the su command”](#) on page 96. (APAR OA62850, which also applies to z/OS 2.4)

May 2022 refresh

- z/OS is enhanced to enable the collection of compliance data from the IBM z16 CP Assist for Cryptographic Function (CPACF) counters and several z/OS products and components. A new z/OSMF compliance data collection REST API sends an event notification facility (ENF) signal to all systems. Participating products and components collect and write compliance data to new SMF 1154 records associated with its unique subtype. The SMF 1154 records can be integrated into solutions, such as IBM Z® Security and Compliance Center. See [“z/OS compliance data collection”](#) on page 24.
- A new priced feature, IBM z/OS Change Tracker, is added to z/OS 2.5. See [“IBM z/OS Change Tracker”](#) on page 17.
- A new base element, IBM Z Deep Neural Network Library (zDNN), is now available. See [“IBM Z Deep Neural Network Library”](#) on page 8. (APAR OA62901 (z/OS 2.5); APAR OA62849 (z/OS 2.4))
- Starting with z/OS V2R5 with APAR OA62267 applied, a RACF VSAM data set can be encrypted. If you choose to encrypt a RACF data set, you must ensure that your infrastructure supports data set encryption in its disaster and recovery planning. See [“RACF VSAM database encryption support”](#) on page 86.

April 2022 refresh

- IBM provides the IBM z16™ Upgrade Workflow as part of the z/OS product. This workflow contains the z/OS upgrade steps for the IBM z16™ server. The workflow includes z/OS considerations, restrictions, and actions to take before and after you receive your server, and a checklist of items that are planned to be discontinued on future servers. Updates and fixes for the workflow are delivered through the standard z/OS service process. For more information, see [“IBM® z16™ Upgrade Workflow”](#) on page 23.
- [“ICSF: Support for Crypto Express8 adapters, Kyber keys, and new key sizes for the Dilithium digital signature algorithm”](#) on page 42 was added. (APAR OA61609, which applies to Cryptographic Support for z/OS V2R2 - z/OS V2R4 (FMID HCR77D1) and z/OS V2R5).
- z/OS Data Set File System is available. See [“Data Set File System \(DSFS\)”](#) on page 52 (APAR OA63150, 2.5 only)
- Integrated Security Services is updated with a new function enhancement. See [“Kerberos IP Address Bind Support”](#) on page 66. (APAR OA61733, which also applies to z/OS 2.4)
- [“Providing a merged view of files and directories using the union file system \(UFS\)”](#) on page 96 was added. (APAR OA61759, z/OS 2.5 only)

January 2022 refresh

- [“z/OS Advanced Data Gatherer”](#) on page 20 is updated with information about enabling the IBM z/OS Workload Interaction Correlator feature and [“z/OS Workload Interaction Correlator”](#) on page 20 is added.

November 2021 refresh

- [“ICSF: CCA and PKCS #11 Algorithm Currency enhancements”](#) on page 42 (APAR OA61253 also applies to Cryptographic Support for z/OS V2R2 - z/OS V2R4 (FMID HCR77D1)).
- The *z/OS Management Services Catalog* (zMSC) task is new. With zMSC, administrators can create services that allow system programmers to perform repetitive or common tasks on a z/OS system. For more information, see [“z/OSMF z/OS Management Services Catalog”](#) on page 95.

Prior to November 2021 refresh

- IBM provides the z/OS V2R5 Upgrade Workflow and the z/OS z15™ Upgrade Workflow as part of the z/OS product. Updates and fixes for the z/OS Upgrade Workflows are delivered through the standard z/OS service process. With the workflows now included in the z/OS product, you can access these important technical upgrade materials faster and more conveniently than by obtaining them from an external location. For more information, see [“z/OS V2R5 Upgrade Workflow”](#) on page 23.
- There is new information about migrating to the latest version of z/OS OpenSSH in [“z/OS OpenSSH”](#) on page 13.
- The z/OS Data Gatherer base element and the z/OS Advanced Data Gatherer priced feature have been added. See [“z/OS Data Gatherer”](#) on page 12 and [“z/OS Advanced Data Gatherer”](#) on page 20.
- For RSM, information is added about defining a system with more than 4 TB of online real memory. See [“Real Storage Manager \(RSM\) considerations”](#) on page 26.
- The DFSMSdfp base element has new functions to consider. For more information, see:
 - [“OAM-provided commands for lookup of OAM macro and OSREQ error codes”](#) on page 52
 - [“Cloud as a tier”](#) on page 52
 - [“Cloud and file system backup support”](#) on page 53
 - [“Generic variable OAMVAR on CBROAMxx ONLYIF statement”](#) on page 53
 - [“OAM Db2 connection management enhancements”](#) on page 54 `dfsmssoam_db2_mgmt.dita`
 - [“OSMC CBR9370I message enhanced to now display deletion attempted and done statistics”](#) on page 54
 - [“DB2ID restriction lift for multiple OAM configuration with only 1 object subsystem”](#) on page 54
 - [“Multiple OAM object address space limit raised from 2 to 5”](#) on page 55
- z/OS Communications Server has new functions to consider. For details, see [“Communications Server new functions to consider”](#) on page 30
 - [“Hardware support”](#) on page 31
 - [“Usability and skills”](#) on page 32
 - [“Scalability and performance”](#) on page 33
 - [“Systems management”](#) on page 35
 - [“Enhancing security”](#) on page 35
 - [“Application development”](#) on page 41
- Cryptographic Services has new functions to consider for ICSF. For more information, see:
 - [“ICSF: Changed master key for audit purposes”](#) on page 43
 - [“ICSF: Enforce SAF checking of the private-key name in ECC tokens”](#) on page 43
 - [“ICSF: KDS support for larger key sizes”](#) on page 44
 - [“ICSF: Limit archived keys to decrypt operations only”](#) on page 44

- [“ICSF: Support for password-based key derivation function 2 \(PBKDF2\)” on page 44](#)
- [“ICSF: Cryptographic services enhancements for CCA” on page 44](#)
- Cryptographic Services has new functions to consider for System SSL. For more information, see:
 - [“System SSL: Certificate failure diagnostics \(RAS\)” on page 51](#)
- Cryptographic Services has new functions to consider for PKI Services. For more information, see:
 - [“PKI Certificate Fingerprint support” on page 50](#)
 - [“PKI removal of PKI TrustPolicy plugin” on page 50](#)
- Hardware Configuration Definition (HCM) has new functions to consider. For more information, see:
 - [“Support of Alternate Subchannel Sets for z/VM operating systems” on page 60](#)
 - [“Hardware only dynamic activation” on page 60](#)
 - [“Virtual function number prompt” on page 61](#)
 - [“New processor support” on page 61](#)
- Integrated Security Services has a new function to consider. For more information, see
 - [“Kerberos Full NDBM FIPS Support” on page 66](#)
- Language Environment® has new functions to consider. For more information, see:
 - [“Java-COBOL interoperability” on page 71](#)
 - [“IBM Open Enterprise SDK for Go” on page 71](#)
 - [“Allocating aligned memory blocks” on page 71](#)
 - [“Availability of exec functions in AMODE 64 multithreaded environments” on page 71](#)
- Resource Measurement Facility (RMF) has new functions to consider. For more information, see [“New features, functions, and support for z/OS 2.5” on page 73](#).
- z/OS Security Server (RACF) has new functions to consider. For more information, see:
 - [“RACF data base encryption and I/O modernization” on page 86](#)
 - [“RACF Certificate Fingerprint support” on page 87](#)
 - [“RACF Disallow profile management for users with ALTER access” on page 87](#)
 - [“RACF Enhanced PassTicket support with improved cryptographic methods and options” on page 87](#)
 - [“RACF Health Checks” on page 88](#)
 - [“RACF VSAM Data Set” on page 88](#)
- z/OS Management Facility (z/OSMF) has new functions to consider. For more information, see [“z/OS Management Facility \(z/OSMF\)” on page 13](#).
- z/OS UNIX System Services has new functions to consider. For more information, see:
 - [“Enhanced viewing of files in the z/OS UNIX file system” on page 97](#)
 - [“Monitoring system limits by default ” on page 97](#)
 - [“Tagging files when using BPXCOPY ” on page 97](#)
 - [“Returning proper return codes from submitted jobs ” on page 97](#)
 - [“Managing processes and threads ” on page 98](#)
 - [“Enhanced BPXPRMxx syntax checker” on page 98](#)
 - [“Extended SMF record support in _smf_record\(\)” on page 98](#)

Changed

The following content is changed.

- The structure of the Resource Measurement Facility (RMF) feature has changed. See [“Resource Measurement Facility \(RMF\)”](#) on page 19.

Deleted

The following content was deleted.

- All content that is not related to z/OS versions V2R4 or V2R5 was removed.
- It has been announced that EIM and OCSF and all their plug-ins will be removed in this release.

Summary of changes for z/OS Introduction and Release Guide for z/OS Version 2 Release 4 (V2R4)

The following content is new, changed, or no longer included in V2R4.

New

The following content is new.

December 2021 refresh

- The z/OS Management Services Catalog (zMSC) task is new. With zMSC, administrators can create services that allow system programmers to perform repetitive or common tasks on a z/OS system.

May 2021 refresh

- [“Preventing files from being deleted from the root directory”](#) on page 98.

August 2020 refresh

- [“Using wildcards when specifying aggregates”](#) on page 95 was added.
- [“Copying from MVS to z/OS UNIX and from z/OS UNIX to MVS”](#) on page 98 was added.
- [“z/OSMF Software Update task”](#) on page 94 was added.

July 2020 refresh

- [“RACF ENF signal for revoked user by password attempts”](#) on page 88 was added.
- [“Storage Management Subsystem: Displaying zHyperlink write statistics”](#) on page 55 was added.

June 2020 refresh

- z/OS Authorized Code Scanner (zACS) is added. For details, see [“z/OS Authorized Code Scanner \(zACS\)”](#) on page 20.

Prior to June 2020 refresh

- New system-level functions to consider, such as new base elements, optional features, or interfaces are listed in [“z/OS system-level new functions to consider”](#) on page 23.
- BCP (MVS™) has new functions to consider. For details, see [“Cross-System Coupling Facility \(XCF\) enhancements for z/OS V2R4”](#) on page 29.
- MVS SMF has a new function to consider. For details, see [“SMF Workload Interaction Correlator considerations”](#) on page 28.
- BCPii has new functions to consider: For details, see:
 - [“BCPii considerations”](#) on page 25.
- Cryptographic Services has new functions to consider. For details, see [“Cryptographic Services new functions to consider”](#) on page 42:
 - [“ICSF: Enhancements for IBM z15 Model T02 and EMV service update”](#) on page 45
 - [“ICSF: Enhancements for Crypto Express5S \(CCA Release 5.4 and later\) and Crypto Express6S \(CCA Release 6.2 and later\)”](#) on page 45

- [“ICSF: CCA redirection for Regional Crypto Enablement” on page 46](#)
- [“ICSF: ChaCha20 and Poly1305 algorithms” on page 46](#)
- [“ICSF: Dynamic Service update: Applying service to a running ICSF instance without causing an interruption to your applications” on page 46](#)
- [“ICSF: Early ICSF availability” on page 47](#)
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Changed

The following content is changed.

January 2021 refresh

- [“SMF Workload Interaction Correlator considerations”](#) on page 28 was updated for APAR OA60372.

November 2020 refresh

- [“DFSMS data set encryption enhancements for z/OS V2R4”](#) on page 56 was updated for APAR OA56622.

September 2020 refresh

- [“System Recovery Boost”](#) on page 29 was updated for APAR OA59813.
- [“Cross-System Coupling Facility \(XCF\) enhancements for z/OS V2R4”](#) on page 29 was updated for APAR OA56774.

Prior to June 2020 refresh

- Distributed File System (DFS) is now z/OS File System (zFS). For more information, see [“Removal of Distributed File Service/Server Message Block \(DFS/SMB\)”](#) on page 96. [“z/OS base elements”](#) on page 1 was also updated.

Deleted

The following content was deleted.

Prior to June 2020 refresh

- All content that is not related to z/OS versions V2R3 or V2R4 was removed.

- The following base elements are deleted in z/OS V2R4:
 - BookManager[®] READ
 - Library Server
 - OSA Support Facility (OSA/SF)

Chapter 1. z/OS elements and features

z/OS base elements

z/OS provides function that is equivalent to the following elements. For the version and release numbers of those elements that also exist as separately orderable products, see [z/OS Planning for Installation](#).

For an extra set of integrated features that is available on an optional basis, see [“z/OS optional features” on page 2](#).

The following base elements are included in z/OS:

- Alternate Library for REXX.
- Base Control Program (BCP)
- Bulk Data Transfer (BDT)
- Common Information Model (CIM)
- Communications Server
- Cryptographic Services (includes ICSF, PKI Services, and System SSL)
- Data Set File System (DSFS)
- DFSMSdfp
- EREP
- ESCON Director Support
- First Failure Support Technology/MVS (FFST/MVS)
- GDDM (includes PCLK and OS/2 Link)
- Hardware Configuration Definition (HCD)
- High Level Assembler (HLASM)
- IBM HTTP Server - Powered by Apache (includes IBM HTTP Server NA Secure)
- IBM Documentation for z/OS
- IBM Tivoli Directory Server for z/OS
- IBM z/OS Liberty Embedded
- z/OS Management Facility (z/OSMF)
- ICKDSF (Devise Support Facility)
- IBM Z Deep Neural Network Library (zDNN)
- Integrated Security Services
- ISPF
- JES2
- Language Environment
- Metal C Runtime Library
- MICR/OCR
- Network File System (NFS)
- Runtime Library Extensions
- SMP/E
- Terminal Input Output Controller (TIOC)
- Time Sharing Option/Extensions (TSO/E)

- XML Toolkit for z/OS
- z/OS Container Extensions (zCX)
- z/OS Data Gatherer
- z/OS File System (zFS)
- z/OS Font Collection
- z/OS OpenSSH
- z/OS UNIX System Services
- z/OS Xvfb
- 3270 PC File Transfer Program

z/OS optional features

Some optional features are not priced, but priced as well as unpriced features are included in z/OS integration-testing. All priced, host-based features are capable of being dynamically enabled or disabled. For the version and release levels of those features that also exist independently, see [z/OS Planning for Installation](#).

The following is a list of z/OS optional features:

- Bulk Data Transfer (BDT) File-to-File
- Bulk Data Transfer (BDT) SNA NJE
- Communications Server Security Level 3
- DFSMSdss
- DFSMSHsm
- DFSMSrmm
- DFSMStvs
- DFSORT
- GDDM-PGF
- GDDM-REXX
- Hardware Configuration Manager (HCM)
- High Level Assembler (HLASM) Toolkit
- IBM z/OS Change Tracker
- IBM z/OS Workload Interaction Correlator
- Infoprint Server
- JES3
- Resource Measurement Facility (RMF)
- Restricted Use Common Service Area (RUCSA)
- System Display and Search Facility (SDSF)
- Security Server (includes RACF)
- XL C/C++
- z/OS Authorized Code Scanner (zACS)
- z/OS Security Level 3 (includes OCSF Security Level 3, IBM Tivoli Directory Server for z/OS Security Level 3, Network Authentication Service Security Level 3, and System Secure Sockets Layer (SSL) Security Level 3)
- z/OS Advanced Data Gatherer
- zEnterprise Data Compression (zEDC)

Chapter 2. z/OS base elements descriptions

The following is a description of each base element in z/OS.

Alternate Library for REXX

Alternate Library for REXX enables users who do not have the REXX on IBM Z[®] library installed to run compiled REXX programs. It contains a language processor that transforms the compiled programs and runs them with the REXX interpreter, which is shipped as part of the z/OS operating system.

Software developers are no longer required to distribute the Alternate Library for REXX with their compiled REXX programs. Customers who have the REXX on IBM Z[®] Library installed will gain the performance benefits of running compiled REXX, while those customers who have the Alternate Library for REXX installed may still run the programs as interpreted.

By using the Alternate Library for REXX with z/OS, software developers gain the benefits of shipping compiled REXX programs without the source code:

- Maintenance of the program is simplified since the code can not be modified inadvertently.
- Compiled programs can be shipped in load module format, simplifying packaging and installation.
- The Alternate Library for REXX does not need to be shipped and installed with the software program.
- Maintenance of the Alternate Library for REXX is handled by the z/OS system administrator.

BCP (Base Control Program)

The backbone of the z/OS system is the Multiple Virtual Storage (MVS) Base Control Program with JES2 or JES3. These provide the essential services that make z/OS the system of choice when you need to process your workloads reliably, securely, with complete data integrity and without interruption.

Unicode support:

The Unicode Standard is the universal character encoding standard used for representation of text for computer processing; it provides the capacity to encode all of the characters used for the written languages of the world. z/OS Unicode support is based on Version 6.0 of the Unicode Standard, although earlier versions are supported by some services. Review each individual service to see the Unicode Standard versions supported. z/OS Unicode Services supports the following services:

- Character conversion
- Case conversion
- Normalization
- Collation
- Stringprep
- Bidirectional transformation
- Conversion information service
- Dynamic locale service

Find summary and complete details about these services in [*z/OS Unicode Services User's Guide and Reference*](#).

z/OS XML System Services:

z/OS XML System Services is an integrated component of the BCP. It is a system-level XML parser intended for use by system components, middleware, and applications that need a simple, efficient, non-validating XML parser. It provides a buffer-in, buffer-out processing model in which the document to

parse is provided by the caller in one buffer; the z/OS XML System Services parser creates a parsed record stream in another buffer, also provided by the caller. Large documents can be processed by replenishing the input buffer with more data, and reusing the output buffer or specifying a new one when it is filled. z/OS XML System Services is invoked as a callable service and provides an assembler interface for callers to use. It is accessible from normal environments such as batch and z/OS Unix System Services, as well as from more esoteric environments such as SRB mode and cross-memory.

BDT (Bulk Data Transfer)

Bulk Data Transfer (BDT) provides the base services that BDT File-to-File and BDT SNA NJE need to transfer data from one computer system to another.

Common Information Model (CIM)

The Common Information Model (CIM) is a standard data model for describing and accessing systems management data in heterogeneous environments. It allows system administrators or vendors to write applications (CIM monitoring clients) that measure system resources in a network with different operating systems and hardware. With z/OS CIM, it is possible to use the DMTF CIM open standard for systems management, which is also implemented on further major server platforms (for example, Linux®, Linux on System x, i5/OS, or AIX®).

z/OS CIM implements the CIM server, which is based on the OpenPegasus open source project. A CIM client invokes the CIM server, which, in turn, collects z/OS data from the system and returns it to the calling client. To get the z/OS data, the CIM server invokes a CIM provider which retrieves the data from z/OS system resources.

The metrics that are obtained by this API are common across server platforms so you can use it to create end-to-end monitoring applications.

Communications Server

IP

IP (formerly known as IBM TCP/IP) is a set of industry standard protocols and applications that allow you to share data and computing resources with other computers, both IBM and non-IBM. UNIX applications use IP. By using IP commands at your workstation, you can perform tasks and communicate easily with a variety of other systems and workstations. IP allows you to perform tasks independent of the computer type. Some common uses of IP include: electronic mail, file transfer, remote logon, and the Internet.

IP CICS® Sockets

IP CICS Sockets, which is integrated into the base TCP/IP stack, provides the ability to use the generalized Application Programming Interface (API) and socket applications in COBOL, PL/I, and assembler.

IP IMS Sockets

IMS IP support, also integrated into the base TCP/IP stack, allows the development of peer-to-peer applications in which IMS and an IP-connected peer form a client/server relationship. Using this support, IMS can be either client or server.

This element consists of three parts:

- The Sockets Extended Application Programming Interface. Using this API, IMS message processing programs can communicate with remote IP-connected hosts using socket protocol.
- If IMS is acting as the server, the IMS Listener can be used to collect incoming transaction requests from remote IP-connected hosts and schedule IMS message processing programs to service these requests.
- The IBM Assist module provides support for the IMS application programmer who wishes to code IP client/server application programs using the IMS API. When used, this optional function intercepts IMS message queue calls and replaces them with socket calls.

SNA

Formerly known as VTAM®, Systems Network Architecture (SNA) is a network communication access method and provides Advanced Peer-to-Peer Networking (APPN). SNA is the interface between application programs in a host processor and other resources in an SNA network, and links peer users of the network. It establishes and terminates sessions between users of the network, forwarding session data to and from each session partner.

In addition to establishing and terminating sessions, it activates and deactivates resources under its control, including application programs and devices to which SNA is directly attached. SNA also maintains information on the network configuration, active sessions, and network conditions.

To help users control a network, SNA receives commands from an operator to perform network services. Through operator messages, the operator is kept informed about those services and about any network conditions.

Cryptographic Services

Cryptographic Services includes ICSF, PKI Services, and System SSL, and provides cryptographic functions for data secrecy, data integrity, personal identification, digital signatures, and the management of cryptographic keys.

ICSF and PKI Services are provided through the combination of secure cryptographic hardware, the ICSF cryptographic API, and the ICSF administration interface. ICSF supports the Common Cryptographic Architecture (CCA), as well as the DES algorithm, RSA public key cryptography, and the Digital Signature Standard. Cryptographic services support a wide variety of applications with high performance, security, and availability.

Additional functions include:

- Trusted Key Entry - The key entry unit for master keys has been replaced by a secure channel version implemented on a workstation known as the Trusted Key Entry Workstation. The unit is an optional cost feature.
- Commercial Data Masking Facility supports privacy functions.
- Public Key API (PKA Support) provides additional formatting or message digest standards.
- Public Key Cryptography Standards #11 (PKCS #11).

Public Key Infrastructure Services (PKI Services) allows you to establish a PKI infrastructure and serve as a certificate authority for your internal and external users, issuing and administering digital certificates in accordance with your own organization's policies. You can use a PKI Services application to request and obtain certificates through their own Web browsers, while your authorized PKI administrators approve, modify, or reject these requests through their own Web browsers. The Web applications provided with PKI Services are customizable, and a programming exit is also included for advanced customization. The approval for certificate requests can be manual or automatic if additional authentication such as RACF user IDs, is provided. You can issue certificates for different purposes, such as virtual private network (VPN) devices, smart cards, and secure e-mail, through different types of templates. PKI Services supports Public Key Infrastructure for X.509 version 3 (PKIX) and Common Data Security Architecture (CDSA) cryptographic standards.

System SSL supports the SSL V2.0, SSL V3.0, TLS (Transport Layer Security) V1.0, TLS V1.1, TLS V1.2, and TLS V1.3 protocols. TLS V1.3 is the latest version of the secure sockets layer protocol.

z/OS provides a set of SSL C/C++ callable application programming interfaces that, when used with the z/OS Sockets APIs, provide the functions required for applications to establish this secure sockets communications.

In addition to providing the API interfaces to exploit the Secure Sockets Layer and Transport Layer Security protocols, System SSL is also providing a suite of Certificate Management APIs. These APIs give the capability to create/manage your own certificate databases, utilize certificates stored in key database and key rings for purpose other than SSL and to build/process PKCS #7 standard messages.

Data Set File System (DSFS)

With Data Set File System (DSFS), z/OS UNIX applications can access data sets by presenting the data sets as a tree-structured file system that is mounted at mount point /dsfs in the z/OS UNIX file system tree. For V2R5, the PTF for APAR OA62150 must be applied.

DFSMSdfp

DFSMSdfp provides the foundation for:

Storage management

DFSMSdfp includes ISMF, an interactive facility that lets you define and maintain policies to manage your storage resources. These policies help to improve the use of storage devices, and to increase levels of service for user data, with minimal effort required from users. SMS manages these policies for the operating system. You can also use the NaviQuest tool under ISMF to help you migrate to SMS, maintain your SMS configuration, and perform many testing, implementation, and reporting tasks in batch.

Tape mount management

SMS provides a means for implementing tape mount management, a methodology for improving tape usage and reducing tape costs. This methodology involves intercepting selected tape data set allocations through the SMS automatic class selection (ACS) process, and redirecting them to a DASD buffer. Once on DASD, these data sets can be migrated to a single tape or small set of tapes, thereby reducing the overhead associated with multiple tape mounts.

Data management

DFSMSdfp helps you store and catalog information on DASD, optical, and tape resources, so that it can be quickly identified and retrieved from the system. You can use the catalog search interface, now part of DFSMSdfp, to access the catalog.

Program management

DFSMSdfp combines programs into executable modules, prepares them to run on the operating system, stores them in libraries, and reads them into storage for execution.

Device management

DFSMSdfp is involved in defining your input and output devices to the system, and in controlling the operation of those devices in the z/OS environment.

Distributed data access

Distributed data access allows all authorized systems and users in a network to exploit the powerful features of system-managed storage, or automated storage management provided by DFSMS. DFSMSdfp uses the Distributed FileManager (DFM) to support remote access of z/OS data and storage resources from workstations, personal computers, or any other system on a SNA LU 6.2 network.

The z/OS UNIX System Services (z/OS UNIX) file system works in conjunction with z/OS UNIX to provide a full UNIX environment within the z/OS system. z/OS becomes a full-feature UNIX client or server when coupled with the z/OS Network File System (z/OS NFS). With the z/OS UNIX file system, z/OS programs can directly access UNIX data. When the z/OS NFS client and z/OS UNIX are used together, z/OS can act as a client and access data from any remote system, including another z/OS or UNIX system that is connected using a TCP/IP network served by a Network File System server.

Environmental Record Editing and Printing Program (EREP)

The Environmental Record Editing and Printing Program (EREP) edits and prints reports for the records placed in the error recording data set (ERDS), helping IBM service representatives fix problems.

ESCON Director Support

When your installation uses ESCON directors, the ESCON Director Device Support feature enables reporting of ESCON director device errors to z/OS.

FFST/MVS (First Failure Support Technology/MVS)

FFST/MVS provides immediate notification and first failure data capture for software events. FFST/MVS also incorporates its own technology by including software probes in its own code. When one of these probes is triggered, FFST/MVS issues a symptom string that describes the event.

FFST/MVS provides the following services for IBM products:

- Customized dumps
- Symptom strings
- Symptom records
- Messages
- Network notification

GDDM (includes PCLK and OS/2 LINK)

GDDM provides presentation services and device-driving capability. GDDM has a powerful application-programming interface for creating, displaying, and storing vector graphics, images and alphanumerics. GDDM drives displays, printers and plotters, and includes several utilities for end users. GDDM's excellence as a graphics program and device driver is recognized worldwide, and as a result it is used extensively as a graphics enabler by other licensed programs, including other elements of z/OS.

HCD (Hardware Configuration Definition)

HCD is used to define both the operating system configuration and the processor hardware configuration for a system. Because HCD validates data when it is defined rather than when a device is accessed, inconsistencies can be corrected right away and unplanned system outages resulting from inconsistent definitions avoided. The defined configuration can be used to POR/IPL or dynamically reconfigure your system.

HLASM (High Level Assembler)

High Level Assembler integrates almost all functions of past assemblers. It also provides extensions and improvements including:

- Many new and expanded cross reference facilities and diagnostics that enable substantial savings in time and in human and machine resources, and support integration of HLASM into tool and development environments.
- Numerous language enhancements that improve the speed and accuracy of application development and the quality and reliability of the resulting code.
- Assembly-time options extensions and enhancements that allow increased flexibility and precision in controlling the processes you use to manage application development.

HLASM helps to maximize the productivity of application programmers by relieving them of many tedious and unproductive tasks that can now be done by the assembler itself and helps organizations avoid the necessity for converting existing -- and working -- applications from Assembler Language to other languages.

IBM HTTP Server - Powered by Apache

The IBM HTTP Server - Powered by Apache is a full-featured web server. This element was previously known as a base element of z/OS under the names Lotus® Domino® Go, the Internet Connection Secure Server (ICSS), and the Internet Connection Server (ICS).

Included in IBM HTTP Server - Powered by Apache is IBM HTTP Server North America (NA) Secure. With IBM HTTP Server - Powered by Apache, IBM HTTP Server NA Secure uses Secure Sockets Layer (SSL) to provide secure communications over an open communications network, such as the Internet. The HTTP

server uses SSL to initiate a secure connection between the client and itself. The server then uses SSL to decrypt and encrypt all of the information in the client request and the server response.

IBM Documentation for z/OS

IBM Documentation is the IBM strategic platform for delivering technical content. z/OS includes IBM Documentation for z/OS, which is an SMP/E packaging of the customer installable version of IBM Documentation for use on the z/OS platform. The customer installable version uses an enhanced version of search technology that is available in IBM information centers.

- IBM Documentation for z/OS provides the ability to display, navigate, and search content in a manner similar to IBM Documentation on **ibm.com**.
- IBM Documentation for z/OS serves IBM product publication content to web browser clients from the z/OS server system.
- Content can be manually added to and maintained in IBM Documentation for z/OS zFS repositories using information in the IBM Documentation for z/OS Configuration and User Guide, SC27-6805.
- By adding and maintaining content, IBM Documentation for z/OS can be made to serve product publications for many different IBM products.

Use IBM Documentation for z/OS to create your own enterprise document repository for local use. IBM Documentation for z/OS is especially valuable for:

- Enterprises with no Internet access either for security reasons or as a valuable backup when internet access is disrupted.
- Personalizing or controlling the content of an enterprise library.

IBM Tivoli Directory Server for z/OS (IBM TDS for z/OS)

The IBM Tivoli Directory Server for z/OS (IBM TDS for z/OS) provides secure access for applications and systems on the network to directory information held on z/OS using the Lightweight Directory Access Protocol (LDAP). This component consists of the LDAP server, LDAP client, and utilities.

IBM z/OS Liberty Embedded

z/OS includes a copy of the IBM Liberty server stack for sharing between IBM z/OS elements. This base element is supported for use by IBM products only. It is not intended for use by customer applications.

