

# What's New in z/OS V2.4



z/OS V2.4 – 1Q2021 Enhancements Edition ([1Q2021 Announce](#))

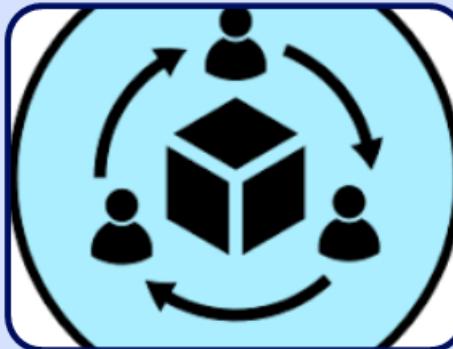
Statements regarding IBM future direction and intent are subject to change or withdrawal, and represent goals and objectives only.

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**(CD)** - Continuous Delivery items

## Release Themes



### AGILITY

Agility in the adoption of new technologies in DevOps, microservices, and consumption models that can be delivered as a service to accelerate their time to value

### OPTIMIZATION

Optimization through the ability to run computing workloads in the most efficient environment

### RESILIENCY

Resiliency to deliver continuity of business services through exploitation of functions such as encryption and high availability

## z/OS V2.4 Content Overview

### Usability and Skills

z/OSMF Desktop; Sysplex management; Software management & workflows; Assembler skill reduction; XCF transport class simplification; Improve z/OSMF configuration; Improved z/OS upgrade experience; ...

### Application Development

**z/OS Container Extension; IBM Open Data Analytics for z/OS; LE support for C++; Unicode V9; NFS support for Unicode; Web enablement toolkit UTF8 support; xvfb support; DFSORT improvements; ...**

### Scalability & Performance

AMODE 64; Alternate subchannels set for XRC & Linux; Improved dump capture time; Asynchronous XI for CF cache; ...



### Enhancing Security

Encryption for sequential, basic & large format; Encryption for PDSE; RACF ACEE privilege escalation; TSO logon time out; MCS console passphrases; OpenSSH V7; ...

### Availability

Dynamic I/O for standalone CFs; TVS Auto Commit; JES2 resiliency; Remote pair flashcopy for XRC; Logger support for GDPS k system; zFS HA improvements; ...

### Systems Management

**Tailored Fit Pricing;** zFS file back-up & restore; JES2 enhancements for JES3 migration; z/OS cloud provisioning for z/OS middleware; NFS improvements for SMB; Multiple NFS servers on a system; SDSF improvements; RMM improvements; ...

### Networking

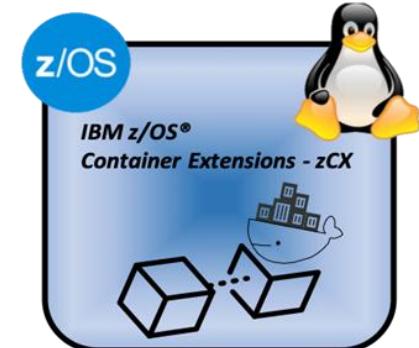
Code page enhancements for CSSMTP; HiperSockets Converged Interface (HSCI); TLS 1.3 support; z/OS Encryption Readiness Technology (zERT); ...

## Release Highlights

Feature	Description
z/OS Container Extensions	<p><b>Workload Enablement:</b> A solution architect can create a solution to be deployed on z/OS based on components available as Docker containers in the LoZ ecosystem transparently exploiting z/OS QoS, without requiring z/OS development skills.</p>
Tailored Fit Pricing for IBM Z	<p><b>Pricing Transparency:</b> As a solution architect, I want the ability to deploy a new solution, co-located or on a new LPAR, without any direct impact to the rolling 4-hour average. Additionally, I'd like an alternative to the R4HA for my z SW pricing for my entire enterprise</p>
Open Data Analytics on z/OS	<p><b>Modernization:</b> Any application developer can further their mainframe modernization initiative by building business solutions using cognitive, analytic, and well-known building blocks/tools to leverage z/OS qualities of service without requiring deep z-specific skills.</p>

## What is z/OS Container Extensions (zCX)?

**z/OS Container Extensions is intended to Modernize and Extend your z/OS Applications**



### Optimization

Co-location of applications ushers in a new level of optimization. The ability to run nearly any Linux on IBM Z Docker container in direct support of z/OS® workloads on the same z/OS® system.

### Agility

Access the most recent development tooling and processes available in the Linux on z ecosystem and deploy on z/OS®. Reusing popular Linux skills and patterns.

### Operational Efficiency

Retain the operational benefits of z/OS®, mature business processes, and the ability to maintain overall operational control within z/OS® with z/OS® Quality of Service.

- Learn more at: <http://ibm.biz/zOSContainerExtensions>

## [z/OS Container Extensions](#)

- This is the capability to run Linux on z Docker images directly in z/OS
  - Linux distribution and Docker CE provided
  - Service entitled as part of z/OS service entitlement
- IBM software is planned to be licensed and priced in line with Linux on z offering
- Intended for workloads with affinity to z/OS
  - For data or applications
- Provide ease of use in Lifecycle Management of a Docker Appliance
  - z/OSMF Workflow for creation and removal
  - Additional support for applying service
- This workload is planned to be zIIP eligible
- Operational consistency with z/OS

## z/OS Container Extensions (cont.)

Pre-packaged Docker Environment provided by IBM

- Includes Linux and Docker Engine components
- Supported directly by IBM
- Can include clustering and registry capabilities
- Initial focus is on base Docker capabilities
- Competitive price/performance (Exploits zIIPs)

