What's New in z/OS 3.1

z/OS 3.1 – Preview Announce Edition
March 2023 (Preview: IBM z/OS 3.1)

Gary Puchkoff
z/OS Development
puchkoff@us.ibm.com

Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

Table of Contents

(CD) – Base z/OS 3.1 items that were **C**ontinuous **D**elivery on previous release(s)
(CD) – **C**ontinuous **D**elivery items post z/OS 3.1 General Availability
(SOD) – Statement of Direction
 - Content solution pages

Table of Contents

IBM z/OS 3.1: An AI-infused operating system for the next generation of computing

IBM z/OS 3.1 marks a new era in operating system intelligence. The new version of z/OS is planned to provide a framework for infusing AI throughout the system, enabling intelligent systems administration guidance and automation that learns and improves. With z/OS 3.1 as the foundation of a hybrid cloud strategy, enterprises can deploy and co-locate Linux-based applications together with their existing business critical workloads and enjoy the unique value propositions of both environments. Built on over 50 years of continuous innovation, research, and development, IBM z/OS is the core computing platform for the world's top financial institutions, insurers, retailers, utilities, governments and more.

3.1 General Messaging		
AI-infusion	**Modernization & Simplification**	**Security & Resiliency**
Scale the value of data and drive digital transformation powered by AI and intelligent automation	Build new and modernize existing applications and workloads while optimizing and simplifying technology infrastructure with a flexible hybrid cloud strategy	Protect and thrive with unparalleled security and resilience capabilities with quantum-safe technologies

z/OS 3.1 Release Overview - Release Highlights

Feature	Description
AI Platforms & Operations	Scale the value of data and drive digital transformation powered by AI and intelligent automation, including support for a new AI Framework for system operations, and a certified Ansible collection for automation.
Application Modernization	Build new and modernize existing applications and workloads with a flexible hybrid cloud strategy based on modern APIs and DevOps platforms, including continued enhancements to z/OS Container Extensions (zCX).
OS Management Simplification	Manage and optimize technology infrastructure with industry-popular interfaces for system programmers of all experience levels, with help from new features like IBM z/OS Change Tracker to comprehensively track, manage, and control changes to software libraries.
Security & Resiliency	Protect and thrive with exceptional security and resilience capabilities, including a new Authorized Code Monitor to guard against potential vulnerabilities, expanded System Recovery Boost solutions, and new interfaces for runtime diagnostics and resource monitoring.
Data Serving & Storage	Create a resilient, modern infrastructure that integrates mainframe data, operations, and applications with hybrid cloud environments, allowing new and existing data alike to be accessed through NoSQL APIs or stored to the cloud with standard object storage interfaces.

For Additional Education

z/OS IBM Education Assistant

- For z/OS 3.1 educational materials, please see the z/OS github entry (https://github.com/IBM/IBM-Z-zOS/tree/main/zOS-Education/zOS-3.1-Education)
- - Details for many topics referred to in this presentation (as well as a PDF of the latest version of this presentation)

z/OS 3.1 Release Overview – z/OS support summary

Release	z10 EC z10 BC WdfM	z196 Z114 WdfM	zEC12 zBC12 WdfM	z13 Z13s WdfM	z14 ZR1 WdfM	z15	z16	End of Service	Extended Defect Support
z/OS V2.2	X	X	X	X	X	X	X	9/20	9/23[2]
z/OS V2.3			X	X	X	X	X	9/22	9/25[2]
z/OS V2.4			X	X	X	X	X	9/24[1]	9/27[2]
z/OS V2.5				X	X	X	X	9/26[1]	9/29[2]
z/OS 3.1					X	X	X	9/28[1]	9/31[2]

Notes:

[1] - All statements regarding IBM's plans, directions, and intent are subject to change or withdrawal without notice.

[2] - Extended support dates are projected and are subject to change or withdrawal without notice.

WdfM - Server has been withdrawn from Marketing

Legend

Defect support provided with IBM Software Support Services for z/OS
Generally supported

Table of Contents

Z Hardware Support

IBM **z16 (3931) Model A01** Functions & Features

One hardware model, Five Features, 1-4 19” Frame System
Up to 85 user partitions, 32 TB per partition, 200 CPUs/zIIPs/IFLs per partition, up to 224 PUs **• Up to 16 TB per z/OS LPAR with z/OS V2.5**
•2 CP chips on a Dual Chip Module (DCM), 5.4 GHz **•L1 Private 128K i & 128K d** **•-L2 n/a** **•L3 Shared 32 MB / core, 192 MB effective shared** **•L4 n/a**
256 GB HSA, 40 TB maximum, 10 TB per drawer
Channel Subsystem scalability **•Up to six (6) Channel Sub Systems (CSSs)** **• 4 Subchannel Sets per CSS**
HiperDispatch Enhancements
IBM Z Integrated Accelerator for AI
Hardware Instrumentation Services (CPUMF)
New machine instructions
Crypto Express8S
OSA Express7S 1.2

(z/OS support in blue)

IBM System Recovery Boost
Coupling Express2 LR 10Gb (CX6-DX) PCIe adapter
CF Level 25 **•Retry buffers for cache and lock commands** **•Cache residency time metrics** **•Scalability improvements** **•Request latency/performance improvements**
ICA-SR 1.1 **Max ICA SR per CEC 48 adapters/96ports (same as z15)**
Max ICP CHPIDs per CEC – 64
10 GbE and 25 GbE RoCE Express 3 SR and LR (CX6-DX)
FICON Express 32S
zHyperLink® Express1.1 **• Maximum 16 Adapters /32 ports**
IBM Flexible Capacity for Cyber Resilience

Z Hardware Support

IBM z15 Model T02 functions & features

One hardware model T02 19-inch frame
zArchitecture Mode ONLY
Up to 65 processors configurable as CPs, zIIPs, IFLs, ICFs or optional SAPs
•L1 Private 128K i & 28K d -L2 Private 2MB i & 2MB d •L3 Shared 256 MB / chip -L4 Shared 956 MB / drawer
Up to 16 TB of Redundant Array of Intendent Memory (RAIM) – 1 TB Memory Increment – 8 TB/Drawer - Max • Up to 16 TB per/z/OS LPAR with z/OS V2.5
160 GB Fixed HSA
Channel Subsystem • Up to 40 LPARs • Up to three (3) Logical Channel Sub Systems (LCSSs) • 3 Subchannel Sets per LCSS
HiperDispatch Enhancements
Two-way simultaneous multithreading (SMT) • Support for SAPs
30+ New instructions: Java, Vector enhancements for Analytics and sort acceleration
XL C/C++ ARCH(13) and TUNE(13) exploitation: • New z15 hardware instructions • Aligned Vector Load/Store Hint instructions • Vector Enhancement Facility 2 • Miscellaneous-Instruction-Extension Facility 3
Hardware Instrumentation Services (CPUMF)

(z/OS support in blue)

IBM Virtual Flash Memory & CF Exploitation of VFM Up to 4 Features – Feature Size=0.5TB
IBM System Recovery Boost
IBM Integrated Accelerator for Z Sort
IBM Integrated Accelerator for z Enterprise Data Compression (on-Chip Compression)
CF Level 24 •CF Fair Latch Manager 2 •Message Path SYID Resiliency Enhancement •DYNDISP Default THIN •CF Monopolization Avoidance
• Coupling CHPIDs increased to 384 from 256 per CEC • ICA SR increased to 48; CE-LR to 64; ICP increased to 64
Integrated Coupling Adapter (ICA-SR) links NB + CF
Coupling Express (CX3) LR, NB + CE LR CF
Next Gen RoCE 25/10 GbE RoCE-Express2.1 (CX4)
FICON Express16S+ (Fiber Channel Endpoint Security not supported)
OSA Express6S GbE, 10GbE, 1000Base-T OSA Express7S 25 GbE SR1.1
IBM zHyperLink® Express1.1 2 Port Adapter FC0451 / CF
Crypto Express7S (FC 0899 - 1 HSM, FC 0898 - 2 HSM) • Max 40 Combination of (CEX7S. CEX6S,CEX5S) • CEX6S and CEX5S can be Carried Forward (CF) • Support for CCA 7.1 • New ECC Edward Curves support

Z Hardware Support

IBM z16 highlights (CD)

- Up to 16 TB of memory per z/OS instance used by select middleware
- 20 new instructions to help improve COBOL and AI applications, including instructions to leverage the new AI accelerator
- A new level of coupling facility support, CFLEVEL 25, which provides Coupling and Parallel Sysplex enhancements
- IBM Z Integrated Accelerator for AI is designed to provide machine learning acceleration with high throughput and low latency
  - IBM Deep Learning Compiler (DLC) enables deep learning models to be deployed on IBM Z, exploiting the IBM Integrated Accelerator for AI.
  - 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.
- z/OS IBM z16 Upgrade Workflow provided to help position z/OS for use on IBM z16 server

Z Hardware Support

ICSF HW Support Enhancements

- Full Support for IBM z16
  - Support for new Crypto Express 8 Coprocessor
  - New Quantum Safe Algorithms, CRYSTALS-Dilithium 8,7 and CRYSTALS-Kyber
  - HW Toleration for older ICSF releases.
- New TR-31 Export/Import options in support of updated Visa Payment Network requirements
- Enhancements to TR-34 services to support a large Certificate Revocation List (CRL) and allow controlled use of expired certificates.

Table of Contents

z/OS 3.1 Release Overview

Usability and Skills
z/OSMF File compare utility, upload/download, Security Configuration assistant, Sysplex Mgmt and Policy Editor, Release Upgrade, ServerPac improvements…

Application Development
Artificial Intelligence, z/OS Container Extensions, Red Hat OpenShift, z/OS Containers, JSON Parser improvements, ISPF member gens, ABO, Java 11/17, Node.js, Python, Go…

Enhancing Security
RACF DB encryption, RACF custom fields, ICSF, zACS monitor, compliance support…

Scalability & Performance
Greater than 4TB memory, Dedicated Memory, RMF UI improvements…

Data Serving & Storage
Cloud Data Access, EzNoSQL APIs, DFSMSrmm z/OSMF plug-in, simplified Catalog recovery & management, DFSMShsm & SMS enhancements, NFS Server enhancements, Union File System, Data Set File System…

Availability
Anomaly Mitigation, PFA and RTD improvements, system recovery boost, Notepad resiliency…

Systems Management
AI infused z/OS, JES2 expanded policy support, Change Tracker, CP&M z/OS System Provisioning Service, z/OS Management Services Catalog, zWIC, SDSF new displays…

Networking
zERT, RDMA over ROCE 3, SyslogD, FTP security…

Table of Contents

Application Development

- Expand scope of existing application functions driven mainly by customer usage scenarios
  - Provide new APIs or services
  - Unique support for building and deployment of executables
  - Enhance debugging capability
  - Support for specific standards where required
- Exploit IBM Z-specific technology (including HW) to further advantage application deployment on our platform
- Provide timely internationalization support
  - Support Unicode character sets
  - Other support driven by world events
- Upgrade open source and other imbedded IBM technology to current levels and take advantage of z/OS QoS
  - zCX
  - OpenSSH and other Linux/UNIX-based tools
  - WAS Liberty
- Support new development and deployment model using industry accepted concepts of containers and orchestration for z/OS applications.

Application Development Resources

AI on z/OS – New materials to help jump start your AI adoption journey

- Journey to AI on IBM zSystems and LinuxONE content solution
  - Guidance on identifying use cases, available solutions, recent developments and more.
  - https://www.ibm.com/support/z-content-solutions/journey-to-ai-on-z/
- AI on IBM Z and LinuxONE community
  - Read recent blogs and announcements
  - Engage with subject matter experts on the latest topics around AI on IBM Z
  - https://ibm.biz/BdPBud
- Client Engineering Workshops
  - Learn about analytics and AI technologies and solutions on IBM Z and where you are in your AI Journey
  - Each workshop is tailored to fit your needs
  - Contact ce4s@ibm.com or your local IBM Client Engineering team to find out more
  - https://ibm.biz/aionz-workshop

Application Development- Ecosystem

Open-source AI frameworks on zCX (running Linux in z/OS)

- Deploy AI frameworks co-located with z/OS applications for low latency response times
- Popular machine learning and deep learning frameworks, such as TensorFlow and IBM Z Deep Learning Compiler (zDLC), are available as a pre-built image in the IBM Z and LinuxOne Container Registry
- Select frameworks will leverage the z16 Integrated Accelerator for AI
- Utilize Anaconda to install and manage data science packages: https://www.ibm.com/blogs/systems/announcing-anaconda-for-linux-on-ibm-z-linuxone/

Optimize libraries and compilers to leverage Integrated Accelerator for AI

- zDNN is a high level language interface for the Integrated Accelerator for AI, packaged with z/OS
- IBM Snap ML now installable in Linux environments using PyPI (pip install)
  - Developed by IBM, a library for training and scoring traditional ML models.
  - Exploits the AI accelerator for inferencing of tree-based models. This includes random forest and boosted tree model types.