IBM Z Deep Neural Network Library

IBM Z Deep Neural Network library (zDNN) is a software library that provides high-level C APIs, which enable simplified exploitation of the IBM Z Integrated Accelerator for AI by AI frameworks and libraries. The IBM zDNN library provides APIs for the deep learning and machine learning primitives that are accelerated by the IBM Z Integrated Accelerator for AI. AI framework developers, AI compiler developers, as well as runtime providers, can leverage the zDNN accelerated primitive APIs to drive the exploitation of the IBM Z Integrated Accelerator for AI through the Neural Network Processor Assist (NNPA) facility instruction. The zDNN library enables high-level language exploitation of the optimized NNPA implementation for matrix multiplication, convolution, activation functions, and many other standard DNN primitives.

ICKDSF (Device Support Facility)

ICKDSF enables you to perform functions needed for the installation and use of IBM DASD. You can also use it to perform service functions, error detection, and media maintenance.

Integrated Security Services

Integrated Security Services includes:

Network Authentication Service

Network Authentication Service, which is based on Kerberos Version 5, provides Kerberos security services. These services include native Kerberos application programming interface (API) functions, including the Generic Security Service application programming interface (GSS-API) functions defined in Internet RFC 2078, Generic Security Service Application Program Interface, Version 2 and Internet RFC 2744, Generic Security Service API Version 2: C-bindings. Network Authentication Service performs authentication as a trusted third-party authentication service by using conventional shared secret-key cryptography. Network Authentication Service provides a means of verifying the identities of principals, without relying on authentication by the host operating system, without basing trust on host addresses, without requiring physical security of all the hosts on the network, and under the assumption that packets traveling along the network can be read, modified, and inserted at will.

ISPF

ISPF provides facilities for all aspects of host-based software development.

- Programmers can use ISPF to develop and document batch and interactive programs.
- Data center administrators and system programmers can monitor and control program libraries, and communicate with MVS through TSO commands, CLISTS, or REXX EXECs.
- Users can work with interactive applications called dialogs.

ISPF has three major components:

Dialog Manager (DM)

The Dialog Manager (DM) provides services to dialogs and users. These services include:

- Display
- Variable services
- Input and output
- User and application profiles
- Table management
- System interface services
- Dialog testing and debugging aids

Program Development Facility (PDF)

The Program Development Facility (PDF) provides services to assist dialog or application developers. These include

- Edit and Browse functions
- A wide range of foreground and batch compilers
- Data set and catalog utilities
- TSO command interfaces
- Data set search and compare functions.

Software Configuration and Library Manager (SCLM)

The Software Configuration and Library Manager (SCLM) is a tool that automatically controls, maintains, and tracks all of the software components of the application throughout the development cycle.

On May 15, 2018, IBM issued a statement of direction that the Software Configuration and Library Management (SCLM) component of ISPF is functionally stabilized. While it will continue to be maintained and supported, it will not be enhanced with new features in the future.

JES2

JES2 accepts the submission of work for the BCP. Major JES2 functions and design features include:

- The interpretation of job control language (JCL) statements

- The disposition of output
- A single-system image
- The ability to run multiple copies of JES2 (poly-JES)
- JES2 WLM for Sysplex

JES2 differs from JES3 in two main processing areas:

- JES2 exercises independent control over its job processing functions. JES3 exercises centralized control. Each JES2 processor in a multi-processor environment controls its own job input, job scheduling, and job output processing.
- JES3 does pre-execution of job setup. JES2 does not do this.

Language Environment

Language Environment provides common services and language-specific routines in a single runtime environment. It ensures consistent and predictable results for your language applications, independent of the language they are written in.

Language Environment is the prerequisite runtime environment for applications that are generated with the following IBM compiler products:

- z/OS XL C/C++ (feature of z/OS)
- z/OS C/C++
- OS/390® C/C++
- C/C++ for MVS/ESA
- C/C++ for z/VM®
- XL C/C++ for z/VM
- AD/Cycle C/370
- IBM Toolkit for Swift on z/OS
- VisualAge® for Java, Enterprise Edition for OS/390
- Enterprise COBOL for z/OS
- Enterprise COBOL for z/OS and OS/390
- COBOL for OS/390 & VM
- COBOL for MVS & VM (formerly COBOL/370)
- Enterprise PL/I for z/OS
- Enterprise PL/I for z/OS and OS/390
- VisualAge PL/I
- PL/I for MVS & VM (formerly PL/I MVS & VM)
- VS FORTRAN and FORTRAN IV (in compatibility mode)
- IBM Open Enterprise SDK for Go

Language Environment supports the VS FORTRAN compiler's object/load module compatibility, which means FORTRAN load modules can be run under Language Environment and object code can be link-edited with Language Environment and run under it. Language Environment also provides a set of assembler macros for running assembler language routines.

Language Environment supports, but is not required for, an interactive debug tool for debugging applications in your native z/OS environment. The interactive IBM Debug Tool is available with the latest release of the PL/I compiler or this product can be ordered separately for use with the IBM XL C/C++, COBOL, and PL/I compilers on z/OS. For more information, see [Debug Tool Utilities and Advanced Functions \(www.ibm.com/software/awdtools/debugtool\)](http://www.ibm.com/software/awdtools/debugtool).

Some benefits are that you can:

- Mix old code with new code.
- Handle conditions, such as program checks or abends, in your COBOL programs without having to use assembler.
- Share common runtime services.
- Run applications that conform to the POSIX 1003.1 standard or the X/Open Single UNIX Specification, also known as UNIX 95 or XPG4.2.
- Access CICS and IMS transactions and data through a C, COBOL, or PL/I server from any client in your network.
- Perform interlanguage communication more efficiently.
- Manage storage dynamically for your C/C++, COBOL, and PL/I routines with a common storage manager.
- Access a rich set of math services.

Metal C Runtime Library

The Metal C runtime library element provides a set of header files and functions for use with the XL C METAL compiler option.

The XL C METAL compiler option generates code that does not require access to the Language Environment support at run time. Instead, the METAL option provides C-language extensions that allow you to specify assembly statements that call system services directly. Using these language extensions, you can provide almost any assembly macro, and your own function prologs and epilogs, to be embedded in the generated HLASM source file. When you understand how the METAL-generated code uses MVS linkage conventions to interact with HLASM code, you can use this capability to write freestanding programs.

Prior to the introduction of Metal C runtime library, all z/OS XL C compiler-generated code required Language Environment. In addition to depending on the C runtime library functions that are available only with Language Environment, the generated code depended on the establishment of an overall execution context, including the heap storage and dynamic storage areas. These dependencies prohibit you from using the XL C compiler to generate code that runs in an environment where Language Environment did not exist.

MICR/OCR

MICR/OCR provides the device support code for the following devices:

- 1287/1288 - IBM Optical reader and page reader respectively
- 3540 - IBM Disk device
- 3886 - IBM Optical Character reader
- 3890 - IBM Magnetic Ink Reader
- 3895 - IBM Printer device

Network File System (NFS)

The z/OS NFS server acts as an intermediary to read, write, create or delete z/OS UNIX files and MVS data sets that are maintained on a z/OS host system. The remote MVS data sets or z/OS UNIX files are mounted from the host processor to appear as local directories and files on the client system. This server makes the strengths of a z/OS host processor (storage management, high-performance disk storage, security, and centralized data) available to the client platforms.

The NFS uses the communication services provided by TCP/IP, a suite of protocols that includes the remote procedure call (RPC) and external data representation (XDR) protocols. RPC allows a program on one machine to start a procedure on another machine, as if the procedure is local. XDR resolves the differences in data representation of different machines. The NFS, then, can be used for file sharing between platforms and file serving (as a data repository).

Runtime Library Extensions

Run-Time Library Extensions delivers the following libraries and utilities to support existing programs:

Common Debug Architecture (CDA) Libraries

Introduced in z/OS V1R5, CDA provides a consistent format for debug information on z/OS. The CDA Libraries provide a set of APIs to access this information.

c89 Utility

This utility compiles, assembles, and binds z/OS UNIX System Services C/C++ and assembler applications.

UNIX System Laboratories (USL) Libraries

The USL I/O Stream Library provides the standard input and output capabilities for C++. The USL Complex Mathematics Library provides the facilities to manipulate complex numbers and to perform standard mathematical operations

Note: The UNIX System Laboratories (USL) I/O Stream Library and Complex Mathematics Library are still supported on z/OS. Although support for these classes is not being removed at this time, it is recommended that you migrate to the Standard C++ iostream and complex classes. This is especially important if you are migrating other USL streaming classes to Standard C++ Library streaming classes, because combining USL and Standard C++ Library streams in one application is not recommended. For more information about the Standard C++ I/O Stream Library, see [Standard C++ Library Reference](#).

SMP/E

SMP/E is a tool for installing and maintaining software, and for managing the inventory of software that has been installed. SMP/E provides a consistent and reliable method for installing and upgrading the software in a z/OS system.

Time Sharing Option/Extensions (TSO/E)

TSO Extensions is a base interactive interface that provides non-DP professionals, end users, system and application programmers, and administrators with an extensive set of commands, services, facilities and programming languages to do productive work on z/OS, and helps to ease systems management. TSO/E is an integral part of z/OS, and serves as a platform for other elements, such as HCD and ISPF.

Terminal Input Output Controller (TIOC)

TIOC is the interface between TSO and VTAM. It allows TSO to communicate with the terminal hardware.

z/OS Data Gatherer

The Data Gatherer function that was previously part of the RMF feature is included as a z/OS base element. The z/OS Data Gatherer collects z/OS resource usage and performance data and provides the following base functionality:

- SMF type 70 subtype 1 records are written to the SMF buffer and to SMF data sets or log streams. Note that these records are required as input to IBM software pricing tools.
- The Sysplex Data Server API can be used to access Monitor II and SMF type 70 subtype 1 record data.
- The z/OS Data Gatherer API, GRBSMFR, and the Sysplex Data Server API, ERB3XDRS, can be used to retrieve any SMF record type and Monitor III data from SMF and Monitor III VSAM data sets.

For information about the impact of the z/OS Data Gatherer on z/OS installation and migration, see:

- *z/OS 2.5 Program Directory*
- *z/OS Planning for Installation*
- *z/OS Upgrade Workflow*

z/OS File System (zFS)

The z/OS File System (zFS) support provides a physical file system (PFS). zFS file systems contain files and directories that are accessed with the z/OS application programming interfaces. They can be mounted into the z/OS UNIX hierarchy along with other local (or remote) file system types such as TFS and NFS.

z/OS Font Collection

The z/OS Font Collection consists of character sets, coded fonts, and Advanced Function Presentation (AFP) code pages for printing documents. The z/OS Font Collection includes these fonts:

- AFP outline fonts
- AFP raster fonts, including a complete set of IBM expanded core fonts and a set of Math, PI, and Sonoran 240-pel raster fonts
- TrueType and OpenType fonts, including a prebuilt resource access table (RAT) that can be used for AFP printing

z/OS Management Facility (z/OSMF)

IBM z/OS Management Facility (z/OSMF) provides system management functions in a task-oriented, web browser-based user interface with integrated user assistance so that you can more easily manage the day-to-day operations and administration of your z/OS systems. By streamlining some traditional tasks and automating others, z/OSMF can help to simplify some areas of z/OS system management.

z/OSMF provides a framework for managing various aspects of a z/OS system through a web browser interface.

z/OSMF presents a single point of control for:

- Viewing, defining, and updating policies that affect system behavior
- Monitoring the performance of the systems in your enterprise
- Managing your z/OS software
- Performing problem data management tasks
- Consolidating your z/OS management tools.

With z/OSMF, you can communicate with the z/OS system through a web browser, so you can access and manage your z/OS system from anywhere. Multiple users can log in to z/OSMF from different computers, different browsers, or multiple instances of the same browser.

For more information about z/OSMF, see the following resources:

- Topics on configuration and security in [*IBM z/OS Management Facility Configuration Guide*](#)
- Topics on programming interfaces, such as z/OS REST services, in [*IBM z/OS Management Facility Programming Guide*](#)
- z/OSMF online help for comprehensive user assistance information. You can access the online help by clicking the help link from any z/OSMF user interface (UI) page.

z/OS OpenSSH

z/OS OpenSSH is a port of Open Source Software release OpenSSH 7.6p1 and provides secure encryption for both remote login and file transfer.

z/OS OpenSSH includes the following utilities:

- `ssh`, a z/OS client program for logging into a z/OS shell. It can also be used to log into other platform's UNIX shells. It is an alternative to `rlogin`.
- `scp` for copying files between networks. It is an alternative to `rcp`.

- `sftp` for file transfers over an encrypted ssh transport. It is an interactive file transfer program similar to `ftp`.
- `sshd`, a daemon program for ssh that listens for connections from clients. The z/OS OpenSSH implementation of `sshd` supports both SSH protocol versions 1 and 2 simultaneously.

The default `sshd` configuration only runs protocol version 2.

Other basic utilities such as `ssh-add`, `ssh-agent`, `ssh-keysign`, `ssh-keyscan`, `ssh-keygen` and `sftp-server` are also included.

To ensure secure encrypted communications, OpenSSH uses ciphers such as AES, Blowfish and 3DES.

z/OS OpenSSH provides the following z/OS extensions:

- System Authorization Facility (SAF) key ring. z/OS OpenSSH can be configured to allow z/OS OpenSSH keys to be stored in SAF key rings.
- Multilevel security. It is a security policy that allows the classification of data and users based on a system of hierarchical security levels combined with a system of non-hierarchical security categories.
- System Management Facility (SMF). z/OS OpenSSH can be configured to collect SMF Type 119 records for both the client and the server.
- Hardware Cryptographic Support. OpenSSH can be configured to choose Integrated Cryptographic Service Facility (ICSF) callable service for implementing the applicable SSH session ciphers and HMACs.

For more information about migrating from older releases of OpenSSH to the newest release, see the step called "OpenSSH: Accommodate a new level of OpenSSH" in the z/OS Upgrade Workflow (which is part of the z/OS product). Prior levels of the z/OS Upgrade Workflows are available online at [z/OSMF workflows for the z/OS platform \(github.com/IBM/IBM-Z-zOS/tree/main/zOS-Workflow\)](https://github.com/IBM/IBM-Z-zOS/tree/main/zOS-Workflow)

z/OS UNIX System Services (X/Open UNIX 95 functions)

z/OS UNIX System Services Application Services (Shell, Utilities, and Debugger)

Shell and Utilities provides the standard command interface familiar to interactive UNIX users. z/OS includes all of the commands and utilities specified in the X/Open Company's Single UNIX Specification, also known as UNIX 95 or XPG4.2. This feature will allow your UNIX programmers and other users to interact with z/OS as a UNIX system without necessarily having to learn the z/OS command language or other interactive interfaces. The z/OS UNIX Services Debugger provides a set of commands that allow a C language program to be debugged interactively. The command set is familiar to many UNIX users.

z/OS UNIX System Services Kernel

These services add the world of open UNIX-based computing to the z/OS operating system. With Language Environment, they support industry standards for C programming, shell and utilities, client/server applications, and the majority of the standards for thread management and the X/Open Single UNIX Specification. Application developers and interactive users using these interfaces can exploit the capabilities of z/OS without having to understand z/OS itself. The combination of open computing and z/OS allows the transparent exchange of data, easy portability of applications, cross-network management of data and applications, and the exploitation of traditional MVS system strengths in an open environment.

z/OS Xvfb

Xvfb is an X server that can run on machines with no display hardware and no physical input devices. It emulates a dumb framebuffer using virtual memory. `serve` and other command line options are available for use with Xvfb.

3270 PC File Transfer Program

This program transfers files from the host to the workstation for off-line data manipulation or transfers local data for storage on the host.

Chapter 3. z/OS optional features descriptions

The following is a description of each optional feature in z/OS.

Bulk Data Transfer (BDT) File-to-File

The BDT File-to-File element allows users at one z/OS system in a SNA network to copy data sets to or from another z/OS system in the network.

Bulk Data Transfer (BDT) SNA NJE

The BDT JES3 SNA NJE element allows users with the JES3 element to transmit jobs, output (SYSOUT), commands, and messages from one computer system to another within a SNA network.

Communications Server Security Level 3

This feature provides authentication and security services in an IP network environment. It provides support for packet filtering, tunnels, and network address translation (NAT), which enables secure communication over private and public networks. It uses the Triple DES (TDES) and AES encryption algorithms, and it includes SSL/TLS with TDES and AES, SNMPv3 with TDES, and IPSec with TDES and AES.

DFSMS Features (DFSMSdss, DFSMShsm, DFSMSrmm, and DFSMStvs)

There are four DFSMS features:

DFSMSdss

DFSMSdss is a DASD data and space management tool. DFSMSdss can be used to copy and move data sets between volumes; dump and restore data sets, entire volumes, or tracks; convert data sets and volumes to and from SMS management; compress partitioned data sets; release unused space in data sets; and consolidate free space and data sets on volumes.

DFSMShsm

DFSMShsm is a DASD storage management and productivity tool for managing low-activity and inactive data. It improves DASD use by automatically managing space and data availability in a storage hierarchy. Working with SMS, DFSMShsm performs space management and availability management of data sets as directed by their management class attributes.

DFSMSrmm

DFSMSrmm allows you to manage your removable media as one enterprise-wide library across systems. DFSMSrmm manages your installation's tape volumes and the data sets on those volumes. DFSMSrmm manages all tape media, such as cartridge system tapes and 3420 reels, as well as other removable media you define to it. For example, DFSMSrmm can record the shelf location for optical disks and track their vital record status; it does not manage the objects on optical disks.

DFSMStvs

DFSMS Transactional VSAM Services, an optional feature, enables running batch jobs concurrently with CICS online transactions to allow updates to the shared VSAM data sets. Multiple batch jobs and online transactions can be run against the same VSAM data sets. DFSMStvs ensures data integrity for concurrent batch updates while CICS provides it for online updates.

DFSORT

DFSORT is IBM's high performance sort, merge, copy, analysis and reporting product for z/OS. This high-speed, flexible data processing tool provides fast and efficient sorting, merging, copying, reporting

and analysis of business information, as well as versatile data manipulation at the record, field and bit level.

DFSORT is designed to optimize the efficiency and speed with which operations are completed through synergy with processor, device, and system features (for example, memory objects, hiperspace, data space, striping, compression, extended addressing, DASD and tape device architecture, processor memory, processor cache, and so on) and other products (for example, The SAS System**, COBOL, PL/I, IDCAMS BLDINDEX, and so on).

DFSORT includes the high-performance ICEGENER facility, the versatile ICETOOL utility, multiple output and reporting capability with the powerful OUTFIL feature, the time-saving ability to use Symbols for fields and constants in DFSORT and ICETOOL statements, and much more.

For more information on DFSORT, visit the DFSORT Web site.

GDDM-PGF

GDDM-PGF (Presentation Graphics Facility), a set of programs for creating presentation material in a variety of styles, provides:

Interactive Chart Utility

The Interactive Chart Utility (ICU), an easy-to-use end-user program for creating business charts.

Vector Symbol Editor

The (VSE), a means of creating and modifying symbols for use with the ICU or other GDDM functions.

An application programming interface

An application programming interface that enables programs to call either the ICU or a set of presentation-graphics routines for chart creation.

Online Presentation Services (OPS)

GDDM-PGF now incorporates an enhanced presentation-producing capability, Online Presentation Services (OPS). GDDM-OPS provides a command interface, which is simple and easy to use, yet which is also powerful enough to allow the very concise creation of high-quality presentations. These can then be used from displays (perhaps using the built-in automatic scrolling feature), or can be saved for printing or plotting.

Typical applications of GDDM-OPS are:

- Public presentations using a video monitor or projector
- Educational sessions for private or public display
- Scrollable interactive presentations of business charts
- Production of high-quality foils.

GDDM-REXX

GDDM-REXX/MVS is a productivity tool that enables programmers to prototype GDDM applications and to create small routines and utility programs quickly and easily.

Hardware Configuration Manager (HCM)

Hardware Configuration Manager (HCM) is a PWS-based client/server interface to z/OS Hardware Configuration Definition (HCD). It combines the logical and physical aspects of z/OS hardware configuration management. In addition to defining the logical connections (accomplished via HCD), you can also manage the physical aspects of your configuration.

All updates are done with HCM's intuitive graphical user interface, and all changes are written into the IODF and fully validated for accuracy and completeness by HCD, avoiding unplanned system outages that are due to incorrect definitions.

High Level Assembler Toolkit

This toolkit provides a powerful set of capabilities to improve application development, debugging, and recovery.

The Toolkit provides six components:

- A disassembler which converts binary machine language to assembler language source statements.
- A flexible source-code analysis and cross-referencing tool to help determine variable and macro usage, analyze high-level control flows, and locate specific uses of arbitrary strings of characters in single or multiple modules.
- A workstation-based program analysis tool that displays control-flow graphs and source-code views within single programs or across entire application modules.
- A powerful and sophisticated low-level symbolic debugger for applications written in assembler and other compiled languages. It handles programs using 24, 31, and 64-bit addressing. (It does not support debugging privileged or supervisor-state code.)
- A rich set of macro instructions that implement a complete menu of the most widely used structured-programming constructs (IF/ELSE/ELSEIF, DO/ITERATE/ASMLEAVE, CASE, SEARCH, SELECT/WHEN/OTHRWISE, etc.). These macros simplify and clarify coding, and help eliminate errors in writing additional labels and branch instructions.
- A versatile file searching and comparison tool (*SuperC*) that scans or compares single file or groups of files with an extensive set of selection and rejection criteria.

IBM z/OS Change Tracker

As IBM continues to provide a suite of robust tools to help system programmers manage z/OS, IBM is offering IBM z/OS Change Tracker, a comprehensive configuration change management tool for tracking, controlling, and managing changes in software, as a priced feature of z/OS V2R5.

With a simple control interface to identify, manage, and audit configuration files, IBM z/OS Change Tracker can help you with aspects of the change configuration management experience, including software management and resiliency.

Today, monitoring hundreds of software configuration files can be a manual and tedious process, making it difficult to do so without the right tools and leaving the potential for undesired or unintentional system configuration changes. With IBM z/OS Change Tracker, system programmers can easily identify and control configuration assets. This priced feature includes a planned automatic backup capability for configuration assets, which can help to support a resilient environment. IBM z/OS Change Tracker can also help system programmers quickly understand the differences between two groups of data sets or volumes to see whether deployment of software results in identical copies.

IBM z/OS Change Tracker offers the following capabilities:

- Real-time, system-wide software configuration change tracking and control for system libraries, across all LPARs in a sysplex.
- Automatic versioning of identified system control data sets, including customization of the number of backups.
- Member-level recovery and reporting of real-time changes.
- Capabilities to roll back and undo unplanned or unsuccessful updates of the changed library members.
- Comparisons between snapshots of system control data sets, or even entire volumes, with differences identified, which can help to ensure that software deployments are successful.

For more information about IBM z/OS Change Tracker, see the following resources:

- [IBM z/OS Change Tracker \(www.ibm.com/support/z-content-solutions/zos-change-tracker/\)](http://www.ibm.com/support/z-content-solutions/zos-change-tracker/)
- [*IBM z/OS Change Tracker Guide and Reference*](#)

Infoprint Server

Infoprint Server consists of several components that support printing on a z/OS system:

Print Interface

This component accepts print requests from z/OS UNIX System Services and remote systems in your IP network. It allocates output data sets on the JES2 or JES3 spool for printing.

NetSpool

This component receives print output from VTAM applications and allocates output data sets on the JES2 or JES3 spool for printing.

Transform Manager

This component calls separate IBM transform products to transform data to and from Advanced Function Presentation (AFP) format. For example, IBM transform products can transform PCL, PDF, PostScript, SAP R/3, and Xerox data to AFP format, and can transform AFP data to PCL, PDF, and PostScript format.

IP PrintWay

This component sends output data from the JES2 or JES3 spool to remote printers or print servers in your IP or SNA network. IP PrintWay can also send output data to email destinations. You can run IP PrintWay in basic or extended mode. In extended mode, IP PrintWay provides better performance, improved usability, and more function.

Printer Inventory

This component provides a single set of printer definitions that all the components of Infoprint Server use. The Printer Inventory also contains printer customization information that Print Services Facility (PSF) for z/OS uses.

Infoprint Central

This component is a web application that lets help desk operators and other authorized users work with print jobs on the JES spool, printers controlled by IP PrintWay extended mode or PSF, NetSpool logical units, and job selection rules. It also lets users see Infoprint Server system status and printer definitions in the Printer Inventory.

Infoprint Port Monitor for Windows

This component sends documents and job attributes from Windows systems to Infoprint Server for printing on any printers that are defined in the Infoprint Server Printer Inventory.

JES3

You might choose to enable JES3 as an alternative to the base JES2 element. It also accepts the submission of work for the BCP. Major JES3 functions and design features include:

- The interpretation of job control language (JCL) statements
- The disposition of output
- A single system image
- Workload balancing
- Deadline scheduling
- Dependent job control
- Control flexibility

JES3 differs from JES2 in two main processing areas:

- JES3 exercises centralized control over its job processing functions. JES2 exercises independent control. With JES3, a single, global processor controls job, device, and workflow for all processors in a multi-processor environment.
- JES3 does pre-execution of job setup. JES2 does not do this.

Resource Measurement Facility (RMF)

The Resource Measurement Facility (RMF) feature generates performance reports based on the data provided by the z/OS Advanced Data Gatherer feature. Generation of RMF reports with sysplex scope is only supported if the RMF feature is enabled on all systems in the Parallel Sysplex®.

Note: Enabling the RMF feature also implicitly enables the z/OS Advanced Data Gatherer feature.

With RMF, you can choose between reports about activities and delays, and can focus on storage, I/O or processor data. A wide range of options allows selection of the relevant information, including the attainment of Workload Manager goals.

The RMF monitors present snap-shot and short-term reports real-time in ISPF dialogs with on-line help, and you can have the results printed if you wish. The RMF Postprocessor provides long-term reports for detailed analysis of historical data gathered by RMF. These reports can be printed or displayed.

In addition to host-based reporting functions in RMF, there are other components available that offer reporting capabilities at the workstation. The RMF PM Java Edition provides an interface between the workstation and the z/OS sysplex through a TCP/IP connection that gives you the flexibility to create unique scenarios to monitor the performance of your sysplex. The Spreadsheet Reporter, running on your Windows workstation, gives you the ability to extract reports from RMF Postprocessor output to convert them into a common spreadsheet format and allows your spreadsheet application to use the RMF data. This function enables you to integrate RMF data into your business process. It also means you can easily produce presentation graphics which illustrate performance analysis results.

Restricted use common service area (RUCSA)

For installations that cannot eliminate user-key (8 - 15) common storage usage, RUCSA provides a way to isolate user-key common storage to a select set of users, thus controlling or eliminating the security risk associated with common user-key storage.

SDSF (System Display and Search Facility)

SDSF provides you with information to monitor, manage and control your z/OS system. SDSF provides an easy and efficient way to control job processing (hold, release, cancel and purge jobs) and to control devices (such as printers, lines and initiators). It allows you to monitor jobs while they are running and browse output without printing it. You can also browse the system log, including the sysplex-wide operations log. SDSF provides sort, filter, arrange, search, and print functions to help you locate and organize information. Single-character commands eliminate the need to learn and remember complex system commands. You can easily change characteristics of an object, such as a job or node, by typing over a displayed value. An optional action bar and pop-up windows make it easy to find and use SDSF functions. You can establish security for SDSF using SDSF's own security parameters, or with IBM's standard interface, SAF (System Authorization Facility). You can access SDSF function through REXX execs or Java programs.

SDSF provides complete online help and an interactive tutorial.

Security Server

The Security Server includes:

Resource Access Control Facility (RACF)

RACF provides a strong security base that enables the Security Server element of z/OS to incorporate additional components that aid in securing your system as you make your business data and applications accessible by your intranet, extranets, or the Internet.

XL C/C++

This language-centered XL C/C++ application development environment on the z/OS platform includes a C compiler, a C++ compiler, and C/C++ application development utilities. This feature exploits the

C/C++ runtime environment and library of runtime services available with the Language Environment and Run-Time Library Extensions elements of z/OS.

z/OS Advanced Data Gatherer

The Advanced Data Gatherer function that was previously part of the RMF feature was moved to a new z/OS optional feature. When enabled, the z/OS Advanced Data Gatherer feature augments the z/OS Data Gatherer element and provides the following functionality:

- System administrators can configure the z/OS Data Gatherer to write type 70 - 78 records to the SMF buffer and to SMF data sets or log streams.
- Application programs can access collected Monitor II, Monitor III, and SMF type 70 - 78 record data via the Sysplex Data Server and z/OS Data Gatherer APIs.

Note: Enabling the z/OS Advanced Data Gatherer feature also implicitly enables the z/OS Workload Interaction Correlator feature.

For information about the impact of the z/OS Advanced Data Gatherer on z/OS installation and migration, see:

- *z/OS Program Directory*
- *z/OS Planning for Installation*
- *z/OS Upgrade Workflow*

z/OS Authorized Code Scanner (zACS)

The IBM z/OS Authorized Code Scanner (zACS) dynamically scans authorized code and provides diagnostic information for subsequent investigation as needed.

z/OS Security Level 3

z/OS Security Level 3 includes IBM Tivoli Directory Server for z/OS Security Level 3 (new in z/OS V1R8; replaces LDAP Security Level 3), Network Authentication Service Security Level 3, OCSF Security Level 3, and System Secure Sockets Layer (SSL) Security Level 3.

z/OS Workload Interaction Correlator

IBM z/OS Workload Interaction Correlator is an optional feature that enables a product, such as a z/OS component, middleware, or application, that runs in multiple instances that are distributed across multiple address spaces to generate high-frequency, summarized, system-wide and compartmental data. Products can use z/OS Workload Interaction Correlator services to generate SMF correlator records every 5 seconds. The correlator records contain data about the products' activities in a standardized, synchronized, contextualized format.