Application developers can deploy software using Docker interface

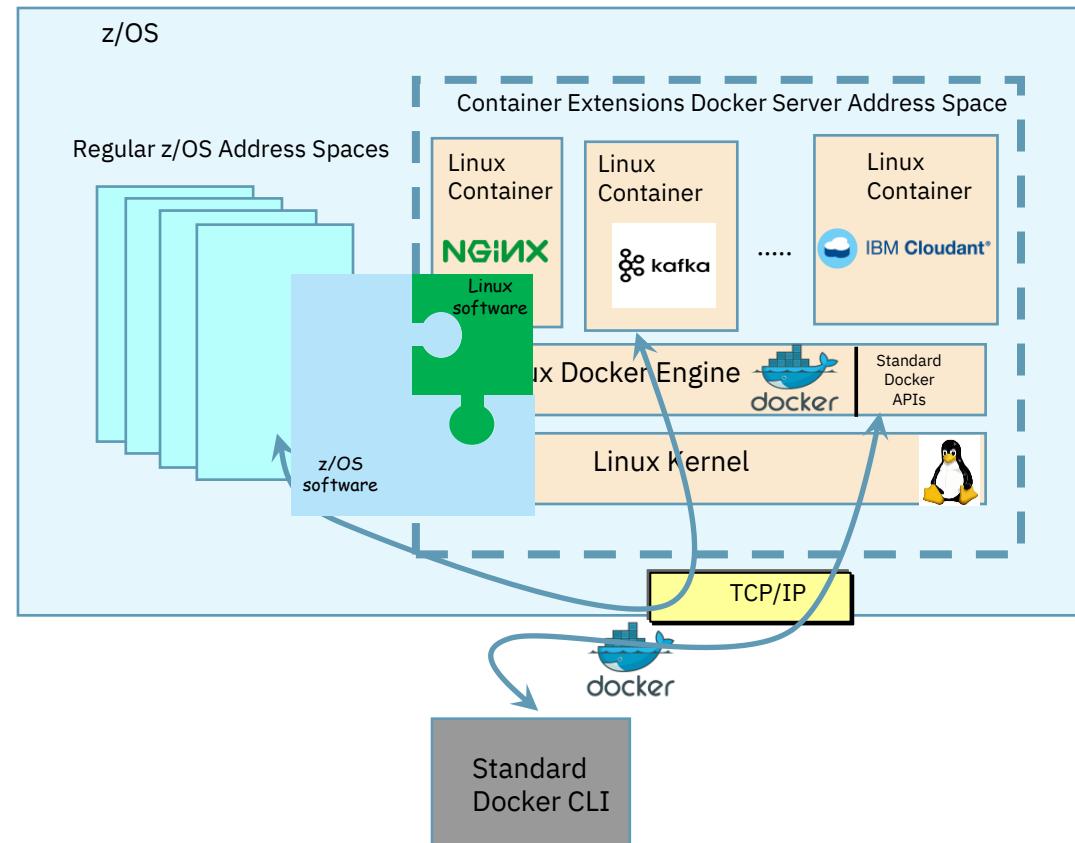
- Any software available as a Docker image on Z System (growing ecosystem available on Docker Hub)
- Any home-grown Linux for Z application packaged as a Docker image
- Using standard Docker interfaces

Limited visibility into Linux environment

- No root access
- Access as defined by Docker interfaces
- Limited Linux administrative overhead

Also provides IBM and ISVs a means of delivering solutions into this environment

- Requires packaging of software as Docker images



## **z/OS Container Extensions Qualities of Services**

- Integrated Disaster Recovery & Planned Outage coordination
  - z/OS DR/GDPS for site failures
  - Integrated planned outage coordination
  - No need to coordinate with non-z/OS administrators
- z/OS storage resilience
  - Eliminate single points of failure
  - Transparent encryption and failure detection with hyperswap
  - Configuration validation I/O health checks
  - Automatic detection of zHyperlink
- z/OS networking virtualization
  - Support for VIPAs
  - High speed communications
- z/OS Workload Management
  - WLM service goals and resource caps
  - Capacity Provisioning Manager (CPM)
  - SMF support for accounting and chargebacks

## [z/OS Container Extensions Trial \(CD 1Q20\)](#)

- 90 day trial without HW feature code 104  
(90-day trial is free subject to normal hardware and software consumption when adding a workload to z/OS)
- Customer self service
- Added via OA58969

## [z/OS Container Extensions Performance Enhancement \(CD 1Q20\)](#)

- Improved performance and reduced locking
- zIIP eligibility improved - 95%+ ziip offload in lab measurements\*
- Added via OA58296

## [z/OS Container Extensions IBM License Metric Tool \(ILMT\) \(CD 1Q20\)](#)

- For use with sub-capacity pricing of IBM Linux on z software
- Manual counting no longer required

## [z/OS Container Extensions Diagnostics Improvements \(CD 1Q20\)](#)

### [Open Mainframe Project](#)

- Ambitus system z opensource ecosystem

\* All performance information was determined in a controlled environment. Actual results may vary. Performance information is provided "AS IS" and no warranties or guarantees are expressed or implied by IBM.

## Proxy server for IBM z/OS Container Extensions (CD 4Q19)

- zCX is enhanced to support proxy configuration, allowing the Docker daemon to use the proxy server in your enterprise to access external public and private Docker registries.
- The optional proxy configuration for z/OS Container Extensions can be configured using the provisioning and reconfiguration z/OSMF workflows.
- The proxy capabilities are enabled with the PTF for APAR OA58267.

## z/OS Container Extensions additional performance (CD 3Q20)

- Updates are made with the PTF for APAR OA59111 to support single instruction multiple data (SIMD) processes.
- Updates are made with the PTF for APAR OA59865 for the following:
  - zCX to support 1 MB and 2 GB large pages.
  - The maximum number of containers supported is raised to 1,000.
  - The amount of guest memory can be configured up to 1 TB.

## z/OS Container Extensions resiliency **(CD 3Q20)**

- Updates are made with the PTF for APAR OA59835 for the following:
  - Support to monitor and log zCX resource usage of the root disk, guest memory, swap disk, and data disks in the servers job log.
  - A new operator command option to display the version and service information about any zCX server and all the relevant components used to provision and run it.
  - The zCX instance root disk can be enlarged when using the software upgrade workflow of the zCX appliance.
  - zCX resource shortage z/OS alerts. These proactive alerts are sent to the z/OS system log (SYSLOG) or operations log (OPERLOG) to improve monitoring and automated operations. This function is available with PTF for APAR OA60303. **(CD 4Q20)**

## z/OS Container Extensions IPv^6 Support **(CD 4Q20)**

- Support is added to zCX in support of IPv6 with the PTF for APAR OA59508.

## z/OS Container Extensions Increased Disk Capacity **(CD 4Q20)**

- The number of data and swap disks per appliance is increased to as many as 245. This enables zCX to address more data at one time and is delivered with the PTF for APAR OA60452.