Application Development- Ecosystem

IBM Z Platform for Apache Spark

- Apache Spark 3.2 available on z/OS
- In-memory compute engine and analytics runtime, supports big data popular languages Java, Scala, Python and R
- Foundational capabilities for leveraging lightning-fast data processing on large volumes of z/OS data.
- Simplified data access and streamlined development on a wide range of algorithms and to accelerate analytics results


IBM Z Content Solutions | Journey to open data analytics

Python AI Toolkit for IBM z/OS

- Industry leading AI Python packages available on z/OS
- Unlocks verified open-source software with supply chain security
- Familiar, flexible, and agile package installation process leveraging PyPi


IBM Z Content Solutions | Journey to open data analytics

Application Development- Strategic Offerings

Watson Machine Learning for z/OS

- Real-time analytics at the source with machine learning and deep learning models without impacting SLAs.
- Supporting build anywhere and deploy on Z strategy: easily import, optimize and deploy Open Neural Network Exchange (ONNX) deep learning models to z/OS natively
    - Leverages the IBM Deep Learning Compiler
    - In-transaction scoring for native CICS, IMS & Batch COBOL applications with near-zero latency
    - Telum on-chip AI Accelerator exploitation for AI inferencing at scale
    - IMS and batch Cobol native scoring capability

Watson Machine Online Scoring Community Edition

- A lightweight no-charge trial of Watson Machine Learning for z/OS that enables you to score ONNX models for in-transaction inferencing in zCX.
- Leverage the IBM z16 Integrated Accelerator for AI to optimize ONNX model execution.
- Snap ML reference supporting traditional machine learning tree-based models, leveraging the z16 Integrated Accelerator for AI

Application Development

z/OS Container Extensions – Run Linux Containerized workloads on z/OS!

- z/OS Container Extensions provides a virtual appliance for running Linux on Z workloads on z/OS
- The **same binary** container images that run on Linux on Z under z/VM or zKVM will run in zCX
  - No porting is typically required from Linux on Z
- The open mainframe project Ambitus provides an ecosystem for zCX

- Scalable to:
  - Up to 64 servers per z/OS image
  - Up to 1 TB of guest memory per server
  - Up to 245 virtual devices per server
    - Disk devices up to 1TB each
  - Up to 1000 containers per server
  - zIIP eligibility - 98%+ ziip offload in lab measurements*

- A self service trial is available to all z/OS customers, after 90 days purchase Container Hosting Foundation product to continue using zCX

For more information, see the zCX content solution (https://www.ibm.com/support/z-content-solutions/container-extensions/).

Application Development

zCX Currency and LDAP Function (CD)

- zCX large UID and GID range support.
- zCX Linux kernel is updated to use 5.4.0-81-generic.
- zCX Docker update and latest container runtime packages

zCX Workflow Recovery (CD)

- zCX support to back out disk allocation failures

zCX NFS persistent storage (CD)

- Securely store and access stateful data using z/OS NFS server

zCX Support for WebSphere Hybrid Edition (CD)

- IBM zCX Foundation for Red Hat OpenShift can now support WebSphere Hybrid Edition co-located with z/OS

Application Development

IBM zCX Foundation for Red Hat OpenShift – New Product (CD)

- Bringing Red Hat OpenShift Benefits to z/OS
- Key value
  - IBM zCX Foundation for Red Hat OpenShift that provides enterprise-level container orchestration and management capabilities around containerized software.
  - Clients can extend and modernize their native z/OS ecosystem through an agile and flexible deployment of Linux on Z applications in a self-contained Red Hat OpenShift cluster on z/OS while exploiting z/OS Quality of Service.
  - Enables Red Hat OpenShift applications to run on z/OS.
- Key information
  - Entitlement to Red Hat OpenShift is included in the purchase of IBM zCX Foundation for Red Hat OpenShift via ShopZ
  - The license for Red Hat OpenShift on z/OS (via zCX) is non-transferable between zCX and Linux on Z
  - Committed Term License options (1,3, and 5 years)
  - Price is based on zIIPs (not IFLs, as zCX and zCX for OpenShift do not run on IFLs)
  - Priced per core (this is comparable to OpenShift on Linux on Z)

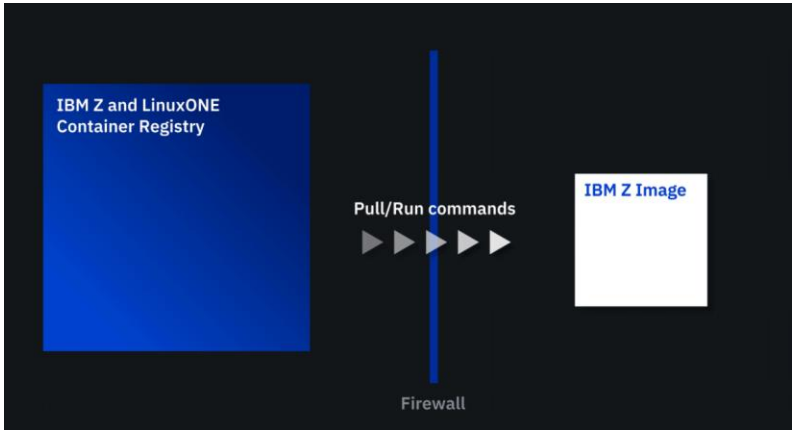
Products like IBM Security and Compliance Center, IBM WebSphere Hybrid Edition, etc. will pre-req this new product.

IBM Z and LinuxONE container registry

IBM Z® and LinuxONE Container Registry contains an ever-growing collection of common Open Source images that are used to create new workloads. Providing a trustworthy channel that enables IBM zSystems clients running z/OS®, Linux®, and LinuxONE to fully participate in the Open Source ecosystem

Benefits of the IBM Z and LinuxONE Container Registry

- Images are built from source - no un-intended binary payloads
- Images are scanned for known vulnerabilities with reports provided
- Hashes for each image are published for reference and secure image pulls
- Free of charge



Click the icon and get started today!

https://ibm.biz/BdfAdW

Application Development

z/OS Containers (SOD)

- In June of 2020 IBM® made the following statements of general direction:
  - *IBM intends to deliver a container runtime for IBM z/OS® in support of Open Containers Initiative (OCI) compliant images comprising traditional z/OS software.*
  - *IBM intends to deliver Kubernetes orchestration for these containers on z/OS.*

- z/OS intends to provide the basis for future support of an OCI container runtime and Kubernetes container orchestration for **IBM z/OS applications and workloads**. This will enable clients to adopt a container based cloud native strategy for application development and operation of mission critical z/OS applications

- As a future item in z/OS - z/OS Containers intends to provide an industry standard container experience for z/OS that is consistent and familiar to application developers.

Latest Compiler Offerings on z/OS

IBM Enterprise COBOL for z/OS 6.4

IBM Automatic Binary Optimizer 2.2

IBM Enterprise PL/I for z/OS 6.1

z/OS 3.1 XL C/C++
(entitled also to IBM Open XL C/C++ 1.1)

IBM Semeru Runtime Certified Edition for z/OS v11.0

IBM Open Enterprise SDK for Node.js – z/OS v18

IBM Open Enterprise SDK for Python v3.11

IBM Open Enterprise SDK for Go v1.17

Application Development

z/OS 3.1 and Java

- z/OS 3.1 supports Semeru 11 as the minimum required Java level.
    - Java 8 support for application compatibility
- IBM Semeru Runtime Certified Edition for z/OS, Version 17 – Statement of Direction

Java service stream updates

- See features blog for latest service release levels
- Java on z/OS security providers are available for download (link)
- Installing Semeru 11 via Installation Manager now available (link)

Ecosystem support of Semeru 11 on z/OS – Liberty, CICS, IMS, Db2, MQ, etc (link)

Celebrating 25 Years of Innovation: Java on z/OS – see more details here

Application Development

COBOL-Java Interoperability

- Support to manage parallel 31-bit and 64-bit Language Environment addressing mode (AMODE) enclaves within the same address space.
- Enables transparent traversal between the two AMODE enclaves.
- This interoperability support enables clients to modernize their existing high-level language applications.
    - 31-bit COBOL applications can now be extended by calling 64-bit Java programs (or vice versa) directly, in the same application context and address space with the enhancements made to IBM Java 8/11 SDK.
- Other features of this support include coordinated condition handling, easier serviceability because both enclaves are automatically part of the same dump and having the same security context for the entire application.
- While the primary focus is for COBOL-Java interoperability, the LE support is designed to work for any combination of high-level languages interoperating between 31-bit and 64-bit addressing modes.
- New callable service allows an application to interrogate if it is running in this interoperability environment. (CD)
- This support is available with IBM SDK Java 8
    - and now with IBM Semeru Runtime 11 (CD)

Application Development

ISPF Enhancements

- ISPF support for PDSE V2 member generations
  - Support specification of generation numbers in the Edit and View panels and primary commands BROWSE, EDIT, and VIEW.
  - A “generation list” can be viewed for members with generations, allowing the use of line commands to access commonly-used functions for desired generations.
  - Select ISPF services are also enhanced with additional member generations information.
- ISPF Allocate Data Set panel adds ‘dataset key label’ in support of pervasive encryption.
- z/OS UNIX Directory List Utility now supports case-insensitive sort option
- The settings from the ”Edit Color Settings” panel are available programmatically through ISPF variables. (CD)

Application Development

z/OS UNIX Utility Enhancements

- **su** auditing capability by issuing SYSLOGD message
- **date** utility support for Julian date conversion
- **find** utility enhancement to print filenames with a null character.
  - This allows file names that contain newlines or other types of white space to be correctly interpreted by programs that process the find output.
- Address column collapsing in **ps** command output

zlib encryption Enhancement

- Support for **CRC-32** - a practical algorithm commonly used in digital networks and storage devices to detect accidental changes to digital data.

New C runtime APIs and header constants

- New APIs and constants to facilitate the porting of UNIX/Linux programs to z/OS.

Application Development

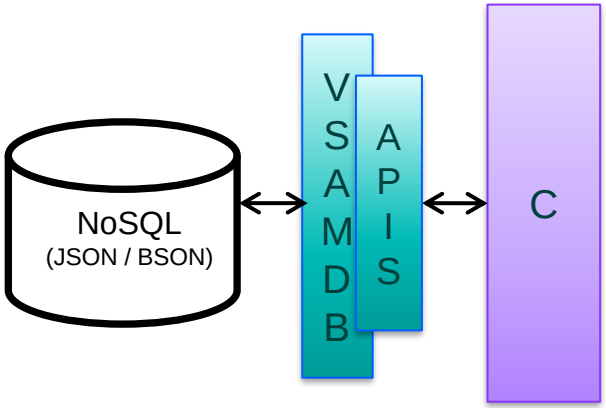
JSON Parser Improvements (CD)

- JSON Parser comment support
  - Toleration support for single-line and multi-line comments as defined by JSON5
  - The parser will Successfully parse commented JSON text, but the application will not be able to retrieve or Modify any comments that may have been encountered in the JSON text

- CPU and elapsed time associated with the parsing of JSON content is reduced by up to 50%[1]

[1] Disclaimer: This reduction is based on internal measurements done on an IBM z15 using a z/OS V2.5 LPAR with 8 CPs. The z/OS JSON Parser was used to parse a 568 MB JSON input file containing public property tax records and geospatial data. The input file included 7,875,189 numbers, 3,038,859 arrays, 2,217,825 strings, 54,336 nulls, no booleans, and no comments. The maximum nesting depth of any member or element was 7 levels. Reported results were derived from measurements that tested 100 parses of the input file back to back. Results may vary.

Data Serving and Storage



EzNoSQL APIs (CD)

- NoSQL for z/OS provides a key:value document store on z/OS and allows applications the ability to store open standard BSON/JSON (UTF-8) objects.
- EzNoSQL provides a set of modern APIs, with a C-based, key-value interface, to simplify the application effort needed to access NoSQL VSAMDB data sets on z/OS in real-time, at scale, and with consistency.
  - C-based key-value interface to a NoSQL database enables higher level languages and interfaces.

Content Solution website (https://www.ibm.com/support/z-content-solutions/eznosql) has everything needed to get started!