Records from z/OS Workload Interaction Correlator produce a summary view of the component's activities across address spaces of similar priority and CPU usage and highlight data from exceptional address spaces. These records are generated on a synchronized, high-frequency 5-second interval across multiple products.

Analytics tools, such as IBM z/OS Workload Interaction Navigator, can analyze these records across z/OS components, middleware, and applications to detect and correlate anomalies. Presenting an organized progression of interacting anomalies reduces the time and expertise needed to diagnose a performance problem. When an action is taken to solve or mitigate the performance problem, the system programmer can verify that the fix is behaving as expected by comparing the results before and after the implementation of the action.

Note: Enabling the z/OS Resource Measurement Facility (RMF) or the z/OS Advanced Data Gatherer feature also implicitly enables the z/OS Workload Interaction Correlator feature.

For information about z/OS Workload Interaction Correlator, see:

- *z/OS Planning for Installation*
- *z/OS Workload Interaction Correlator*
- *IBM z/OS Workload Interaction Correlator in z/OS MVS System Management Facilities (SMF)*
- *z/OS Workload Interaction Correlator in z/OS MVS Programming: Authorized Assembler Services Guide*

zEnterprise Data Compression (zEDC) for z/OS

For previous IBM Z servers, zEDC for z/OS provided exploitation of the zEDC Express[®] adapter for hardware data compression.

On the IBM z15™ and later servers, the zEDC Express adapter (feature code #0420) is no longer supported or required. The zEDC compression functions are transferred to the processor chip, which is referred to as IBM Integrated Accelerator for z Enterprise Data Compression (zEDC). Support is available on z/OS V2R1, z/OS V2R2, z/OS V2R3, and z/OS V2R4 when running on z15.

Data that was compressed with zEDC Express can be decompressed with IBM Integrated Accelerator for zEDC. Also, IBM Integrated Accelerator for zEDC compressed data can be decompressed on z14 and earlier servers.

As was done previously for zEDC, parmlib member IFAPRDxx is used to enable compression. However, with IBM Integrated Accelerator for zEDC compression on the z15, you use IFAPRDxx only for enabling asynchronous processing (by using the FPZ4 authorized services). Entitlement of the zEDC priced feature of z/OS is not required for using zlib-based functions.

Chapter 4. What is new in z/OS (V2R4 - V2R5)

The following major enhancements were introduced in z/OS V2R5 and V2R4. Some enhancements require customization actions before you can use them. This information helps ensure that you can locate the documents that describe the customization actions.

Note: The document lists for each function are not exhaustive and generally omit links to purely reference books for items that include system messages, system codes, and data areas.

z/OS system-level new functions to consider

This information describes z/OS system-level enhancements in this and the previous release.

IBM® z16™ Upgrade Workflow

Description

The IBM® z16™ Upgrade Workflow contains the z/OS upgrade steps for the IBM z16 server. The steps include considerations, restrictions, and actions to take before and after you receive your server, and a checklist of items that are planned to be discontinued on future servers.

The IBM z16 Upgrade Workflow is provided and maintained with z/OS PTFs that are assigned the following SMP/E fix category (FIXCAT): `IBM.Device.Server.z16-3931.RequiredService`. After the PTFs are installed, you can create the workflow on your z/OS system.

When change was introduced:

z/OS V2R5

Reference information:

[z/OS Upgrade Workflow](#)

z/OS V2R5 Upgrade Workflow

The z/OS V2R5 Upgrade Workflow provides the information that you need for upgrading to z/OS V2R5. Two z/OSMF workflows are provided. Depending on whether you are upgrading from z/OS V2R4 or z/OS V2R3, select the workflow that applies to your upgrade path and open it in z/OSMF to begin the upgrade process. In the workflow, discovery functions run automatically to further streamline your upgrade experience. Only the upgrade actions that apply to your particular system are presented in the z/OSMF user interface (UI).

Description

Now included with z/OS: IBM provides the upgrade workflows as part of the z/OS product, along with IBM service and support. Updates and fixes for the workflows are delivered through the standard z/OS service process. With the workflows now included with z/OS, you can access this important resource faster and more conveniently than by obtaining it from an external location.

To obtain the latest PTFs for the z/OS V2R5 Upgrade Workflow, run the SMP/E `REPORT MISSINGFIX` command on your z/OS systems and specify a FIXCAT value of "IBM.Coexistence.z/OS.V2R5".

The z/OS V2R5 Upgrade Workflow can be run on z/OS releases V2R3, V2R4, and V2R5.

Prior levels of the z/OS Upgrade Workflow for z/OS V2R2, V2R3, V2R4, and z14 are available online at the following location: [z/OSMF workflows for the z/OS platform \(github.com/IBM/IBM-Z-zOS/tree/main/zOS-Workflow\)](https://github.com/IBM/IBM-Z-zOS/tree/main/zOS-Workflow). The z/OS z15 Upgrade Workflow is provided and maintained in the z/OS APAR OA60711 information and on the web at [z15 Upgrade Workflow \(github.com/IBM/IBM-Z-zOS/tree/main/zOS-Workflow/zOS%20z15%20Workflow\)](https://github.com/IBM/IBM-Z-zOS/tree/main/zOS-Workflow/zOS%20z15%20Workflow).

When change was introduced:

z/OS V2R5

Reference information:

[z/OS Upgrade Workflow](#)

z/OS compliance data collection

Description

For highly regulated industries, such as financial services, achieving compliance is a critical step toward protecting customer and application data. Compliance officers need to adhere to multiple regulations or laws at the same time. They are responsible for understanding and implementing the controls that are required for your business. They also have a responsibility to gather data that proves to external auditors that security checks are in place and systems are in continuous compliance.

z/OS is enhanced to enable the collection of compliance data from the IBM z16 CP Assist for Cryptographic Function (CPACF) counters and several z/OS products and components. A new z/OSMF compliance data collection REST API sends an event notification facility (ENF) signal to all systems. Participating products and components collect and write compliance data to new SMF 1154 records associated with its unique subtype. These new SMF 1154 records can be integrated into solutions, such as the IBM Z Security and Compliance Center.

This support requires PTFs for z/OS 2.4 and z/OS 2.5. The PTFs are identified by a fix category that is designated specifically for Compliance data collection support named `IBM.Function.Compliance.DataCollection`. Use this fix category to identify and install the specific PTFs that enable compliance data collection.

When change was introduced:

z/OS V2R4

Reference information:

[z/OS MVS System Management Facilities \(SMF\)](#)

z/OS Font Collection: base element

Description:

z/OS Font Collection is a comprehensive set of fonts for IBM products that were traditionally ordered separately. The fonts include selected object fonts, AFP, and IBM Infoprint fonts. z/OS Font Collection is updated with these enhancements:

- AFP raster fonts from these IBM products:
 - APL2 Fonts, Version 1 Release 1 (5771-ADB)
 - Data1 Fonts, Version 1. Release 1 (5771-ADA)
 - Sonoran Sans Serif Font, Version 1 Release 1 (5771-ABB)
 - Sonoran Sans Serif Condensed Font, Version 1 Release 1 (5771-AFL)
 - Sonoran Sans Serif Expanded Font, Version 1 Release 1 (5771-AFN)
 - Sonoran Sans Serif Headliner Font, Version 1 Release 1 (5771-ADX)
 - Sonoran Serif Font, Version 1 Release 1 (5771-ABA)
 - Sonoran Serif Headliner Font, Version 1 Release 1 (5771-ADW)
- Version 8.2 of WorldType fonts

When change was introduced:

z/OS V2R3

Reference information:

- [z/OS Font Collection](#).

- [z/OS Upgrade Workflow](#)

HTTP streaming support for the z/OS Client Web Enablement Toolkit

Description:

The z/OS Client Web Enablement Toolkit adds new streaming send and receive functionality to support the sending of large request and response bodies. Instead of the current requirement to have all data sent from and received into a single contiguous buffer, the streaming support allows an application to stage its sending and receiving into multiple buffers. This allows toolkit applications to send and receive a virtually unlimited amount of data. New optional streaming exits (streaming send and streaming receive) can be set to enable the streaming method of processing outgoing and incoming data. For both exits, the toolkit takes an input of buffers from the exit, sends from or receives into these buffers, and then drives the exit again to potentially receive new buffers for it to process until all the data has been processed. All languages except REXX are supported.

When change was introduced:

z/OS V2R3

Reference information:

[z/OS MVS Programming: Callable Services for High-Level Languages](#)

BCP (MVS) new functions to consider

BCPii considerations

The following BCPii function is new in z/OS V2R4:

- **z/OS BCPii support for absolute capping for an LPAR group:** The z/OS BCPii HWIQUERY and HWISET services have been updated to support absolute capping attributes for an LPAR group, which are supported when targeting a CPC at the z13 GA2 level or later. The new image attributes allow an LPAR group's absolute capping status (enablement or disablement) as well as the LPAR group's absolute capping value (maximum usage capacity) to be both queried and set for every processor type.
- **z/OS BCPii support for Dynamic CPC name change:** z/OS BCPii exploits a new enhancement in the firmware on zEC12 and z13 CPCs to allow an installation to dynamically change the name of the CPC in the HMC network while BCPii has active connections to that CPC. When BCPii detects that either the local CPC has changed its name or that a request going to a remote CPC no longer is targeting the same physical machine, BCPii terminates all connections associated with the affected CPC and broadcasts a name change ENF event to notify all parties on the local image that the CPC name change has occurred.
- **New z/OS BCPii HWISET2 service:** The existing HWISET service has been enhanced with the introduction of the new HWISET2 service to allow for multiple attributes to be set on a single API call. This support can provide quicker adjustments to multiple attributes in the hardware configuration, helping to reduce periods of potential configuration inconsistency when setting a single attribute at a time. An additional benefit of this support is having a "two-phase commit" like behavior where either all changes or none of the changes are made when targeting a CPC at the z13 GA2 level or later.
- **JSON data streams:** The web enablement toolkit has new enhancements to better handle JSON data streams for improved time to value for application developers.
- **LPAR group control support:** In z/OS V2.4, BCPii provides simplified programmatic control over active image, through LPAR Group, and activation image profiles, through Group Profiles, in the same manner that BCPii already provides for other hardware configuration entities.

When change was introduced: z/OS V2R4

Reference information: [z/OS MVS Programming: Callable Services for High-Level Languages](#).

Real Storage Manager (RSM) considerations

Expanding beyond 4 TB of real memory

Description:

A system can be defined with more than 4 TB of online real memory (central storage). All the memory exceeding 4 TB will be available as 2GB large pages, thus enabling workloads with extensive real memory requirements.

When change was introduced:

V2R5

Reference information:

[*z/OS MVS Initialization and Tuning Guide*](#)
[*z/OS MVS Initialization and Tuning Reference*](#)
[*z/OS MVS System Management Facilities \(SMF\)*](#)

Tagging 64-bit memory objects for data privacy

Description:

The IARCP64, IARST64, and IARV64 services are enhanced to support data privacy tagging of 64-bit memory objects through the use of the new SENSITIVE parameter. Data that has been tagged as sensitive will be redacted when post processed by Data Privacy for Diagnostics (DPfD).

When change was introduced:

V2R4 with APAR OA57633

Reference information:

- [*Tagging 64-bit memory objects for data privacy in z/OS MVS Programming: Assembler Services Guide*](#)
- [*z/OS MVS Programming: Extended Addressability Guide*](#)
- [*z/OS MVS Programming: Assembler Services Reference IAR-XCT*](#)
- [*z/OS MVS Programming: Authorized Assembler Services Reference EDT-IXG*](#)
- [*z/OS MVS Diagnosis: Reference*](#)

VSM/RSM new function

Description:

Address Space Layout Randomization (ASLR) is a security enhancement that is used to increase the level of difficulty of performing a buffer overflow attack that requires the attacker to know the location of an executable. VSM/RSM provides options to enable ASLR for 24- and 31- bit low private as well as 64-bit private.

When change was introduced:

z/OS V2R4

Reference information:

- [*z/OS MVS Initialization and Tuning Guide*](#)
- [*z/OS MVS Initialization and Tuning Reference*](#)

IARV64 GETSTOR enhancement

Description:

For programs that need to obtain private storage starting at a specific virtual address to meet alignment-sensitive needs, the IARV64 REQUEST=GETSTOR service now provides an INORIGIN parameter. You can use the INORIGIN parameter to obtain this storage without exceeding the virtual area of certain virtual range areas, such as 2GTO64GAREA or LOCALSYSAREA.

When change was introduced:

z/OS V2R4

Reference information:

- [z/OS MVS Programming: Assembler Services Reference IAR-XCT](#)
- [z/OS MVS Programming: Authorized Assembler Services Reference EDT-IXG](#)

System logger considerations

The following enhancements are made to system logger.

Single-system scope Couple Data Set types**Description:**

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

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

Release introduced

z/OS V2R4

Reference information:

- [z/OS MVS Diagnosis: Reference](#)
- [z/OS MVS Initialization and Tuning Reference](#)
- [z/OS MVS Planning: Global Resource Serialization](#)
- [z/OS MVS Programming: Assembler Services Guide](#)
- [z/OS MVS Programming: Assembler Services Reference IAR-XCT](#)
- [z/OS MVS Programming: Authorized Assembler Services Guide](#)
- [z/OS MVS Programming: Authorized Assembler Services Reference EDT-IXG](#)
- [z/OS MVS Setting Up a Sysplex](#)
- [z/OS MVS System Commands](#)
- [z/OS MVS System Messages, Vol 10 \(IXC-IZP\)](#)

Enhanced security options for log stream write-only access**Description:**

Support is added for logger enhanced security options for log stream write-only access. Installation can control when connector to log stream is not allowed or is allowed as limited or full use when AUTH=WRITE specified via access to security profiles for CLASS(LOGSTRM) covering RESOURCE(WRITE_ONLY_log-stream-name and RESOURCElog-stream-name). This enhanced support provides clients and log stream exploiters the ability to allow more discrete use of log streams via a security profile specification given existing programmatic log stream connection attributes. This support allows an installation to provide a more consistent secure system environment and aids in meeting corporate and industry security requirements.

APAR OA56050 support for z/OS V2.4 for logger provides new SAF profile checking and allows limited log stream access for the connector. This support was delivered as an early release APAR on z/OS V2.3. Other than applying and activating the PTF for APAR OA56050, there are no additional installation considerations.

Release introduced

z/OS V2R4

Reference information:

- [z/OS MVS Programming: Assembler Services Guide](#)
- [z/OS MVS Programming: Assembler Services Reference IAR-XCT](#)
- [z/OS MVS Programming: Authorized Assembler Services Reference EDT-IXG](#)
- [z/OS MVS Setting Up a Sysplex](#)

SVC considerations

The following SVC function is new in z/OS V2R4:

- **SVC dump processing:** SVC dump processing has been enhanced to improve overall dump capture times in an unconstrained environment. When sufficient system resources are available, dump processing will utilize more parallelism to reduce the amount of time it takes to capture the requested dump.

When change was introduced: z/OS V2R4

Reference information:

[z/OS MVS System Messages, Vol 6 \(GOS-IEA\)](#)

[z/OS MVS System Commands](#)

[z/OS MVS IPCS Commands](#)

System Management Facility (SMF) considerations

This topic describes new System Management Facility (SMF) functions in z/OS.

SMF type 1154 provides compliance data

The following SMF function is new in z/OS V2R4:

- **Compliance data collection:** In z/OS V2R4 and later, the process of collecting compliance data is assisted with the introduction of SMF type 1154. This new record type is used to collect system settings and other forms of compliance data. On receiving an event notification facility (ENF) code 86 signal from the z/OS Compliance REST API, selected z/OS components and products collect and write compliance data to their associated SMF 1154 subtype records. Each subtype must include the SMF extended header and the SMF1154 common type header, as defined by the IFAR1154 macro. The remainder of the subtype data is specific to the selected component or product.

This support is provided with APAR OA61444 and associated APARs.

When change was introduced: z/OS V2R4

Reference information:

[z/OS MVS System Management Facilities \(SMF\)](#)

SMF Workload Interaction Correlator considerations

The following SMF function is new in z/OS V2R4:

- **IBM z/OS Workload Interaction Correlator:** z/OS Workload Interaction Correlator is a priced feature that provides infrastructure for z/OS software to generate synchronized, standardized, concise, content-rich data with common context for automated analysis by an analytics engine like the IBM z/OS Workload Interaction Navigator. IBM z/OS Workload Interaction Correlator requires IBM z14™ or z15™

hardware. Support is included in the PTF for APAR OA57165 for z/OS V2R4. With APAR OA60372, updates have been made to recommend how to configure correlator data generation for sysplex analysis.

When change was introduced: z/OS V2R4

Reference information:

[*z/OS MVS Initialization and Tuning Reference*](#)

[*z/OS MVS System Commands*](#)

[*z/OS MVS System Management Facilities \(SMF\)*](#)

Digital signatures for SMF records

Description:

z/OS V2R4 extends the digital signature support for SMF records written to log streams to optionally include a second digital signature. When enabled, the second signature will use a quantum-safe algorithm to provide an alternative to current algorithms that have been deemed at risk in a quantum computing environment. Also, SMF's signature verification function is extended to include this second signature to help you determine if SMF records have been altered or removed. This function is intended to protect SMF data into the future. The support is provided with APAR OA57371 and requires Cryptographic Support for z/OS V2R2 - V2R4 (HCR77D1) and IBM z15™.

Release introduced

z/OS V2R4

Reference information:

[*z/OS MVS System Management Facilities \(SMF\)*](#)

WLM considerations

This topic describes new WLM functions in z/OS:

System Recovery Boost

Description: System Recovery Boost is a feature that provides capabilities to reduce the time it takes to shut down, restart, and process the backlog that accumulated during a system outage, by providing additional processor capacity and throughput for the boosted image. System Recovery Boost can deliver higher processor capacity for a limited time after an IPL, or for shutting down a system. In addition to WLM, support is also provided by MVS and RMF.

Enhanced System Recovery Boost capabilities enable clients to leverage a new class of boost that can be applied to a range of sysplex recovery processes, including Sysplex partitioning, Coupling Facility structure recovery, Coupling Facility data sharing member recovery, and IBM HyperSwap.

For more information on System Recovery Boost, see: [IBM Z System Recovery Boost Content Solution \(www.ibm.com/support/z-content-solutions/system-recovery-boost/\)](http://www.ibm.com/support/z-content-solutions/system-recovery-boost/) or [IBM Documentation \(www.ibm.com/docs/en/zos\)](http://www.ibm.com/docs/en/zos).

When change was introduced: z/OS V2R4 and V2R5

XES/XCF considerations

Cross-System Coupling Facility (XCF) enhancements for z/OS V2R4

Description: XCF improvements in z/OS V2R4 include:

- **Transport Class Simplification:** XCF transport classes no longer need to be defined to group signals purely by size. The number of signal paths only needs to be appropriate for the workload. XCF ensures that signal throughput and timely transfer are maintained for the signal workload independent of any particular transport class configuration.

- There is a new XCF switch XTCSIZE to enable or disable the new behavior. There is a new XCF defined pseudo-transport class named `_XCFMGD` that is used to report XCF signal activity when the new behavior is enabled. You obtain the new behavior only when both the sender and target systems are running on z/OS V2R4 (and the XTCSIZE switch is enabled).
- There are new metrics available using XCF accounting and measurement services (IXCMG and IXCYAMDA) that are intended to provide additional information to help understand the number of signal paths that are needed. Specifically, there are new metrics to describe signal path utilization and signal transfer delays induced by inbound signal path "no buffer" conditions.

For more information, see [z/OS MVS Setting Up a Sysplex](#).

When change was introduced: z/OS V2R4.

- **CFMONOPAVID function:** The CFMONOPAVID function controls the z/OS response to detection of structure monopolization of coupling facility (CF) resources. When a structure is allocated in a CF at or above CFLEVEL 24, the CF indicates to z/OS when the structure appears to be consuming a disproportionate share of CF resources. When this function is enabled on a z/OS system, that z/OS instance will respond to the CF notification by limiting CF requests for that structure until the monopolization condition clears.

For more information, see [z/OS MVS Setting Up a Sysplex](#).

When change was introduced: z/OS V2R4 with APAR OA56774.

Communications Server new functions to consider

Support considerations

Description: z/OS Communications Server includes the following enhancement for support considerations.

- **Support considerations in V2R5**

- Rejects the invalid configuration of TLSRFCLEVEL CCCNONOTIFY with TLSMECHANISM ATTLS for both the FTP client and the FTP server.
- Support for the following functions is discontinued.
 - Workload distribution to non-z/OS targets (IBM WebSphere DataPower appliances)
 - Native TLS/SSL support from TN3270E Telnet server, FTP server, and DCAS
 - Support for NCA policy import
 - CMIP from VTAM
 - Sysplex Distributor optimized load balancing with Cisco Multi-Node Load Balancer
- Several migration health checks:
 - ZOSMIGV2R5_NEXT_CS_LSA
 - ZOSMIGV2R5_NEXT_CS_OSADLH
 - ZOSMIGV2R4_NEXT_CS_DCAS_NTVSSL
 - ZOSMIGV2R4_NEXT_CS_FTPCLI_RFCLVL
 - ZOSMIGV2R4_NEXT_CS_FTPSRV_NTVSSL
 - ZOSMIGV2R4_NEXT_CS_FTPSRV_RFCLVL
 - ZOSMIGV2R4_NEXT_CS_TN3270_NTVSSL
 - ZOSMIGV2R4_NEXT_CS_OSIMGMT

When change was introduced: z/OS V2R5

Reference information: See the following topic in [z/OS Communications Server: New Function Summary](#) for detailed descriptions that include any applicable restrictions, dependencies, and steps on using the functions:

- *Support considerations in V2R5*

Hardware support

Description: z/OS Communications Server includes the following enhancements for hardware:

- **OSA-Express Enhanced Inbound Blocking (EIB)**

z/OS V2R5 Communications Server, with TCP/IP APAR PH44281 and SNA APAR OA62831, OSA-Express Enhanced Inbound Blocking (EIB) is a QDIO performance enhancement that might be beneficial for OSA interfaces with a high volume of inbound network bulk or streaming traffic.

Restriction:

QDIO Enhanced Inbound Blocking is supported on OSA-Express7s on z15 or later systems (with supporting MCL).

When change was introduced: z/OS V2R5 with TCP/IP APAR PH44281 and SNA APAR OA62831

- **Communications Server support for RoCE Express3**

z/OS V2R5 Communications Server with TCP/IP APAR PH34117 extends the Shared Memory Communications over Remote Direct Memory Access (SMC-R) function to support the next generation IBM RoCE Express3 feature. The IBM RoCE Express3 feature allows TCP/IP stacks on different LPARs within the same central processor complex (CPC) to leverage the power of these state-of-the-art adapters to optimize network connectivity for mission critical workloads by using Shared Memory Communications technology.

Incompatibilities: This function does not support IPAQENET interfaces that are defined by using the DEVICE, LINK, and HOME statements. Convert your IPAQENET definitions to use the INTERFACE statement to enable this support.

Dependencies: This function requires the IBM z16 or later systems. To enable the z/OS Communications Server support for RoCE Express3 features, complete the appropriate tasks in the following table.

When change was introduced: z/OS V2R5 with TCP/IP APAR PH34117

- **Shared Memory Communications multiple IP subnet support (SMCv2)**

- In z/OS V2R5 Communications Server, Shared Memory Communications - Direct Memory Access (SMC-D) is enhanced to remove the same subnet restriction by exploiting SMC-Dv2.
- In z/OS V2R5 Communications Server, Shared Memory Communications - Remote Direct Memory Access (SMC-R) is enhanced to remove the same IP subnet restriction by exploiting SMC-Rv2.
- In z/OS V2R5 Communications Server, SMC is enhanced to allow greater control of which peers are to perform SMC negotiation using SMC global filters.

Dependencies:

- SMC-Dv2 is enabled with new IBM Z capability provided by the IBM Z Internal Shared Memory (ISM) function. The new ISMv2 capability is available on IBM z15. For IBM z15 T01, refer to the MCL number P46601.067 driver D41C. The ISMv2 support is in the base of the IBM z15 T02.

Downlevel SMC partners might require a toleration PTF. If you plan to enable SMC-Dv2 on a host which has connections to a down-level SMC (SMC-Dv1 or SMC-Rv1) system (z/OS Communications Server, Linux on Z, and AIX), the down-level host will require the following toleration maintenance applied prior to enabling SMC-Dv2:

- For z/OS Communications Server, the down-level host will need the appropriate PTF for PH17556.
- For Linux on Z, see the Linux on Z web page at <https://linux-on-z.blogspot.com/p/smc-for-linux-on-ibm-z.html> for information related to toleration requirements.
- For AIX, see the AIX web page at https://www.ibm.com/support/knowledgecenter/en/ssw_aix_72/rdma/smc_r.html for information related to toleration requirements.

Note: Failure to apply the proper toleration maintenance might result in connection hangs or failures when SMC-Dv2 is enabled on z/OS.

When change was introduced: z/OS V2R5 and with TCP/IP APAR PH22695 and SNA APAR OA59152 for z/OS V2R4

- **Communications Server QDIO display enhancements** - Starting with z/OS Communications Server V2R4, read errors, if any, on the OSA inbound queues are displayed under the queue ID when VTAM TRLE display commands are issued.

When change was introduced: z/OS V2R4

- **Communications Server support for OSA-Express7S 25 GbE features** - z/OS V2R4 Communications Server is enhanced to support the OSA-Express7S feature with 25 GbE bandwidth.

When change was introduced: z/OS V2R4 and with the PTFs for APARs PI95703 and OA55256 for z/OS V2R3

Reference information: See the following topics in [z/OS Communications Server: New Function Summary](#) for detailed descriptions that include any applicable restrictions, dependencies, and steps on using the functions:

- *OSA-Express Enhanced Inbound Blocking (EIB)*
- *Communications Server support for RoCE Express3*
- *Shared Memory Communications multiple subnet support (SMCv2)*

Simplification

Description: z/OS Communications Server includes the following enhancements for simplification:

- **Communications Server exploitation of the IBM Function Registry for z/OS**

z/OS 3.1 Communications Server is enhanced to register VTAM general information with the IBM Function Registry for z/OS. This information allows you to understand the extent of SNA application activity in your network.

When change was introduced: with SNA APAR OA63555 for z/OS V2R5

Reference information: See the following topics in [z/OS Communications Server: New Function Summary](#) for detailed descriptions that include any applicable restrictions, dependencies, and steps on using the functions:

Usability and skills

z/OS Communications Server includes the following enhancements for usability and skills:

- **HiperSockets Converged Interface support** - z/OS Communications Server provides HiperSockets Converged Interface (HSCI) solution to support the z/VM bridge environment. With this solution, a Linux guest can connect to z/OS via Layer 2 HiperSockets and to the external network by using a single IP interface. This support also significantly improves HiperSockets usability by dynamically provisioning and activating a HiperSockets interface when an OSD interface is activated for the same physical network ID (PNetID). With this support, the TCP/IP stack only sees the OSD interface. This design approach greatly reduces the network administration costs as HiperSockets interfaces no longer are required to be configured, operated, or managed in z/OS Communications Server. This solution allows a single IP interface (OSD) to provide access to the external Ethernet LAN and transparent access to HiperSockets for LPAR to LPAR communications within the central processor complex (CPC). This solution also eliminates the need to reconfigure z/OS HiperSockets interfaces when moving a z/OS instance from one CPC to another. The HSCI is also referred to as an IQDC interface.

Incompatibilities:

- This function does not support IPAQENET interfaces that are defined by using the DEVICE, LINK, and HOME statements. Convert your IPAQENET definitions to use the INTERFACE statement to enable this support.

- This function also requires the virtual MAC (VMAC) operand be specified on your IPAQENET interfaces to request OSA-generated VMACs.

Dependencies:

- This function minimally requires a zEnterprise EC12 (zEC12).
- This function requires an Internal Queued Direct I/O (IQD) channel path ID (CHPID) configured with the external bridge function.

Note: With V2R3 APAR PI94208, you can configure this function in Network Configuration Assistant (NCA).

When change was introduced: z/OS V2R4 and with the PTFs for APARs PI83372 and OA53198 for z/OS V2R3

Reference information: See the following topics in [z/OS Communications Server: New Function Summary](#) for detailed descriptions that include any applicable restrictions, dependencies, and steps on using the functions:

- *HiperSockets Converged Interface support*

Scalability and performance

z/OS Communications Server includes the following enhancements for scalability and performance:

- **Persistent Pause Support for Sysplex Distributor DVIPAs** - z/OS 2.5 Communications Server, with APAR PH50408, is enhanced to pause and resume sysplex distribution to specific z/OS application servers, irrespective of the state of the application, the target stack or LPAR and across sysplex failovers.

Dependency: To update the TCP/IP profile with Network Configuration Assistant (NCA), NCA APAR PH50948 is required.

When change is introduced: z/OS V2R5 with APAR PH50408

- **zERT Aggregation recording interval** - z/OS V2R5 Communications Server provides a zERT Aggregation recording interval that is not bound to the system SMF interval. This interval allows zERT summary records to be generated at an interval that can range from 1 to 24 hours.

zERT summary records can be collected as SMF type 119, subtype 12 records in the System Management Facility data sets or log streams. zERT summary records can also be collected by a real-time NMI application using the SYSTCPES service.



Warning:

Decreasing the frequency at which zERT summary records are written can increase the amount of 64-bit pageable, private memory needed. This is because zERT aggregation information is held longer in memory before being captured in SMF records.

When change is introduced: z/OS V2R5 and with APAR PH25049 for z/OS V2R4 and V2R3

- **Inbound Workload Queueing (IWQ) support for IBM z/OS Container Extensions** - z/OS V2R4 Communications Server, with VTAM APAR OA58300 and TCP/IP APAR PH16581, is enhanced to support inbound workload queueing for IBM z/OS Container Extensions (zCX) workloads for OSA-Express in QDIO mode.