## IBM Z Container Image Registry

Early Access Program

A registry for open source container images\*

- Building blocks for creating workloads
- IBM Z versions of popular images
- Foundational distros, languages, databases, web serving, CI/CD infrastructure

Hosted at the IBM Container Registry

- Images are built from scratch by IBM
- IBM controls the contents of the channel
- Images are scanned by IBM Vulnerability Manager
  - Reports available to review
- Image digest hashes published to enable secure pull
- Images deploy on IBM z/OS zCX and Linux on Z/LinuxONE

Accommodate common Z security requirements  
by working with a source you can trust to deliver  
container images built using best practices

\* This program has important terms and conditions for use of the images of this registry. Please see the program agreement for a full details of these terms.



(and several more)

Get started at <https://ibm.biz/zregeap>

## What is Tailored Fit Pricing for IBM Z

**Tailored Fit delivers transformative new pricing models for IBM software.**

**Features two new enterprise models that provide comprehensive alternatives to the rolling four-hour average.**

- Delivers simple, flexible, and predictable cloud-like pricing, with economies of scale for all workloads on IBM z/OS.
- Removes the need for complex and restrictive capping, and offers reduced pricing for all types of workload growth.
- Existing “Container Pricing for IBM Z” workload solutions are rebranded under the Tailored Fit umbrella:
  - Application Development and Test Solution
  - New Application Solution
- Learn more: <https://www.ibm.com/it-infrastructure/z/software/pricing-tailored-fit>

## Tailored Fit Pricing

- Simple and predictable pricing models unlocked by z/OS technology
  - Flexible deployment options that support best technical fit
    - z/OS ability to define tenant resource groups (TRG) to meter workloads
    - SCRT enhancements to utilize RMF TRG data for co-located workload
    - SCRT enhancements to enable full LPAR containers
  - Enables Solution Consumption License Charges
    - Utilizes z/OS ability to provide detailed resource consumption metrics
    - SCRT calculates and reports true MSU consumption of a solution
- A Technical Pricing strategy for the ecosystem
  - Enhancements provide:
    - More flexible product registration and usage services
    - Sub-LPAR (TRG) tracking of product usage
    - RMF Monitor III reporting functionality of WLM Resource Groups & TRGs
  - LE wrapper enables easier use of product usage services (IFAUSAGE) in supported languages
  - SCRT support allows ISVs to take advantage of z/OS enhancements to track non-IBM products for ISV specific reporting

## What is IBM Open Data Analytics for z/OS?

**Solution designed to simplify data analysis. It optimizes the runtime of open source technologies, including Apache Spark, Anaconda and Python to gain insights from data at its source by:**

- Incorporating a wide variety of current data on and off z/OS, to reduce latency of insights and derive higher value from analytics.
- Reducing data movement and protecting business data with IBM Z systems crypto cards, which zero out when tampered with. Encrypt your data and analyze it at the source of origin.
- Improving interoperability with its integration with enterprise business applications.
- Integrating data across a heterogeneous environment using modern analytic capabilities commonly used by data scientists everywhere.
- Learn more by searching for ‘IzODA’ or starting here: <https://www.ibm.com/us-en/marketplace/open-data-analytics-for-zos>

## IBM Open Data Analytics for z/OS

- Spark
  - Support for Workload Manager integration, allowing the ability to differentiate Spark users based on business priority and resource restrictions
  - Enhanced Security with end-user authentication and encryption with the ability to authenticate users deploying to Spark as well as ensuring encryption of all data flowing between connections
  - Spark can now leverage more z/OS infrastructure to allow enhanced auditing and support to associate users with their applications to allow tracking of resource usage as well as leverage started tasks that enable the Spark master and worker to run on z/OS, consistent with running other MVS batch jobs, job steps, or started tasks
  - z/OSMF workflows are provided to simplify configuration
- Anaconda
  - Apache Maven support for better build automation
  - Support for XGBoost that is highly preferred in the industry for its implementation of gradient boosted decision trees designed for speed and performance

## **IBM Open Data Analytics for z/OS (cont.)**

- Mainframe Data Services (MDS)
  - MDS now supports real-time SMF data streaming and better performance for accessing IBM DB2 data with enhancements to Ibm DB2 direct sub-component in MDS.
  - Security administrators can leverage new security enhancements as well with DRDA authentication support, and userid encoding support between driver and data service server
- z/OS Infrastructure with Metering and Capping
  - The new metering and capping support for z/OS allows the system capacity planner more granular control over CPU and memory consumption for various workloads and enables the system to host new workloads more easily.

# z/OS Support Summary



Release	z9 EC z9 BC <b>WdfM</b>	z10 EC z10 BC <b>WdfM</b>	z196 Z114 <b>WdfM</b>	zEC12 zBC12 <b>WdfM</b>	z13 Z13s <b>WdfM</b>	z14 ZR1	z15	End of Service	Extended Defect Support
z/OS V2.1	X	X	X	X	X	X	X	9/18	9/21 <sup>2</sup>
z/OS V2.2		X	X	X	X	X	X	9/20	9/23 <sup>2</sup>
z/OS V2.3				X	X	X	X	9/22 <sup>1</sup>	9/25 <sup>2</sup>
z/OS V2.4				X	X	X	X	9/24 <sup>1</sup>	9/27 <sup>2</sup>

## Notes:

<sup>1</sup> - All statements regarding IBM's plans, directions, and intent are subject to change or withdrawal without notice.

<sup>2</sup> - 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

## Release Notes

- JES3

- JES3 is planned to be included in z/OS 2.4 and z/OS.next but not beyond that, customers affected can get more information by emailing: [JES3Q@us.ibm.com](mailto:JES3Q@us.ibm.com)
- Starting in z/OS v2.4 ServerPac, IBM will no longer offer an option to remove JES2 during configuration.
- Aligned with the JES3 Removal, the next release after z/OS 2.4 will be the last release that Bulk Data Transfer (BDT) is included in z/OS. This applies to both priced features, BDT SNA NJE and BDT File-to-File (F2F).