Table of Contents

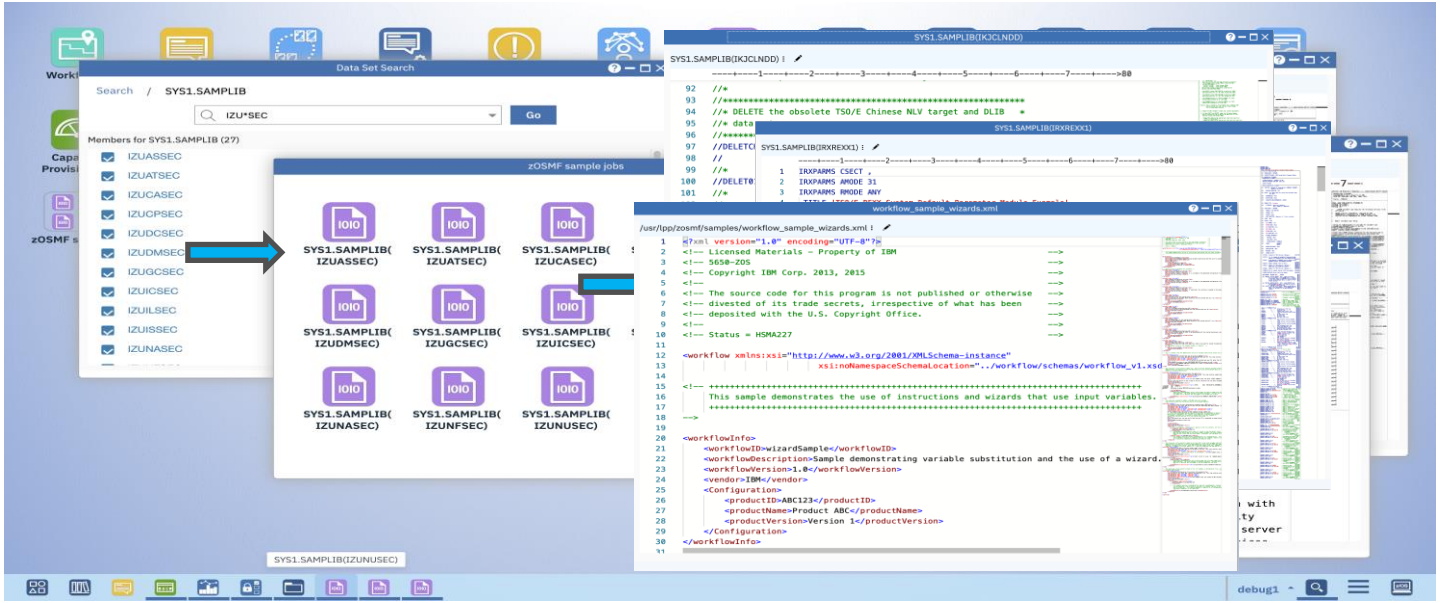
Usability & Skills

- Bring a browser-based ecosystem to z/OS Management
  - Consistent with industry- popular user interfaces
  - Enhance old ISPF interfaces
  - Client platform agnostic – OS, devices etc.
  - Integrate daily utilities into intuitive elements
- Develop Applications focused on z/OS unique needs
  - Task-oriented with streamlined and automated abilities
  - Reduced effort, errors, and skill requirements
- Integrate and expand the z/OS ecosystem
  - Provide REST API's for public consumption
    - Secure, efficient, and flexible
    - Can be driven through z/OSMF Workflows and Ansible®
  - Numerous plug-ins that add signification functionalities
- Reduce reliance on Assembler skills
  - Provide solutions that don't require assembler code where possible
  - Support higher level language extensions of z/OS

Usability & Skills

z/OSMF Desktop – multi-tasking

- Customer grouping of items in folders, such as data sets or Jobs
- Search, Browse, Edit files and data sets
- Submit, query, browse jobs – Job Output Task
- Editor Syntax highlighting, user created links,



Usability & Skills

z/OSMF Productivity Enhancements (CD)

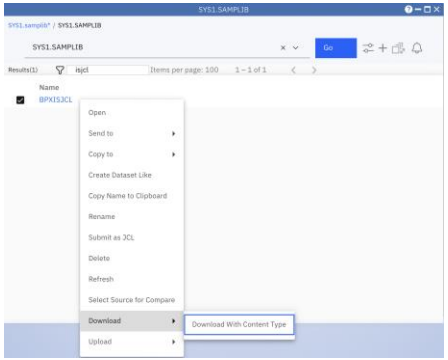
- Ability to perform data set and USS file operations directly from the desktop
- Copy, Rename, Change File Permissions, Update Attributes

z/OSMF Data Set and File Compare (CD)

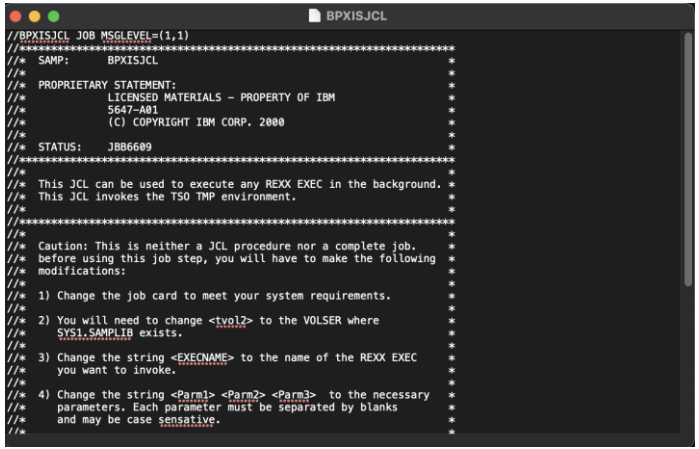
- Enhanced desktop editor to compare two files and visualize the differences.
- See next page

z/OSMF Upload & Download files on Desktop (CD)

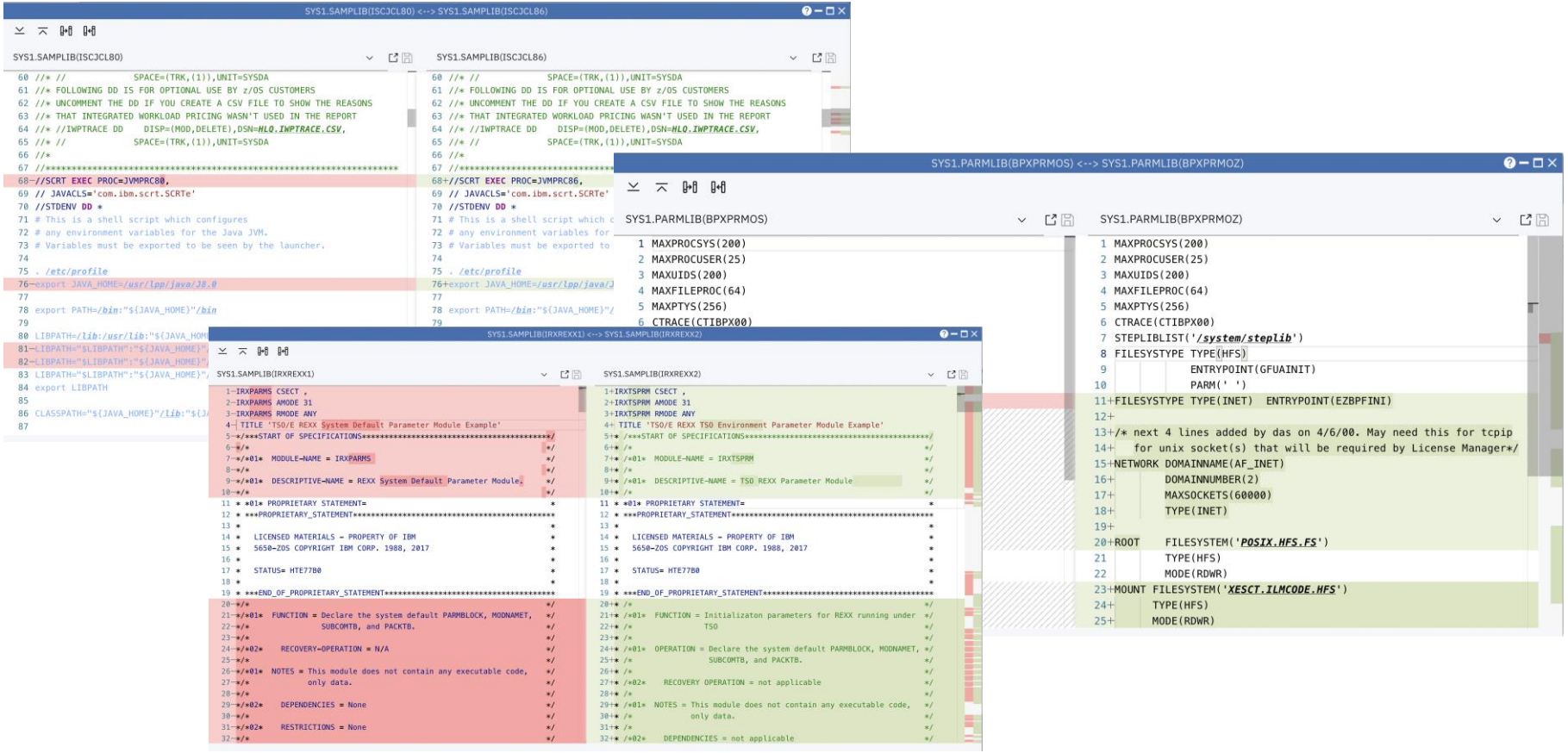
- Users can upload or download a sequential data set, PDSE member, or zFS file between z/OS and their workstation with a few clicks or drag and drop



→



Usability & Skills

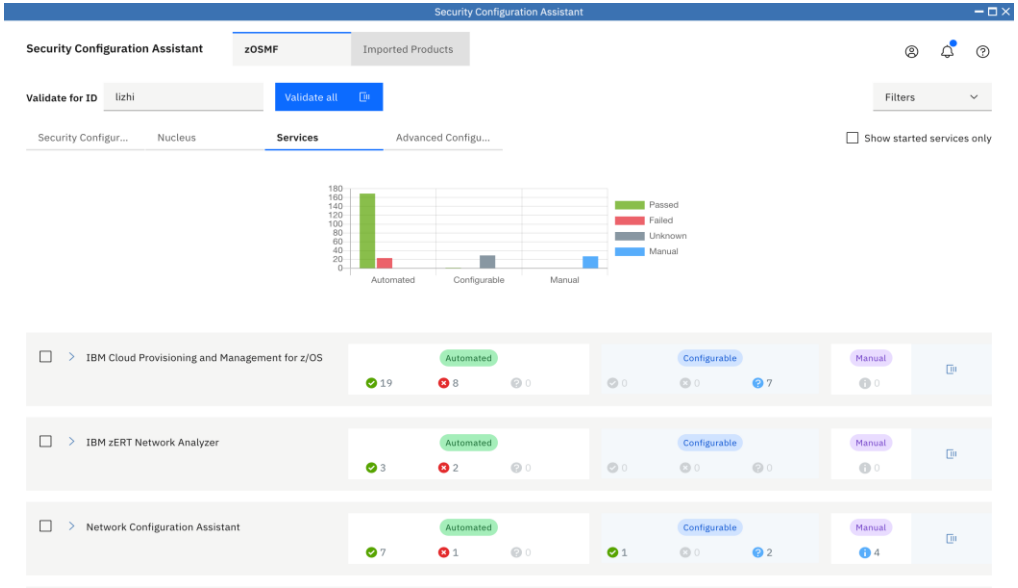


Usability & Skills

Security Configuration Assistant (SCA)

A new z/OSMF application to help system programmers in configuring z/OS security

- Support for variable substitution, user groups, external applications
  - SDSF, DFSMSdss, DFSMShsm, etc.
- Validation REST API (CD)
- Support to create or optionally fix security configuration (CD)
- Line mode SCA support for use before z/OSMF starts (CD)



Usability & Skills

z/OSMF Sysplex Management Plugin

- View Sysplex configuration
  - Table and graphical views
- Modify Sysplex configuration
  - Sysplex-wide commands and results display
  - Command Log retained across IPL
  - Allows review of who took what action when (and the detailed results of each action)
  - Optionally view generated commands before issuing them
  - Actions include Rebuild, Duplex, Reallocate, CF actions, CF connectivity management, Couple Dataset Mgmt.

- Sysplex CFRM Policy Editor
  - Edits information about Sysplex CFRM policy including structure sizes
  - Policy actions – create, delete, rename, activate
  - CF and CF structure definition, modify, delete, rename
  - Full referential integrity, health checking and best practices
    - Prevent mistakes rather than recover from them!
  - Replacing the need for IXCMIAPU batch utility
    - Co-exists and interoperates with IXCMIAPU batch utility
  - REST APIs (CD)
    - Copy, Rename, Delete, Changing CFRM Policy
  - Import/Export of CFRM policy data and bulk copy of structures (CD)
  - Exporting policies in CSV format and comparing policies after changes (CD)

Usability & Skills

z/OSMF REST JOBS Updates

- Remove dependency on CIM and CEA and replace with JES2 (CD)
- Additional notification points when a job is submitted and when a job begins execution (CD)

z/OSMF Storage Management REST APIs

- New APIs to retrieve data class or storage class available (CD)
- New API to add a volume to a storage group (CD)

z/OSMF REST files and datasets Updates

- Support for international characters in a data set or file name (CD)
- Support for adding and removing USS symbolic links (CD)

z/OSMF Workflow updates

- Policy-based archive workflow management (CD)
- Signed workflow steps in support of running as another user
- Catchall workflow archive policy

Usability & Skills

z/OSMF REST API for SYSLOG (CD)

- Retrieves SYSLOG entries based on timestamps.

z/OSMF REST API for System Symbols (CD)

- Retrieves current value of z/OS system symbols.

z/OSMF Systems Task Improvements (CD)

- Fast validation of connection status for managed systems.

z/OSMF Incident Log Support for HTTPs (CD)

- New option on PDUU to transfer data over HTTPs.

Usability & Skills

IBM z/OS Management Services Catalog (CD)

z/OS Management Services Catalog in z/OSMF leverages the power of z/OSMF workflows to enable system programmers to run services that help complete z/OS management tasks faster and with fewer errors.

Experienced z/OS system programmers are able to create a catalog of customized services, each written with unique institutional knowledge, protocols, and processes. These services can then be run by less experienced colleagues.

Capabilities include:

- Powerful graphical interface for creating new services, editing existing and sample services, importing and exporting services, as well as managing and running services on z/OS
- Sample services that provide step-by-step guidance for completing z/OS management tasks, including new services in z/OS 3.1:
    - List Attributes of RACF user ID
    - Create a RACF certificate
    - Add Load Library to LNKLST
    - Rename zFS Data set (CD)
    - Encrypt zFS file system (CD)
    - Remove Expired Certificates from Keyring

Learn more about services on the z/OS Management Services Catalog content solution (https://www.ibm.com/support/z-content-solutions/management-services).