Inbound workload queueing uses multiple input queues for each QDIO data device (subchannel device) to improve TCP/IP stack scalability and general network optimization. To implement the performance improvements for zCX workloads, enable inbound workload queueing to process zCX, IPSec, EE, sysplex distributor, and streaming bulk data traffic all concurrently with other types of inbound QDIO traffic. When you enable these improvements for a QDIO interface, zCX, inbound IPSec, EE, sysplex distributor, and streaming bulk data traffic are each processed on their own ancillary input queue (AIQ). All other inbound traffic is processed on the primary input queue.

Incompatibilities: This function does not support IPAQENET interfaces that are defined by using the DEVICE, LINK, and HOME statements. Convert your IPAQENET definitions to use the INTERFACE statement to enable this support.

Dependencies:

- This function is limited to OSA-Express6S Ethernet features or later in QDIO mode running on IBM z14. For more information about the QDIO inbound workload queueing function and the OSA-Express features that support it, see *QDIO inbound workload queueing in z/OS Communications Server: IP Configuration Guide*. See the 3906DEVICE or 3907DEVICE Preventive Service Planning (PSP) bucket for more information.
- This function is supported only for interfaces that are configured to use a virtual MAC (VMAC) address.

When change is introduced: z/OS V2R5 and with VTAM APAR OA58300 and TCP/IP APAR PH16581 for z/OS V2R4

- **Sysplex notification of TCP/IP stack join or leave** - z/OS V2R4 has enhanced Event Notification Facility code 80 to send a signal when a stack joins or leaves a sysplex group.

When change is introduced: z/OS V2R4

- **Network support for z/OS Container Extensions** - z/OS Container Extensions provides native z/OS support for Linux Docker based application workloads. The Communications Server support provides network support for z/OS Container Extensions workloads by introducing a new type of DVIPA called a zCX DVIPA. The zCX DVIPA represents an instance of a Docker server allowing TCP/IP to provide unique IP routing and apply various TCP/IP QoS functions for container workloads running within each Docker server address space.

The Communications Server VTAM support introduces a new type of zCX network transport that dynamically provides optimized internal network connectivity from each Docker server address space ID (ASID) to TCP/IP for providing access to and from the external network. The VTAM support also introduces the z/OS Container Extensions Direct Network Interface Component (DNIC) that provides a Virtual NIC for the Docker server virtualization environment.

When change was introduced: z/OS V2R4

- **IWQ support for IPSec** - z/OS Communications Server is enhanced to support inbound workload queueing for IPSec workloads for OSA-Express in QDIO mode. Inbound workload queueing uses multiple input queues for each QDIO data device (subchannel device) to improve TCP/IP stack scalability and general network optimization. To implement the performance improvements for IPSec workloads, enable inbound workload queueing to process IPSec, EE, sysplex distributor, and streaming bulk data traffic all concurrently with other types of inbound QDIO traffic. When you enable these improvements for a QDIO interface, inbound IPSec, EE, sysplex distributor, and streaming bulk data traffic are each processed on their own ancillary input queue (AIQ). All other inbound traffic is processed on the primary input queue.

Incompatibilities: This function does not support IPAQENET interfaces that are defined by using the DEVICE, LINK, and HOME statements. Convert your IPAQENET definitions to use the INTERFACE statement to enable this support.

Dependencies:

- This function is limited to OSA-Express6S Ethernet features or later in QDIO mode running on IBM z14[®]. For more information about the QDIO inbound workload queueing function and the OSA-Express features that support it, see *QDIO inbound workload queueing in z/OS Communications Server: IP Configuration Guide*. See the 3906DEVICE or 3907DEVICE Preventive Service Planning (PSP) bucket for more information.
- This function is supported only for interfaces that are configured to use a virtual MAC (VMAC) address.

When change was introduced: z/OS V2R4 and with the PTF for APAR PI77649 for z/OS V2R3

Reference information: See the following topics in *z/OS Communications Server: New Function Summary* for detailed descriptions that include any applicable restrictions, dependencies, and steps on using the functions:

- *Persistent Pause Support for Sysplex Distributor DVIPAs*
- *zERT Aggregation recording interval*
- *Inbound Workload Queueing (IWQ) support for IBM z/OS Container Extensions*
- *Sysplex notification of TCP/IP stack join or leave*
- *Network support for z/OS Container Extensions*
- *IWQ support for IPSec*

Systems management

Description: z/OS Communications Server includes the following enhancements for systems management:

- **Ping output enhanced to provide microsecond precision** -z/OS V2R5 Communications Server enhances the output for the TSO PING command and the z/OS UNIX ping command to provide the response time with a precision of microseconds.

When change was introduced: z/OS V2R5

- **Notification of availability of TCP/IP extended services** - z/OS V2R5 Communications Server has enhanced TCP/IP to dynamically generate a new console message (EZD1314I), Event Notification Facility signal, and Name/Token pair when the TCP/IP stack and all its extended stack services are fully initialized. You can use TCP/IP profile configuration to determine which extended services are required based on your needs.

When change was introduced: z/OS V2R5

Reference information: See the following topics in *z/OS Communications Server: New Function Summary* for detailed descriptions that include any applicable restrictions, dependencies, and steps on using the functions:

- *Ping output enhanced to provide microsecond precision*
- *Notification of availability of TCP/IP extended services*

Enhancing security

z/OS Communications Server includes the following security enhancements:

- **z/OS UNIX syslogd support for secure logging over TCP**

z/OS V2R5 Communications Server with APAR PH47666 provides syslog daemon support to receive and send messages over the network using TCP. These TCP connections can be protected with AT-TLS.

Restriction: The syslog daemon supports receiving and sending messages with octet-counted framing over TCP connections. The syslog daemon does not support receiving or sending messages with traditional (non-transparent) framing over TCP connections.

Dependencies: Syslogd is an AT-TLS aware application. To secure messages received by syslogd over a TCP connection, an AT-TLS server rule must be configured for the connection. To secure messages sent by syslogd over a TCP connection, an AT-TLS client rule must be configured for the connection.

When change was introduced: With APAR PH47666 for z/OS V2R5

- **AT-TLS Currency with System SSL**

z/OS V2R5 Communications Server with APAR PH49284 provides AT-TLS support for the following functions:

- TLS Version 1.3 sysplex session ticket support
- Domain-based server certificate validation during an SSL/TLS session negotiation

With APAR PH53064, you can configure these functions in IBM Network Configuration Assistant for z/OS Communications Server.

Dependencies:

- To use TLS Version 1.3 sysplex session tickets:
 - z/OS V2R5 System SSL APAR OA63252 is required.
 - GSKSRVR must be started for all systems in the sysplex acting as AT-TLS servers for the workload.
- To use domain-based server certificate validation, z/OS V2R5 System SSL APAR OA63164 is required.

When change was introduced: With APAR PH49284 for z/OS V2R5

• **AT-TLS support for x25519 and x448 key exchange for TLSv1.2**

z/OS 3.1 Communications Server with APAR PH45902 provides AT-TLS support for a TLSv1.2 server to specify which elliptic curves can be used for the handshake key exchange when an ephemeral ECDH (Elliptic curve Diffie-Hellman) cipher is used. Support is also added for the x25519 and x448 curves for TLSv1.2 handshake key exchange.

These updates also apply to TLSv1.0 and TLSv1.1.

Restriction: For TLSv1.0, TLSv1.1, and TLSv1.2, curves x25519 and x448 are not enabled by default and must be configured explicitly both for the AT-TLS client and server.

When change was introduced: With APAR PH45902 for z/OS V2R5

• **Support for SMF compliance evidence**

z/OS V2R5 Communications Server with APAR PH37372 generates new SMF type 1154 records that provide compliance evidence for the TCP/IP stack (subtype 1), FTP daemon (subtype 2), TN3270E Telnet server (subtype 3), and CSSMTP client (subtype 4).

This data can be helpful in determining compliance with various industry regulations and standards.

These records are generated whenever an Event Notification Facility (ENF) 86 signal is emitted by a system in the sysplex and the ENF 86 parameter list includes the local z/OS system name. The ENF 86 signal is triggered by a z/OSMF Compliance REST API.

Restriction: z/OS APARs OA61443 and OA61444 are required to support the new ENF 86 signal.

Dependencies:

- The TCP/IP stack must be active to provide the TCP/IP stack compliance evidence SMF record.
- The FTP daemon must be active to provide the FTP daemon compliance evidence SMF record.
- The TN3270E Telnet server must be active to provide TN3270E Telnet server compliance evidence SMF records (one per server port).
- CSSMTP must be active to provide the CSSMTP client compliance evidence record.

When change was introduced: With APAR PH37372 for z/OS V2R4 and V2R5

• **FTP server JES access control**

z/OS V2R5 Communications Server with APAR PH42618 supports a new SAF resource in the SERVAUTH class to control which users are allowed to access FTP JES mode. When the SERVAUTH class is active and a profile is defined for the EZB.FTP.sysname.ftpdemonname.ACCESS.JES SAF resource, only users with permission to the profile are allowed to access FTP JES mode.

Dependency: The SERVAUTH class must be active for the EZB.FTP.sysname.ftpdemonname.ACCESS.JES SAF resource to provide access controls.

When change was introduced: With APAR PH42618 for z/OS V2R3, V2R4, V2R5

• **IBM zERT Network Analyzer passphrase and password management support**

The IBM zERT Network Analyzer with APAR PH43119 for z/OS V2R5 supports the use of passphrases up to 100 characters to connect to the Db2® for z/OS database. The IBM zERT Network Analyzer

includes additional enhancements in the **Database Settings** panel to clear existing database credentials to allow for easier switching to a different database user ID.

When change was introduced: With APAR PH43119 for z/OS V2R4 and V2R5, APAR PH43118 for z/OS V2R3

- **AT-TLS currency with System SSL** - z/OS V2R5 Communications Server provides AT-TLS support for RFC 7627 "Transport Layer Security (TLS) Session Hash and Extended Master Secret Extension". RFC 7627 defines an extended master secret extension. The extension is used to negotiate whether an extended master secret computation will be used for a TLSv1.2 or earlier handshake.

Incompatibility: TLSv1.3 does not use the extended master secret extension to negotiate whether an extended master secret computation will be used or not. The same protection provided by the extended master secret computation is built into the base TLSv1.3 support.

When change was introduced: z/OS V2R5

- **zERT policy-based enforcement** - z/OS V2R5 Communications Server enhances the z/OS Encryption Readiness Technology (zERT) function to provide enforcement of your network encryption standards. The zERT policy-based enforcement (zERT enforcement) solution allows policy-based rules that describe different levels of cryptographic protection along with optional actions to take when TCP connections match those rules. zERT enforcement actions enable immediate notification through messages, auditing through SMF records, and automatic connection termination when questionable or unacceptable cryptographic protection is detected.

z/OS network security administrators can create and manage zERT enforcement rules and actions through the Network Configuration Assistant with APAR PH35304 and the z/OS Communications Server policy agent.

Restrictions:

- zERT enforcement applies only to TCP traffic. It does not apply to UDP traffic (including EE) or traffic using other IP protocols.
- For TLS and SSH, zERT enforcement uses the cryptographic protection attributes that are obtained through stream observation only. A limited amount of security attribute data is available through observation as compared to data obtained by zERT enabled z/OS cryptographic protocol providers.
- zERT discovery collects cryptographic security attributes for the TLS, SSL, SSH, and IPsec protocols. No other cryptographic security protocols are supported.

Dependencies:

- z/OS Encryption Readiness Technology (zERT) function must be enabled with the GLOBALCONFIG statement in the TCP/IP profile.
- To create and manage zERT enforcement rules and actions with the Network Configuration Assistant (NCA), NCA APAR PH35304 is required.
- zERT enforcement requires policy agent to be started.
- If you plan to configure zERT enforcement to log messages to syslogd, the syslog daemon and traffic regulation manager daemon (TRMD) must be active.

When change was introduced: z/OS V2R5

- **AT-TLS and IPsec certificate diagnostics** - z/OS V2R5 Communications Server provides additional certificate diagnostic data to allow you to more quickly determine the cause of an AT-TLS or IPsec negotiation failure. New syslogd messages are provided to identify certificate validation errors detected when processing a peer's certificate.

Restrictions:

- Certificate diagnostic messages are provided when the validation of the peer's certificate fails. For validation failures accessing the local certificate, certificate diagnostic data is not provided.
- For IPsec negotiation failures due to errors with the peer's certificate, certificate diagnostic data will only be provided when the failure is detected by System SSL.

Dependencies:

The syslog daemon (i.e. syslogd) must be active. For AT-TLS and IPsec, the additional certificate diagnostic messages are written to syslogd.

When change was introduced: z/OS V2R5

- **IPsec certificate reporting enhancements** - In V2R5, the z/OS UNIX ipsec command has been enhanced to display local and remote certificate information, such as serial number and expiration date, for phase 1 tunnels. The same certificate information is provided in the IPsec Network Management Interface (NMI) NMSec_GET_IKETUN and NMSec_GET_IKETUNCASCADE message responses, and the SMF type 119 IPsec IKE tunnel activation (subtype 73) and tunnel deactivation (subtype 74) records.

Restriction: When using the z/OS UNIX ipsec command to retrieve phase 1 tunnel data from a remote system, both the local and remote system must be at z/OS V2R5 or later for the new certificate fields to be displayed.

When change was introduced: z/OS V2R5

- **IBM Health Checker for use of native TLS/SSL support for DCAS** - z/OS V2R3 and V2R4 Communications Server, with TCP/IP APAR PH16144 and SNA APAR OA58255, provides a new migration health check to use with the IBM Health Checker for z/OS function. The migration health check identifies if DCAS uses native TLS/SSL support.

Dependencies: You must install TCP/IP APAR PH16144 and SNA APAR OA58255 and start the IBM Health Checker for z/OS to use the new migration health check.

When change was introduced: z/OS V2R3 and V2R4 with TCP/IP APAR PH16144 and SNA APAR OA58255

- **IBM Health Checker for use of native TLS/SSL support for the FTP server** - z/OS V2R3 and V2R4 Communications Server, with TCP/IP APAR PH21573 and SNA APAR OA59022, provides a new migration health check to use with the IBM Health Checker for z/OS function. The migration health check identifies active FTP servers using native TLS/SSL support.

z/OS V2R4 Communications Server, with TCP/IP APAR PH24732 and SNA APAR OA59490, provides additional migration health checks to use with the IBM Health Checker for z/OS function. These migration health checks identify FTP servers and clients that are configured with an invalid configuration of TLSRFCLEVEL CCCNONOTIFY with TLSMECHANISM ATTLS.

Dependencies:

- You must install TCP/IP APAR PH21573 and SNA APAR OA59022 and start the IBM Health Checker for z/OS to use the new migration health check to identify active FTP servers using native TLS/SSL support.
- You must install TCP/IP APAR PH24732 and SNA APAR OA59490 and start the IBM Health Checker for z/OS to use the new migration health checks to identify FTP servers and clients that are configured with an invalid configuration of TLSRFCLEVEL CCCNONOTIFY with TLSMECHANISM ATTLS.

When change was introduced: z/OS V2R3 and V2R4 with TCP/IP APARs PH21573 and PH24732 and SNA APARs OA59022 and OA59490

- **IBM Health Checker for use of native TLS/SSL support for the TN3270 server** - z/OS V2R3 and V2R4 Communications Server, with TCP/IP APAR PH16144 and SNA APAR OA58255, provides a new migration health check to use with the IBM Health Checker for z/OS function. The migration health check identifies active TN3270 servers using native TLS/SSL support.

Dependencies: You must install TCP/IP APAR PH16144 and SNA APAR OA58255 and start the IBM Health Checker for z/OS to use the new migration health check.

When change was introduced: z/OS V2R3 and V2R4 with TCP/IP APAR PH16144 and SNA APAR OA58255

- **IBM zERT Network Analyzer database administration enhancements** - z/OS Management Facility (z/OSMF) with the IBM zERT Network Analyzer provides additional flexibility in IBM zERT Network Analyzer's Db2 for z/OS database schema definitions and reduces the access privileges required by the IBM zERT Network Analyzer's database user ID. The supplied database schema tooling now supports

customized values for the database schema name, index names and even table names along with many other operational parameters that were already configurable.

Dependencies: No new dependencies are introduced. The IBM zERT Network Analyzer requires z/OSMF to be installed and a type 4 JDBC connection to Db2 for z/OS 11 or higher.

When change was introduced: z/OS V2R5 and with APAR PH24494 for z/OS V2R4 and with APAR PH24492 for z/OS V2R3

- **Sysplex Autonomics for IPsec** - z/OS V2R5 enhances the sysplex autonomics function to monitor IPsec infrastructure. You can request that sysplex autonomics delay a TCP/IP stack from joining a sysplex group until the IPsec infrastructure is active. You can also request that sysplex autonomics monitor the IPsec infrastructure after the stack has joined the sysplex group. If monitoring the IPsec infrastructure is enabled, you are alerted with new messages when the IPsec infrastructure is not operational. You can optionally configure the TCP/IP stack to also take a recovery action and leave the sysplex when it detects that the IPsec infrastructure is not active. This allows a backup TCP/IP stack to take over DVIPAs from the system that left the sysplex.

Restrictions:

- The monitoring of the IPsec infrastructure can only be enabled for a TCP/IP stack that is using sysplex-wide security sessions (SWSA) and has the DVIPSEC parameter configured on the IPSEC statement in the TCP/IP profile.
- While the EZBDVIPA coupling facility structure is required for IPsec sysplex-wide security associations (SWSA), the ability of the TCP/IP stack to connect to or access the EZBDVIPA structure is not monitored by sysplex autonomics for IPsec. A failure related to the EZBDVIPA structure would typically be sysplex-wide. It would not be beneficial for a TCP/IP stack to leave the sysplex for a sysplex-wide failure.
- In IPsec configurations where both a primary and backup NSSD are configured for certificate services, no monitoring of the IKED connection to NSSD is done after the TCP/IP stack joins the sysplex. See the IP Configuration Guide “Sysplex Autonomics for IPsec infrastructure” for additional information.

Incompatibilities:

- If your IPsec infrastructure includes the Network Security Services daemon (NSSD), and the IKED to NSSD connection uses a DVIPA as the source or destination IP address, the sysplex autonomics IPsec infrastructure monitoring function should not be enabled.
- If you use a centralized Policy Agent server for IPsec or AT-TLS policy, and the connection from the policy client to the policy server uses a DVIPA as the source or destination IP address, the sysplex autonomics IPsec infrastructure monitoring function should not be enabled.

Note: With V2R4 APAR PH16303, you can configure this function in Network Configuration Assistant (NCA).

When change was introduced: z/OS V2R5 and with APAR PH12788 for z/OS V2R4

- **AT-TLS support for TLS v1.3** - z/OS V2R4 Communications Server adds support for TLS Version 1.3 for Application Transparent Transport Layer Security (AT-TLS). This includes support for the following new TLSv1.3 cipher suites: TLS_AES_128_GCM_SHA256, TLS_AES_256_GCM_SHA384, and TLS_CHACHA20_POLY1305_SHA256.

z/OS V2R4 Communications Server enhances the z/OS Encryption Readiness Technology (zERT) function to detect and report TLSv1.3 security session information using SMF Type 119 subtype 11 and 12 records. The IBM zERT Network Analyzer z/OSMF plug-in is also enhanced to accept and display TLSv1.3 information and to allow IBM zERT Network Analyzer users to query database content using the new TLSv1.3 security session characteristics.

Restrictions:

Support for TLS Version 1.3 is provided only for AT-TLS. Native TLS support for the FTP server and client, the TN3270E server, and DCAS is not updated to support TLSv1.3.

Incompatibilities:

- The cipher suites supported for TLS Version 1.2 and earlier are not supported for TLS Version 1.3. And the cipher suites supported for TLS Version 1.3 are not supported by earlier versions of TLS. If TLSv1.3 and earlier versions are enabled, the configured list of supported cipher suites must include values supported for TLSv1.3 and values supported by earlier TLS versions.
- The FIPS 140-2 standard does not define support for TLSv1.3 or the new cipher suites defined for it. Enabling both the TLSv1.3 protocol and FIPS support results in an error.

Dependency:

The Integrated Cryptographic Services Facility (ICSF) must be active to provide support for all TLSv1.3 cipher suites.

When change was introduced: z/OS V2R4

- **IBM zERT Network Analyzer** - IBM zERT (z/OS Encryption Readiness Technology) Network Analyzer is a web-based graphical user interface that z/OS network security administrators can use to analyze and report on data reported in zERT Summary records.

Dependency:

- You must have installed z/OSMF to use IBM zERT Network Analyzer.
- The IBM zERT Network Analyzer task requires either Db2 11 for z/OS or Db2 12 for z/OS.

When change was introduced: z/OS V2R4 and with the PTFs for zERT Network Analyzer V2R3 APAR PH03137 and z/OSMF V2R3 APARs PH04391 and PH00712

- **z/OS Encryption Readiness Technology (zERT) aggregation** - z/OS Communications Server introduced a new function called z/OS Encryption Readiness Technology (zERT). With zERT, the TCP/IP stack acts as a focal point in collecting and reporting the cryptographic security attributes of IPv4 and IPv6 application traffic that is protected using the TLS/SSL, SSH, and IPsec cryptographic network security protocols. The collected connection level data is written to SMF in SMF 119 subtype 11 records. In certain environments, the volume of SMF 119 subtype 11 records can be large. z/OS V2R4 Communications Server provides the zERT aggregation function. The zERT aggregation function provides an alternative SMF view of the collected security session data. This alternate view is written in the form of new SMF 119 subtype 12 records that summarize the use of security sessions by many application connections over time and which are written at the end of each SMF interval. This alternate view condenses the volume of SMF record data while still providing all the critical security information.

Restrictions:

The following restrictions apply to both zERT discovery and zERT aggregation functions.

zERT collects information for TCP and Enterprise Extender (EE) connections. Information is not collected for non-EE UDP traffic or traffic using other IP protocols.

zERT collects cryptographic security attributes for the TLS, SSL, SSH, and IPsec protocols. No other cryptographic security protocols are supported.

The following z/OS cryptographic protocol providers are fully enabled for zERT: z/OS Communications Server IPsec and AT-TLS, z/OS Cryptographic Services System SSL, and z/OS OpenSSH. Detailed security attribute data is available for connections using these protocol providers. Other TLS, SSL, and SSH implementations running on z/OS are monitored through stream observation only. A limited amount of security attribute data is available for these connections.

For information on the specific cases where security attribute data is limited or unavailable, see *zERT discovery limitations* in [z/OS Communications Server: IP Configuration Guide](#).

Dependency: To properly monitor IBM Sterling Connect:Direct traffic when it is protected through SecurePlus TLS/SSL support, apply Connect:Direct APAR PI77316.

Note: With Network Configuration Assistant (NCA) V2R3 APAR PI94208, this function is available in the TCP/IP security resources, and in the SMF and real time Network Management services.

When change was introduced: z/OS V2R4 and with the PTF for APAR PI83362 for z/OS V2R3

- **TN3270E Telnet server Express Logon Feature support for Multi-Factor Authentication** - The TN3270E Telnet server Express Logon Feature (ELF) is extended to support IBM Multi-Factor Authentication (MFA) for z/OS. With this support, TN3270E clients can experience the same single sign-on behavior that is already offered by the PassTicket-based ELF, but now via an MFA token that is assigned by a SAF-compliant external security manager like IBM Security Server RACF. With the new EXPRESSLOGONMFA parameter in the TN3270E Telnet server profile, ELF attempts to authenticate clients by using their X.509 client certificate through MFA. If no MFA token is available for the user, the authentication fails by default. ELF can be configured to revert back to PassTicket authentication in certain cases where MFA authentication is unsuccessful.

Dependencies:

- IBM Security Server RACF APAR OA53002
- IBM Multi-Factor Authentication for z/OS APAR PI86470 and PI93341

When change was introduced: z/OS V2R4, and z/OS V2R3 with the PTFs for APAR PI85185, RACF APAR OA53002, and IBM MFA for z/OS APARs PI86470 and PI93341

Reference information: See the following topics in *z/OS Communications Server: New Function Summary* for detailed descriptions that include any applicable restrictions, dependencies, and steps on using the functions:

- *z/OS UNIX syslogd support for secure logging over TCP*
- *AT-TLS currency with System SSL (with APAR 49284)*
- *AT-TLS support for x25519 and x448 key exchange for TLSv1.2*
- *Support for SMF compliance evidence*
- *FTP server JES access control*
- *IBM zERT Network Analyzer passphrase and password management support*
- *AT-TLS currency with System SSL*
- *zERT policy-based enforcement*
- *AT-TLS and IPsec certificate diagnostics*
- *IPsec certificate reporting enhancements*
- *IBM Health Checker for use of native TLS/SSL support for DCAS*
- *IBM Health Checker for use of native TLS/SSL support for the FTP server*
- *IBM Health Checker for use of native TLS/SSL support for the TN3270 server*
- *IBM zERT Network Analyzer database administration enhancements*
- *Sysplex autonomics for IPsec*
- *AT-TLS support for TLS v1.3*
- *IBM zERT Network Analyzer*
- *z/OS Encryption Readiness Technology (zERT) aggregation*
- *TN3270E Telnet server ELF support for MFA*

Application development

z/OS Communications Server includes the following enhancements for application, middleware, and workload enablement:

- **SMTDP compatibility enhancements for CSSMTP** - z/OS Communications Server enhances the Communications Server SMTP (CSSMTP) application with three new configuration parameters to provide better compatibility with SMTDP for your migration from SMTDP to CSSMTP.

When change was introduced: z/OS V2R5 and with APAR PH18237 for z/OS V2R4 and z/OS V2R3

- **Communications Server resolver enhancements** - The Resolver caching function provided users with the ability to set a maximum time-to-live (TTL) value for cached Domain Name System (DNS) name

server information, but the MAXTTL resolver setup statement applied to all types of cached DNS name server entries. Starting with z/OS V2R4 Communications Server, users can specify two different maximum TTL values: a new MAXNEGTTTL resolver setup statement for negative cache entries and the existing MAXTTL resolver setup statement for all other cache entries. In addition, the output of the MODIFY RESOLVER,DISPLAY|REFRESH command is enhanced to include the name of the most recently used resolver setup file.

When change was introduced: z/OS V2R4

- **Code page enhancements for CSSMTP** - z/OS V2R4 Communications Server is enhanced to support multi-byte character sets with the Communications Server SMTP (CSSMTP) application. This enhancement allows migration from SMTPD to CSSMTP for customers that use multi-byte character set code pages, and provides improved code page support for characters in the mail subject line.

When change was introduced: z/OS V2R4 and with the PTF for APAR PI93278 for z/OS V2R3

Reference information: See the following topics in [z/OS Communications Server: New Function Summary](#) for detailed descriptions that include any applicable restrictions, dependencies, and steps on using the functions:

- [SMTPD compatibility enhancements for CSSMTP](#)
- [Communications Server resolver enhancements](#)
- [Code page enhancements for CSSMTP](#)

Cryptographic Services new functions to consider

This topic describes new Cryptographic Services functions in z/OS.

ICSF

This topic describes new ICSF function in z/OS.

ICSF: Support for Crypto Express8 adapters, Kyber keys, and new key sizes for the Dilithium digital signature algorithm

Description: ICSF provides support for the following enhancements:

- Crypto Express8 adapter.
- New key sizes for the Dilithium digital signature algorithm, including NIST Round 2 and Round 3 versions.
- New Kyber keys, which are a Quantum Safe Algorithm used for key exchange mechanisms.

When change was introduced: PTF for APAR OA61609 and Cryptographic Support for z/OS V2R2 - z/OS V2R4 (FMID HCR77D1) and z/OS V2R5.

Reference information:

[z/OS Cryptographic Services ICSF Overview](#)

[z/OS Cryptographic Services ICSF Administrator's Guide](#)

[z/OS Cryptographic Services ICSF Application Programmer's Guide](#)

[z/OS Cryptographic Services ICSF System Programmer's Guide](#)

[z/OS Cryptographic Services ICSF Messages](#)

[z/OS Cryptographic Services ICSF Writing PKCS #11 Applications](#)

ICSF: CCA and PKCS #11 Algorithm Currency enhancements

Description: ICSF added support for the following enhancements:

- CCA services:

- A new callable service, Encrypted PIN Verify 2 (CSNBPVR2), which can be used to compare two ISO-4 PIN Blocks.
- New 'One Way Function' options added to Symmetric Algorithm Encipher (CSNBSAE) and Diversified Key Generate (CSNBKDG) callable services in support of Australian Payment Networks (APN) standards.
- The ability to have the Random Number Generate Long (CSNBRNGL) callable service return data encrypted with a provided cipher key.
- New EC-SDSA signatures for elliptic curves secp256r1 and secp521r1.
- Support for the Schnorr digital signature algorithm.
- The ability to export ECC, RSA, and AES key tokens in "Azure object format" for use in cloud services.
- New key usage keywords to the Key Generator Utility Program (KGUP) for AES CIPHER keys.
- A new C header file for mapping SMF Type 82 records.
- PKCS #11 services:
 - A new PKCS#11 Secret Key Reencrypt (CSFPSKR) callable service to allow ciphertext to be encrypted under a new encryption key within the boundary of the HSM.
 - Enhancements for Koblitz elliptic curves.

When change was introduced: PTF for APAR OA61253 and Cryptographic Support for z/OS V2R2 - z/OS V2R4 (FMID HCR77D1) and z/OS V2R5.