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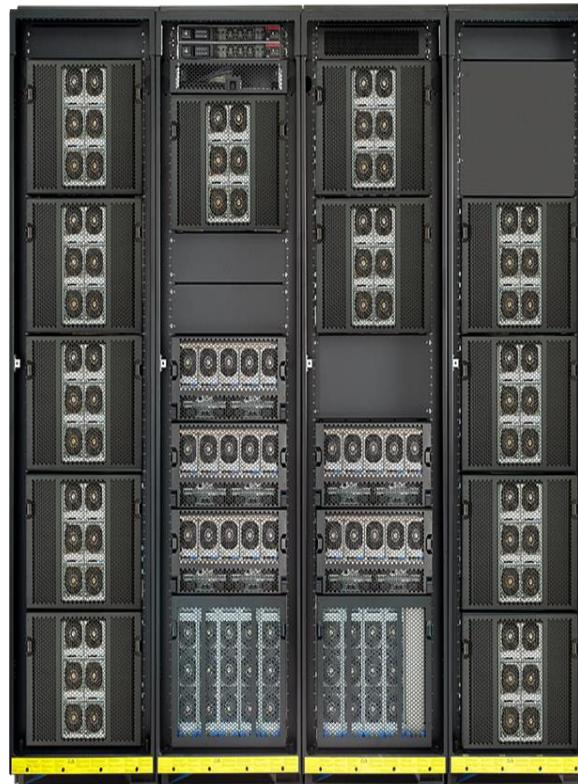
# Hardware Support

IBM Z

IBM

## IBM z15 Model T01 Functions & Features

One hardware model, Five Features, 1-4 19" Frame System
<u>z/Architecture Mode ONLY</u>
<ul style="list-style-type: none"><li>• L1 Private 128K i &amp; 28K d</li><li>• L3 Shared 256 MB / chip</li><li>-L2 Private 2MB i &amp; 2MB d</li><li>-L4 Shared 956 MB / drawer</li></ul>
<p>Up to 190 processors configurable as CPs, zIIPs, IFLs, ICFs or optional SAPs</p> <ul style="list-style-type: none"><li>• Up to 190-way on z/OS V2.1 and later (non-SMT mode)</li></ul>
<p>Up to 40 TB of Redundant Array of Independent Memory (RAIM) – 1TB Memory Increment – 8TB/Drawer - Max</p> <ul style="list-style-type: none"><li>• Up to 4 TB per z/OS LPAR with z/OS V2.1 and later</li></ul>
256 GB Fixed HSA
Channel Subsystem scalability <ul style="list-style-type: none"><li>• Up to 85 LPARs</li><li>• Up to six (6) Channel Sub Systems (CSSs)</li><li>• 4 Subchannel Sets per CSS</li></ul>
HiperDispatch Enhancements
Two-way SMT for zIIPs, IFLs, and SAPs
30+ New instructions: Java, Vector enhancements for Analytics and sort acceleration
Hardware Instrumentation Services (CPUMF)
<p>z/OS V2R4 XL C/C++ ARCH(13) and TUNE(13) exploitation:</p> <ul style="list-style-type: none"><li>• New z15 hardware instructions</li><li>• Aligned Vector Load/Store Hint instructions</li><li>• Vector Enhancement Facility 2</li><li>• Miscellaneous-Instruction-Extension Facility 3</li></ul>



(z/OS support in blue)

CD support in Red

IBM Virtual Flash Memory & CF Exploitation of VFM Up to 12 Features – Feature Size=0.5TB
IBM System Recovery Boost – Sysplex Recovery
IBM Integrated Accelerator for Z Sort
IBM Integrated Accelerator for z Enterprise Data Compression (on-Chip Compression)
Coupling Facility Level 24 <ul style="list-style-type: none"><li>• Coupling Facility Fair Latch Manager 2</li><li>• Message Path SYID Resiliency Enhancement</li><li>• DYNDISP Default THIN</li><li>• Coupling Facility Monopolization Avoidance</li></ul>
<ul style="list-style-type: none"><li>• Coupling CHPIDs increased to 384 from 256 per CEC</li><li>• ICA SR increased to 96; ICP increased to 64</li></ul>
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 Express16SA
OSA Express7S (1,10,25 GbE) <ul style="list-style-type: none"><li>• Greater than 16 Adapters support</li></ul>
zHyperLink® Express1.1 (FC 0451) / CF <ul style="list-style-type: none"><li>• Maximum 16 Adapters</li></ul>
Crypto Express7S (FC 0899 - 1 HSM, FC 0898 - 2 HSM) <ul style="list-style-type: none"><li>• Max 60, Combination of (CEX7S, CEX6S, CEX5S)</li><li>• Up to 16 (CEX6S and CEX5S) can be Carried Forward but rest must be CEX7</li><li>• Support for new CCA 7.1 functions</li><li>• New ECC Edward Curves support</li></ul>

# Hardware Support



IBM Z

## IBM z15 model T02 Functions & Features (CD 2Q20)

One hardware model T02 19-inch frame
<b>zArchitecture Mode ONLY</b>
Up to 65 processors configurable as CPs, zIIPs, IFLs, ICFs or optional SAPs
<ul style="list-style-type: none"><li>• L1 Private 128K i &amp; 28K d</li><li>• L2 Private 2MB i &amp; 2MB d</li><li>• L3 Shared 256 MB / chip</li><li>• L4 Shared 956 MB / drawer</li></ul>
Up to 16 TB of Redundant Array of Independent Memory (RAIM) <ul style="list-style-type: none"><li>• Up to 4 TB per z/OS LPAR with z/OS V2.1 and later</li></ul>
160 GB Fixed HSA
Channel Subsystem <ul style="list-style-type: none"><li>• Up to 40 LPARs</li><li>• Up to three (3) Logical Channel Sub Systems (LCSSs)</li><li>• 3 Subchannel Sets per LCSS</li></ul>
HiperDispatch Enhancements
Two-way simultaneous multithreading (SMT) <ul style="list-style-type: none"><li>• Support for SAPs</li></ul>
30+ New instructions: Java, Vector enhancements for Analytics and sort acceleration
XL C/C++ ARCH(13) and TUNE(13) exploitation: <ul style="list-style-type: none"><li>• New z15 hardware instructions</li><li>• Aligned Vector Load/Store Hint instructions</li><li>• Vector Enhancement Facility 2</li><li>• Miscellaneous-Instruction-Extension Facility 3</li></ul>
Hardware Instrumentation Services (CPUMF)



IBM Virtual Flash Memory & CF Exploitation of VFM Up to 4 Features – Feature Size=0.5TB
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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) <ul style="list-style-type: none"><li>• Max 40 Combination of (CEX7S, CEX6S, CEX5S)</li><li>• CEX6S and CEX5S can be Carried Forward (CF)</li><li>• Support for CCA 7.1</li><li>• New ECC Edward Curves support</li></ul>