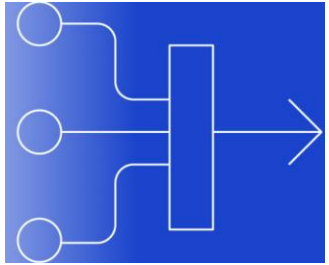
Usability & Skills

z/OS Release Upgrade Enhancements

- z/OSMF *z/OS 3.1 Upgrade Workflow* ***is part of and serviced with z/OS***
  - Use the *z/OS 3.1 Upgrade Workflow* directly from your z/OS system. Resides in: `/usr/lpp/bcp/upgrade/`
  - *z16 Upgrade Workflow* is also be part of and serviced with z/OS.
  - Find the Workflow update PTFs with SMP/E FIXCAT `IBM.Coexistence.z/OS.3.1`
- New enhancements for *z/OS 3.1 Upgrade Workflow* :
  - Assistance with coexistence service verification
  - Help with identifying those upgrade actions already performed during the service cycle
- Continued enhancements still allow for discovering functions used, tailoring information specific to your system, and verification of many upgrade action.
- The exported format of the *z/OS 3.1 Upgrade Workflow* continues to be available on IBM Documentation for those that prefer a viewable copy from IBM Documentation.

Usability & Skills

z/OSMF Software Management Installation of z/OS 3.1 ServerPac



- Uses a simplified web-based GUI replacing the ISPF CustomPac Dialog
  - Manages allocation and placement of data sets, cataloging, and deployment in z/OSMF Software Management
  - Customization and verification is done in z/OSMF Workflows
  - Data set merge and disconnect Master Catalog on driving system (CD)
  - Remove temporary catalog aliases are supported (CD)
  - REST APIs to run missing critical updates, missing FIXCAT updates, and software update search (CD)
- New Portable Software Instance Package signing – IBM plans to ship z/OS 3.1 ServerPac and PTF's with a signature that clients can verify. This will provide a means to verify the integrity of software. (CD)

- IBM (and participating major ISVs) deliver z/OSMF Portable Software Instances as a common installation method for z/OS stack software.
  - IBM z/OS, IMS, Db2, and CICS Transaction Server and associated products, all can be installed with z/OSMF today. CBPDO remains available and is unchanged.
  - z/OS 3.1 ServerPac is only provided as a z/OSMF Portable Software Instance
    - z/OSMF is a driving system requirement for all IBM ServerPacs. (CD)

For more information, see the z/OSMF ServerPac content solution (https://www.ibm.com/support/z-content-solutions/serverpac-install-zosmf/)

- Try a sample z/OSMF Portable Software Instance to be familiar with the install, before you install any ServerPac.

Usability & Skills

z/OSMF Software update task

- GUI provides a simplified and guided process to install any SMP/E-packaged PTF, regardless of software vendor.
- Enables you to review and track SMP/E HOLD data in an orderly fashion. All installation output is saved so you can review it at any time.
- Supports three update use cases:
  1. **Corrective.** Install individual software updates to fix a problem.
  2. **Recommended**. Install all software updates that are recommended by software vendors. The IBM recommendations are those designated as IBM Recommended Service Upgrade (RSU) fixes.
  3. **Functional**. Install software updates to support new hardware, software, or functions identified with a SMP/E FIXCAT.

- Existing traditional methods to install SMP/E-packaged software updates (batch JCL jobs) are still possible, but z/OSMF Software Upgrade is expected to provide a simpler experience requiring lesser SMP/E skill.

 For more information about z/OSMF Software Update, including helpful instructions on how to get started, see the Software Update with z/OSMF content solution (https://www.ibm.com/support/z-content-solutions/software-update-zosmf/).

Usability & Skills

Assembler Skills Reduction

- JES2 policy-based exit reduction
  - Intended to provide a non-assembler facility to *extend* JES2
    - Can be mixed with traditional JES2 exits
  - Support for
    - Job input is new (approximately exit 20/50)
    - Pre conversion
    - Post conversion (approximately exit 44)
    - Sysout Group (approximately exit 40)
  - New predicates and actions
    - Ability to access symbols during input processing
    - Ability to use system symbols in JES2 policy
  - Policy files are Release neutral and do not require change during release or service upgrades (no reassembly required)
  - Dynamically enabled – Changes can be applied and removed while JES2 is running
  - Policies generally apply across the JESplex

Usability & Skills

Simplification via Removal of Obsolete Function

- Removal of JES3 & BDT
- Replace Job notification in CIM
- z/OSMF Workload Manager Policy application removes CIM dependency
- Removal of OSA DEVICE/LINK/Home configuration support from the TCP/IP profile
- Withdrawal of support of VTAM Link Station Architecture (LSA) and TCP/IP LAN Channel Station (LCS) devices
- Removal of the z/OS Alternate Base
  - Consolidation of the Communication Server Security Level 3 export controlled feature into the z/OS Security Level 3 export controlled featues.
- Removal of z/OS Global Mirror (aka XRC) support

Table of Contents

Scalability & Performance

- Goal is release to release equivalence
  - Ensure smooth release to release migration
  - Performance focus on selected areas
- Exploit hardware features
  - Synergistic improvements with new hardware including:
    - Hardware instructions and memory topology
    - Accelerators
    - I/O technology exploitation
  - Expand the software that can exploit features
- Constraint relief
  - Identify and remediate constraints before client impact
  - Long term - continue AMODE 64 and RMODE 64 roadmap items
- System scalability and performance metrics
  - Metrics for resource consumption
  - Capacity planning tools

Scalability & Performance

Increase z/OS Memory limit to 16TB

- 16TB of real storage in a single z/OS Operating system Image
  - Prior to z/OS 2.5 the limit for real storage consumption in z/OS was 4 TB
- Storage above 4TB is delivered in fixed storage with 2GB frame sizes.
- The new storage requires the use of new API's and is therefore limited to a subset of z/OS applications
- It can be used for z/OS Container Extensions, and is planned for other large memory consumers

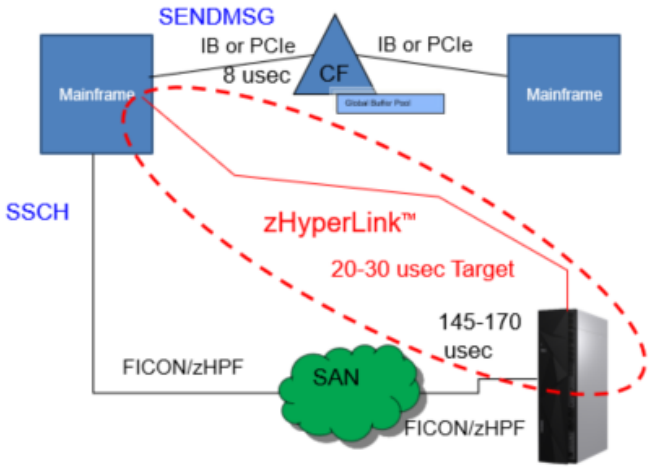
Dedicated Real Memory Pools

- Dedicated memory pools allow the installation to set aside assigned memory for specific applications
- These applications don't have to compete with the rest of the system for this storage
- Designed for zCX, DB2 Buffer Pools, SVC Dumps, Java etc.
- Expected to be in 2G, 1M, and 4K frame sizes

Scalability and Performance

zHyperLink write support for multi-volume data sets (CD)

- With the DFSMS Media Manager support for zHyperLink writes, Db2 12 or Db2 13 for z/OS can improve log throughput by exploiting zHyperLink for active log writes.
  - zHyperLink write processing can speed up commit by making the log write faster.
  - Designed to improve transaction response time, reduce the latency for log writes, and potentially speed up commits of the transactions.
- Enhancements to Media Manager provide support for multivolume data sets, which expands the zHyperLink use cases for Db2 log data sets and IMS write ahead data sets.
  - .



Scalability & Performance

IBM Resource Measurement Facility – RMF Priced Feature

- A new browser based UI is planned for monitor 3 metrics and reports
- The new UI plans to support setting thresholds and issuing alerts
- A new DDS server is planned with 64 bit exploitation and additional security options
- RMF is enhanced to report on crypto express 8S card (CD)
- RMF monitor III has been enhanced to show all logical partitions of a CPC and allows machine configurations up to 256 physical processors (CD)

Table of Contents

Availability

- Provide industry-leading availability for mission-critical application workload through synergy between resilient hardware, operating system, middleware, and storage technologies
- Exploit Parallel Sysplex and the coupling technology to mitigate impacts from planned or unplanned outages
  - Extend Data Sharing exploitation and efficiency
  - Provide workload balancing and routing optimizations and efficiencies
  - Enhance sysplex recovery mechanisms for improved performance and recovery time (e.g. CF structure duplexing)
  - Provide near-continuous access to shared data stored in Filesystems (e.g. zFS, NFS)
- Detect and Mitigate system resource and serialization problems
  - Monitor resource consumption and system/sysplex operations in real-time
  - Provide operational insight into anomalies and trends that require attention
  - Mitigate problems quickly, proactively, and autonomically with policy-based controls
- Support dynamic modification of shared resources without incurring disruptions in which the resources are made temporarily unavailable (“always on”)
- Support state-of-the-art disk replication technologies
  - Data availability (Metro Mirror and Hyperswap) – locally and at distance
  - Global Mirror
  - Disaster recovery capabilities for 2-site, 3-site, and 4-site DR configurations
- Extend Geographically Dispersed Parallel Sysplex (GDPS) environments
  - Multi-site “stretched” Parallel Sysplex across metro distances and improved isolation/availability of the GDPS k-system
  - Continuous Availability (Active/Active Sites) solution through improved software replication technologies, and innovative solutions to improve the achievement of RPO and RTO objectives to near zero

Availability

z/OS Anomaly mitigation client pain points

- Improve client triage of anomaly observations and predictions with IBM System Automation mechanism to capture report details, including recommended actions
- Predictive failure analysis (PFA)
  - Predicts health based on velocity metrics, JES2 spool consumption, common storage consumption, above the bar private area etc.
- Runtime Diagnostics (RTD) enhancements
  - A New REST API will expose RTD data to other management products.
- Detection of active SLIP/PER events enabled. (CD)

Availability

XCF Note Pad Resiliency (CD)

- Provides Applications with a simple way to share data in a sysplex
- Global Note Pad failure notification and automatic recovery
- Dynamic Note Pad size change both increase and decrease in size non-disruptively

Availability

System Recovery Boost – Sysplex Recovery enhancements

- System Recovery Boost provided recovery acceleration via additional processor capacity and parallelism, but only during image-level events like image Shutdowns and re-IPLs
  - IPL and Shutdown boosts
    - Speed boost and/or zIIP boost
    - GDPS orchestration enhancements
    - Up to 60 minutes of boost at IPL and up to 30 minutes of boost at shutdown
    - Optional, priced SRB Upgrade temporary capacity for zIIP Boost
- Support extended to provide recovery boosts for smaller-scope, occasional sysplex recovery activities, that introduce small-scale disruptions when they occur
  - Boosts automatically initiated when these events occur
  - And on the relevant set of systems in the sysplex where the recovery is taking place
  - Short-term boost periods, limited in total amount (30 minutes per LPAR per day)
- New support for z16 includes: (CD)
  - Middleware start-up boosts
  - SVC Dump boosts
  - Hyperswap configuration load and reload
- No increase in IBM software licensing costs!
-

For more information see the Systems Recovery Boost Content solution (https://www.ibm.com/support/z-content-solutions/system-recovery-boost/).

Table of Contents

Systems Management

- Provides system programmer efficiency, confidence, and consistency
  - Consistent z/OS installation platform for IBM & Vendors
    - Packaging, delivery, installation, deployment, configuration, and validation, and guided experiences
  - Simplified installation of products and maintenance, including secure delivery
  - Improved security configuration
    - Automate validation and drive simple fixes
  - Focus on common tasks
    - Expanded standard service catalog
    - Track, control, and manage system changes
  - Streamlined z/OS release upgrade process
    - Reduced manual steps for both SW and HW upgrades

- Facilities to meet general and specific needs
  - Entitled with z/OS and backed with full system support

- Flexible integration of z/OS from various platforms
  - Features or products (IBM or Vendor)

Systems Management

AI Infused z/OS

- **IBM intends to infuse AI with z/OS and augment it with intelligence to provide simplification, enable system self-management, and intelligent operations**
- Targeting optimized IT processes, improved performance, and reduced skill requirements
- Underlying AI capabilities to support AI model lifecycles with a focus on model operationalization, including built-in functionality to train, deploy, and manage AI assets
- Initial focus is to infuse AI into z/OS Workload Manager. AI capabilities are planned to be delivered iteratively

IBM SMF Explorer with Python (CD)

- Data access and analysis toolkit designed to help access SMF data and extract insights in an easy and modern way
- Leverages state-of-the-art technologies like Jupyter Notebooks and Python
- Understand, interpret SMF data and unlock value from it even with limited z/OS skills
- https://ibm.github.io/IBM-SMF-Explorer/
- Hot Topics Blog - How to turn your SMF data into valuable insights without z/OS expertise

Systems Management

z/OS System Provisioning

Problem : z/OS system provisioning in a single system or sysplex environment is complex, cumbersome and time consuming. Frequently z/OS systems are defined using configuration approaches that no longer exploit current system capabilities

Solution : z/OS Cloud Provisioning and Management (CP&M) is enhanced to provide capability to provision an entire new z/OS system.