Reference information:

[*z/OS Cryptographic Services ICSF Overview*](#)
[*z/OS Cryptographic Services ICSF Administrator's Guide*](#)
[*z/OS Cryptographic Services ICSF Application Programmer's Guide*](#)
[*z/OS Cryptographic Services ICSF System Programmer's Guide*](#)
[*z/OS Cryptographic Services ICSF Writing PKCS #11 Applications*](#)

ICSF: Changed master key for audit purposes

Description: The DISPLAY ICSF command has been updated such that the MKVPS and KDS options show the timestamp for when a master key verification pattern was first written to a KDS or changed as a result of a change master key operation. These updated displays provide a quick and easy way to determine the age of a Crypto Express master key, which can then be used to prove adherence to key rotation policies.

When change was introduced: Cryptographic Support for z/OS V2R5 (FMID HCR77D2).

Reference information:

[*z/OS Cryptographic Services ICSF Administrator's Guide*](#)
[*z/OS Cryptographic Services ICSF System Programmer's Guide*](#)
[*z/OS Cryptographic Services ICSF Messages*](#)

ICSF: Enforce SAF checking of the private-key name in ECC tokens

Description: ICSF provides the ability to create CSFKEYS profiles to enable the same SAF checking of the private key name field within an ECC token as is available for RSA and QSA private key tokens.

When change was introduced: Cryptographic Support for z/OS V2R5 (FMID HCR77D2).

Reference information:

[*z/OS Cryptographic Services ICSF Administrator's Guide*](#)
[*z/OS Cryptographic Services ICSF Application Programmer's Guide*](#)
[*z/OS Cryptographic Services ICSF System Programmer's Guide*](#)
[*z/OS Cryptographic Services ICSF Messages*](#)

ICSF: KDS support for larger key sizes

Description: ICSF adds support for a new large common record format (KDSRL) to the CKDS and PKDS.

When change was introduced: Cryptographic Support for z/OS V2R5 (FMID HCR77D2).

Reference information:

[*z/OS Cryptographic Services ICSF Overview*](#)

[*z/OS Cryptographic Services ICSF Administrator's Guide*](#)

[*z/OS Cryptographic Services ICSF Application Programmer's Guide*](#)

[*z/OS Cryptographic Services ICSF System Programmer's Guide*](#)

ICSF: Limit archived keys to decrypt operations only

Description: A new SAF resource in the XFACILIT class, CSF.KDS.KEY.ARCHIVE.DATA.DECRYPT, allows ICSF administrators to restrict the use of archived keys to data decryption operations only. The intent is to allow archived keys to decrypt existing ciphertext which would enable reencryption with a new key, but not allow that same archived key to generate new ciphertext. If the SAF resource does not exist, the behavior of the archived keys is governed by the CSF.KDS.KEY.ARCHIVE.USE resource.

When change was introduced: Cryptographic Support for z/OS V2R5 (FMID HCR77D2).

Reference information:

[*z/OS Cryptographic Services ICSF Administrator's Guide*](#)

[*z/OS Cryptographic Services ICSF Application Programmer's Guide*](#)

[*z/OS Cryptographic Services ICSF System Programmer's Guide*](#)

[*z/OS Cryptographic Services ICSF Messages*](#)

ICSF: Support for password-based key derivation function 2 (PBKDF2)

Description: ICSF implemented support for secure password-based key-derivation methods in order to support current industry standards. Two APIs are enhanced to add support for PBKDF2:

- A new rule was added to the PKCS #11 Generate secret key (CSFPGSK and CSFPGSK6) callable service.
- Support added to C_GenerateKey in the ICSF PKCS #11 libraries for CKM_PKCS5_PBKD2.

When change was introduced: Cryptographic Support for z/OS V2R5 (FMID HCR77D2).

Reference information:

[*z/OS Cryptographic Services ICSF Application Programmer's Guide*](#)

[*z/OS Cryptographic Services ICSF Writing PKCS #11 Applications*](#)

ICSF: Cryptographic services enhancements for CCA

Description: ICSF added support for the new wrapping method for DES keys, WRAPENH3. All DES keys except keys with a zero control vector can be wrapped with the WRAPENH3 method. The Key Test2 (CSNBKYT2 and CSNEKYT2) service has a new rule array key word, KEY-LEN. The MAC Generate (CSNBMGN and CSNEMGN) and MAC Verify (CSNBMVR and CSNEMVR) services are enhanced to support the TDES-CMAC algorithm for double-length and triple-length keys. The CKDS conversion utility, CSFCNV2, enables you to convert all tokens in the CKDS to use the WRAP-ECB, WRAP-ENH, or WRAPENH3 wrapping methods.

When change was introduced: PTF for APAR OA60318 and Cryptographic Support for z/OS V2R2 - z/OS V2R4 (FMID HCR77D1).

Reference information:

[*z/OS Cryptographic Services ICSF Overview*](#)

[*z/OS Cryptographic Services ICSF Administrator's Guide*](#)

[*z/OS Cryptographic Services ICSF Application Programmer's Guide*](#)

[z/OS Cryptographic Services ICSF System Programmer's Guide](#)

[z/OS Cryptographic Services ICSF Messages](#)

[z/OS Cryptographic Services ICSF TKE Workstation User's Guide](#)

ICSF: Enhancements for IBM z15 Model T02 and EMV service update

Description: ICSF is updated to provide:

- Full support across CCA and PKCS#11 callable services for a lattice-based cryptographic algorithm for key generation and digital signature operations, both clear key and secure key.
- The addition of Elliptic Curve Cryptography operations to its CCA protected key functions.
- Enhancements to the TR-31 callable services to support using key blocks to export and import HMAC keys.
- The addition of Edwards curves (Ed25519 and Ed448) to its CCA key generation and digital signature operations.
- Support for Visa CVN 18 to the Derive ICC MK (CSNBDCM and CSNEDCM), Derive Session Key (CSNBDSK and CSNEDSK), EMV Transaction (ARQC/ARPC) Service (CSNBEAC and CSNEEAC), and Generate Issuer MK (CSNBGIM and CSNEGIM) callable services.

When change was introduced: PTF for APAR OA58880 and Cryptographic Support for z/OS V2R2 - z/OS V2R4 (FMID HCR77D1).

Reference information:

[z/OS Cryptographic Services ICSF Overview](#)

[z/OS Cryptographic Services ICSF Administrator's Guide](#)

[z/OS Cryptographic Services ICSF Application Programmer's Guide](#)

[z/OS Cryptographic Services ICSF System Programmer's Guide](#)

[z/OS Cryptographic Services ICSF Writing PKCS #11 Applications](#)

ICSF: Enhancements for Crypto Express5S (CCA Release 5.4 and later) and Crypto Express6S (CCA Release 6.2 and later)

Description: Enhancements include:

- ISO-4 format PIN blocks as described in the ISO-9564-4 standard. In addition to a new service, PIN Translate 2 (CSNBPTR2), the following services are updated to support ISO-4 format PIN blocks: Clear PIN Encrypt (CSNBCPE), DK PIN Verify (CSNBKPV), DK PIN Change (CSNBKPC), and DK PAN Modify in Transaction (CSNBKMT).
- Three-key TDES Keys. Currently, only DATA key types are available in 3-key TDES key types. This enhancements allows for the following key types to be operational as a 3-key TDES key: CIPHER, ENCIPHER, DECIPHER, EXPORTER, IMPORTER, MAC, MACVER, IPINENC, OPINENC, PINGEN, and PINVER.
- DK Key Diversification. The German Banking Industry Committee (GBIC) introduced a new key diversification scheme such that a single diversification key can be used to generate keys with different key usage attributes. A new key type is introduced, KDKGENKY, as well as a new callable service Diversify Directed Key (CSNBDDK). The following callable services are updated in support of DK Key Diversification: Diversified Key Generate 2 (CSNBKDG2), Key Token Build 2 (CSNBKTB2), and Key Generate 2 (CSKBKGN2).
- ISO-20038 Key Wrapping. In support of the ISO-20038 standard, the TR-31 Import (CSNBT31I) and TR-31 Export (CSNBT31X) callable services are updated to use AES IMPORTER and EXPORTER key types for key wrapping.
- Crypto Express6S, in addition to the enhancements above, symmetric keys can now be restricted from being eligible for CPACF protected key. With updated flags in the control vector, it is possible to mark a key as either eligible or ineligible for being exported for CPACF use as a protected key. In addition, CCA provides the ability for 3-key TDES keys to be “tagged” such that they are restricted to PCI HSM compliance usage

When change was introduced: PTF for APAR OA55184, rolled into the base of Cryptographic Support for z/OS V2R2 - z/OS V2R3 (FMID HCR77D0) and z/OS V2R4.

Reference information:

[z/OS Cryptographic Services ICSF Overview](#)

[z/OS Cryptographic Services ICSF Administrator's Guide](#)

[z/OS Cryptographic Services ICSF Application Programmer's Guide](#)

[z/OS Cryptographic Services ICSF System Programmer's Guide](#)

[z/OS Cryptographic Services ICSF Messages](#)

ICSF: CCA redirection for Regional Crypto Enablement

Description: Certain CCA callable services have the ability to direct the request to a regional crypto server. This enhancement introduces the concept of "RCS Redirection" through a new XFACILIT resource, and adds the concept of an "RCS Token" to existing symmetric key token types.

When change was introduced: PTF for APAR OA54132, rolled into the base of Cryptographic Support for z/OS V2R2 - z/OS V2R3 (FMID HCR77D0) and z/OS V2R4.

Reference information:

[z/OS Cryptographic Services ICSF Administrator's Guide](#)

[z/OS Cryptographic Services ICSF Application Programmer's Guide](#)

[z/OS Cryptographic Services ICSF System Programmer's Guide](#)

[z/OS Cryptographic Services ICSF Messages](#)

ICSF: ChaCha20 and Poly1305 algorithms

Description: These new algorithms are available via the PKCS#11 interfaces and clear key only.

When change was introduced: Cryptographic Support for z/OS V2R2 - z/OS V2R3 (FMID HCR77D0) and z/OS V2R4.

Reference information:

[z/OS Cryptographic Services ICSF Administrator's Guide](#)

[z/OS Cryptographic Services ICSF Application Programmer's Guide](#)

[z/OS Cryptographic Services ICSF System Programmer's Guide](#)

[z/OS Cryptographic Services ICSF Writing PKCS #11 Applications](#)

ICSF: Dynamic Service update: Applying service to a running ICSF instance without causing an interruption to your applications

Description: ICSF has a new operator command that allows running requests to finish, pause incoming requests, prepare to restart with the service libraries, and then stop ICSF. Through system automation (preferred), ICSF is restarted and the paused requests are resumed without a visible interruption.

When change was introduced: Cryptographic Support for z/OS V2R2 - z/OS V2R3 (FMID HCR77D0) and z/OS V2R4.

Reference information:

[z/OS Cryptographic Services ICSF Overview](#)

[z/OS Cryptographic Services ICSF Administrator's Guide](#)

[z/OS Cryptographic Services ICSF Application Programmer's Guide](#)

[z/OS Cryptographic Services ICSF System Programmer's Guide](#)

[z/OS Cryptographic Services ICSF Messages](#)

ICSF: Early ICSF availability

Description: ICSF is now able to start much earlier in the IPL process, such that ICSF should be available for work as early as full function start. ICSF also added new ways to provide installation options via a more standard PARMLIB interface.

When change was introduced: Cryptographic Support for z/OS V2R2 - z/OS V2R3 (FMID HCR77D0) and z/OS V2R4.

Reference information:

[z/OS Cryptographic Services ICSF Application Programmer's Guide](#)

[z/OS Cryptographic Services ICSF System Programmer's Guide](#)

[z/OS Cryptographic Services ICSF Messages](#)

ICSF: KGUP and SAF profile prefixing

Description: KGUP can now be made to honor CSFKEYS resource profiles and can be configured to require higher permission when performing destructive operations on an existing key (such as UPDATE or DELETE). In addition, CSFKEYS resources can now permit a user or group to a CSFKEYS resource (but only for specific callable services), and the CSFSERV and CSFKEYS resources can now have ICSF prepend a system name resource name prior to the SAF check.

When change was introduced: Cryptographic Support for z/OS V2R2 - z/OS V2R3 (FMID HCR77D0) and z/OS V2R4.

Reference information:

[z/OS Cryptographic Services ICSF Administrator's Guide](#)

[z/OS Cryptographic Services ICSF Application Programmer's Guide](#)

[z/OS Cryptographic Services ICSF System Programmer's Guide](#)

[z/OS Cryptographic Services ICSF Messages](#)

ICSF: New BSI mode (BSI 2017)

Description: A new compliance mode, BSI 2017, has been added to the EP11 Coprocessor.

When change was introduced: Cryptographic Support for z/OS V2R2 - z/OS V2R3 (FMID HCR77D0) and z/OS V2R4.

Reference information:

[z/OS Cryptographic Services ICSF Administrator's Guide](#)

[z/OS Cryptographic Services ICSF Application Programmer's Guide](#)

[z/OS Cryptographic Services ICSF System Programmer's Guide](#)

[z/OS Cryptographic Services ICSF Writing PKCS #11 Applications](#)

ICSF: Updates to PKCS#11 Wrap Key (CSFPWPK) and PKCS#11 Unwrap Key (CSFPUWK)

Description: Callable services PKCS#11 Wrap Key (CSFPWPK) and PKCS#11 Unwrap Key (CSFPUWK) have been updated to accept AES-GCM as a key wrapping mechanism for secret and private clear keys.

When change was introduced: Cryptographic Support for z/OS V2R2 - z/OS V2R3 (FMID HCR77D0) and z/OS V2R4.

Reference information:

[z/OS Cryptographic Services ICSF Administrator's Guide](#)

[z/OS Cryptographic Services ICSF Application Programmer's Guide](#)

[z/OS Cryptographic Services ICSF System Programmer's Guide](#)

[z/OS Cryptographic Services ICSF Writing PKCS #11 Applications](#)

ICSF: New DISPLAY ICSF, MKVPs operator command

Description: A new DISPLAY ICSF, MKVPs operator command is used to display the master key verification patterns recorded in the ICSF key data stores in comparison with the same MKVPs in online crypto coprocessors in such a way that discrepancies can be detected.

When change was introduced: Cryptographic Support for z/OS V2R2 - z/OS V2R3 (FMID HCR77D0) and z/OS V2R4.

Reference information:

[z/OS Cryptographic Services ICSF Application Programmer's Guide](#)

[z/OS Cryptographic Services ICSF System Programmer's Guide](#)

ICSF: CPACF support for elliptic curve algorithms (MSAE9)

Description: ICSF provides CPACF acceleration of clear Elliptic curve operations.

When change was introduced: Cryptographic Support for z/OS V2R2 - z/OS V2R4 (FMID HCR77D1).

Reference information:

[z/OS Cryptographic Services ICSF Overview](#)

[z/OS Cryptographic Services ICSF Administrator's Guide](#)

[z/OS Cryptographic Services ICSF Application Programmer's Guide](#)

[z/OS Cryptographic Services ICSF System Programmer's Guide](#)

ICSF: Crypto Express7 adapter support and new ICSF_WEAK_CCA_KEYS health check

Description: ICSF supports the Crypto Express7 adapter and added a new health check, ICSF_WEAK_CCA_KEYS, to detect RSA keys in the PKDS that are considered weak.

When change was introduced: Cryptographic Support for z/OS V2R2 - z/OS V2R4 (FMID HCR77D1).

Reference information:

[z/OS Cryptographic Services ICSF Overview](#)

[z/OS Cryptographic Services ICSF Administrator's Guide](#)

[z/OS Cryptographic Services ICSF Application Programmer's Guide](#)

[z/OS Cryptographic Services ICSF System Programmer's Guide](#)

[z/OS Cryptographic Services ICSF Messages](#)

[IBM Health Checker for z/OS User's Guide](#)

ICSF: Event Auditing Improvements

Description: An SMF record is cut for the set or change of a master key in order to provide the ability to maintain secure environments and the ability to pass security audits.

When change was introduced: Cryptographic Support for z/OS V2R2 - z/OS V2R4 (FMID HCR77D1).

Reference information:

[z/OS Cryptographic Services ICSF Overview](#)

[z/OS Cryptographic Services ICSF Administrator's Guide](#)

[z/OS Cryptographic Services ICSF System Programmer's Guide](#)

ICSF: Health Check for RACDCERT use of PSS Certificates

Description: The ICSF_PKCS_PSS_SUPPORT health check verifies that RSA keys can be used for PSS signatures based on an active ECC master key and an active coprocessor of CCA 5.3 or above.

When change was introduced: PTF for APAR OA56837 and Cryptographic Support for z/OS V2R2 - z/OS V2R4 (FMID HCR77D1).

Reference information:

[z/OS Cryptographic Services ICSF Administrator's Guide](#)

[z/OS Cryptographic Services ICSF Messages](#)

[IBM Health Checker for z/OS User's Guide](#)

ICSF: New elliptic curve types and ChaCha20 keys

Description: ICSF services can use ChaCha20/Poly1305 encryption algorithms and curve25519/curve448 elliptic curves in order to support a TLS 1.3 protocol.

When change was introduced: PTF for APAR OA56349 and Cryptographic Support for z/OS V2R2 - z/OS V2R4 (FMID HCR77D1).

Reference information:

[z/OS Cryptographic Services ICSF Application Programmer's Guide](#)

[z/OS Cryptographic Services ICSF System Programmer's Guide](#)

[z/OS Cryptographic Services ICSF Writing PKCS #11 Applications](#)

ICSF: Support for CCA 5.5 and CCA 6.3

Description: Enhancements include six new CCA services and three changed services:

- New services For CCA 5.5 and 6.3:
 - DK Random PIN Generate2 (CSNBDRG2)
 - DK PRW Card Number Update2 (CSNBDCU2)
- New services for CCA 6.3:
 - TR-34 Bind-Begin (CSNDT34B)
 - TR-34 Bind-Complete (CSNDT34C)
 - TR-34 Key Distribution (CSNDT34D)
 - TR-34 Key Receive (CSNDT34R)
- Updated services for CCA 6.3:
 - Random Number Generate Long (CSNBRNGL)
 - TR-31 Import (CSNBT31I)
 - TR-31 Export (CSNBT31X)

When change was introduced: PTF for APAR OA57089 and Cryptographic Support for z/OS V2R2 - z/OS V2R4 (FMID HCR77D1).

Reference information:

[z/OS Cryptographic Services ICSF Overview](#)

[z/OS Cryptographic Services ICSF Administrator's Guide](#)

[z/OS Cryptographic Services ICSF Application Programmer's Guide](#)

[z/OS Cryptographic Services ICSF System Programmer's Guide](#)

[z/OS Cryptographic Services ICSF Messages](#)

PKI Services

This topic describes new PKI Services function in z/OS.

PKI Certificate Fingerprint support

Description: PKI Certificate Fingerprint support provide a mean, by using the certificate fingerprint, to track the PKI Services certificate life cycle on the z/OS system and follow its path to the non z/OS system if necessary.

When change was introduced: z/OS V2R5

Reference information:

[z/OS Cryptographic Services PKI Services Guide and Reference](#)
[z/OS Security Server RACF Macros and Interfaces](#)
[z/OS Security Server RACF Callable Services](#)

PKI removal of PKI TrustPolicy plugin

Description: PKI Services provides a plugin called Trust Policy for certificate validation. It makes use of the Open Cryptographic Services Facility (OCSF). It has been announced that OCSF and all its plugins will be removed in this release.

In this release, we will remove the PKI Trust Policy plugin, its installation verification program and sample. We will also remove code that has any OCSF interfaces.

When change was introduced: z/OS V2R5

Reference information:

[z/OS Cryptographic Services PKI Services Guide and Reference](#)

PKI Services Enrollment over Secure Transport (EST)

Description: PKI Services Enrollment over Secure Transport (EST) permits PKI to support the certificate enrollment protocol standardized in RFC7030, which is a successor protocol to Simple Certificate Enrollment Protocol (SCEP). Cisco IOS Software and Cisco IOS XE support protocol.

When change was introduced: z/OS V2R4

Reference information:

[z/OS Cryptographic Services PKI Services Guide and Reference](#)
[z/OS Security Server RACF Callable Services](#)

PKI synchronous certificate fulfillment

Description: PKI synchronous certificate fulfillment enables the web page interface to generate a synchronous certificate request. When the requestor obtains a transaction ID the certificate has been generated and the requestor can pick up the certificate immediately as the function provides a switch to request certificate synchronously through the PKI Services web interface.

When change was introduced: z/OS V2R4

Reference information:

[z/OS Cryptographic Services PKI Services Guide and Reference](#)

PKI RSAPSS algorithm support

Description: PKI RSAPSS algorithm support permits PKI Services to validate requests and sign issued certificates using the RSA Probabilist Signature Scheme (RSASSA-PSS). RSAPSS algorithms using SHA-256, SHA-384, and SHA512 hasing algorithms are supported.

When change was introduced: z/OS V2R4

Reference information:

[z/OS Cryptographic Services PKI Services Guide and Reference](#)

System SSL

This topic describes new System SSL function in z/OS.

System SSL: Certificate failure diagnostics (RAS)

Description: System SSL provides applications the capability to obtain diagnostic validation details for digital certificates for quicker resolution of certificate failures.

When change was introduced: z/OS V2R5.

Reference information:

[z/OS Cryptographic Services System SSL Programming](#)

System SSL: PKCS #7 signed data message has been enhanced to support detached (external) signatures

Description: System SSL supports the creation of a detach signature style SignData message. A detached signature SignedData message is a message where the content or application data is included in the data when the digital signatures are generated, but are not included in the final SignedData message.

When change was introduced: z/OS V2R4 and with the PTF for APAR OA54821 for z/OS V2R3.

Reference information:

[z/OS Cryptographic Services System SSL Programming](#)

System SSL: RSASSA-PSS support

Description: System SSL supports a number of signature algorithms and extends support to RSA Signature Scheme with Appendix-Probabilistic Signature Scheme (RSASSA-PSS) operations.

When change was introduced: z/OS V2R4.

Reference information:

[z/OS Cryptographic Services System SSL Programming](#)

System SSL: TLS 1.3 support

Description: System SSL supports the TLS V1.3 protocol so that TLS applications can be protected with the most current TLS protocol and continue to inter-operate with other TLS V1.3 applications.

When change was introduced: z/OS V2R4.

Reference information:

[z/OS Cryptographic Services System SSL Programming](#)

Data Set File System (DSFS) new functions to consider

Specifying multiple qualifiers to be represented as a single high-level qualifier directory

Description:

You can specify multiple qualifiers to be represented as a single high-level qualifier directory in DSFS.

Release introduced:

In z/OS 2.5 with the PTF for APAR OA63218 applied.

Reference information:

[z/OS Data Set File System Administration](#)

Data Set File System (DSFS)**Description:**

With Data Set File System (DSFS), z/OS UNIX applications can access data sets by presenting the data sets as a tree-structured file system that is mounted at mount point /dsfs in the z/OS UNIX file system tree.

Release introduced:

In z/OS 2.5 with the PTF for APAR OA62150 applied. This APAR applies to z/OS 2.5 only.

Reference information:

[z/OS Data Set File System Administration](#)

DFSMS: New functions to consider**DFSMS Object Access Method (OAM): Cloud as a new tier, file system and cloud backups, and other recent enhancements****OAM-provided commands for lookup of OAM macro and OSREQ error codes****Description:**

- These methods function by issuing a command and passing it a reason code as input. The returned display gives the error description that is commonly found in this documentation, therefore, allowing a user to see that information without having to reference an outside source.
- From a console environment, the following commands are now available:

```
DISPLAY OAM,OAMRC,xyyy
DISPLAY OAM,OSREQRC, wwxyyyzz
```

- From a TSO environment, the following commands are now available:

```
OAMUTIL OAMRC xyyy
OAMUTIL OSREQRC wwxyyyzz
```

Release introduced:

z/OS V2R3 and z/OS V2R4 with OA58344 and base z/OS V2R5.

Reference information:

[z/OS DFSMS OAM Planning, Installation, and Storage Administration Guide for Object Support](#)

Cloud as a tier**Description:**

- A new DFSMS component, Cloud Data Access (CDA), is introduced which provides a common interface to cloud providers that support the S3 API. CDA also manages cloud access keys.
- Ability to store and manage primary copies of OAM objects on cloud storage with the same capabilities for access, transition, and backup as currently exist for primary object copies stored on a file system. Backups can continue to be stored to removable media (optical or tape).
- Ability to recall an object that is stored in the cloud to the disk level of the storage hierarchy in any of the same ways that primary object copies on tape or optical can currently be recalled. Cloud objects can be recalled to both disk sublevels (Db2 or file system).
- Ability to define a user configurable mapping between OAM object storage groups and user-defined cloud containers. For new objects, each storage group is associated with a single container, but multiple storage groups can share a container. When an object is stored, it remains in the same

container and continue to be accessible even if the container associated with its storage group is changed.

- Ability to store an object with the same storage group name, collection name, and object name from multiple unrelated OAM instances in the same cloud container and ensure that each instance only accesses its own object, however, OAM typically recommends using a different container for better management/logical partitioning of the data.
- File names for OAM objects that are stored in the cloud have a naming schema (by using forward slashes) that enables customers to create pseudo hierarchical folders for information lifecycle management (ILM) within the cloud.

Release introduced:

z/OS V2R3 and z/OS V2R4 with OA55700 and base z/OS V2R5.

Reference information:

z/OS DFSMS OAM Planning, Installation, and Storage Administration Guide for Object Support

Cloud and file system backup support

Description:

- Ability to store immediate backup copies of OAM objects on cloud storage and file system (disk level 2) storage in addition to removable media storage (optical or tape) today.
- Ability for OSMC storage management cycle function to create and manage back up copies on cloud storage and file system (disk level 2) storage in addition to removable media storage (optical or tape) today.
- Ability to retrieve backup copies of an object by using OSREQ RETRIEVE command and using the Auto Access to Back up facility from cloud storage and file system (disk level 2) storage.
- Ability to delete the associated backup copies from cloud storage and file system (disk level 2) storage when a primary object is being deleted by using OSREQ DELETE command.
- Single object recovery from backup copies on cloud or file system.
- Volume recovery utility can recover volumes containing primary objects from backup copies on cloud and file system. It can recover backup volumes to new backup location of cloud or file system.
- MOVEVOL utility can move a backup volume to a new backup location of cloud or file system.
- New displaying cloud task and cloud task cancel operator commands can be used to display cloud task information and cancel a cloud task.

Release introduced:

z/OS V2R3 and z/OS V2R4 with OA59615 and base z/OS V2R5.

Reference information:

z/OS DFSMS OAM Planning, Installation, and Storage Administration Guide for Object Support

Generic variable OAMVAR on CBROAMxx ONLYIF statement

Description:

- This new ONLYIF keyword provides another option for more granularity/filtering of OAM statements based on user controlled literal values and system_symbols. It performs a comparison and if the values match, the ONLYIF is enabled, otherwise, the ONLYIF is ignored. Both the system_symbol and literal_value are required for the OAMVAR keyword to be processed.

Release introduced:

z/OS V2R3 and z/OS V2R4 with OA59711 and base z/OS V2R5.

Reference information:

z/OS DFSMS OAM Planning, Installation, and Storage Administration Guide for Object Support

OAM Db2 connection management enhancements

Description:

- A new configurable timer is added for situations when the OAM address space detects that Db2 has entered maintenance mode. Before V2R5, OAM would attempt a reconnect to Db2 every 5 minutes. With this support, OAM introduces a new DB2RECONNECTWAITTIME keyword for the SETOPT statement within CBROAMxx PARMLIB member which allows the user to configure the number of seconds (10-300) for OAM to wait before attempting a reconnect to Db2.
- In addition to the configurable timer, an immediate connect function is also added with the new F OAM,DB2CONN operator command. Use this when the operator does not want to wait for OAM to attempt an auto reconnect, but rather would like to attempt a reconnect immediately. This eliminates unnecessary downtime of the OAM address space when Db2 is brought back up to normal operating capacity.
- The F OAM,RESTART operator command now accepts a new keyword DB2SSID. The DB2SSID keyword can be used to force the OAM address space restart to issue CBR0006D which prompts the operator to explicitly specify the DB2SSID that should be used for this OAM address space. This allows the ability for an OAM address space to switch between non-object/object classic configurations, including switching between different Db2 subsystems.
- Various OAM address space initialization improvements are made for when Db2 is detected to be in an inoperable state. Before V2R5, a classic OAM address space would fail to initialize. With this support, a classic OAM address space now gives the operator the option to continue address space initialization with no object support (SMStape support only). This allows the operator to have higher OAM accessibility for SMStape related activities during situations when Db2 maintenance is occurring or other Db2 issues are being resolved.

Release introduced:

z/OS V2R5 base.

Reference information:

[*z/OS DFSMS OAM Planning, Installation, and Storage Administration Guide for Object Support*](#)

OSMC CBR9370I message enhanced to now display deletion attempted and done statistics

Description:

- This update helps aid users in diagnosing slow OSMC run times, where OSMC might be attempting to expire many objects (with management class criteria with expiration criteria met) while CBRHADUX exit is set to deny expiration function.

Release introduced:

z/OS V2R3 and z/OS V2R4 with OA58002 and base z/OS V2R5.

Reference information:

[*z/OS DFSMS OAM Planning, Installation, and Storage Administration Guide for Object Support*](#)

DB2ID restriction lift for multiple OAM configuration with only 1 object subsystem

Description:

- The OSREQ DB2ID keyword is now optional for Multiple OAM configurations with only 1 object subsystem. This allows for users to migrate from a Classic to a Multiple configuration with 1 object subsystem without API changes.

Release introduced:

z/OS V2R3 and z/OS V2R4 with OA57842 and base z/OS V2R5.

Reference information:

[*z/OS DFSMS OAM Planning, Installation, and Storage Administration Guide for Object Support*](#)

Multiple OAM object address space limit raised from 2 to 5

Description:

- Before this support, a Multiple OAM configuration was capped at 2 object instances and 1 tape instances per LPAR... With this new support, the cap is raised to 5 object instances and 1 tape instance per LPAR. This allows for more flexibility in splitting data workloads between more Db2 subsystems.