## IBM z15 Highlights

- Improved compression performance (up to 17x throughput improvement\*)
- Up to 20% More coupling links and up to 50% more CHPIDs for the T01 model and 2-3x more coupling links and up to 50% more CHPIDs for the T02 model (**CD 2Q20**)
- CFCC improvements
  - Thin interrupt as the default
  - Improved fairness in dispatching
  - Improved message path resiliency
- z/OS SLIP to monitor an address or range for a key change and take diagnostic action
- Sort accelerator – updates to DFSORT (**CD 3Q20**)
  - New **SORTL** instruction, which is standard on the z15.
  - Designed to cut the CPU costs and improve the elapsed time for eligible sort workloads
  - DFSORT and DB2 for z/OS utilities Suite exploit the SORTL instruction
  - DFSORT is available on z/OS V2.3 with PTF UI90067 and V2.4 with PTF UI90068

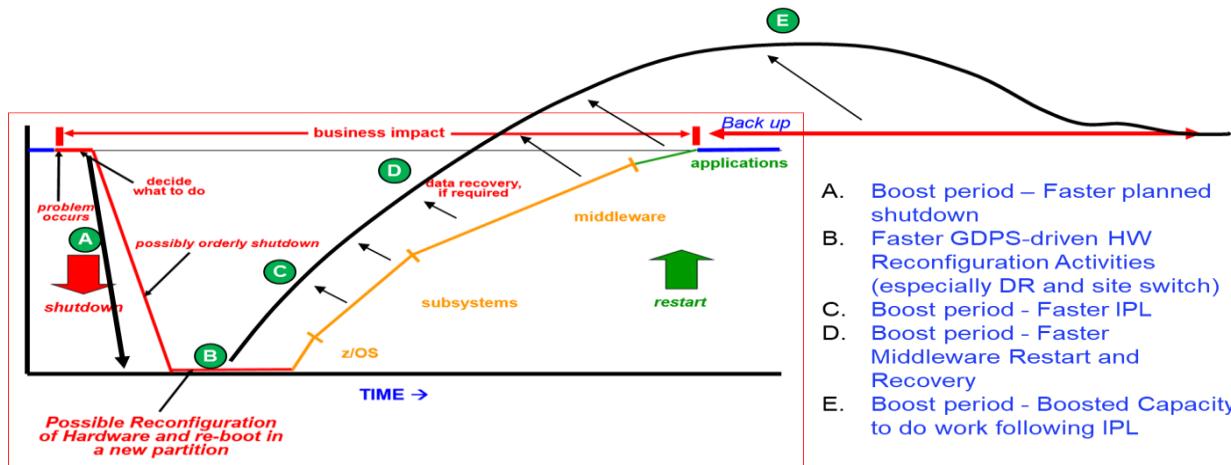
# Hardware Support

IBM Z

IBM

## IBM z15 Highlights

- System Recovery Boost support
  - IPL and Shutdown boost
    - Speed boost
    - zIIP boost
    - Up to 60 minutes of boost at IPL and up to 30 minutes of boost at shutdown
  - Sysplex Recovery (**CD 3Q20**)
    - Sysplex partitioning – boost surviving systems for recovery
    - CF structure recovery – boost systems participating in structure recovery
    - CF data sharing member recovery – boost all systems recovering
    - HyperSwap – boost systems participating in HyperSwap processing



# Hardware Support

IBM Z



## ICSF HCR77D1 WD#19 w/ APAR OA58880 (CD 2Q20)

- Full support for >16 cryptographic coprocessors
  - Exploitation support rolled back to HCR77B0 w/ APAR OA56965
- New HW features being exploited by ICSF:
  - CEX7 updates with CCA Release 7.1
    - Edwards ECC Curves for digital signatures
    - Protected Key support for select ECC curves
    - Lattice-based algorithms for digital signatures
    - TR-31 support for HMAC keys
  - CEX5 and CEX6 updates with CCA 5.6 and CCA 6.4
    - TR-31 export of DES OPINENC and IPINENC keys for P0 block (CSNBTD31X)
    - New rules for Diversify Directed Key service (CSNBDDK)
    - Ability to generate OPOP AES PINPROT keys (CSNBKGN2)
    - Encrypted PIN Translate 2 updated for different PAN formats and new random padding scheme (CSNBPTR2)
    - The CEX5/CEX6 enhancements are available on HCR77C1 and HCR77D0 as well as HCR77D1
- ICSF Updates
  - EMV support services updated to support CVN-18 and PAN-19
  - With the PTF for APAR OA60317, ICSF enables clear keys to be used for generating and verifying message authentication codes (MAC) using the Hash-based Message Authentication Code (HMAC) algorithm. (CD 4Q20)