- Entry level system programmers can provision a new z/OS system in less than one hour using Cloud Provisioning and Management automation and a template provided by an experienced system programmer.
- A z/OS System is configured from scratch using an IBM provided best practices workflow. Experienced system programmers can customize a small set of environment specific properties and provide them as a template in the CP&M Catalog.
- One or more z/OS Systems can be provisioned on pre-defined LPARs identified by the system programmer in the CP&M LPAR Pool.
- Initial capability is provided to provision a z/OS with a “MONOPLEX” configuration.
- New capability to configure NJE, SMS, ICSF, RACF, Health Checker and Policy Agent (CD)

Systems Management

z/OS Cloud Provisioning and Management

- Cloud Provisioning and management is enhanced to support provisioning of a new z/OS system.
  - The Resource Management task now includes actions for creating, viewing, and modifying an LPAR resource pool.
  - LPAR resource pool is enhanced to support SMS and NJE configuration for z/OS instance (CD)
  - Shared resource pool support for the z/OS provisioning service that allows one resource pool to be shared across multiple z/OS provisioning templates. (CD)
  - Automatic creation of a default shared resource pool for use during provisioning in "default" domain (CD)
- Cloud provisioning and management UI is enhanced to provide improved user experience. (CD)
- Users can now see template and resource pool associations.
  - Users can now see software instance and resource pool associations.
  - User can easily access public variables of provisioned instance with a single click.
- Administrators can archive history captured for various actions performed against software templates and resource pools. (CD)
- The template approval process is enhanced to support RACF group and any user in RACF group can approve a RunAsUser step. (CD)

For more information, see the Cloud Provisioning and Management content solution (https://www.ibm.com/support/z-content-solutions/cloud-provisioning/).

Systems Management

JES2 enhancements

- Replace JES2 exits with policies
  - See section usability and skills
- Additional job notification capability
  - With JES system symbol SYS_JOB_NOTIFYX job notification is extended to submission and start of execution (CD)
  - Job notification is done without CIM
  - Job notifications are retained on spool to improve delivery
  - Job notifications include failures early in job processing

Systems Management

MEMLIMIT Diagnostics Improvement (CD)

- Improved IPCS subcommands for diagnosing high virtual memory

z/OS BCPii (CD)

- HWIREST support for commands from ISV and TSO/E REXX environments

Systems Management

SDSF – System Display and Search Facility Priced Feature

- Key new feature Module Fetch Monitoring
  - Planned to show modules fetched, where, when and who
- Key new feature Significant Event logging
  - Indication of events such as volumes coming on and offline, actions etc.
- Many new Primary Displays Planned
- New viewable fields
- The browser based UI (in z/OSMF) is planned to be updated to continue to match function with ISPF
- SDSF is planned to be enabled for the Security Configuration Assistant of z/OSMF to ease security settings

Systems Management

IBM z/OS Change Tracker: *Software solution for system management* (CD)

IBM z/OS Change Tracker is a comprehensive configuration change management tool for tracking, controlling, and managing changes in software across the z/OS platform

Real-time software configuration change tracking and control for system libraries

Identify and protect against undesired configuration changes

Enhance system resiliency with automatic data set versioning and recovery

IBM z/OS Change Tracker helps clients achieve a more secure, resilient IT system.

Software management

z/OS System Programmers can easily identify and control configuration files associated with software executables. Plan for a new strategic Change Tracker plug-in on z/OSMF.

Resiliency

Member-level backup and recovery for immediate rollback to undo unwanted/unplanned changes.

Compliance

Reliable, comprehensive reports on hardened system configuration changes to satisfy audit requirements.

Self-service 90-day trial planned with APAR PH51954.
For more information, visit the z/OS Change Tracker content solution page.

Systems Management

Infoprint Server Priced Feature

- Comprehensive tool for managing print and printers
- Support for extended address volumes (EAV) (CD)
- Support improved sendmail configuration (CD)

Systems Management

zWIC – Workload Interaction Correlator Priced Feature

- A priced feature of z/OS that implements a facility to report on high frequency events and can be used to improve diagnosis on z/OS
- Addresses the problem of capturing data on a production system running under load by providing an efficient way to capture and report on various diagnostic items
- Input/Output (IOS) information is planned to be added to zWIC.
- IBM priced product IBM z/OS Workload Interaction Navigator can be used to visualize the data
- zWIC is now entitled with RMF or the Advanced Data Gatherer (ADG) feature, available (CD)

- **Announce** (http://www-01.ibm.com/common/ssi/ShowDoc.wss?docURL=/common/ssi/rep_sm/n/897/ENUS5698-WKN/index.html&lang=en&request_locale=en))

Table of Contents

Networking

- Exploit platform features and enable efficient network access
  - Support latest OSA and RoCE hardware adapters, HiperSockets and Internal Shared Memory (ISM), and provide for efficient network communications, including external network and intra-CPC communications
- Provide support for network security standards and enable network security monitoring and compliance
  - Support pervasive encryption by protecting data-in-flight with evolving security standards such as TLSv1.3
  - Assist in determining security compliance posture through the use of z/OS Encryption Readiness Technology (zERT) and the zERT Network Analyzer (zNA)
- Simplify network configuration through the IBM Network Configuration Assistant (NCA)
  - Simplify networking configuration, including the configuration of TCP/IP stacks as well as policy-based networking functions, such as Application-Transparent TLS (AT-TLS), IPSec, and zERT policy-based enforcement
- Application development and workload enablement
  - Enable efficient network access to Linux applications deployed in z/OS Container Extensions (zCX) and to z/OS applications deployed in z/OS containers
- Enhance availability and resilience
  - Enhance application availability in parallel sysplex environments through sysplex autonomics

Networking

z/OS Encryption Readiness Technology (zERT)

- zERT Network Analyzer, a z/OSMF plug-in, that provides an easy-to-use web UI for analyzing zERT data reported in SMF 119 subtype 12 records
  - Significantly improves Time-To-Value of gaining insights into zERT data and driving a Pervasive Encryption strategy for all z/OS network communications
  - With z/OS 3.1, the zERT Network Analyzer is enhanced to automatically upgrade application and database settings from those configured for V2R4 or V2R5 releases.
  - Additionally, new tooling is provided to easily upgrade an existing V2R4 or V2R5 zERT Network Analyzer database to the 3.1 schema.
- zERT security improvements (CD)
  - Support for passphrases
  - Support for saving DB2 users password or passphrase values

Networking

Communications Server support for RDMA over Converged Ethernet (RoCE) Express3 (CD)

- SMC – Shared Memory Communication is a more efficient protocol for sending data to and from z/OS.
- An improved protocol SMCv2 allows for multiple IP subnet support.
  - SMC-Rv2 is used over IBM RoCE Express2 adapters beginning with the IBM z15.
- z/OS 3.1 Communications Server 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 is designed to allow 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.

Networking

More Granular Control Over the FTP Server JES Mode (CD)

- New System Authorization Facility (SAF) resource to control which z/OS users are permitted to use FTP server JES mode.

z/OS UNIX syslogd support for secure logging over TCP (CD)

- z/OS UNIX syslog daemon (syslogd) is enhanced to support network connectivity to other syslogd instances over TCP, with or without AT-TLS protection.

SNA Application and Session Reporting (CD)

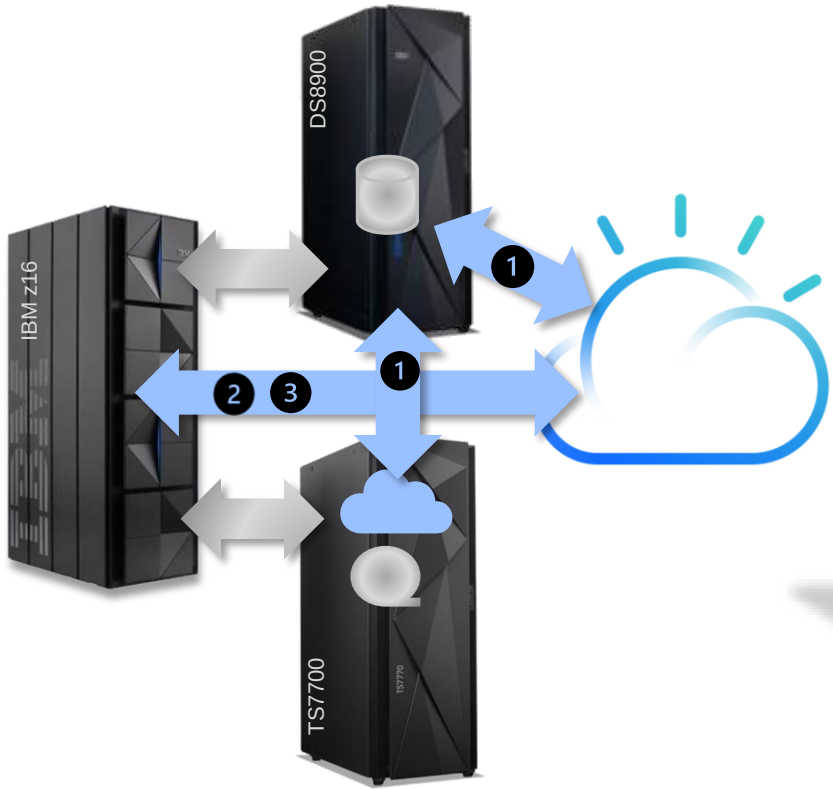
- Communications Server is enhanced to regularly store information about the maximum number of SNA applications and sessions in the IBM Function Registry for z/OS. This information provides z/OS clients with insight into the amount of SNA application workloads executing on z/OS.

Table of Contents

Data Serving & Storage

- Provide flexible, secure, and resilient data storage and serving solutions for on premises or hybrid cloud applications.
- Integrate cloud object storage into traditional disk and tape environments to create a hybrid storage architecture and modernize data lifecycle management by adding the intrinsic strengths of cloud solutions for backup and archive to enable new use cases, increase business agility, reduce the complexity of storage environments, and provide cost optimization.
  - Direct access to data in cloud object stores via a new z/OS callable service, Cloud Data Access (CDA)
- Manage the exponential growth of data and eliminate impactful data constraints to create a resilient, modern infrastructure that integrates mainframe data, operations, and applications with hybrid cloud environments to better share, store, access, manage, and audit data while continuing to scale and perform to extract value from mission critical data.
  - Enhancements to address numerous client DFSMS RFEs and ideas
  - Simplified access to NoSQL VSAMDB data sets via EzNoSQL

Data Serving and Storage



Cloud Storage

z/OS clients are integrating cloud object storage into traditional disk and tape environments to create a hybrid storage architecture that enables clients to leverage the strengths of on-premises disk and tape storage while adding the intrinsic strengths of cloud solutions for backup, archive, and unstructured data to enable new use cases, increase business agility, reduce the complexity of storage environments, and provide cost optimization.

There are *several* existing DFSMS Solutions that leverage Cloud Object Storage …

Serverless Data Management

1. DS8900 Transparent Cloud Tiering (TCT) and TS7700 DS8000 Object Store enable DFSMS backup and archive to be performed with *none* of the data passing through z/OS, *minimizing MIPS*

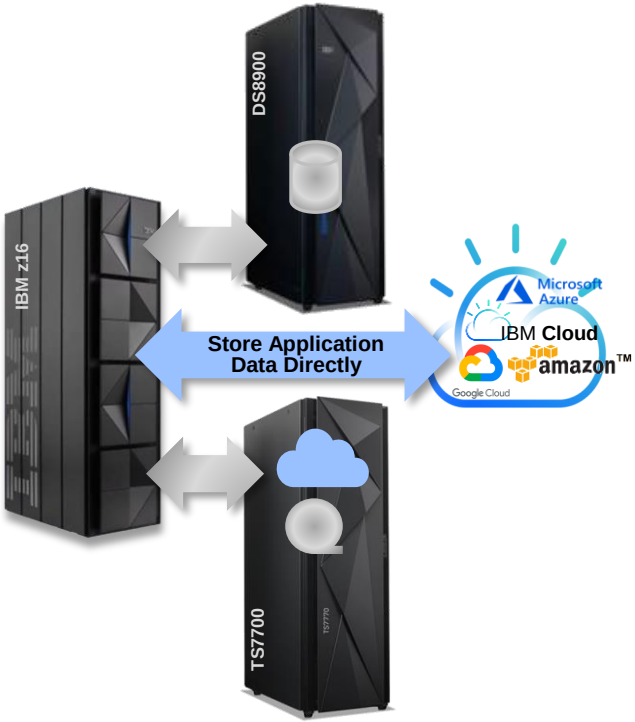
Store Application Data Directly

2. OAM stores and manages unstructured data as objects to public, private, or hybrid cloud infrastructures
3. Cloud Data Access will provide a simple method to store any z/OS data directly onto cloud object storage

Data Serving and Storage

Cloud Data Access (CDA)

- Provides a simple method to store and share any z/OS data directly onto cloud object storage.
  - Enables S3 / Cloud Object Storage as another tier for z/OS applications.
  - Simplified data sharing – reduce and/or eliminate ETL.
  - Simplified application development and flexibility with a single API to interact with various Cloud Object Storage providers.
  - Simplified authentication with the Provider Configuration File describing the target Cloud Object Storage provider.
  - Supported cloud providers include IBM Cloud Object Storage, Amazon Simple Storage Service (Amazon S3), Azure Blob Storage, and Google Cloud Storage.