Release introduced:

z/OS V2R3 and z/OS V2R4 with OA56291 and base z/OS V2R5.

Reference information:

[*z/OS DFSMS OAM Planning, Installation, and Storage Administration Guide for Object Support*](#)

DFSMS Object Access Method (OAM): Enhancements to LIBRARY DISPDRV

Description:

The LIBRARY DISPDRV command is enhanced with new MOUNTED and MOUNTED,ALL parameters to optionally display the following information:

- Status information for volumes that are mounted in the TS7700 Virtualization Engine for a specified composite or distributed library. Information pertaining to the distributed library that owns the device for the mount as well as distributed library information associated with the primary and the secondary tape volume cache (TVC) is displayed.
- For a distributed library in a TS7700 Virtualization Engine, additional drives that are not owned by the specified distributed library can be displayed using MOUNTED,ALL. The additional drives are displayed if the distributed library specified is the primary or secondary TVC for the mounted volume. This option can be useful when a distributed library is going into service and can be used to determine if the specified distributed library is associated with a mount request from another distributed library.

This support was introduced with APAR OA47487 (z/OS V1R13 and later).

Release introduced:

z/OS V2R4 and z/OS V2R3 with the PTF for APAR PH05611 applied.

Reference information:

[*z/OS DFSMS OAM Planning, Installation, and Storage Administration Guide for Tape Libraries*](#)

Storage Management Subsystem: Displaying zHyperlink write statistics

Description:

With the PTF for APAR OA57717 installed, zHyperlink write statistics can be displayed for specified data sets.

Release introduced:

z/OS V2R4

Reference information:

z/OS MVS System Management Facilities (SMF)
z/OS MVS System Commands

Storage Management Subsystem: Virtual storage constraint relief

Description:

Prior to z/OS V2R4, each online DASD volume obtained a volume statistics block (VSB) which consumed 616 bytes of 31-bit common storage. In z/OS V2R4 (or earlier releases with APAR OA55711), each online DASD volume consumes 48 bytes in 31-bit common storage and an additional 896 bytes above the 2G bar. This change provides virtual storage constraint relief.

Release introduced:

z/OS V2R4, or earlier releases with APAR OA55711.

Reference information:*z/OS DFSMS Using Data Sets***Storage Management Subsystem: New ACS read-only variables****Description:**

To allow for more flexibility and control when writing automatic class selection (ACS) routines, Storage Management Subsystem provides additional read-only variables.

Release introduced:

z/OS V2R4

Reference information:*z/OS DFSMSdftp Storage Administration***DFSMS data set encryption new functions**

This topic describes new functions in DFSMS related to DASD data set level encryption in z/OS.

DFSMS data set encryption enhancements for z/OS V2R4

z/OS DFSMS introduces pervasive encryption of data at rest for extended format data sets accessed through access methods without requiring application changes. z/OS data set encryption through RACF command and SMS policies can be used to identify the data sets or groups of data sets that require encryption.

You can protect viewing the data in the clear based on SAF access to the key label that is associated with the data set used by the access methods to encrypt and decrypt the data. The data set owner specifies an encryption key label, which refers to an AES 256-bit encryption key that exists in the ICSF key repository (CKDS).

z/OS DFSMS data set encryption can be used to encrypt the following types of data sets:

- Sequential extended format data sets that are accessed through BSAM and QSAM.
- VSAM extended format data sets (KSDS, ESDS, RRDS, VRRDS, LDS) that are accessed through base VSAM and VSAM/RLS.
- Version 2 PDSEs, accessed through BSAM, QSAM or BPAM.
- Sequential basic and large format data sets that are accessed through BSAM, QSAM and EXCP.

To create an encrypted data set, you must assign a key label to the data set when it is first allocated (that is, when the data set is created). A key label can be specified through any the following methods:

- RACF data set profile
- JCL, dynamic allocation, TSO ALLOCATE, IDCAMS DEFINE
- SMS data class

Encrypted data sets must be SMS-managed. They also can be compressed format.

DFSMSdss and DFSMSshm support backup and migration of encrypted data sets while preserving the data in encrypted form. You can identify data sets that are encrypted through interfaces, such as LISTCAT, IEHLIST LISTVTOC, ISMF, SMF, and DCOLLECT.

For an overview of restrictions, dependencies, and steps on using the new function, see the following publications:

Coexistence requirements

- On a z/OS V2R2 system with OA50569, you can create encrypted data sets as well as access encrypted data sets created on a z/OS V2R2 (with OA50569) or later system.
- On a z/OS V2R1 system with OA50569, you cannot create encrypted data sets. However, you can access encrypted data sets created on a z/OS V2R2 (with OA50569) or later system.

Note: The minimum software release that can support encrypted data sets is z/OS V2R1 with OA50569. An attempt to access an encrypted data set on a lower release will result in loss of access to the data. Ensure that all systems are at the minimum hardware and software levels before encrypting any data sets.

Note: The minimum software release that can support PDSEs is z/OS V2R2 with OA56324. An attempt to access an encrypted data set on a lower release will result in loss of access to the data. Ensure that all systems are at the minimum hardware and software levels before encrypting any data sets.

Note: The minimum software release that can support encrypted basic and large format data sets is z/OS V2R3 with OA56622. An attempt to access an encrypted basic and large format data set on a z/OS V2R2 system without OA60160 installed or on a lower release will have unpredictable results. With APAR OA60160 installed on z/OS V2R2, an attempt to open an encrypted basic or large format data set will result in an expected ABEND0C1 with associated message IEC999I.

Before enabling this function

Because data set encryption has both hardware and software requirements, you must consider all systems that share data with a system on which you plan to enable data set encryption before creating an encrypted data set. This includes backout software levels, backup systems, read-only systems, replication target systems and disaster recovery systems. Before encrypting data sets other than those used for testing, be sure that all the systems that must access encrypted data sets are capable of doing so by meeting the required hardware and software requirements. In addition to the hardware and software requirements that must be available on every system that will access the encrypted data sets, all key labels and encryption keys associated with the encrypted data sets must also be available.

Take these steps to make data set encryption unavailable to users who are not explicitly authorized to use it:

- Define the STGADMIN.SMS.ALLOW.DATASET.ENCRYPT profile in the FACILITY class, and set the universal access to NONE:

```
RDEFINE FACILITY STGADMIN.SMS.ALLOW.DATASET.ENCRYPT UACC(NONE)
```

- To add PDSE as a supported data set type for encrypted data set allocation, define the STGADMIN.SMS.ALLOW.PDSE.ENCRYPT profile in the FACILITY class.

```
RDEFINE FACILITY STGADMIN.SMS.ALLOW.PDSE.ENCRYPT UACC(NONE)
```

- If the FIELD class is active, check for any profile that would allow any user without SPECIAL attribute access to the DATASET.DFP.DATAKEY. If there are none, no additional action is needed. If there is any profile that would allow access to DATASET.DFP.DATAKEY, create a DATASET.DFP.DATAKEY profile in the FIELD class with a UACC of NONE:

```
RDEFINE FIELD DATASET.DFP.DATAKEY UACC(NONE)
```

Taking the steps above is intended to assure that only authorized users are allowed to use data set encryption. Such users should be made aware that until the decryption functions are available on all sharing systems, backup systems, and disaster recovery systems, access to encrypted data can be lost at any time.

Note: When change was introduced: z/OS V2R4

References:

[*z/OS DFSMS Using the New Functions*](#)

[*z/OS DFSMS Access Method Services Commands*](#)

[*z/OS DFSMSdfp Storage Administration*](#)

[*z/OS DFSMSdss Storage Administration*](#)

[*z/OS DFSMShsm Storage Administration*](#)

DFSMSdss: Enhancements

- New keywords on the DUMP command let you backup DASD data to an object storage cloud. See the section on backing up data sets, and descriptions of the CLOUD, CLOUDCREDENTIALS, CONTAINER, OBJECTPREFIX, and DEBUG keywords for the DUMP command, in [z/OS DFSMSdss Storage Administration](#).
- New and updated keywords on the RESTORE command let you restore backed up DASD data from an object storage cloud. See the section on restoring data sets, and descriptions of the CLOUD, CLOUDCREDENTIALS, CONTAINER, OBJECTPREFIX, and DEBUG keywords for the RESTORE command in [z/OS DFSMSdss Storage Administration](#).
- The new SPACEREL command is added, allowing you to release physical space associated with free space extents on specified extent space efficient (ESE) volumes.
- The maximum number of data sets that can potentially reside in a logical data set backup is increased, from 131,070 to 2,147,483,392. For more information, see [z/OS DFSMS Using the New Functions](#).
- A reason code has been added to message ADR383W, to identify specific causes for a data set not being selected and specific actions to be taken.

DFSMSHsm: Enhancements

DFSMSHsm provides the following enhancements:

- **DFSMS UNIX file backup**

APAR OA52703 provides DFSMS backup of UNIX files. This support gives you the ability to perform availability management of your z/OS UNIX files using DFSMSdss and DFSMSHsm command.

- **Common recover queue (CVQ) enhancements**

With this enhancement, storage administrators have the ability to distribute the processing of volume restores (RECOVER *, FRRECOV COPYPOOL, and FRRECOV TOVOLUME with FROMDUMP) to all DFSMSHsm tape resources available in a group of DFSMSHsm hosts. New parameters on the SETSYS COMMONQUEUE command define the common recover group and its members (hosts) in the HSMplex. The HOLD, RELEASE, QUERY, CANCEL, and ALTERPRI commands all now support this function. XCF system facilities are used to provide this support. Message simplification supports a host running a common recover queue.

- **Message simplification**

To simplify the analysis of fast replication errors during FRBACKUP, FRRECOV COPYPOOL and copy pool auto dump, and FRRECOV TOVOLUME FROMDUMP, DFSMSHsm now collects all related DFSMSHsm and DFSMSdss messages and records them in a unique fast replication message data set. (These messages continue to be recorded in their respective logs.) You can choose and control this option with the new MESSAGEDATASET(YES|NO HLQ(*hlq*)) parameters on the SETSYS FASTREPLICATION command.

For more information, refer to [SETSYS command](#) in [z/OS DFSMSHsm Storage Administration](#).

On the FRBACKUP and FRRECOV COPYPOOL commands, use a MESSAGEDATASET parameter to specify the date and time used in the message data set name. The message simplification function supports distributed tape processing, common dump queue, and common recover queue processing.

MESSAGEDATASET is an optional parameter that allows you to specify the date and time used in the name of the fast replication command message data set. Specifying the date and time ensures that you can identify the message data set that corresponds with the FRRECOV request. If you don't specify the date and time with the MESSAGEDATASET parameter, DFSMSHsm uses the date and time when the message data set name is generated.

For more information, refer to [FRRECOV command](#) in [z/OS DFSMSHsm Storage Administration](#).

DFSMSrmm: Enhancements

- Several improvements were made to the defaults table. Support for scratch pooling has been added, along with the PGMNAME and EDM keywords.
- A new ONLYIF command is now available to be used in the EDGRMMxx and EDGDEFxx PARMLIB members, when defining the settings for RMM.
- The report generator in DFSMSrmm can now work with dates that are in European and American formats, and allows them to be sorted correctly.
- Search support for the EDM bit has been added.
- New messages have been added to alert the users when the RMM subsystem interface is down, to prevent data loss.
- A new warning message has been added (EDG2120W) warning the user that the RMM CDS is about to fill up.
- To help clients comply with the new European GDPR legislation, that has a focus on forgetting data, several new options were added to DFSMSrmm.
- A new sample has been added to SYS1.SAMPLIB, which can be used to create a backup of the currently defined Vital Record Selection policies.
- Specify expiration time for added volumes and data sets: The ADDDATASET, ADDVOLUME, and GETVOLUME subcommands have been enhanced to enable the user to specify the time (in *hhmmss* format) that should be used, in addition to the date, when deciding when to expire volumes and data sets.
- Specify that an added data set not expire while cataloged: A new WHILECATALOG option has been added to the EDGRMMxx parmlib member OPTION command and to the ADDDATASET TSO subcommand to enable the user to specify either that:
 - The added dataset will be kept as long as it is cataloged. If the dataset is uncataloged, it will still be kept if the expiration date has not been reached yet.
 - The added dataset will be kept as long as it is cataloged, but no later than the expiration date.

DFSORT new functions to consider

This topic describes new DFSORT functions in z/OS.

Integrated accelerator for DFSORT

Description:

DFSORT and DFSORT's ICETOOL are enhanced to exploit the IBM Integrated Accelerator for Z Sort feature termed as "ZSORT" to reduce the CPU costs and improve the elapsed time for eligible workloads.

When change was introduced: z/OS V2R4

Reference information: [z/OS DFSORT Application Programming Guide](#)

Regular expressions

Description: TDFSORT now supports Regular expressions in the following DFSORT comparison operands: COND, INCLUDE, OMIT, BEGIN, END, WHEN and TRLID. This support allows DFSORT users to use Regular expressions in their batch jobs for additional filtering capabilities. Regular expressions contain a series of characters that define a pattern of text to be matched, which allows for more robust filtering capabilities.

When change was introduced: z/OS V2R4

Reference information: [z/OS DFSORT Application Programming Guide](#)

Unicode comparisons

Description: DFSORT supports the usage of Unicode data formats (UTF-8, UTF-16 and UTF-32) in the following comparison operands: COND, INCLUDE and OMIT.

When change was introduced: z/OS V2R4

Reference information: [z/OS DFSORT Application Programming Guide](#)

ASCII free format numeric

Description: DFSORT supports two new ASCII free format numeric data formats (AUF and ASF) in SORT and MERGE operands. The new ASCII free format numeric data formats (AUF and ASF) are also now supported in the following comparison operands: COND, INCLUDE and OMIT.

When change was introduced: z/OS V2R4

Reference information: [z/OS DFSORT Application Programming Guide](#)

Encryption support

Description: DFSORT supports reading and writing to sequential extended format data sets, VSAM extended format data sets (KSDS, ESDS, RRDS, VRRDS) and PDSE data sets.

When change was introduced: z/OS V2R4

Reference information: [z/OS DFSORT Application Programming Guide](#)

Exploit zHPF for DFSORT work data sets

Description: DFSORT to create channel programs that exploit System z High Performance FICON (zHPF) with DFSORT work data sets to provide I/O performance improvements without the need for application changes.

When change was introduced: z/OS V2R4

Reference information: [z/OS DFSORT Application Programming Guide](#)

Hardware Configuration Definition (HCD) new functions to consider

Support of Alternate Subchannel Sets for z/VM operating systems

Description: HCD allows devices assigned to Operation System Definitions of type VM to be in an alternate subchannel set. To get a list of devices that support that operation check the supported hardware report.

When change was introduced: z/OS V2R5

Reference information:

[z/OS HCD User's Guide](#)

[z/OS and z/VM HCD Messages](#)

Hardware only dynamic activation

Description: HCD allows to edit IODF names for the active IODF during hardware only dynamic activation.

When change was introduced: z/OS V2R5

Reference information:

[z/OS HCD User's Guide](#)

[z/OS and z/VM HCD Messages](#)

Virtual function number prompt

Description: When prompting for a virtual function number when defining a new PCIe function HCD now includes that port number when deciding for allowed values.

When change was introduced: z/OS V2R5

Reference information:

[*z/OS HCD User's Guide*](#)
[*z/OS and z/VM HCD Messages*](#)

New processor support

Description: HCD supports to define the latest processor type IBM z15 (processor type 8561 and 8562).

When change was introduced: z/OS V2R5

Reference information:

[*z/OS HCD User's Guide*](#)
[*z/OS and z/VM HCD Messages*](#)

Removal of processor support

Description: HCD removed support for the following processors as they went out of service:

- IBM z9 BC (processor type 2096)
- IBM z9 EC (processor type 2094)
- IBM z10 BC (processor type 2098)
- IBM z10 EC (processor type 2097)

Before migrating to this HCD release, you need to remove processor configurations for these processor types from your IODF.

When change was introduced: z/OS V2R5

Reference information:

[*z/OS HCD User's Guide*](#)
[*z/OS and z/VM HCD Messages*](#)

Hardware Configuration Manager (HCM) new functions to consider

New function, features, and support for Hardware Configuration Manager (HCM).

IBM Tivoli Directory Server for z/OS new functions to consider

Enhanced SDBM search

Description:

The SDBM extended search mode offers enhanced search capabilities, including full search filter support, and the removal of 4096-line output restriction on searching the RACF profiles.

Release introduced:

z/OS V2R4

Reference information:

[*z/OS IBM Tivoli Directory Server Client Programming for z/OS*](#)
[*z/OS IBM Tivoli Directory Server Administration and Use for z/OS*](#)

Enhanced activity logging

Description:

To reduce resource contention, activity logging can be run in asynchronous mode if the LDAP server configuration has been customized with the new LogFileSync keyword.

Release introduced:

z/OS V2R4

Reference information:

[*z/OS IBM Tivoli Directory Server Administration and Use for z/OS*](#)

Transport Layer Security (TLS) protocol version 1.3

Description:

In z/OS® V2R4, z/OS IBM® Tivoli® Directory Server introduces support for the TLS V1.3 protocol as specified in RFC 8446 to z/OS Cryptographic Services' System SSL component and to the z/OS Communications Server's Application Transparent TLS (AT-TLS) function. This support is intended to make the latest and most secure TLS standard available to use by any z/OS System SSL application and any application that accesses System SSL through AT-TLS.

When change was introduced:

z/OS V2R4

Reference information:

[*z/OS IBM Tivoli Directory Server Administration and Use for z/OS*](#)

[*z/OS Cryptographic Services System SSL Programming*](#)

[*z/OS Communications Server: IP Configuration Guide*](#)

IBM Z Deep Neural Network Library new functions to consider

IBM Z Deep Neural Network Library (zDNN)

Description:

IBM Z Deep Neural Network Library (zDNN) provides APIs and a toolkit to exploit a new NNPA facility instruction, which drives the on-chip inference accelerator in IBM z16, known as IBM Z Integrated Accelerator for AI. zDNN provides support for transforming tensor memory layout from standard layout to nonstandard layout, which is required by NNPA. zDNN also provides support for converting tensor element data types from standard types to the NNPA required DLFloat16 format and call deep learning primitives supported on NNPA.

IBM zDNN also includes the IBM Z Artificial Intelligence Data Embedding Library.

Release introduced:

- z/OS 2.5 with the PTF for APAR OA62901
- z/OS 2.4 with the PTF for APAR OA62849

Reference information:

[*zDNN Programming Guide and Reference*](#)

ICKDSF new functions to consider

This topic describes new functions in ICKDSF.

Control command

Description: The CONTROL command for FBA devices. You can use the CONTROL command to reset certain subsystem conditions that have been previously set.

When change was introduced: z/OS V2R4

Reference information:

[Device Support Facilities \(ICKDSF\) User's Guide and Reference](#)

z/architecture changes

Description: z/architecture changes for the stand alone version of ICKDSF. With APAR PI46151, when IPLed, ICKDSF switches to z/Architecture mode.

When change was introduced: z/OS V2R4

Reference information:

[Device Support Facilities \(ICKDSF\) User's Guide and Reference](#)

DSEXIST parameter

Description: DSEXIST parameter for the INIT command. This parameter overrides the NODSEXIST parameter default and allows the INIT command to a volume that contains data sets other than the VTOC index data set or VVDS.

When change was introduced: z/OS V2R4

Reference information:

[Device Support Facilities \(ICKDSF\) User's Guide and Reference](#)

Infoprint Server new functions to consider

This topic describes z/OS Infoprint Server enhancements.

Responsive design

InfoPrint Server enables use of the browser zoom option through InfoPrint Central.

Description:

Infoprint Central allows users to use the browser zoom option to a maximum of 400% while preserving readability of text. Infoprint Central uses responsive design to automatically adjust the page layout to fit the screen size and orientation. To use this function, the browser window must be at least 1280 pixels wide.

When change was introduced:

z/OS V2R5.

Reference information:

- *[z/OS Infoprint Server Customization](#)*
- *[z/OS Infoprint Server Messages and Diagnosis](#)*
- *[z/OS Infoprint Server Operation and Administration](#)*
- *[z/OS Infoprint Server User's Guide](#)*

XML Toolkit 1.11 support

InfoPrint Server supports XML Toolkit 1.11.

Description:

Infoprint Server now supports XML Toolkit 1.11. It no longer supports XML Toolkit 1.10.

When change was introduced:

z/OS V2R5.

Reference information:

- *[z/OS Infoprint Server Customization](#)*

- [z/OS Infoprint Server Messages and Diagnosis](#)
- [z/OS Infoprint Server Operation and Administration](#)
- [z/OS Infoprint Server User's Guide](#)

Accessible and signed PDFs

InfoPrint Server has added job attributes and corresponding fields on the ISPF panels to support accessible and signed PDFs.

Description:

To support accessible PDFs, new attributes specify the values of the PDF title, author, subject, and keyword properties. Another new attribute specifies the UNIX file name of the Index Control File (ICF), which contains rules that the Accessible PDF Transform uses to tag input. To support signed PDFs, new attributes specify the name of the signer, contact information for the signer, the location where the PDF was signed, the reason for signing it, and the name of the digital certificate used to create the signed PDF document.

When change was introduced:

z/OS V2R4.

Reference information:

- [z/OS Infoprint Server Operation and Administration](#)
- [z/OS Infoprint Server User's Guide](#)

Enhanced PDF encryption with AES options

InfoPrint Server has added values for the **pdf-encryption** job attribute and the **Encryption level** field on the Processing ISPF panel to support AES encryption.

Description:

To support AES encryption of PDFs, the **ae128** and **ae256** values are added for the **pdf-encryption** job attribute. The **AES (128-bit key)** **AES (256-bit key)** values are added for the corresponding **Encryption level** field on the Processing ISPF panel. These values provide increased levels of security.

When change was introduced:

z/OS V2R4.

Reference information:

- [z/OS Infoprint Server Operation and Administration](#)
- [z/OS Infoprint Server User's Guide](#)

Dynamic configuration at all times

Dynamic configuration is now always enabled.

Description:

Dynamic configuration lets you change Infoprint Server configuration attributes without stopping and restarting Infoprint Server. It lets administrators use the Infoprint Server ISPF panels or the Printer Inventory Definition Utility to change most system configuration attributes instead of editing the `aopd.conf` file. You must still edit a few startup attributes in `aopd.conf`.

When change was introduced:

z/OS V2R4.

Reference information:

- [z/OS Infoprint Server Customization](#)
- [z/OS Infoprint Server Messages and Diagnosis](#)
- [z/OS Infoprint Server Operation and Administration](#)
- [z/OS Infoprint Server Printer Inventory for PSF](#)

Infoprint Central enhancements

The Infoprint Central user interface is updated with usability and accessibility enhancements.

Infoprint Central enhancements for V2R4

Infoprint Central is updated with functional and usability enhancements in V2R4.

Description

- Predictable JVM user ID:

By setting the new **use-http-userid** attribute (**Use Apache server ID** on the ISPF System Configuration panel) to **yes**, you can start the Java virtual machine (JVM) using the user ID of the IBM HTTP Server—Powered by Apache instead of the user ID of the first user to log into Infoprint Central. Using a predictable user ID lets you use that ID to customize Work Load Manager (WLM) parameters. It improves performance because the WLM can identify JVM jobs and allocate more system resources to them. It also allows all users to view trace files, and prevents the JVM from crashing when it tries to write to a trace file created by a different user ID.

- Security enhancement:

By default, InfoPrint Central now requires you to enable and use the Secure Sockets Layer (SSL) on the IBM HTTP Server—Powered by Apache. The SSL provides an encrypted and authenticated connection between the web browser and the server and lets you use Resource Access Control Facility (RACF) to restrict access to printers and print jobs. If you do not want SSL encryption for this connection, set the new **use-unencrypted-connection** attribute (**Use unencrypted connection** on the ISPF System Configuration panel) to **yes**.

Note: IBM does not recommend setting **use-unencrypted-connection** to **yes**.

- More classes for printer work selection criteria:

You can specify up to 36 output classes that a printer can select for processing.

- Usability and accessibility enhancement:

The new **Limit** field lets you specify the maximum number of objects to display on a search page.

When change was introduced:

z/OS V2R4.

Reference information:

- [z/OS Infoprint Server Operation and Administration](#)

Security enhancements

Infoprint Server is updated with security enhancements in V2R4.

Description

- InfoPrint Central uses SSL by default:

InfoPrint Central now requires you to enable and use the Secure Sockets Layer (SSL) on the IBM HTTP Server—Powered by Apache by default. The SSL provides an encrypted and authenticated connection between the web browser and the server and lets you use Resource Access Control Facility (RACF) to restrict access to printers and print jobs. If you do not want to use SSL, you can set the new **use-unencrypted-connection** attribute (**Use unencrypted connection** on the ISPF System Configuration panel) to **yes**.

Note: IBM does not recommend setting **use-unencrypted-connection** to **yes**.

- RACF messages about unauthorized access attempts:

New messages are written to the common message log when an unauthorized user tries to access objects protected by the Resource Access Control Facility (RACF).

When change was introduced:

z/OS V2R4.

Reference information:

- [z/OS Infoprint Server Messages and Diagnosis](#)

Integrated Security Services new functions to consider

For security-related products, see “[Security Server \(RACF\) new functions to consider](#)” on page 86 and “[Cryptographic Services new functions to consider](#)” on page 42.

Kerberos IP Address Bind Support

Description: Kerberos IP Address Bind Support is a new function enhancement that will provide support to identify the network interfaces that the KDC will bind network listeners for inbound Kerberos requests. The support will be enabled and configured by new environment variables in the KDC envvar file that is processed at KDC startup. (APAR OA61733 also applies to V2R4).

When change was introduced: z/OS V2R4

Reference information:

[z/OS Integrated Security Services Network Authentication Service Administration](#)

Kerberos Full NDBM FIPS Support

Description: Integrated Security Services is enhanced to provide FIPS support for the NDBM database, following the FIPS support for the SAF database in V2R4. When Kerberos KDC is set up with NDBM database and FIPS mode is enabled; all the processes must conform to the FIPS level configured. The kdb5_ndbm utility (dump and load); the kadmin subcommands (add_principal; change_password; add_key; add_policy; modify_policy) and the keytab command will be updated to be FIPS sensitive. The default master key type for NDBM database creation will be changed to the stronger type; aes256-cts-hmac-sha384-192.

If FIPS is enabled; the default master key type; and the encryption types of the predefined principals will be created according to the corresponding FIPS level configured. A new utility will be added to help the migration of the NDBM database to run in FIPS mode.

When change was introduced: z/OS V2R5

Reference information:

[z/OS Integrated Security Services Network Authentication Service Administration](#)

Flexible Authentication Secure Tunneling (FAST)

Description: Integrated Security Services is enhanced to implement the following mandatory requirements on the Flexible Authentication Secure Tunneling (FAST) mechanism:

- Clients must support the PA-FX-COOKIE pre-authentication data type. This padata type is used to maintain KDC state information and is sent to the client by the KDC in cases where multiple messages are required to authenticate the client. The client is required to copy the PA-FX-COOKIE padata into subsequent messages to a KDC in the specified realm.
- Clients, servers, and the KDC must support the Kerberos FAST Padata. The FAST Padata does not authenticate the client or the KDC; instead, it provides a typed hole to allow pre-authentication data to be tunneled. A pre-authentication data element used within FAST is called a "FAST factor". A FAST factor captures the minimal work required for extending Kerberos to support a new pre-authentication scheme.
- The FX_FAST_ARMOR_AP_REQUEST armor type must be supported.
- The encrypted challenge FAST factor must be supported.

When change was introduced: z/OS V2R4

Reference information:

[*z/OS Integrated Security Services Network Authentication Service Administration*](#)
[*z/OS Integrated Security Services Network Authentication Service Programming*](#)

Crypto Algorithm Currency

Description: Integrated Security Services is enhanced to include two new encryption types and two new checksum types for Kerberos 5 using AES with 128 bit and 256 bit keys. The encryption and checksum types are intended to support environments that use SHA-256 or SHA-384 as hash algorithms. A key derivation function using the SHA-256 or SHA-384 hash algorithm is used to produce keys for encryption, integrity protection, and checksum operations. The pseudorandom function used by PBKDF2 (password based key derivation function) is HMAC-SHA-256 or HMAC-SHA-384.

The new encryption types are:

- aes128-cts-hmac-sha256-128
- aes256-cts-hmac-sha384-192

The new checksum types are:

- hmac-sha256-128-aes128
- hmac-sha384-192-aes256

When change was introduced: z/OS V2R4

Reference information:

[*z/OS Integrated Security Services Network Authentication Service Administration*](#)
[*z/OS Integrated Security Services Network Authentication Service Programming*](#)
[*z/OS Security Server RACF Data Areas*](#)

ISPF new functions to consider

Message enhancements for PDSE v2 member generations

Description:

This enhancement provides improved visibility to generation numbers in ISPF edit, view, and the member information panel.

Introduced:

z/OS V2R5

Reference information:

- [*z/OS ISPF Messages and Codes*](#)
- [*z/OS ISPF Edit and Edit Macros*](#)
- [*z/OS ISPF User's Guide Vol II*](#)

Support for SUBSYS parameter on the ISPF SUBMIT command

Description:

This enhancement provides support for the SUBSYS parameter on the ISPF SUBMIT command. The support has been added to the following areas:

- Edit Primary command line
- Browse Primary command line
- Within Edit Macros

Introduced:

z/OS V2R5

Reference information:

- [z/OS ISPF Edit and Edit Macros](#)
- [z/OS ISPF Messages and Codes](#)
- [z/OS ISPF Reference Summary](#)
- [z/OS ISPF User's Guide Vol II](#)

Removal of support for the ISPF Workstation Agent**Description:**

The ISPF Workstation Agent (WSA) application, and all ISPF functions that support WSA, is removed in z/OS V2R5. z/OS V2R4 is the last release to support the ISPF WSA. WSA is an application that runs on your local workstation and maintains a connection between the workstation and the ISPF host.