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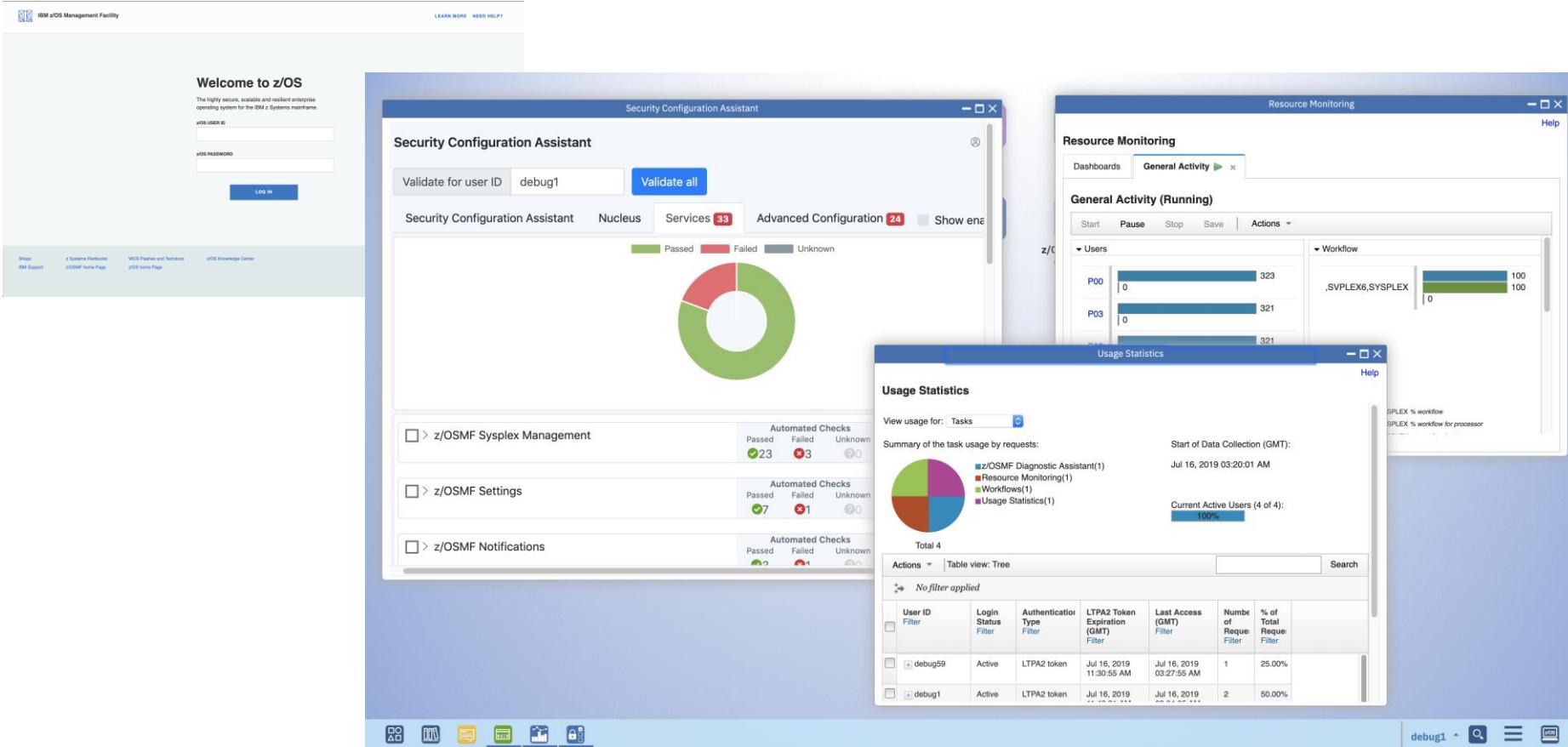
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## Overview, goals & directions

- Bring a browser based ecosystem to z/OS Management
  - Consistent with other platform User interfaces
  - Modern compared to ISPF 3270
  - Client platform agnostic – OS, devices etc.
  - Exploit graphics and other techniques where appropriate
- Develop Applications focused on z/OS unique needs
  - Task Oriented
  - Reduced effort
- Integrate and expand the z/OS ecosystem
  - Provide API's for public consumption
  - Securely and efficiently
- Reduce Reliance on Assembler Skills
  - Provide solutions that don't require code where possible
  - Support higher level language extensions of z/OS

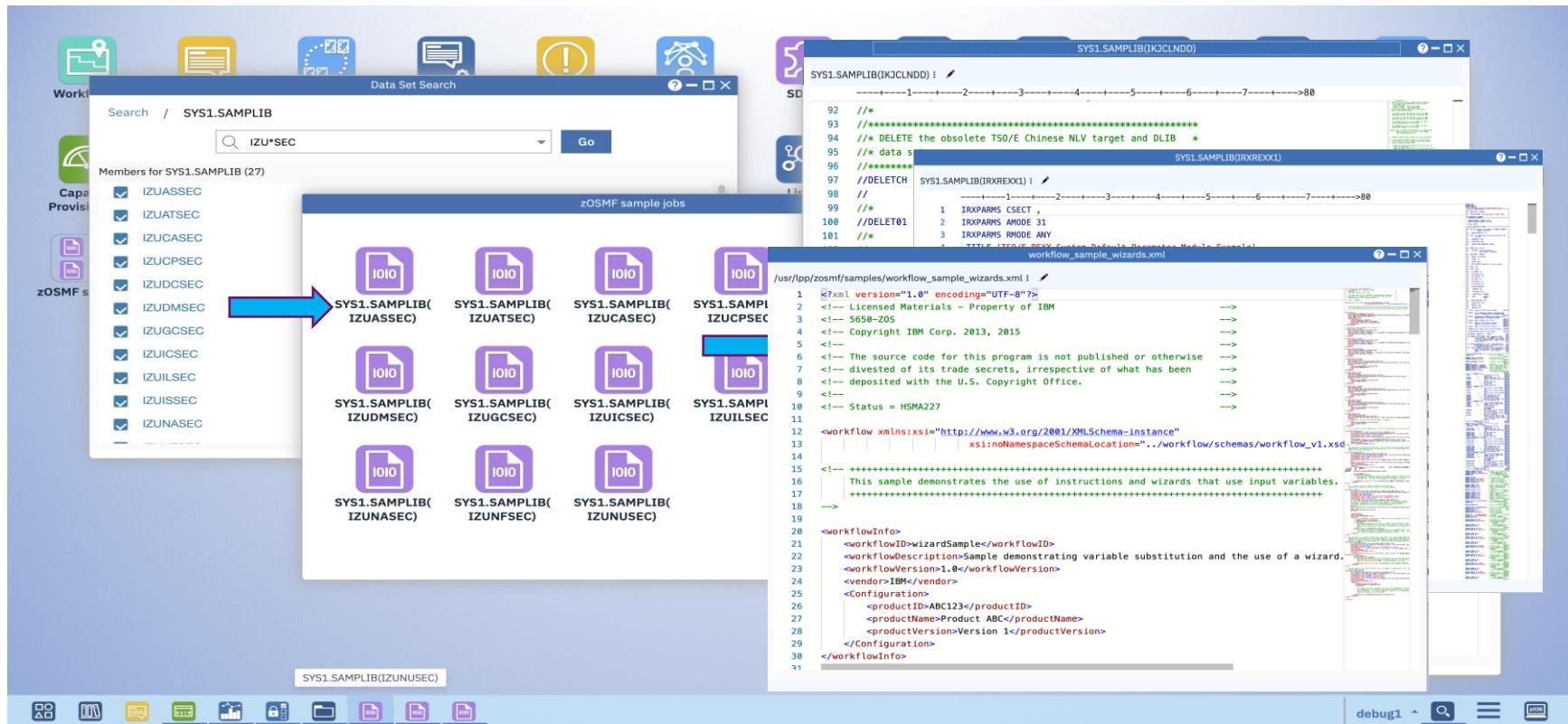
## z/OSMF Desktop

- z/OSMF a desktop-like user interface, default for z/OS 2.4
- Benefits – Multi-tasking, more screen available, intuitive to new users