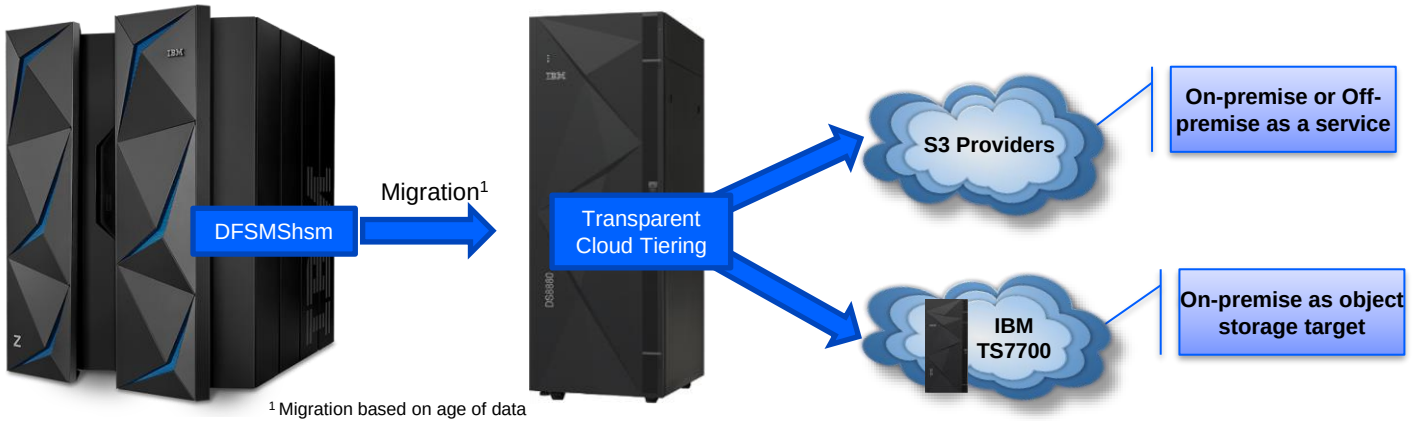


Data Serving and Storage

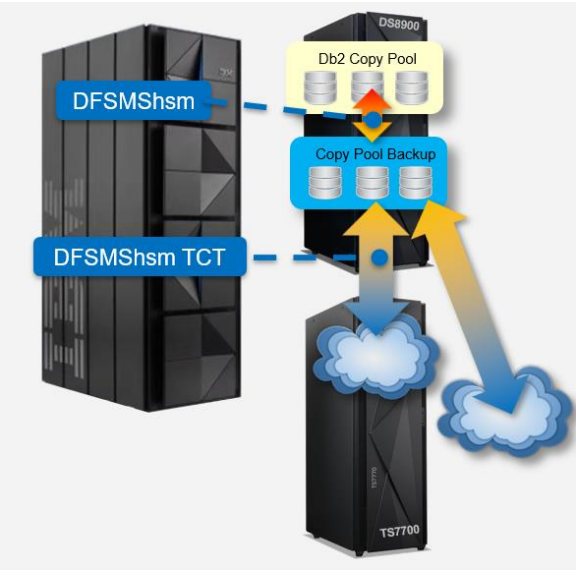
Transparent Cloud Tiering improves business efficiency and flexibility while reducing capital and operating expenses with direct data transfer from DS8900 to hybrid cloud environments for simplified data archiving operations on IBM Z.

Transparent Cloud Tiering

- Off-loads data movement responsibility to the DS8880 avoiding the need for additional HW infrastructure.
- Dramatically reduces CPU resources to be efficiently used in other business-oriented applications.
- Saves z/OS MIPS utilization by eliminating constraints tied to original tape methodologies:
  - 16K Block sizes, dual data movement, recycle, serial access to tape



Data Serving and Storage



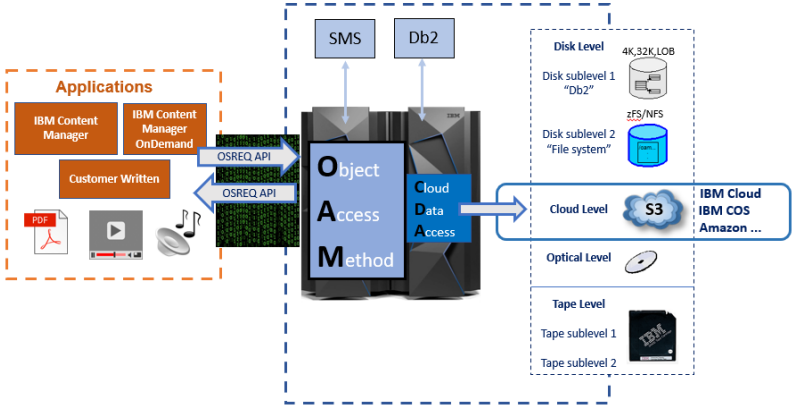
DFSMShsm Transparent Cloud Tiering full-volume dump (CD)

- DFSMShsm provides full-volume dump and restore support for transparent cloud tiering leveraging support provided by DFSMSdss.
  - Enables all I/O for full-volume dumps to be performed by a DS8000 directly to a TS7700 enabled as an object store, or directly to cloud object storage.
  - To minimize the time that a volume is locked, an initial full-volume FlashCopy can be performed that can then be dumped to the object store, with none of the data passing through the z/OS host.
  - Backup copies can be created as needed without impacting other workloads due to minimal CPU consumption.
  - Enables creating a complete Db2 system level backup, via FRBACKUP and FRRECOV functions, without any of the data passing through the z/OS host.

Data Serving & Storage

OAM Cloud Tier Support (CD)

- DFSMS OAM has included a cloud tier to its existing storage hierarchy allowing objects to be managed and stored to public, private, or hybrid cloud infrastructures supporting the S3 API.
  - Through SMS policies, OAM objects can be stored directly to the cloud or can transition to the cloud, based on access requirements.
  - Objects stored in the cloud can be recalled to the disk level.
  - OAM-managed backup copies are also supported in the cloud.
- OAM has extended its cloud tier support to enable an alternate set of cloud credentials to be used.
  - Within a single cloud provider file an alternate (read-only) set of credentials can be used to access the production container or containers for the purposes of a disaster recovery (DR) test.



Data Serving & Storage

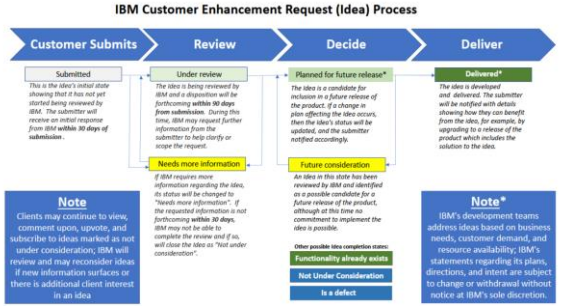
Cloud Storage Access for z/OS (CD)

- Cloud object storage enables a low-cost storage tier that's easily accessible and provides a simple mechanism to share data.
- A new utility, GDKUTIL, can download or upload between cloud objects and z/OS using S3 APIs.
  - Supported data set types include UNIX files, sequential data sets, PDS or PDSE members, or GDG versions.
  - Can be invoked through JCL.
  - Data can be converted from EBCDIC to UTF-8 on upload, and from UTF-8 to EBCDIC on download commands.
  - Requires software dependency for Web Toolkit.
  - Quick-Start Guide provided to help with initial configuration.

Data Serving and Storage

Enhancements to address client RFEs and ideas

- Enhanced Catalog Recovery
  - Simplified catalog recovery with the use of more granular timestamps in the Catalog SMF records for more accurate merging of updates, and one IDCAMS command that drives the ICFRU recovery.
- MODIFY CATALOG Enhancements
  - Additional information about ICF catalogs and their environment to more effectively manage and maintain them.
  - Updates to the MODIFY CATALOG,REPORT output to indicate the current number of active tasks to provide a more accurate measure of the current activity in the Catalog Address Space (CAS).
  - Updates to the MODIFY CATALOG,ALLOCATED command to optionally filter by catalog name instead of VOLSER could potentially reduce the size of an IEC348I display for more efficient viewing.
- Simplified Catalog Address Space Startup
  - Enable the CAS and full catalog function to be available earlier during system startup and potentially improve the overall time it takes to startup or restart the system.

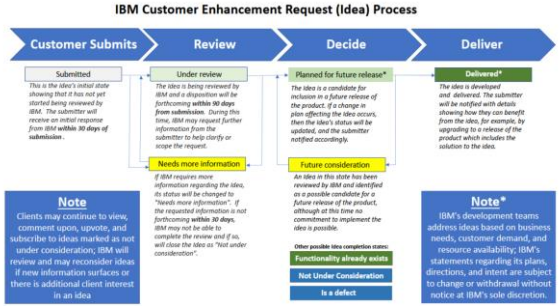


IBM Ideas Portal

Data Serving and Storage

Enhancements to address client RFEs and ideas

- Improved access control to DFSMShsm FIXCDS command
  - Provide controlled access to specific capabilities of the DFSMShsm (HSM) FIXCDS command to allow users to display records but limit who can modify the control data sets.
- Improved DFSMShsm Extent Consolidation Configuration
  - Configure HSM such that extent consolidation only occurs on data sets for which a valid backup exists, providing the ability to recover in case a problem occurs while consolidating the extents.
- Task Automation for DFSMShsm ARC0100I messages
  - Write ARC0100I message to syslog when HSM HOLD and RELEASE commands are issued from TSO or ISPF, to enable system automation to carry out necessary tasks to confirm the request.
- Direct DFSMShsm HSENDCMD commands to a specified host
  - Provide equivalent TSO functionality to ARCHSEND macro.

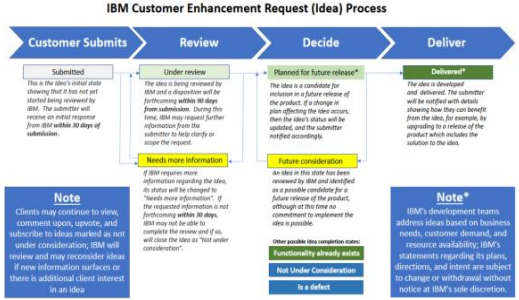


IBM Ideas Portal

Data Serving and Storage

Enhancements to address client RFEs and ideas

- Simplified IGD306I Messages
  - SMS enhancements to clean-up logrec records cut due to internal errors and avoid filling up sys1.logrec datasets.
- Improved Data Set Allocation Processing
  - Display a new message indicating how many candidate volumes are marked as primary, secondary, tertiary, or rejected which can help determine the effectiveness of various configuration settings related to performance.
- Improved SMS Reporting
  - Provide additional message diagnostics to easily identify the datasets not assigned to a storage group so ACS routines can be reviewed and modified to rectify any issues.
  - Provide additional information to SMF 42.6 records to help optimize in-memory buffers for improved performance and utilization.
- SMS Storage Class Enhancements
  - Provide a storage class option that specifies if allocation should prefer or require an allocation to a storage controller that enables FlashCopy to be used as a copy technique.
- Improved SMS Storage Group WRITE Statement
  - SMS ACS WRITE statement will print out the entire list of assigned storage groups, instead of just the first one in the list, to assist in testing and troubleshooting SMS ACS routines.
- Dynamic SMS Exits
  - Install a new version or replace an existing version of SMS ACS installation exits (IGDACSDC, IGDACSMC, and IGDACSSC) without scheduling an IPL, as exits will use dynamic exit services.

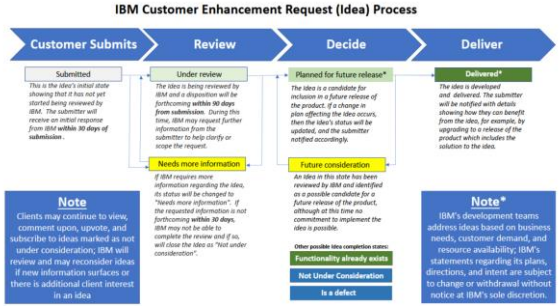


IBM Ideas Portal

Data Serving and Storage

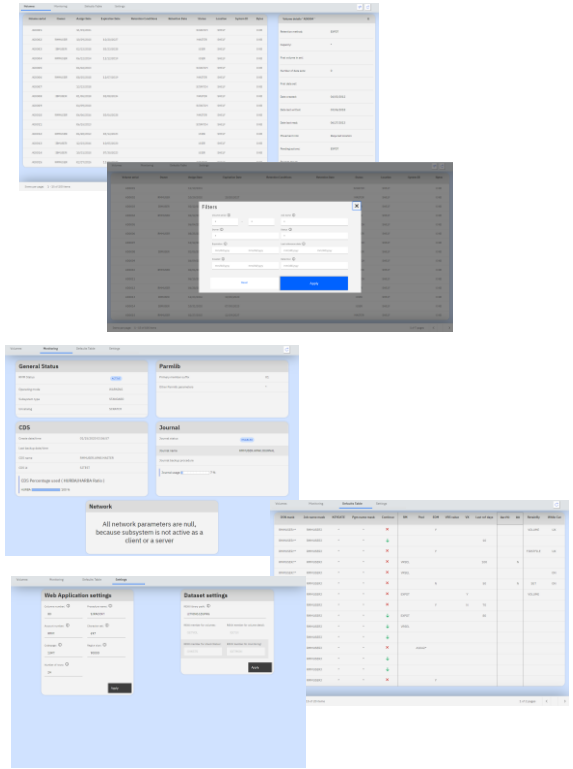
Enhancements to address client RFEs and ideas

- Modify EDGUX100 IGNORE Processing
  - Eliminate DFSMSrmm (RMM) exit customization and usage but still appropriately handle security checking for tape volumes that are ignored by RMM to allow for improved security enforcement and tighter control over IGNORE processing.
  - Ensures RMM will only ignore the tape volume if the user is authorized to access it.



IBM Ideas Portal

Data Serving and Storage



DFSMSrmm z/OSMF plug-in enhancements

- DFSMSrmm (RMM) supports a modern graphical user interface via a z/OSMF plugin in addition to the existing TSO and ISPF dialog support.
- Customizable RMM z/OSMF plug-in displays
  - Allow the table columns within Defaults Table view to toggle on/off and settings to be stored with the user profile providing improved usability.
- z/OSMF plug-in enhancements to provide additional features to support the RMM Defaults Table (CD)
  - Easily view defaults table entries that are applicable to an existing data set or to a specified set of conditions in order to ensure the policies are set up as expected.