Introduced:

z/OS V2R5

Reference information:

- [z/OS ISPF Dialog Developer's Guide and Reference](#)
- [z/OS ISPF Dialog Tag Language Guide and Reference](#)
- [z/OS ISPF Messages and Codes](#)
- [z/OS ISPF Edit and Edit Macros](#)
- [z/OS ISPF Planning and Customizing](#)
- [z/OS ISPF Reference Summary](#)
- [z/OS ISPF Software Configuration and Library Manager Guide and Reference](#)
- [z/OS ISPF Services Guide](#)
- [z/OS ISPF User's Guide Vol I](#)
- [z/OS ISPF User's Guide Vol II](#)
- [z/OS Planning for Installation](#)
- [z/OS Program Directory](#)

Removal of ISPF support for HFS**Description:**

In z/OS V2R5, ISPF removes the ability to allocate Hierarchical File System (HFS) data sets. HFS data sets can still be included in the data set lists.

Introduced:

z/OS V2R5

Reference information:

- [z/OS ISPF Messages and Codes](#)
- [z/OS ISPF Planning and Customizing](#)
- [z/OS ISPF User's Guide Vol II](#)

JES2 new functions to consider

JES2 spool encryption

Description:

Support for JES2 spool encryption is introduced in z/OS V2R4, which provides a simple, transparent, and consumable approach to enable extensive encryption and compression of JES2-managed data

sets on SPOOL. You can also identify data sets for compression only. The identification of data sets to encrypt or compress or both is done without any application source code changes when you use standard APIs.

When change was introduced:

z/OS V2R4 with the PTFs for the following APARs applied:

- OA58757
- OA58699
- OA58718
- OA57466

Reference information:

[z/OS JES2 Commands.](#)

[z/OS JES2 Initialization and Tuning Guide.](#)

[z/OS JES2 Initialization and Tuning Reference.](#)

[z/OS JES2 Messages.](#)

[z/OS MVS JCL Reference.](#)

[z/OS MVS Using the Subsystem Interface.](#)

[z/OS Security Server RACF Security Administrator's Guide.](#)

JES2 policies

Description:

Support for JES2 policies is introduced in z/OS V2R4, while providing facilities for incremental addition of more function in future releases. JES2 policies are an alternative to JES2 installation exits. JES2 polices allow you to customize JES2 processing of z/OS jobs and system output without programming installation exit programs.

When change was introduced:

z/OS V2R4.

Reference information:

[z/OS JES2 Commands.](#)

[z/OS JES2 Initialization and Tuning Guide.](#)

[z/OS JES2 Installation Exits.](#)

[z/OS JES2 Messages.](#)

[z/OS JES2 Macros.](#)

JES2 disk reader support

Description:

JES2 is adding a JES2 command to submit JCL from a predefined DD. The source DD is SUBMITLIB.

- The SUBMITLIB(name) statement (alias SUBLIB) is added and is used to identify a series of partitioned data sets. Operator commands for \$ADD, \$DEL, and \$T (modify) SUBMITLIB are added (including display with \$D). The concatenation supports any format PDS (LRECL and RECFM) that can be used to pass JCL into input processing.
- The SUBMITRDR statement (or SUBRDR) is added and is used to specify JES2 defaults for jobs submitted this way. The parameters are similar to the INTRDR statement with the addition of a default DD name for the new \$SUBMIT command.
- The \$SUBMIT command is added to cause a member of a SUBMITLIB concatenation and is submitted by using SUBMITRDR. The command supports a DD name (SUBMITLIB subscript), a member name, and a HOLD= override.
- Job security is based on the source of the \$SUBMIT command.

When change was introduced:

z/OS V2R4.

Reference information:

[z/OS JES2 Messages.](#)
[z/OS JES2 Commands.](#)
[z/OS JES2 Initialization and Tuning Guide.](#)
[z/OS JES2 Initialization and Tuning Reference.](#)

Health Check for JES2 Checkpoint Configuration**Description:**

A new Health Check is provided to report issues with the JES2 checkpoint configuration that prevents JES2 from automatically recovering checkpoint device errors without operator intervention. In addition, the Health Check verifies that the JES2 checkpoint is configured using best practices.

When change was introduced:

z/OS V2R4.

Reference information:

[z/OS MVS System Messages, Vol 6 \(GOS-IEA\)](#)
[z/OS MVS Using the Subsystem Interface](#)
[IBM Health Checker for z/OS User's Guide](#)

Instruction Execution Protection (IEP)**Description:**

Instruction Execution Protection is a feature of z14 hardware. It allows programmers to allocate storage in a non-executable state. Starting in z/OS V2R4, JES2 uses this by changing the default behavior of the \$GETMAIN macro. If you upgrade to z/OS V2R4 and you are running on z13 or earlier hardware, JES2 continues to function normally, but you do not receive the benefits of the IEP service.

When change was introduced:

z/OS V2R4.

Reference information:

[z/OS JES2 Initialization and Tuning Guide](#)
[z/OS JES2 Macros](#)

Reporting JES2 resiliency data**Description:**

Starting in z/OS V2R4, reporting JES2 Resiliency data to the user through an SSI interface can occur. New functions are added to the JES Job Information Services SSI 71 to request JES Resource Limits Information. Filters can now be supplied so that specific types of data are returned and/or data specific to a supplied resource type is returned.

When change was introduced:

z/OS V2R4.

Reference information:

[z/OS JES2 Macros](#)
[z/OS MVS Using the Subsystem Interface](#)
[z/OS Security Server RACF Security Administrator's Guide](#)

JES3 new functions to consider

This topic describes new JES3 functions in z/OS.

Language Environment new functions to consider

This topic describes new Language Environment functions in z/OS.

Determining interoperability environments

Description:

z/OS Language Environment® new callable services CEEMICT/___le_ceemict() are introduced for high-level language applications such as COBOL, PL/I, Java™, and so on to determine whether they are running in the 31-bit/64-bit interoperability environment. With the PTF for APAR PH45216, this support is available on z/OS V2.4 and z/OS V2.5.

Release introduced:

z/OS V2R5

Reference information:

[z/OS Language Environment Programming Reference](#)

Java-COBOL interoperability

Description:

Language Environment provides Java-COBOL interoperability between COBOL and Java Native Interface (JNI). As part of this interoperability, 31-bit and 64-bit interoperability calls can be made between 64-bit Java and 31-bit COBOL.

Release introduced:

z/OS V2R5

Reference information:

[z/OS Language Environment Debugging Guide](#)
[z/OS Language Environment Vendor Interfaces](#)
[z/OS XL C/C++ Runtime Library Reference](#)

IBM Open Enterprise SDK for Go

Description:

Support has been added for IBM Open Enterprise SDK for Go.

Release introduced:

z/OS V2R5

Reference information:

None.

Allocating aligned memory blocks

Description:

The `_alloc()` library function, was added, which allocates aligned memory blocks.

Release introduced:

z/OS V2R5

Reference information:

[z/OS Language Environment Programming Reference](#)
[z/OS Language Environment Programming Guide](#)
[z/OS Language Environment Programming Guide for 64-bit Virtual Addressing Mode](#)
[z/OS XL C/C++ Runtime Library Reference](#)
[z/OS XL C/C++ Programming Guide](#)

Availability of exec functions in AMODE 64 multithreaded environments

Description:

Language Environment now supports exec functions in AMODE 64 multithreaded environments.

Release introduced:

z/OS V2R5

Reference information:

None.

Support for tracking specific price metrics

Description:

New Language Environment interfaces such as the CEEUSGD callable service were added to enable the use of the IFAUSAGE interface to track specific price metrics.

Release introduced:

z/OS V2R4

Reference information:

[z/OS Language Environment Programming Guide](#)

[z/OS Language Environment Programming Reference](#)

[z/OS Language Environment Concepts Guide](#)

[z/OS Language Environment Programming Guide for 64-bit Virtual Addressing Mode](#)

[z/OS XL C/C++ Runtime Library Reference](#)

Japanese New Era support

Description:

Previously, the Japanese era was Heisei. As of 1 May 2019, the era is Reiwa. Updates were made to the set of date and time services that support the Japanese calendaring scheme.

Release introduced:

z/OS V2R4 and z/OS V2R3 with the PTF for APAR PH05611 applied.

Reference information:

[z/OS Language Environment Programming Reference](#)

Enabling non-executable memory

Description:

To enhance program security, certain memory regions such as the library heap are now allocated as non-executable by default.

Release introduced:

z/OS V2R4

Reference information:

[z/OS Language Environment Customization](#)

[z/OS Language Environment Vendor Interfaces](#)

[z/OS Language Environment Debugging Guide](#)

[z/OS MVS Initialization and Tuning Reference](#)

[z/OS MVS System Commands](#)

Metal C Runtime Library new functions to consider

This topic describes new Metal C Runtime Library functions in z/OS.

NFS new functions to consider

NFS server with Kerberos authentication

Description:

A large appendix has been added to *z/OS Network File System Guide and Reference* that shows how to set up and configure z/OS NFS Server with Kerberos authentication support. It is a quick start guide that covers basic configurations of z/OS NFS Server with various NFS clients and various Key Distribution Centers (KDCs).

When change was introduced: z/OS V2R5

Reference information: [*z/OS Network File System Guide and Reference*](#)

macOS support

Description:

z/OS NFS macOS support.

When change was introduced: z/OS V2R5

Reference information: [*z/OS Network File System Guide and Reference*](#)

Resource Measurement Facility (RMF) new functions to consider

The following topic provides an overview of the new features, functions, and support for Resource Measurement Facility (RMF) that are available in z/OS 2.5 and 2.4.

New features, functions, and support for z/OS 2.5

In z/OS 2.5, the RMF priced feature continues to provide the same functional capability that you have come to expect. The function of RMF is delivered in two parts: the RMF Reporter (now known simply as RMF) and the z/OS Advanced Data Gatherer. RMF continues to provide performance reports, which are based on the metrics from the Advanced Data Gatherer feature, and is designed to be entitled to all clients of the RMF priced feature. The Advanced Data Gatherer 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 Advanced Data Gatherer priced feature. No action is required of existing RMF users due to this change.

RMF and Advanced Data Gatherer provide the following new features, functions, and support in z/OS 2.5:

- Gather information on the performance of hardware using callable services, such as Integrated Cryptographic Service Facility (ICSF) format-preserving encryption, Feistel-based encryption (FFX), and quantum-safe (QSA) digital signatures.

When change was introduced: z/OS 2.5, and earlier releases with the PTF for APAR OA59330

- Provide the capability to analyze additional ICSF data with the RMF Postprocessor Crypto hardware report.

When change was introduced: z/OS 2.5, and earlier releases with the PTF for APAR OA60202

- 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) is planned to indicate Recovery for the new sysplex recovery process boosts in addition to the already supported IPL, Shutdown, or None values for Boost Class.

When change was introduced: z/OS 2.5, and earlier releases with the PTFs for APARs OA59852 and OA59321

- Support the CF monopolization avoidance enhancements of z/OS.

When change was introduced: z/OS 2.5, and earlier releases with the PTF for APAR OA58726

- Report about storage class memory (SCM) busy percentage on an IBM z15 CPC. RMF adds input/output processor (IOP) utilization SCM busy percentage for all IOPs in the I/O Queuing Activity (IOQ) report.

When change was introduced: z/OS 2.5, and earlier releases with the PTF for APAR OA58727

Reference information:

- *z/OS Resource Measurement Facility User's Guide*
- *z/OS Resource Measurement Facility Report Analysis*
- *z/OS Resource Measurement Facility Programmer's Guide*
- *z/OS Data Gatherer User's Guide*
- *z/OS Data Gatherer Programmer's Guide*

New features, functions, and support for z/OS V2R4

Resource Measurement Facility (RMF) provides these new features, functions, and support in z/OS V2R4.

Support for Extended Asynchronous Data Mover (EADM) reporting

Resource Measurement Facility (RMF) now reports EADM-related performance measurements.

When change was introduced: z/OS V2R4

Reference information:

- *z/OS RMF Report Analysis*
- *z/OS RMF Reporter User's Guide*
- *z/OS RMF Reporter Programmer's Guide*
- *z/OS RMF Data Gatherer User's Guide*
- *z/OS RMF Data Gatherer Programmer's Guide*

Support for Tailored Fit Pricing

RMF reporting is extended to provide service administrators and performance analysts with detailed information about the resource groups and tenant resource groups that are defined in the WLM policy.

The Postprocessor Workload Activity and the new Monitor III Resource Group Activity (SYSRG) report show the actual processor and memory consumption per resource group for each system in the sysplex as well as the capacity limits defined for each resource group.

These reports allow you to directly compare the consumption values of a resource group with their defined capacity limits. This can help you to better understand which resource groups are potential candidates for resource group management by the system.

In addition, the Monitor III Sysplex Summary report, the System Information report and the Storage Delay Summary report are enhanced to report on WLM tenant resource groups and associated tenant report classes.

New overview conditions are provided for the Postprocessor, based on the enhanced SMF type 70 subtype 1 record.

The DDS resource model is extended with WLM resources that are added as children of top-level resource 'SYSPLEX'. New resources are defined for the active WLM policy, workloads, service classes, service class periods, report classes, report class periods and resource groups defined in the active WLM policy.

When change was introduced: z/OS V2R4

Reference information:

- *z/OS RMF Report Analysis*
- *z/OS RMF Reporter Programmer's Guide*

Enhanced Crypto Hardware Activity reporting

RMF enhances the Postprocessor Crypto Hardware Activity report to now provide cryptographic hardware performance statistics reflecting the partition activity in addition to the existing statistics reflecting only the CPC activity.

RMF provides three new Monitor III sysplex reports:

- The Crypto hardware overview report provides an overview of cryptographic hardware performance statistics in your sysplex, reporting CPC and partition activity.
- The Crypto accelerator activity report provides detailed performance statistics for your cryptographic accelerator cards in your sysplex, reporting CPC and partition activity.
- The Crypto PKCS11 coprocessor activity report provides detailed performance statistics for your cryptographic PKCS11 coprocessor cards in your sysplex, reporting CPC and partition activity.

When change was introduced: z/OS V2R4

Reference information:

- *z/OS RMF Report Analysis*
- *z/OS RMF Reporter Programmer's Guide*
- *z/OS RMF Data Gatherer User's Guide*

ESS and Cache reporting for synchronous I/O links (zHyperlink performance)

The Postprocessor Cache Activity report is enhanced to report synchronous I/O cache request statistics.

The Postprocessor Enterprise Disk Systems report is enhanced to provide statistics about the occurred synchronous I/O operations on defined synchronous I/O links in a new ESS Synchronous I/O Link Statistics report section.

New overview conditions are provided for the Postprocessor, based on the enhanced SMF type 74 subtype 5 and type 74 subtype 8 records.

When change was introduced: z/OS V2R4

Reference information:

- *z/OS RMF Report Analysis*
- *z/OS RMF Reporter User's Guide*

RUCSA new functions to consider

SDSF new functions to consider

This topic describes new SDSF functions in z/OS.

New features in SDSF for V2R5

Description: This update to SDSF includes the following enhancements and additional commands:

- The online help system was redesigned. New commands and panels display information about the SDSF panels and their columns, and the action characters or commands that can be used on the panels.
- New CSRSEARCH command implements cursor-sensitive search.

When change was introduced: z/OS V2R5

Reference information: [*z/OS SDSF Operation and Customization*](#)

New panels in SDSF for V2R5

Description: This update to SDSF includes 13 new panels:

- Action Help panel (ACTH) displays a table of the action commands that can be issued in SDSF tabular panels.
- Address Space Diagnostics panel (AD) displays information about address spaces and the memory addresses of control blocks.
- CF Data Sets panel (CFD) displays coupling facility data sets defined to the sysplex.
- Command Help panel (CMDH) displays SDSF primary commands and the SAF resource profiles that are used to protect the command.
- Common Storage Subpools panel (CS) displays common storage summary usage by subpool and key.
- Common Storage Subpool Details panel (CSI) panel (CSI) displays common storage details for a selected subpool and key.
- Link List sets panel (LLS) displays link list sets that are defined in the sysplex.
- Memory contents panel (MEM) displays the memory contents for address spaces within the sysplex and provides the ability to map control blocks.
- PC Routines panel (PC) displays currently defined system linkage indexes (LX) PC routines.
- Private Storage Subpool panel (USI) displays private storage details for a selected subpool and key.
- Search Help panel (SEARCH) shows the results of a SEARCH command that was entered on the SDSF command line.
- SVC routines and ESR panel (SVC) displays supervisor calls and ESR (extended service routine) table entries.
- System Parameters panel (SYSP) displays the parameters that are used when the system is IPLed.

When change was introduced: z/OS V2R5

Reference information: [z/OS SDSF Operation and Customization](#)

SDSF configuration changes for V2R5

Description: This update to SDSF includes the following configuration changes:

- The SDSF server is required to be active and user connection to the server is now required.
- SDSF V2R5 makes all security decisions using the Security Authorization Facility (SAF). All users of SDSF V2R5 must use SAF with an External Security Manager (ESM) such as RACF, ACF2, or TSS. SDSF's non-SAF security scheme using ISPFARMS has been removed. Security references throughout the documentation were updated.
- New OPTIONS keyword CSRSEARCH lets you set the program to run when the cursor is placed on a word in an SDSF screen and the assigned PF key is pressed.
- Message ISF015I is no longer issued when running SDSF V2R5, as SAF security products issue messages based on authorization decisions. Custom property Security.Enable.Msg015 is provided to restore issuing ISF015I.
- The ABEND and DIAG SDSF commands no longer require authorization.
- The TRACE command no longer requires authorization unless both client and server side traces are desired. If the user does not have READ access to ISFCMD.MAINT.TRACE, only client side trace records are created.
- The ULOG command no longer requires authorization. You can set the Console.EMCS.UlogAuthReq custom property to TRUE to restore access checking to ULOG; the default for the property is FALSE.
- Custom property Panel.SR.EnableRSYFilter allows the SR display to filter by the current RSYS for users authorized to the RSYS command.

When change was introduced: z/OS V2R5

Reference information:

- [z/OS SDSF Operation and Customization](#)
- [z/OS SDSF Security Migration Guide](#)

New non-overtypable columns on existing SDSF panels for V2R5

Description: This update to SDSF includes the new non-overtypable columns shown in [Table 1](#) on page 77.

Panel	Column Name	Title (Displayed)	Width	Description
AS	AUXSCM	AuxSCM	6	SCM block count
AS	MOBJAUX	MemObjAux	9	Auxiliary storage slots backing memory objects
AS	MOBJREAL	MemObjReal	10	Real frames backing memory objects
AS	STDATE	StartDate	19	Start date
DA	SSNAME	SSName	6	Creating subsystem name
DA	PAGAUX	PageAux	7	Paging rate (auxiliary storage only)
DA	STDATE	StartDate	19	Start date
DA	XCFGROUP	XCFGGroup	8	XCF group name
FS	TSPACE	TotalSpace	10	Total space
FS	USEDPCT	Used%	8	Used percent
FS	USPACE	UsedSpace	9	Used space
NA	IPADDRLOCAL	IPAddrLocal	24	Local IP address
NA	PORTLOCAL	PortLocal	9	Local port number
RES	DESCRIPT	Description	32	Resource description
RES	SCHENV	SchedEnv	16	Scheduling environment
SMSG	USED	UsedMB	7	Used space in megabytes
SMSV	USED	UsedMB	7	Used space in megabytes
SYM	IEASYM	IEASYM	32	IEASYMxx value
SYS	TZOFFSET	TimeZoneOfs	11	Time zone offset from UTC
SYS	HCSUCCESS	HCSuccess	9	HealthCheck success count

Table 1. New Non-Overtimeable Columns for V2R5 (continued)

Panel	Column Name	Title (Displayed)	Width	Description
SYS	HCSEVLOW	HCSevLow	8	HealthCheck severity LOW
SYS	HCSEVMEDIUM	HCSevMed	8	HealthCheck severity MEDIUM
SYS	HCSEVHIGH	HCSevHigh	9	HealthCheck severity HIGH
SYS	BOOST	Boost	8	Boost status
SYS	BOOSTTYPE	BoostType	10	Boost type
SYS	BOOSTCLASS	BoostClass	10	Boost class
SYS	BOOSTREQ	BoostReq	9	Boost requestor
SYS	BOOSTDATE	BoostEndDate-Time	19	Boost expected end date-time
SYS	BOOSTINT	BoostInt	8	Boost interval until end

When change was introduced: z/OS V2R5

Reference information: [z/OS SDSF Operation and Customization](#)

New overtimeable columns on existing SDSF panels

Description: This update to SDSF includes the new overtimeable columns shown in [Table 2 on page 78](#).

Table 2. New Overtimeable Columns

Panel Name	Column Name	Title (Displayed)	Width	Description	Delay
CK	REXXHLQ	RexxHLQ	8	High level qualifier for REXX data sets	
JDS	AFPSTATS	AFPStats	8	AFP statistics report option	X
JDS	RETAINS	RetainS	10	Retain time for successful transmissions	X
JDS	RETAINF	RetainF	10	Retain time for unsuccessful transmissions	X
JDS	RETRYL	RetryL	5	Maximum number of retries	X
JDS	RETRYT	RetryT	10	Time between retries	X

Table 2. New Overtypable Columns (continued)

Panel Name	Column Name	Title (Displayed)	Width	Description	Delay
JDS	PRINTO	Print-Options	16	Entry in PrintWay options data set	X
JDS	PRINTQ	Print-Queue	60	Print queue name	X
JDS	IPDEST	IP-Destination	60	IP address or TCP/IP name	X
JDS	MAILCC	EMailCC	60	Email copy list	X
JDS	MAILBCC	EMailBCC	60	Email blind copy list	X
JDS	MAILFROM	EMailFrom	60	Email sender	X
JDS	MAILTO	EMailTo	60	Email recipient list	X
JDS	MAILFILE	EMailFileName	60	Email attachment file name	X

When change was introduced: z/OS V2R5

Reference information: [z/OS SDSF Operation and Customization](#)

New action characters on existing SDSF panels for V2R5

Description: This update to SDSF includes the new action characters on existing panels shown in [Table 3](#) on page 79.

Table 3. New SDSF action characters for V2R5

Panel	Action Character	Description
AS	JCS	JobCommonStorage
AS	JDCC	JobCFConnections
AS	JDNA	JobNetworkActivity
CSR	JCS	JobCommonStorage
DA	JC	JobModule
DA	JCS	JobCommonStorage
DA	JDCC	JobCFConnections
DA	JDNA	JobNetworkActivity
JM	L	Details
SSI	I	SSIVersionInfo
SYS	DB	DisplayBoost
SYS	DMC	DisplayConfigCPU

When change was introduced: z/OS V2R5

Reference information: [z/OS SDSF Operation and Customization](#)

Obsolete SDSF panel and action character for V2R5

Description: This update to SDSF obsoletes the following:

- The Output Descriptors panel (OD) has been removed.
- The Q action character has been removed from the DA, O, H, I, ST, JOB0, and JDS panels. All columns previously shown on the OD panel are now available on the Job Data Set (JDS) panel, accessed with the ? action character.

When change was introduced: z/OS V2R5

Reference information: [z/OS SDSF Operation and Customization](#)

New features in SDSF

Description: This update to SDSF includes enhancements, new options and features, and additional commands:

- Enhancements to the **ARRANGE** command to hide columns on tabular panels.
- New keywords on the **SRCH** command to filter the results by pattern found, not found, or all.
- New **SET SRCH** command to set **SRCH** command defaults.
- New option to rename a slash command group.
- New option on the **SET FFPS** command to hide or show the point-and-shoot attribute for the fixed field.
- Addition of ISPF View for panels that currently implement ISPF Browse and ISPF Edit.
- New option to suppress data set information on the **APF**, **LNK**, **LPA**, **PARM**, and **PROC** commands.
- New **ABOUT** command to display the SDSF copyright information and suppress the copyright on the main panel.
- Update to the **QUERY AUTH** command to return authorization to / (slash) command.
- Update to the **WHO** command response to identify the emergency JES2 subsystem.
- New **DIAG** command to assist in problem diagnosis.
- New special ddname ISFRXDBG to simplify debugging of SDSF/REXX execs.
- New columns on the Job Data Sets (JDS) panel to support JES2 compression and encryption of SYSOUT data sets.
- New and changed columns on existing panels.
- New action characters on existing panels including ISPF browse, view, and edit on PROC panel.

When change was introduced: z/OS V2R4

Reference information: [z/OS SDSF Operation and Customization](#)

New panels in SDSF

Description: This update to SDSF includes 18 new panels:

- Enqueue panel (ENQD)
- Extended Console panel (EMCS)
- JES Checkpoint panel (CKPT)
- JES Subsystem panel (JES)
- Job Class Members panel (JCM)
- Job DDName panel (JDDN)
- Job Memory Objects panel (JMO)

- JESInfo panel (JRI)
- JESInfo by Job panel (JRJ)
- Link Pack Directory panel (LPD)
- OMVS Options panel (BPXO)
- Exploiting the Resource Monitor Alerts panel (RMA)
- Exploiting the WLM Policy panel (WLM)
- WLM Report Class panel (REPC)
- WLM Resource Groups panel (REPC)
- WLM Service Classes panel (SRVC)
- WLM Workloads panel (WKLD)
- XCF Members and Groups panel (XCFM)

When change was introduced: z/OS V2R4

Reference information: [z/OS SDSF Operation and Customization](#)

SDSF configuration changes

Description: This update to SDSF includes the following configuration changes:

- Low-lighting of columns with a zero value independently of the row highlighting. Values considered significant are not low lighted. A custom property is provided to restore the default behavior.
- Automatic right justification of column titles for numeric fields. A custom property is provided to restore the default behavior.
- New reason codes for abend U0083 when ISFPARMS macros do not match the current release of SDSF.
- Updates to the CK, CKH, DA, ENC, PS, and RM panels to use the HSF data gatherers. These data gatherers run in the SDSFAUX address space and replace the existing client-side data gatherers.
- Client toleration of the SDSF address space not being active. However, the address space is now required for the DA, CK, CKH, ENC, PS, and RM panels. In a subsequent release, the SDSF address space will be required for all client functions.

When change was introduced: z/OS V2R4

Reference information: [z/OS SDSF Operation and Customization](#)

New non-overtypable columns on existing SDSF panels

Description: This update to SDSF includes the new non-overtypable columns shown in [Table 4 on page 81](#).

Panel	Column Name	Title (Displayed)	Width	Description
CDE	CDATTR3	Attr3	5	CSVINFO attribute byte 3 in hexadecimal
CDE	CDATTR4	Attr4	5	CSVINFO attribute byte 4 in hexadecimal
CSR	HVCOM	HVComUsed	9	64-bit common not released (bytes)
DA	ESRBTIME (HSF)	ESRB-Time	9	Enclave CPU time
DA	CPULIMIT (HSF)	CPU-Limit	9	CPU time limit

<i>Table 4. New Non-Overtimeable Columns (continued)</i>				
Panel	Column Name	Title (Displayed)	Width	Description
DA	REUS (HSF)	Reus	4	Reusable address space (yes or no)
DA	SYSLEVEL (HSF)	SysLevel	25	Level of the operating system
H	JOBCRDATE	JobCrDate	19	Job creation date (JES2 only)
I	JOBCRDATE	JobCrDate	19	Job creation date (JES2 only)
JDD	APF	APF	3	APF indicator for loadlib data sets (yes or no)
JS	TIOTHWM	TIOTHWM	7	High water mark for TIOT entries used (bytes, SMF)
JS	TIOTUSED	TIOTUsed	8	Current TIOT space used for entries (bytes). Applies only to interval records (SMF)
JS	TIOTAVAIL	TIOTAvail	9	Size of TIOT available for entries (bytes, SMF)
MAS	CKPTLEV	CkptLevel	9	JES2 checkpoint level (\$ACTIVATE level)
O	JOBCRDATE	JobCrDate	19	Job creation date (JES2 only)
PAG	UNIT	Unit	4	Data set unit address
PAG	DEVNAME	DevName	8	Data set device name
PAG	CUNAME	CUName	8	Data set control unit name
PAG	SUBCHAN	SubChanSet	10	Data set subchannel set
PS	ZIIPTIME	zIIP-Time	9	System and user compute time on zIIP
PS	RUID	RUID	8	Process real user ID
PS	EUID	EUID	8	Process effective user ID

Panel	Column Name	Title (Displayed)	Width	Description
RM	SCOPE	Scope	7	Resource scope (local or JESPLEX)
ST	JOBCRDATE	JobCrDate	19	Job creation date (JES2 only)
SYS	JESTYPE	JESType	7	JES type for primary JES (JES2 or JES3)

When change was introduced: z/OS V2R4

Reference information: [z/OS SDSF Operation and Customization](#)

Changed non-overtimeable columns on existing SDSF panels

Description: This update to SDSF includes the changed non-overtimeable columns shown in [Table 5](#) on page 83.