## z/OSMF Desktop

- Customer grouping of items in folders, such as data sets
- Search, Browse, Edit files and data sets via PH16076 (**CD 1Q20**)
- Submit, query, browse jobs via PH16076 (**CD 1Q20**)
- Syntax highlighting, user created links, improved performance PH24527 (**CD 2Q20**)



## z/OSMF Improved Configuration

- Configuration book restructured to make it possible to:
  - Allow an administrator to complete z/OSMF Nucleus setup very quickly
    - z/OSMF nucleus is just enough config to bring up the user interface
  - Allow an administrator to configure desired services as they are needed
- Restructure Security Set-up
  - IZUNUSEC security sample contains only ALL-MUST-DO setup for Nucleus
  - Every service will have its own security sample job
  - Security requirement will be described more precisely for feature mapping
- Start up performance improvements when there are no changes to PARMLIB, delivered via PH19227 **(CD 1Q20)**

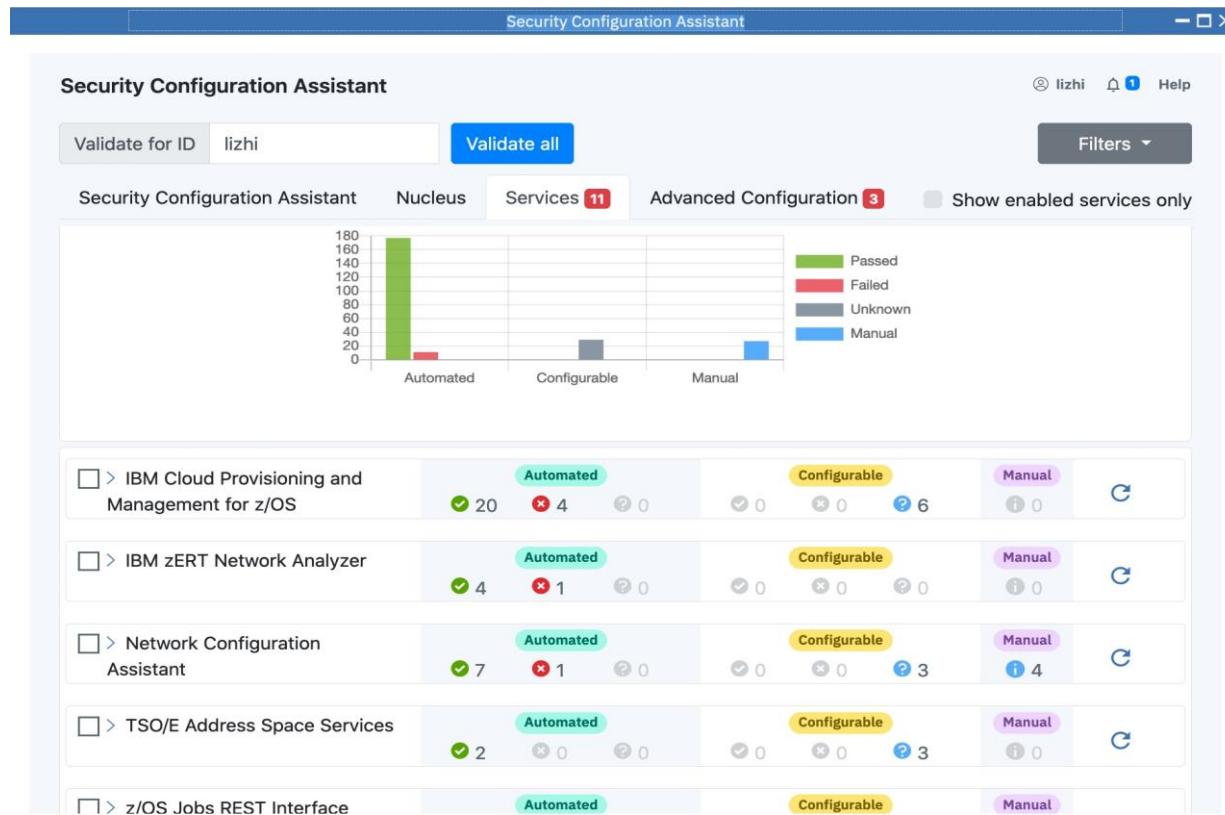
## z/OSMF Authentication Enhancement

- Support using certificate/smart card to logon to z/OSMF UI

## z/OSMF Improved Configuration . (CD 4Q19)

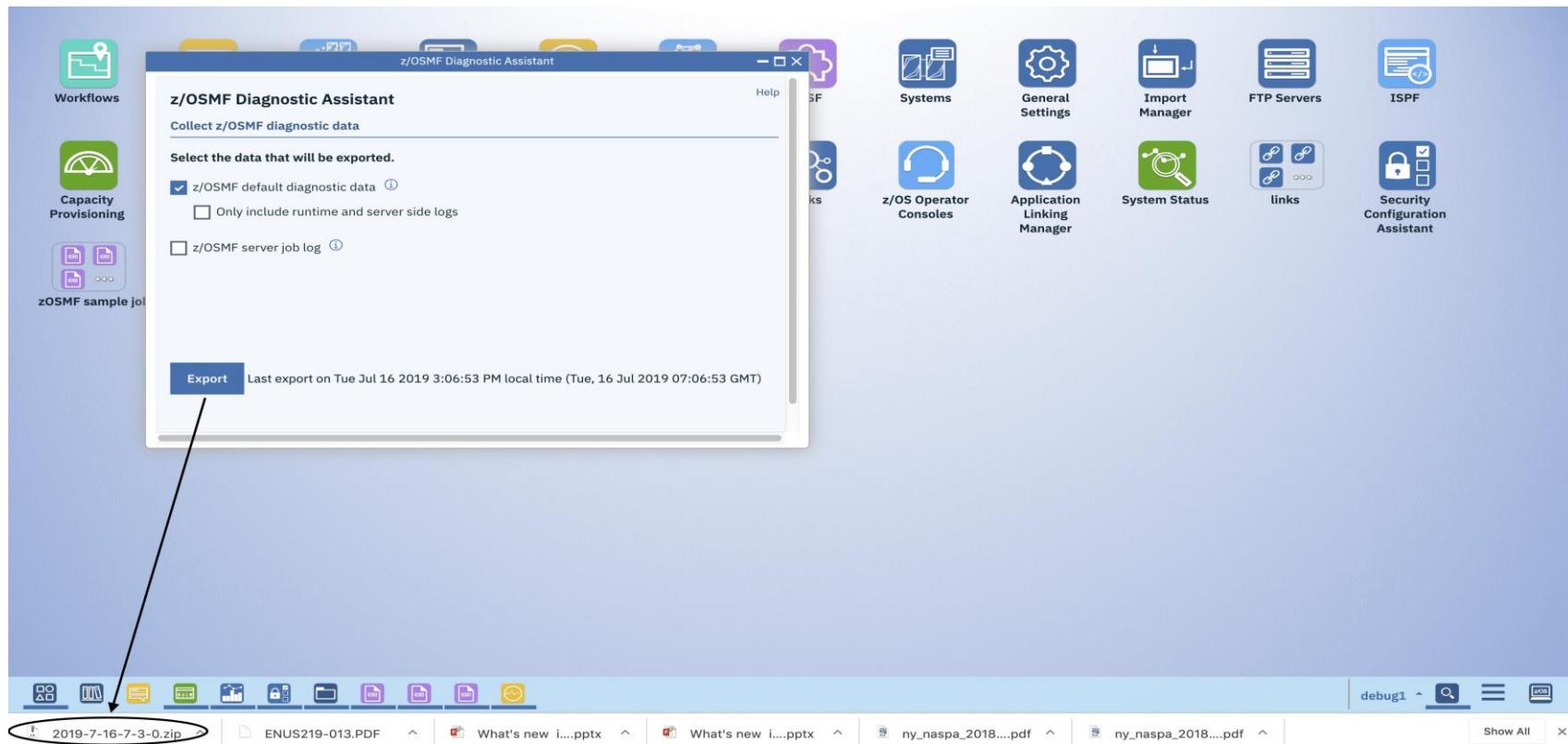
- Security Configuration Assistant

- A new z/OSMF application to help in configuring security, is enhanced to support validation by user group with the PTF for APAR PH17871. (CD 1Q20)
- Support for external applications via PTF for APR PH29907 (CD 1Q21)



## z/OSMF Diagnostic Assistant

- Collect z/OSMF diagnostic data with one click
- Display of z/OSMF data file system utilization (**(CD 3Q20)**)
- Automatic cleanup of z/OSMF diagnostic data based on a predefined policy (**(CD 3Q20)**)



## z/OSMF Sysplex Management

- View Sysplex configuration
  - Table and graphical views
    - Physical and logical views, by CPC, by sysplex, by Coupling Facility, by Structure
    - Coupling Facility, Links, Structures
  - Available in z/OS 2.2 and up
- Modify Sysplex configuration
  - Sysplex-wide commands and results display
  - Command Log retained across IPL's
  - 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 structure(s), all structures
  - Duplex structure(s), all structures
  - Reallocate
  - Couple dataset creation, addition, switching
  - CF actions
  - CF connectivity (link and CHPID) management
  - Create new couple data set, delivered via PH15554 (**CD 1Q20**)

# Usability & Skills

IBM Z

IBM

## z/OSMF Sysplex Management – Modify structures

Sysplex Management > PLEX1 > Coupling Facility Structures for PLEX1

Help