Data Serving & Storage

UNIX file backup / restore enhancements (CD)

- Clients want to use the same tools and applications to backup and restore individual z/OS UNIX files residing in z/OS File System (zFS) data sets as other z/OS data sets.
  - Initial support to manage backup and restore of individual z/OS UNIX files is integrated into existing DFSMShsm/DFSMSdss functionality, allowing for centralized data management across the z/OS platform.

DFSMShsm UNIX file-level backup and recovery with EXCLUDE criteria (CD)

- Unix files can be filtered with a new exclude option that includes directories, specific file names as well as file name patterns.
- Specify a filename of a file that contains the exclude criteria (CD)
  - Exclude criteria in a file works the same as criteria specified in a list on the EXCLUDE keyword. The same file can be used by multiple commands and is easily maintained.

Data Serving & Storage

NFS Server Enhancements (CD)

- NFS server restart recovery
  - improved management of file handle errors
- New AT-TLS security option to allow client certificate handshakes. Improved authentication and end-to-end encryption

Union File System (CD)

- Union file system works on top of the other file systems.
- It enables a user to obtain a merged view of one more directories.
- This merged view is obtained by accessing the union mount point and gives a single coherent and unified view of files and directories.
- It is more of a mounting mechanism than a file system.
- Usage:
  - Union file systems are used extensively by containers.
  - They allow many containers to use one image without having to make multiple copies - saves on disk space.
  - Any changes made by one container will not affect any other container.
- We built a Union File System from scratch - This is not a port of a union file system from Linux, but rather one that is purposefully built for z/OS.

Data Serving & Storage

Data Set File System (CD)

- A new file system type that will allow customers to access data in data sets from the z/OS UNIX space.
- Enables z/OS UNIX applications, tools, and utilities to use data in data sets in a secure and consistent manner.
- Supports Sequential, PDS, PDSE data sets.
- Supports RECFM = F, FB, FBS, V, VB, U
- Compressed or encrypted data sets are also supported
- Existing cataloged data sets (DASD) can be read and written.
- Data Set File System can also create new data sets or delete a data set or PDS / PDSE member.
- Data set serialization is consistent with serialization done by ISPF edit.
- Access to a data set is governed by user permission to the data set - UNIX permissions are **not** used.
- User needs to know the type of data that is in the data set in order to use it under z/OS UNIX.
- A new class of applications can be developed using this technology.
- New support that allows specification of multiple data set qualifiers for the HLQ directory - useful to reduce scope of data sets being accessed by DSFS (CD)
- Use case scenarios:
  - Use **grep** to search for things in data sets.
  - Use **vi** to edit data sets
  - Write data sets into **tar** archives
  - Make data sets part of a **pax** file
  - **sftp** data sets
  - etc…

Table of Contents

Security

- Quantum Safe & Simplified Crypto
  - Encrypted RACF Database
  - Read-only archived key support for data set encryption
  - TLS 1.3 sysplex session caching
- System Hardening
  - RACF Password phrase interval extended
  - AC(1) APF loadmod scanning added to zACS
  - New z/OS Authorized Code Monitoring (zACM)
- Simplified Compliance
  - Multiple components supporting the IBM Z Security & Compliance Center
  - CP Assist for Cryptographic Function (CPACF) counter support
  - CIS Benchmarks

Security

RACF Database Encryption (CD)

- RACF supports the encryption of a RACF database which will be migrated to VSAM linear data set format. With this support, the RACF VSAM data set can be shared among z/OS systems in additional specified configurations.

RACF Password Phrase Interval (CD)

- RACF provides a password phrase change interval, that is separate from the password interval, and can be set above the system limit for individual users.

Custom Fields in the ACEE

- RACF adds support to allow security administrators to identify the user-related custom fields that should be anchored in the user's Accessor Environment Element (ACEE) at logon time.
- Problem-state applications can retrieve this information using the R_GetInfo callable service (IRRSGI00) without incurring RACF database I/O.

Security

Application availability improvement for SPECIAL user revocation (CD)

- RACF allows an installation to suppress, on an application-by-application basis, the prompting for an additional password or password phrase attempt for a SPECIAL user who has exceeded the installation limit for consecutive incorrect password attempts.

Enforcement of RACF for z/OS Database Sharing (CD)

- z/OS RACF now checks for and issues warning messages when a RACF database is shared with z/VM 7.3 or later.

Security

ICSF Enhancements

- Distribution of Master Key Ownership
  - Allows customers to distribute the ownership of key parts across multiple users
    - When using ICSF panels to enter master keys
  - Controlled with a new SAF profile in the XFACILIT class.
  - Users can be permitted to enter the FIRST, MIDDLE, or FINAL master key parts individually.
  - Can also be separately permitted to the RESET capability.
- BCRYPT Hashing
  - The CSNBOWH callable service has been updated to support the BCRYPT hashing algorithm.

Read-only archive key support (CD)

- Enables restricting the use of old keys from encrypting new data
- Encrypted data can still be accessed but avoid creating new encrypted data with the archived key

Security

TKDS Private key removal from expired cert

- PKI Services is enhanced to allow customers to delete the certificate's corresponding private key stored in ICSF's Token Data Set (TKDS) without removing the certificate when it expires. By providing this new maintenance option, we allow greater flexibility to certificate and key management so that customer can utilize TKDS according to their needs.

Disable Directory Name format in CRL DP

- An enhancement that PKI Services administrators would benefit from is a new switch to disable the directory format in the CRLDistributionPoint extension in the certificate so that it can be accepted by some applications that can't handle this format. This enables PKI Services issued certificates to suit different needs from different customers.

Security

TLS v1.0, TLS v1.1 and TLS 1.2 Support for x25519 & x448 Key Exchange (CD)

- System SSL provides the ability for client and server connections to use x25519 or x448 curves for their key exchanges when utilizing ephemeral Elliptic Curve Diffie Hellman ciphers.
- Server configurations can limit the acceptable elliptic curves for the key exchange.
- AT-TLS provides the ability to use the new System SSL function
- Network Configuration Assistant supports the new AT-TLS function

GSKKYMAN use stash file support instead of requiring password entry

- System SSL's gskkyman utility when executed in command line mode will accept the key database file stash file or password options in place of the password prompt when dealing with key database files.

TLS 1.3 Sysplex Session Ticket Caching

- System SSL's TLS v1.3 sysplex session ticket caching support will provide the ability for handshake session ticket information to be shared among like servers within a single system or across multiple systems in a sysplex. Sharing provides the ability to perform cached (abbreviated) handshakes instead of full handshakes when resuming connections to the servers.
- AT-TLS provides the ability to use the new System SSL function
- Network Configuration Assistant supports the new AT-TLS function

Security

z/OS Authorized Code Scanner and Monitor Priced Feature

- The IBM z/OS Authorized Code Scanner is an optional priced feature of z/OS that provides system integrity testing in a development/test environment as part of DevSecOps modernization. It scans for Program Calls (PCs) and Supervisor Calls (SVCs) and generates a series of tests that dynamically scan them for integrity.
- zACS has extended its scanning ability to include AC(1) code found in MVS data sets and USS files, providing users greater coverage in testing their development/test system for potential vulnerabilities for remediation as needed. (CD)
- The z/OS Authorized Code Monitor (zACM) is now available, as a non-disruptive tool for production systems, examining ABENDs from z/OS recovery processing and reporting on potential vulnerabilities found there for remediation as needed. (CD)

Security

Compliance Support for z/OS (CD)

- Modernize reporting
  - z/OS 3.1 is enhanced to enable the collection of compliance data from IBM z16 CP Assist for Cryptographic Function (CPACF) counters and several z/OS products and components.
  - A new ENF signal for compliance recording
  - SMF 1154 records can be integrated into solutions, such as the IBM Z Security and Compliance Center product. To learn more, see the IBM Z Security and Compliance Center web page.
  - Available with PTFs in fix category IBM.Function.Compliance.DataCollection
- Simplified auditing
  - Center for Internet Security (CIS) benchmark V1.0.0 provides best practices and guidance
- Expedited compliance
  - A new health check to scan ICSF key data sets for clear key tokens
  - A new health check to verify that the ICSF address space is active
  - A new option on the CKDS Keys Utility ISPF panel to generate AES CIPHER keys

Requirements

z/OS requirements

- z/OS accepts requirements through the Unified Ideas Portal at https://ideas.ibm.com/ and directly for **z/OS** at https://ibm-z-hardware-and-operating-systems.ideas.ibm.com/?project=ZOS
- Aside from adding new ideas, you can also search, vote and follow ideas
- z/OS also accepts requirements through user groups like SHARE

z/OS Sponsor User Program

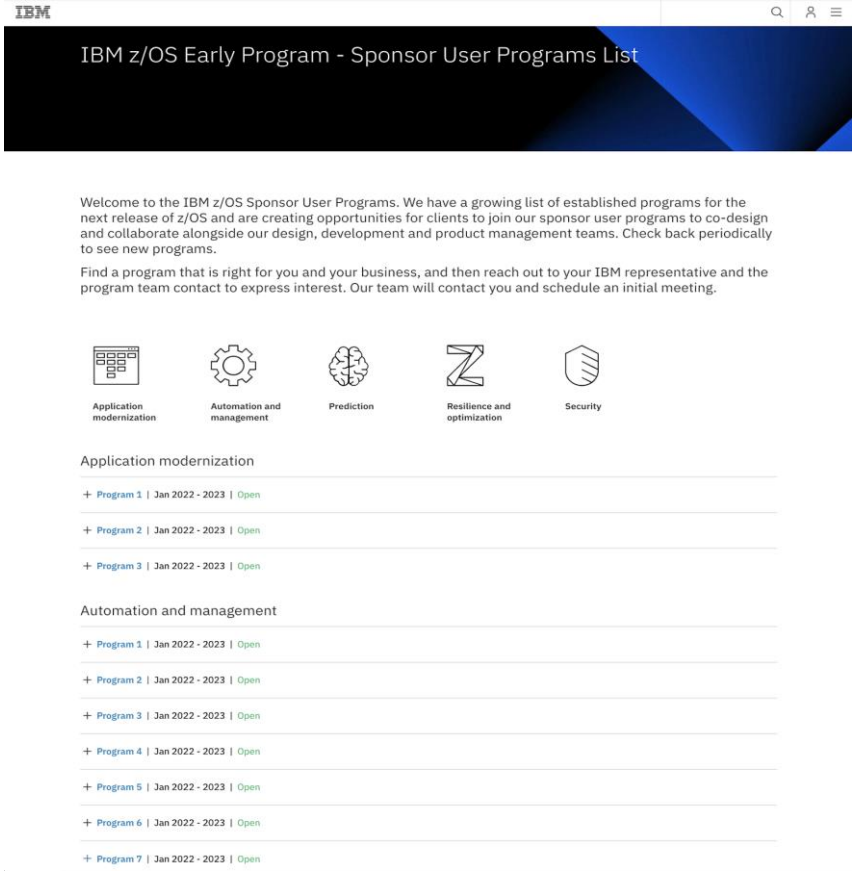
Are you interested in learning more about how to influence the future of z/OS?

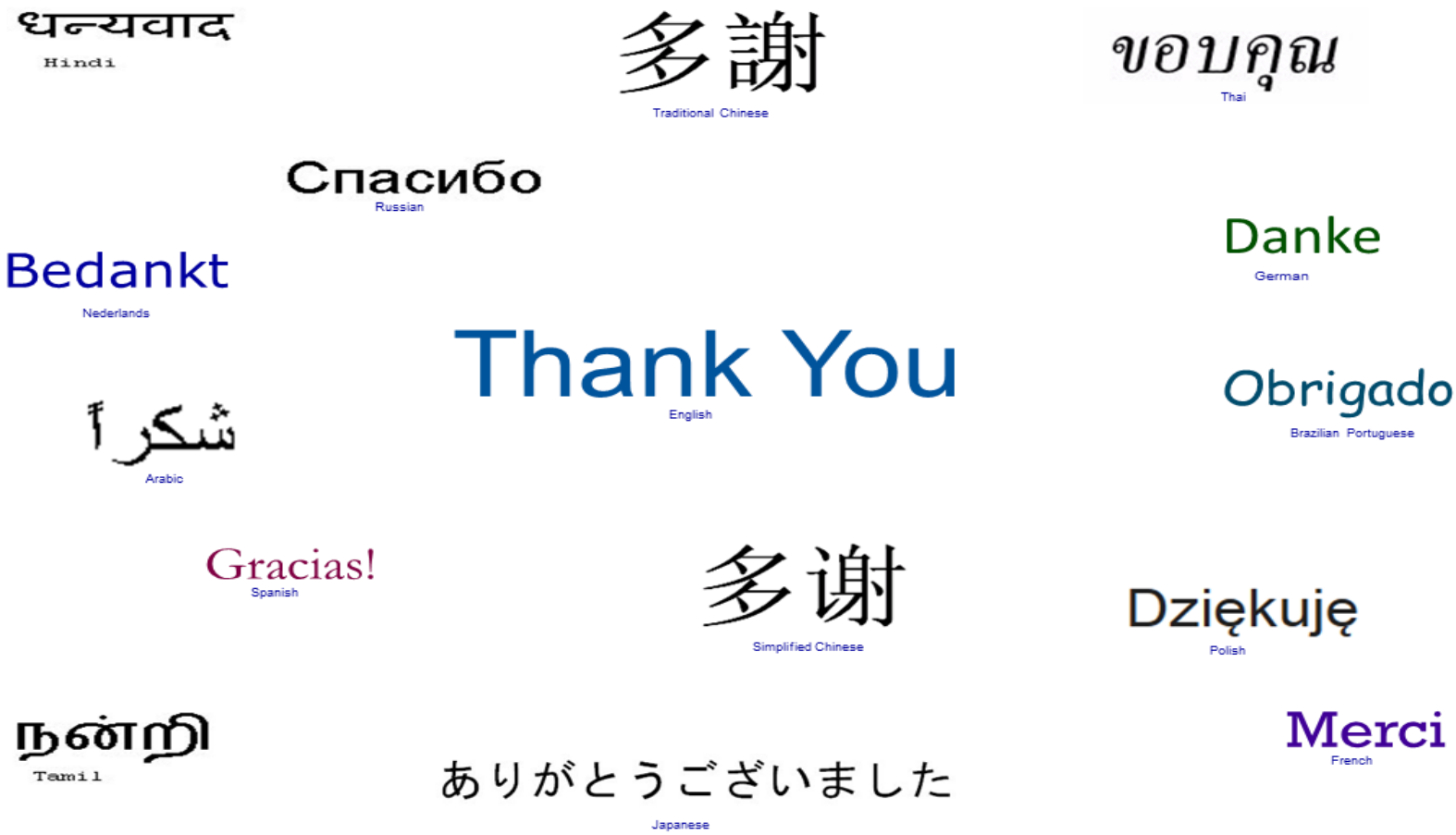
As a sponsor user, you can focus on a specific project. You can participate in a variety of activities such as design reviews and provide user experience feedback on existing tasks and tools.