Panel	Column Name	Title (Displayed)	Width	Description	Delay
CDE	CDATTR	Attr	5	CSVINFO attribute byte 1 in hexadecimal	
CDE	CDATTR2	Attr2	5	CSVINFO attribute byte 2 in hexadecimal	
H	TIMEE	St-Time	8	Time that execution began. In the SDSF task of z/OSMF, this is replaced by the St-DateTime column.	JES3 only
H	DATEE	St-Date	8	Date that execution began. In the SDSF task of z/OSMF, this is replaced by the St-DateTime column.	JES3 only
I	TIMEE	St-Time	8	Time that execution began. In the SDSF task of z/OSMF, this is replaced by the St-DateTime column.	JES3 only

Table 5. Changed Non-Overtimeable Columns (continued)

Panel	Column Name	Title (Displayed)	Width	Description	Delay
I	DATEE	St-Date	8	Date that execution began. In the SDSF task of z/OSMF, this is replaced by the St-DateTime column.	JES3 only
O	TIMEE	St-Time	8	Time that execution began. In the SDSF task of z/OSMF, this is replaced by the St-DateTime column.	JES3 only
O	DATEE	St-Date	8	Date that execution began. In the SDSF task of z/OSMF, this is replaced by the St-DateTime column.	JES3 only
ST	TIMEE	St-Time	8	Time that execution began. In the SDSF task of z/OSMF, this is replaced by the St-DateTime column.	JES3 only
ST	DATEE	St-Date	8	Date that execution began. In the SDSF task of z/OSMF, this is replaced by the St-DateTime column.	JES3 only

When change was introduced: z/OS V2R4

Reference information: [z/OS SDSF Operation and Customization](#)

New action characters on existing SDSF panels

Description: This update to SDSF includes the new action characters on existing panels shown in [Table 6](#) on page 85.

Table 6. New SDSF action characters

Panel	Action Character	Description
APF	SV	ISPF view
AS	JMO	Display the memory objects owned by the job. (Access the Job Memory Objects Panel).
AS	N	Display enqueues
CK	SV	ISPF view
CKH	SV	ISPF view
DA	JMO	Display the memory objects owned by the job. (Access the Job Memory Objects Panel.)
DA	SV	ISPF view
H	SV	ISPF view
I	SV	ISPF view
JC	I	Member information. (Access the Job Class Members panel). JES3 only.
JDS	SV	ISPF view
JG	SV	ISPF view
JO	SV	ISPF view
LNK	SV	ISPF view
LPA	SV	ISPF view
O	SV	ISPF view
OD	SV	ISPF view
PARM	SV	ISPF view
PROC	SB	ISPF browse data set
PROC	SE	ISPF edit data set
PROC	SV	ISPF view data set
SRCH	SV	ISPF view
ST	SV	ISPF view
STEP	SV	ISPF view

When change was introduced: z/OS V2R4

Reference information: [z/OS SDSF Operation and Customization](#)

Obsolete SDSF columns

Description: This update to SDSF obsoletes the statements and keywords shown in [Table 7 on page 86](#):

Panel	Column Name	Title (Displayed)	Width	Description	Delay
Job Module panel (JC)	CDE	CDE	8	CDE address	
Job Module panel (JC)	CDEATTRB	AttrB	5	CDE attribute byte B	

When change was introduced: z/OS V2R4

Reference information: [z/OS SDSF Operation and Customization](#)

Security Server (RACF) new functions to consider

This topic describes new Security Server (RACF) functions in z/OS.

RACF Password Phrase Interval Support

Description: RACF Password Phrase Interval Support provides a new separate password phrase specific change interval which can be different than the existing password interval and supports much longer values. The password phrase interval can be set with the new PHRASEINT keyword at the system level with the SETROPTS command and at the user level with the PASSWORD or PHRASE commands. (APAR OA61951)

When change was introduced: z/OS V2R5

Reference information:

- [z/OS Security Server RACF General User's Guide](#)
- [z/OS Security Server RACF Macros and Interfaces](#)
- [z/OS Security Server RACF Command Language Reference](#)
- [z/OS Security Server RACF Messages and Codes](#)
- [z/OS Security Server RACF Security Administrator's Guide](#)
- [z/OS Security Server RACF Data Areas](#)
- [z/OS Security Server RACROUTE Macro Reference](#)
- [z/OS Security Server RACF Callable Services](#)

RACF VSAM database encryption support

Description: Starting with z/OS V2R5 with APAR OA62267 applied, a RACF VSAM data set can be encrypted. If you choose to encrypt a RACF data set, you must ensure that your infrastructure supports data set encryption in its disaster and recovery planning.

When change was introduced: z/OS V2R5

Reference information:

- [z/OS Security Server RACF System Programmer's Guide](#)
- [z/OS Security Server RACROUTE Macro Reference](#)
- [z/OS Security Server RACF Security Administrator's Guide](#)

RACF data base encryption and I/O modernization

Description: The RACF data base encryption and I/O modernization function leverages the pervasive encryption support infrastructure that was introduced for extended format data sets. The RACF data base will be stored in a VSAM linear data set, a data set format which is consistent with the existing structure of a RACF data set.

Changes to the RACF data manager and the RACF utilities are required to support this function. The RACF data manager is being changed to use the DFSMSdfp Media Manager interfaces. The RACF utilities will use either the Media Manager or VSAM interfaces as appropriate.

When change was introduced: z/OS V2R5

Reference information:

[z/OS Security Server RACF System Programmer's Guide](#)
[z/OS Security Server RACF Messages and Codes](#)
[z/OS Security Server RACF Security Administrator's Guide](#)
[z/OS Security Server RACF Auditor's Guide](#)
[z/OS Security Server RACF Diagnosis Guide](#)
[z/OS Security Server RACF Data Areas](#)

RACF Certificate Fingerprint support

Description: RACF Certificate Fingerprint support provide a mean, by using the certificate fingerprint, to track the certificate life cycle in RACF DB and follow its path to the other components on z/OS and non z/OS system if necessary.

When change was introduced: z/OS V2R5

Reference information:

[z/OS Security Server RACF Macros and Interfaces](#)
[z/OS Security Server RACF Command Language Reference](#)
[z/OS Security Server RACF Security Administrator's Guide](#)

RACF Disallow profile management for users with ALTER access

Description: RACF is enhanced to provide a mechanism to restrict profile management capabilities from users with ALTER access to a discrete profile. The existing behavior may be preserved on a class-wide basis for specific users. This enhancement separates access rights to a resource from management rights of the profile protecting the resource. This allows for easier compliance reporting.

When change was introduced: z/OS V2R5

Reference information:

[z/OS Security Server RACF System Programmer's Guide](#)
[z/OS Security Server RACF Macros and Interfaces](#)
[z/OS Security Server RACF Command Language Reference](#)
[z/OS Security Server RACF Auditor's Guide](#)
[z/OS Security Server RACROUTE Macro Reference](#)
[z/OS Security Server RACF Callable Services](#)

RACF Enhanced PassTicket support with improved cryptographic methods and options

Description: RACF PassTicket technology has been updated with a new optional algorithm that provides the same capabilities as the legacy PassTickets support, with enhanced cryptographic methods and new controls.

When change was introduced: z/OS V2R5

Reference information:

[z/OS Security Server RACF Macros and Interfaces](#)
[z/OS Security Server RACF Command Language Reference](#)
[z/OS Security Server RACF Messages and Codes](#)
[z/OS Security Server RACF Security Administrator's Guide](#)

[z/OS Security Server RACF Data Areas](#)
[z/OS Security Server RACF Callable Services](#)

RACF Health Checks

Description: New RACF Health Checks have been added:

- RACF_PROTECTALL_FAIL check will alert clients to disallow access when there is no rule which allows access.
- RACF_ERASE_ALL check will alert clients when data is not being erased after a scratch or release operation.
- RACF_PTKTDATA_CLASS check will alert clients when a profile is using a masked passkey.

When change was introduced: z/OS V2R5

Reference information:

[z/OS Security Server RACF Messages and Codes](#)
[IBM Health Checker for z/OS User's Guide](#)

RACF VSAM Data Set

Description: The RACF VSAM Data Set function gives clients the option of using a VSAM linear data set as the a RACF data set in certain configurations.

When change was introduced: z/OS V2R5

Reference information:

[z/OS Security Server RACF System Programmer's Guide](#)
[z/OS Security Server RACF Command Language Reference](#)
[z/OS Security Server RACF Messages and Codes](#)
[z/OS Security Server RACF Security Administrator's Guide](#)
[z/OS Security Server RACF Diagnosis Guide](#)
[z/OS Security Server RACF Data Areas](#)

RACF ENF signal for revoked user by password attempts

Description: RACF ENF signal for revoked user by password attempts is changed to emit ENF signal 71 when RACROUTE REQUEST=VERIFY fails due to user revocation. This allows applications maintaining their own credential caches to keep them synchronized with respect to RACF changers.

When change was introduced: z/OS V2R4

Reference information:

[z/OS Security Server RACF System Programmer's Guide](#)
[z/OS Security Server RACF Data Areas](#)
[z/OS MVS Programming: Assembler Services Guide](#)

RACF Custom Fields

Description: RACF is enhanced to allow custom fields to be added to the RACF general resource and DATASET class profiles in a consistent fashion with the existing ability for user and group profiles. For all profile types, the ability to validate the value of a field using a System REXX program is also provided.

RACF is also enhanced to allow retrieval of DATASET class profile fields using the R_admin callable service (IRRSEQ00) and the IRRXUTIL REXX interface.

The IRRXUTIL REXX interface is enhanced to allow retrieval of a general resource class definition from either the static or dynamic Class Descriptor Table (CDT). There is a corresponding "next" function that

allows a caller to iterate through CDT entries. The current SETROPTS settings for the class can be optionally requested.

When change was introduced: z/OS V2R4

Reference information:

[z/OS Security Server RACF System Programmer's Guide](#)
[z/OS Security Server RACF Macros and Interfaces](#)
[z/OS Security Server RACF Command Language Reference](#)
[z/OS Security Server RACF Messages and Codes](#)
[z/OS Security Server RACF Security Administrator's Guide](#)
[z/OS Security Server RACF Data Areas](#)
[z/OS Security Server RACROUTE Macro Reference](#)
[z/OS Security Server RACF Callable Services](#)

RACF IBM Multi-factor Authentication (IBM MFA) Enhancements

Description: RACF IBM MFA is enhanced to improve the MFA user authentication experience:

Identity Token

An Identity Token is used to encode details about a user who can be trusted by the consumer of the token.

RACROUTE Support for Identity Tokens

Support is added to RACROUTE authentication processing to generate and validate Identity Tokens (IDT). An application can call RACROUTE to authenticate a user with an IDT specified instead of a credential such as a password.

IDT Configuration

The security administrator can create profiles in the IDTDATA class to configure how certain fields in an IDT are generated and validated. The profiles can be used to control options such as which key is used to sign the IDT and its validity period.

JSON Web Token (JWT)

A JSON Web Token (JWT) is a token technology used to assert claims between parties. They are often used by a single sign-on system to prove that a user has been authenticated.

When change was introduced: z/OS V2R4

Reference information:

[z/OS Security Server RACF Command Language Reference](#)
[z/OS Security Server RACF Data Areas](#)
[z/OS Security Server RACROUTE Macro Reference](#)
[z/OS Security Server RACF Callable Services](#)

RACF Pervasive encryption support

Description: RACF is enhanced to allow RRSF users to reallocate their RRSF VSAM datasets in order to change their attributes, move them to different volumes, or encrypt them using Pervasive Encryption. Tracing is also added to more parts of the RRSF subsystem, making it easier for IBM support to debug problems.

When change was introduced: z/OS V2R4

Reference information:

[z/OS Security Server RACF System Programmer's Guide](#)
[z/OS Security Server RACF Command Language Reference](#)
[z/OS Security Server RACF Messages and Codes](#)
[z/OS Security Server RACF Security Administrator's Guide](#)

RACF Privilege Escalation Detection

Description: RACF is enhanced to add checking in strategic areas to detect when an ACEE is modified. When a modification is detected, a message will be issued, while still allowing the function to proceed. The function allows normal auditing to proceed so that all the relevant information related to the event can be logged.

Users can implement automation on this message, which will contain as much environmental information as possible to allow such automation to take action, if necessary.

When change was introduced: z/OS V2R4

Reference information:

- [*z/OS Security Server RACF System Programmer's Guide*](#)
- [*z/OS Security Server RACF Messages and Codes*](#)
- [*z/OS Security Server RACF Security Administrator's Guide*](#)
- [*z/OS Security Server RACF Data Areas*](#)
- [*z/OS Security Server RACROUTE Macro Reference*](#)

RACF Improved PassTicket Security

Description: RACF is enhanced to promote the use of ICSF to protect PassTicket keys using the following new functions:

- RACF will display the name of the key label it generates for a particular key when that key is defined using the KEYENCRYPTED keyword in the SSIGNON segment of the RDEFINE and RALTER commands. This will allow the security administration to correlate the keys defined in the ICSF CKDS with the RACF profile in the PTKTDATA class that is using it. IRRDBU00 and the extract functions of the R-admin callable service will return the method of protection or key label name.
- RACF will provide a new ENCRYPTKEY keyword that will convert a masked key to an encrypted key without requiring knowledge of the key and without requiring the key to be changed.
- RACF will provide a new KEYLABEL keyword that will store the specified key label in the PTKTDATA profile. This will allow admins to pre-define the keys in the ICSF using ICSF interfaces, which is consistent with the approach taken with data set encryption.

When change was introduced: z/OS V2R4

Reference information:

- [*z/OS Security Server RACF Macros and Interfaces*](#)
- [*z/OS Security Server RACF Command Language Reference*](#)
- [*z/OS Security Server RACF Messages and Codes*](#)
- [*z/OS Security Server RACF Security Administrator's Guide*](#)
- [*z/OS Security Server RACF Callable Services*](#)

RACF RACDCERT TLS1.3 RSAPSS support

Description: RACF is enhanced to support RACDCERT TLS1.3 RSAPSS. The new function changes the RACF RACDCERT command from handling certificates signed by the hash/signature algorithm pair to the signature algorithm used in the ClientHello message in the TLS1.3 protocol. The support will include the RACDCERT functions GENCERT, REKEY, LIST, LISTCHAIN, and CHECKCERT.

The new algorithm supported is RSA Probabilistic Signature Scheme (RSASSA-PSS). It is a signature algorithm and an RSA key. The new functionality requires that the parameter field in AlgorithmIdentifier cannot be null if present, it must be omitted if there is no value.

Beginning in V2R4, the RACDCERT will store the RSA private key in PKDS protected by the ECC master key. This change will cause the RACDCERT command with RSA(PKDS) sub keyword to fail if the ECC master key is not activated in the system.

The new supported signature algorithms are:

- SHA1RSAPSS
- SHA224RSAPSS
- SHA256RSAPSS
- SHA384RSAPSS
- SHA512RSAPSS

When change was introduced: z/OS V2R4

Reference information:

[z/OS Security Server RACF Command Language Reference](#)

[z/OS Security Server RACF Messages and Codes](#)

[z/OS Security Server RACF Security Administrator's Guide](#)

SMP/E new functions to consider

GIMUNZIP enhancements

Description: The GIMUNZIP file extraction service routine is used to extract the data sets, files, and directories from the archive files in GIMZIP packages. Previously, new sequential and partitioned data sets created by GIMUNZIP were always catalogued, and new data sets could not be allocated using specified storage, management, or data classes. With APAR IO23270, GIMUNZIP is extended to support creating new, uncataloged, data sets, and when allocating new data sets, to use optional storage class, data class, and management class specifications. In addition, a work volume and device unit may be used for temporary data set allocations when extracting partitioned and VSAM data sets.

When change was introduced: APAR IO23270.

Reference information:

[z/OS SMP/E Messages, Codes, and Diagnosis](#)

[z/OS SMP/E Commands](#)

[z/OS SMP/E Reference](#)

[z/OS SMP/E User's Guide](#)

TSO/E new functions to consider

This topic describes new TSO/E functions in z/OS.

LOGON timeout

Description: This support automatically terminates the LOGON process if it takes longer than a predefined amount of time prompting the user for LOGON information, therefore, freeing resources in an address space.

When change was introduced: z/OS V2R4

Reference information:

[z/OS TSO/E Customization](#)

[z/OS MVS System Codes](#)

[z/OS MVS System Messages, Vol 9 \(IGF-IWM\)](#)

Allow special characters within passwords

Description: TSO/E positional operands for IKJPOSIT USERID8 and UID82PWD, are updated to allow special characters within passwords, enabling line mode LOGON to also accept these characters.

When change was introduced: z/OS V2R4

Reference information:

[*z/OS TSO/E Programming Services*](#)

Server-Requester Programming Interface (SRPI) and TSO/E Enhanced Connectivity Facility removal

Description: z/OS support for Server-Requester Programming Interface (SRPI) and TSO/E Enhanced Connectivity Facility is discontinued. The information about Server-Requester Programming Interface and Enhanced Connectivity Facility are removed. The MVSSERV command is no longer issued.

When change was introduced: z/OS V2R4

Reference information:

[*z/OS TSO/E General Information*](#)

[*z/OS TSO/E Command Reference*](#)

[*z/OS TSO/E Messages*](#)

[*z/OS TSO/E Customization*](#)

[*z/OS TSO/E Programming Services*](#)

[*z/OS TSO/E Programming Guide*](#)

[*z/OS TSO/E User's Guide*](#)

XL C/C++ new functions to consider

New and changed compiler options

Description:

The following compiler options or suboptions are new or changed in z/OS V2R4:

- ARCHITECTURE(13)
- TARGET(zOSV2R4)
- TUNE(13)

Release introduced:

z/OS V2R4

Description:

The following compiler options or suboptions are new or changed in z/OS V2R3:

- AGGREGATE(OFFSETDEC | OFFSETHEX)
- ARCHITECTURE(12)
- DEBUG(NOFIELD)
- INFO(STP | NOSTP)
- STACKPROTECT | NOSTACKPROTECT
- TARGET(zOSV2R3)
- TUNE(12)

Release introduced:

z/OS V2R3

Enhanced vector programming support

Description:

The vector programming support is enhanced in the following aspects to take advantage of the Vector Facility for z/Architecture.

Vector built-in functions

The following vector built-in functions are added:

- `vec_float`: Vector Convert from integer to float
- `vec_revb`: Vector Byte Reverse
- `vec_reve`: Vector Reverse
- `vec_search_string_cc`: Vector Search String
- `vec_search_string_until_zero_cc`: Vector Search String Until Zero
- `vec_sldb`: Vector Shift Left Double by Bit
- `vec_srdb`: Vector Shift Right Double by Bit

The following vector built-in functions are extended to support the `vector float` data type at a minimum ARCH level of 13:

- `vec_signed`: Vector Convert double to signed long long
- `vec_unsigned`: Vector Convert double to unsigned long long

Release introduced:

z/OS XL C/C++ V2R4

Description:

The vector programming support is enhanced in the following aspects to take advantage of the Vector Facility for z/Architecture.

Vector data types

The `vector float` data type is supported under ARCH(12).

Operators

Operators are extended to support the `vector float` data type. Use of certain vector data types with some operators is deprecated. These vector data types are still accepted as operands of these operators, but their usage is discouraged.

Vector built-in functions

The following vector built-in functions are added:

- `vec_bperm_u128`: Vector Bit Permute
- `vec_double`: Vector Convert from long long to double
- `vec_doublee`: Vector Convert from float (even elements) to double
- `vec_eqv`: Vector XNOR
- `vec_floate`: Vector Convert from double to float (even elements)
- `vec_load_len_r`: Vector Load Rightmost with Length
- `vec_msum_u128`: Vector Multiply Sum Logical
- `vec_nand`: Vector NAND
- `vec_nmadd`: Vector Negative Multiply Add
- `vec_nmsub`: Vector Negative Multiply Subtract
- `vec_orc`: Vector OR with Complement
- `vec_rint`: Vector Round to Integer
- `vec_signed`: Vector Convert double to signed long long
- `vec_store_len_r`: Vector Store Rightmost with Length
- `vec_unsigned`: Vector Convert double to unsigned long long
- `vec_xl`: Vector Load
- `vec_xst`: Vector Store

Some vector built-in functions are extended to support the vector float data type, or other data types at a minimum ARCH level of 11 or higher.

Use of certain vector data types with some operators is deprecated. These vector data types are still accepted as operands of these operators, but their usage is discouraged.

Some vector built-in functions are deprecated. You can still use these vector built-in functions at a minimum ARCH level of 11, but their usage is discouraged.

Release introduced:

z/OS XL C/C++ V2R3

Reference information:

- [z/OS XL C/C++ Programming Guide](#)

New built-in general-instruction prototypes

Description:

The following built-in general-instruction prototypes are added and supported at a minimum ARCH level of 13 in z/OS V2R4:

- `__mvcrl`
- `__popcnt4`
- `__popcnt8`

Release introduced:

z/OS V2R4

Reference information:

- [z/OS XL C/C++ Programming Guide](#)

z/OS Management Facility (z/OSMF)

This topic describes new z/OSMF functions in z/OS.

New REST API collects compliance data

Description:

In z/OS V2R4 and later, the process of collecting compliance data is assisted with the introduction of the z/OS compliance REST programming interface. This new API is used to request the collection of compliance data from in-scope systems. In response, selected products and components collect and write compliance data to the new SMF 1154 record type.

This support is provided with PTFs.

When change was introduced:

z/OS V2R4

Reference information:

[IBM z/OS Management Facility Programming Guide](#)

z/OSMF Software Update task

Description:

The z/OSMF Software Update task provides a graphical user interface that z/OS system administrators and system programmers can use to easily manage updates for installed SMP/E managed software. With the z/OSMF task, users can apply corrective, recommended, and functional updates to existing software instances and manage in-progress and completed update processes. The task provides a simple alternative to the complex task of running SMP/E JCL and then manually combing through the output and messages to interpret results and take the necessary actions.

Release introduced:

z/OS V2R4, with PTF for APAR PH28412

Reference information:

- [IBM z/OS Management Facility Configuration Guide](#)
- [IBM z/OS Management Facility Programming Guide](#)
- z/OSMF online help

z/OSMF z/OS Management Services Catalog

Description:

The z/OS Management Services Catalog improves how z/OS system programmers manage their z/OS environment using services. Services can streamline repetitive and frequent tasks as well as complex, infrequent tasks. Associated institutional knowledge and processes are embedded in services, therefore helping z/OS system programmers adhere to best practices and internal standards.

Release introduced:

z/OS V2R5

Reference information:

- [IBM z/OS Management Facility Configuration Guide](#)
- [IBM z/OS Management Facility Programming Guide](#)
- z/OSMF online help

z/OS File System (zFS) new functions to consider

None.

Using wildcards when specifying aggregates

Description:

Wildcard capability is added to the **zfsadm chaggr** command.

Release introduced:

z/OS V2R4 and in V2R3 with the PTF for APAR OA59435 applied.

Reference information:

[z/OS File System Administration](#)

Improved reliability and availability for zFS file systems

Description:

With the zFS high availability option, if the file system owner experiences an outage, applications that are accessing that file system on other systems are not affected.

When change was introduced:

z/OS V2R4

Reference information:

[z/OS File System Administration](#)

zFS File Snapshot

Description:

With zFS File Snapshot, you can create a point-in-time snapshot (or copy) of a file in a zFS file system and allow subsequent read requests from that snapshot. Each time files are changed, backup

programs can save only the changed files in a file system instead of saving all the files in the file system.

Release introduced:

z/OS V2R4 and in V2R3 with the PTF for APAR OA56145 applied.

Reference information:

[z/OS File System Administration](#)

Removal of Distributed File Service/Server Message Block (DFS/SMB)

Description:

In z/OS V2R3, the statement of direction was updated to indicate that V2R3 would be the last release to support the DFS/SMB (Distributed File System/Server Message Block) functionality. IBM had previously announced that the Network File System (NFS) was the strategic file sharing protocol for the z/OS platform.

Release introduced:

z/OS V2R4

Reference information:

The following book is removed:

[z/OS Distributed File Service SMB Administration](#)

Identifying SMB-exported file systems

Description:

Because z/OS V2R3 is planned to be the last release to support the DFS/SMB functionality, the ZOSMIGV2R3_NEXT_USS_SMB_DETECTED health check was made available. It provides a list of SMB-exported file systems.

Release introduced:

z/OS V2R3 with APAR OA56251.

Reference information:

[IBM Health Checker for z/OS User's Guide](#)

z/OS UNIX System Services new functions to consider

This topic describes new z/OS UNIX functions in z/OS.

Auditing capability for the su command

Description:

The auditing capability is added to the **su** command.

Release introduced:

In z/OS 2.5 with the PTF for APAR OA62850 applied. This APAR applies to z/OS 2.5 and 2.4.

Reference information:

[z/OS UNIX System Services Planning](#)

[z/OS UNIX System Services Command Reference](#)

Providing a merged view of files and directories using the union file system (UFS)

Description:

The union file system (UFS) is available in 2.5 with the PTF for OA61759 applied. It provides a merged view of two or more directories.

Release introduced:

z/OS V2R5

Reference information:

z/OS UNIX System Services Planning
z/OS UNIX System Services User's Guide

Enhanced viewing of files in the z/OS UNIX file system

Description:

Previously, you could only view files in the z/OS UNIX file system with the **obrowse** or **oedit** shell commands. You could also use the OBROWSE or OEDIT TSO/E commands. In z/OS V2R5, you can now take advantage of the ISPF View facility to view files in the z/OS UNIX file system with the shell command **oview** or the TSO/E command OVIEW.

Release introduced:

z/OS V2R5

Reference information:

z/OS UNIX System Services Command Reference

Monitoring system limits by default

Description:

Previously, you had to specify SYSTEM on the LIMMSG parameter in the BPXPRMxx parmlib member if you wanted to monitor the system. In V2R5, the default was changed from NONE to SYSTEM and all system limits are monitored by default.

Release introduced:

z/OS V2R5

Reference information:

z/OS MVS Initialization and Tuning Reference
z/OS MVS System Commands
z/OS Upgrade Workflow

Tagging files when using BPXCOPY

Description:

To eliminate the need to post-process files, BPXCOPY was enhanced to allow the tagging of output files.

Release introduced:

z/OS V2R5

Reference information:

z/OS UNIX System Services Command Reference

Returning proper return codes from submitted jobs

Description:

BPXBATCH was enhanced to provide the proper return codes from submitted jobs.

Release introduced:

z/OS V2R5

Reference information:

z/OS UNIX System Services Command Reference
z/OS UNIX System Services User's Guide

Managing processes and threads

Description:

Use the prctl service to manage processes and threads. descriptors.

Release introduced:

In z/OS V2R5 with the PTF for APAR OA1972 applied. This APAR applies to z/OS V2R5 only.

Reference information:

z/OS UNIX System Services Programming: Assembler Callable Services Reference

Enhanced BPXPRMxx syntax checker

Description:

The PARM keyword is now checked for zFS file systems as part of the SETOMVS SYNTAXCHECK validation check.

Release introduced:

z/OS V2R5

Reference information:

z/OS MVS System Commands

Extended SMF record support in _smf_record()

Description:

Applications can return SMF extended header records by using the smf_record() service while limiting the record types and subtypes (BPX.SMF.type.subtype) that can be recorded.

Release introduced:

z/OS V2R5

Reference information:

z/OS UNIX System Services Programming: Assembler Callable Services Reference

Preventing files from being deleted from the root directory

Description:

With APAR OA60001, the **rm** command has new options that prevent files from being deleted from the root directory.

Release introduced:

z/OS V2R4

Reference information:

z/OS UNIX System Services Command Reference

Copying from MVS to z/OS UNIX and from z/OS UNIX to MVS

Description:

The **cp** command with the -I option supports copy from MVS to z/OS UNIX, and also from z/OS UNIX to MVS.

Release introduced:

z/OS V2R4, with APAR OA57659

Reference information:

z/OS UNIX System Services Command Reference

Generating and checking cryptographic hashes

Description:

With APAR OA59201, new cryptographic hash utilities are provided. They use the ICSF One-Way Hash Generate callable service to generate cryptographic hashes for input files and can be used to check cryptographic hashes that are read from input files.

Release introduced:

z/OS V2R4

Reference information:

[*z/OS UNIX System Services Command Reference*](#)

z/OS UNIX forkcopy processing

Description:

Previously, with the FORKCOPY option in the BPXPRMxx parmlib member, copy-on-write (COW) mode could be specified for fork processing. The default was FORKCOPY(COW). In V2R4, the COW option is disabled. FORKCOPY will use the copy option whether COPY or COW is specified.

Release introduced:

z/OS V2R4

Reference information:

[*z/OS MVS Initialization and Tuning Reference*](#)

[*z/OS MVS System Commands*](#)

[*z/OS UNIX System Services Planning*](#)

[*IBM Health Checker for z/OS User's Guide*](#)

z/OS UNIX kernel stack allocation

Description:

Previously, with the KERNELSTACK option in the BPXPRMxx parmlib member, stacks could be allocated either above or below the bar. The default was KERNELSTACKS(BELOW). In V2R4, stacks are always allocated above the bar. If KERNELSTACKS(BELOW) is specified, it is ignored and the stacks are allocated above the bar.

Release introduced:

z/OS V2R4

Reference information:

[*z/OS MVS Initialization and Tuning Reference*](#)

[*z/OS MVS System Commands*](#)

Loading RMODE64 programs into common storage

Description:

The loadHFS extended (BPX1LDX/BPX4LDX) callable service can now be used to load RMODE 64 programs directly into 64-bit common storage. After the program is loaded, it is ready to be added to the dynamic link pack area (LPA).

Release introduced:

z/OS V2R4

Reference information:

[*z/OS UNIX System Services Programming: Assembler Callable Services Reference*](#)

Obtaining information about RMODE64 modules that were loaded by the debugged process

Description:

With the new PT_LD64INFO option, information can be returned about the RMODE64 modules that were loaded by the debugged process.

Release introduced:

z/OS V2R4

Reference information:

[z/OS UNIX System Services Programming: Assembler Callable Services Reference](#)

Migrating HFS and zFS file systems to zFS file systems

Description:

Previously, you could only migrate mounted HFS file systems to zFS. You can now use the **bpwmigf** command to migrate mounted zFS file systems to zFS.

Release introduced:

z/OS V2R4

Reference information:

[z/OS UNIX System Services Command Reference](#)

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