You choose your level of involvement.

Some benefits include previewing and influencing upcoming functions and products to ensure we meet your user needs.

Contact zos@ibm.com with your information and request to be invited to our IBM z/OS Sponsor User Programs List website.




धन्यवाद
Hindi
多謝
Traditional Chinese
ขอบคุณ
Thai
Спасибо
Russian
Bedankt
Nederlands
Danke
German
Thank You
English
شكراً
Arabic
Obrigado
Brazilian Portuguese
Gracias!
Spanish
多谢
Simplified Chinese
Dziękuję
Polish
நன்றி
Tamil
Merci
French
ありがとうございました
Japanese

Application Development

Celebrating 25 Years of Innovation: Java on z/OS

"*From its beginning, IBM recognized Java as a key component of delivering innovation, performance and portability on IBM zSystems…*" (blog) Skyla Loomis, Vice President, IBM Z Software

"*After a quarter century of development, improvements, and name changes, the impact of IBM's SDK for Java on IBM zSystems has been pervasive…"* (blog) Shereen Ghobrial, Director, Compilation Technology & Enterprise Products, IBM Z Software

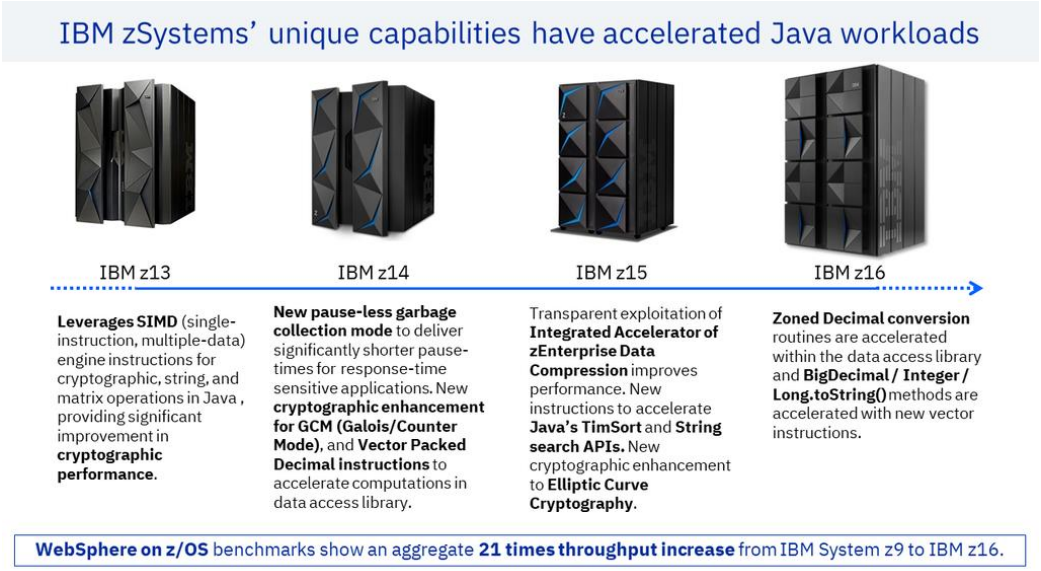


Table of Contents

Continuous delivery

- z/OS embraces continuous delivery through new function APARs
- Get weekly emails when APARs close with My Notification: start at
  - https://www.ibm.com/support/entry/portal/support
- Look on the web, updated monthly:
  - https://www-03.ibm.com/systems/z/os/zos/installation/zosnfapars.html

Table of Contents

IBM’s Statements of Direction

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

IBM’s Statements of Direction

June 2020 – IBM intends to provide clients with capabilities that will help accelerate their transformation to greater portability and agility in a hybrid cloud environment by delivering containers and Kubernetes orchestration support for existing and new IBM z/OS applications and workloads.

This move towards greater portability and agility will be supported by taking advantage of architecture-independent standards and technology for container-based development and deployment on z/OS. As this container-based technology is deployed on core systems of record, it will ensure the isolation of environments and other users from the effects of other containers.

By providing a container runtime for z/OS, and the orchestration of those containers, users can:

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

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

IBM’s Statements of Direction

June 2022 - IBM plans to deliver a solution providing Validated Boot, also known as Secure Boot or Boot Integrity Validation, capability for z/OS IPLs. This solution is intended to validate digital signatures for loaded z/OS executables that have been built and signed as part of the solution. This solution is designed to meet the requirements for achieving the National Information Assurance Partnership (NIAP) OS Protection Profile 4.2.1 Certification.

June 2022 – IBM plans to provide the capability to digitally sign electronically and physically delivered software packages. This new capability is designed to allow a user to ensure the package hasn’t been tampered with and that the package was signed by the expected provider of the package by verifying the signature of the package. Software packages from IBM that are intended to be signed include: ServerPac, CBPDO, Shopz PTF orders, SMP/E RECEIVE ORDER PTFs, and HOLDDATA. This support for signing and verification is planned to be available in both SMP/E and z/OSMF Software Management on all supported z/OS releases.

June 2022 – IBM intends to enhance pervasive encryption to perform encryption within the access methods for tape data sets. It is expected to be transparent to the application program unless it uses EXCP. This new data set encryption support is intended to be independent of any encryption that occurs in the tape subsystem.

*

IBM’s Statements of Direction

June 2022 - z/OS V2.5 is planned to be the last release to support the DFSMS Distributed FileManager (DFM), a seldom used function in z/OS. To determine if DFM is being used, it is recommended to look for JCL that starts DFM; for example, START DFM,SUB=MSTR. If you use DFM to enable remote clients in your network to access data on z/OS systems, it is recommended to use the z/OS Network File System (NFS) instead.

June 2022 - For many z/OS releases, a recommended update action has been to specify z/OS SDSF customization with the ISFPRMxx parmlib member. There are several major advantages to using the ISFPRMxx parmlib member format over the original format, which involves an assembler module and SDSF macros. Beginning with the following release after z/OS V2.5, IBM plans that only the ISFPRMxx parmlib member format will be supported. For this reason, if the parmlib member ISFPRMxx is not currently being used, IBM recommends clients convert to using ISFPRMxx to avoid being impacted in the future.

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

July 2021 - z/OS V2.5 is planned to be the last z/OS release to provide support for the TCP/IP profile statements DEVICE, LINK, and HOME for OSA connectivity. All z/OS users who currently use DEVICE, LINK, or HOME for OSA connectivity should migrate to the INTERFACE statement for defining OSA Express connectivity in their TCP/IP profile.

March 2021 - For decades, IBM has offered two asynchronous replication strategies, IBM z/OS Global Mirror, also known as extended remote copy, or XRC, and DS8000 Global Mirror. IBM plans to support and maintain z/OS Global Mirror on z/OS with its current function only, and z/OS V2.5 will be the last release to provide such support. This withdrawal aligns with what was previously announced in Hardware Announcement 920-001, dated January 07, 2020 which indicated the DS8900F family would be the last platform to support z/OS Global Mirror. New functions to support asynchronous replication technology are intended to be developed only for DS8000 Global Mirror, and it is intended that no new z/OS Global Mirror functions will be provided with DS8900F and z/OS.

March 2021 - As previously announced, for clients that use JES3, z/OS V2.5 is the last release for which IBM plans to include the JES3 feature. Clients should be making plans to migrate to JES2 or an alternative.

December, 2020 – Aligned with the announcement of the end of life for IBM JES3 in Software Announcement 219-0-13, the next release after z/OS 2.4 will be the last release that BDT is included in z/OS. This applies to both priced features, BDT SNA NJE and BDT File-to-File (F2F). BDT SNA NJE offers JES3 clients the ability to send information over SNA networks to other end points. Note that BDT SNA NJE does not apply to JES2 clients as this function has always been included as part of JES2. The BDT F2F feature offers both JES3 and JES2 clients the capability of managed file copying from one system to another system.

Functional replacements for BDT File-to-File include IBM Sterling Connect:Direct for z/OS (5655-X11) and IBM MQ Advanced for z/OS (5655-AV9). This includes MQ File Transfer edition and MQ Advanced Message Security. BDT and it's features are planned to be supported until the discontinuance of support for the next z/OS release.

June 2020 – The release after z/OS V2.4 is intended to be the last release to support the ability to share RACF databases between z/VM and z/OS systems. While databases may remain compatible, sharing between operating systems is discouraged due to the distinct security and administration requirements of different platforms. A future z/OS release will be updated to detect whether a database is flagged as a z/VM database and reject its use if so marked. Sharing of databases between z/OS systems is not affected by this statement.

Notice Regarding Specialty Engines (e.g., zIIPs, ICFs and IFLs)

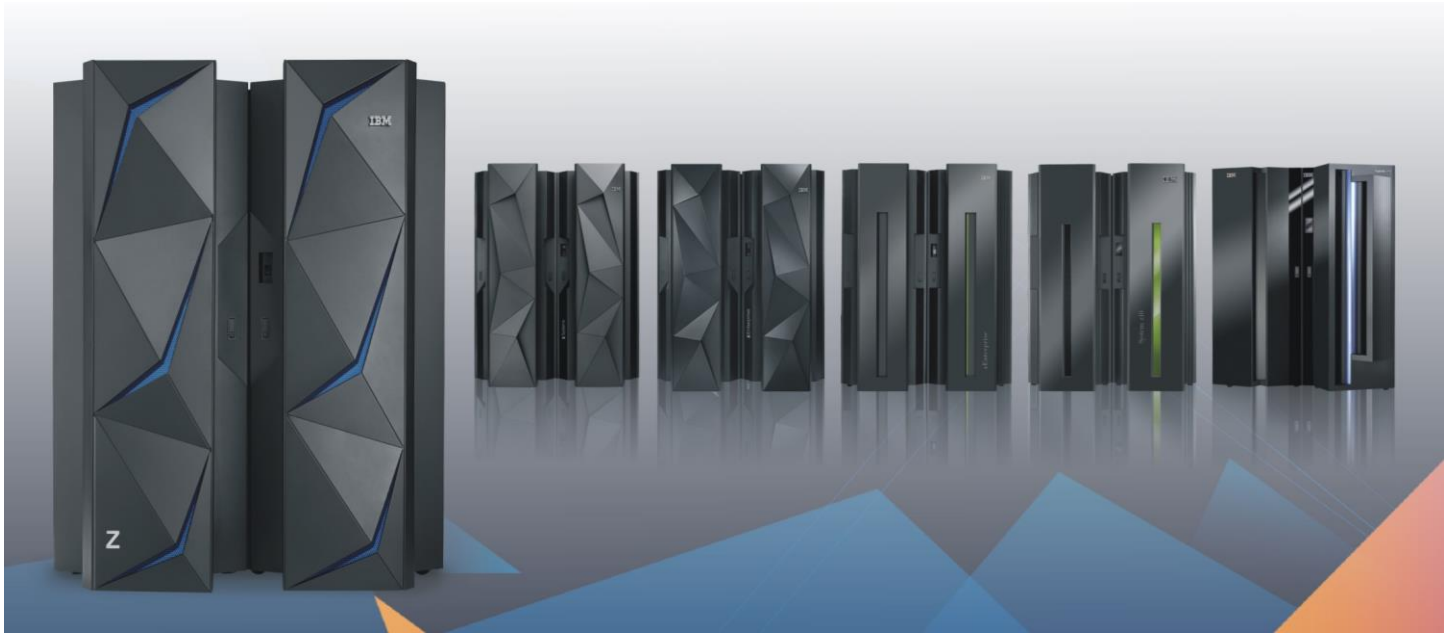
Any information contained in this document regarding Specialty Engines ("SEs") and SE eligible workloads provides only general descriptions of the types and portions of workloads that are eligible for execution on Specialty Engines (e.g., zIIPs, ICFs, and IFLs). IBM authorizes customers to use IBM SE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

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

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

Trademarks:

See URL: https://www.ibm.com/legal/copytrade for a list of trademarks.


IBM
z