### Coupling Facility Structures for PLEX1

The screenshot shows the 'Coupling Facility Structures for PLEX1' interface. In the center, there is a grid of coupling facility structures. On the left, a tree view shows nodes like LF01N, LIST01, LIST02, and IXCTL\_SIG... under a node named LT01. A context menu is open over the LIST01 node, with 'Rebuild' highlighted. Other options in the menu include 'Duplex', 'Relocate All Structures', and 'Properties'. A red arrow points from this interface to the 'Commands Log' interface below.

Sysplex Management > PLEX1 > Coupling Facility Structures for PLEX1

Help

### Coupling Facility Structures for PLEX1

The screenshot shows the same 'Coupling Facility Structures for PLEX1' interface after the rebuild process has completed. The 'Messages' panel at the top now displays a message: 'The command "Start Rebuild Structure" completed.' A red box highlights this message. A red arrow points from this interface to the 'Commands Log' interface below.

Sysplex Management > PLEX1 > Coupling Facility Structures for PLEX1 > Commands Log

Help

### Commands Log for PLEX1 (96)

Actions ▾   Table view: Tree						
No filter applied						
Command Filter	User Filter	Objects Filter	Sysplex Filter	System Filter	Status Filter	Details Filter
					<input checked="" type="checkbox"/> Completed	<input type="checkbox"/> Output

Help

Sysplex Management > PLEX1 > Coupling Facility Structures for PLEX1 > Commands Log > Commands Output

### Commands Output

Command:	Objects:	Sysplex:	Status:
Start Rebuild	LIST01	PLEX1	<span style="color: green;">Completed</span>
<b>Console output:</b>			
Command Submitted: SETXCF START,REBUILD,STRNAME=LIST01,LOCATION=Normal			
Tue Aug 21 05:56:23 GMT 2018 SV1	IKC5211:REBUILD FOR STRUCTURE LIST01 HAS BEEN STARTED.		
Tue Aug 21 05:56:23 GMT 2018 SV1	IKC5211:THE SETXCF START REBUILD REQUEST FOR STRUCTURE LIST01 WAS ACCEPTED.		
Tue Aug 21 05:56:23 GMT 2018 SV2	IKC5261:STRUCTURE LIST01 IS REBUILDING FROM COUPLING FACILITY LF01N TO COUPLING FACILITY LF01N. REBUILD START REASON: OPERATOR INITIATED. INFLUENCE: 00000002 00000002.		
Tue Aug 21 05:56:24 GMT 2018 SV3	IKC5211:REBUILD FOR STRUCTURE LIST01 HAS BEEN COMPLETED.		

## [z/OSMF Software Management](#)

- Ultimate goal is to provide a single approach to software maintenance and management
  - Acquisition
  - New installation
  - Upgrades
  - Fixing a problem
  - Applying preventative maintenance
- An application in z/OSMF to manage software binaries
  - Portable software instances
  - Can be SMP/e or non-smp/e or a mixture
  - Installation via dialog
- Use of z/OSMF Workflows for configuration
  - Standardize the configuration of software
  - Both IBM and non-IBM software
  - Can be instructions or automated or a combination

## z/OSMF Software Management integration with Workflow

- Workflows associated with software instance (PH02650)
- Define workflows for a software instance
- Run workflows for a software instance

Software Management ▶ Software Instances

Software Instances

Name	System	Description	Activity	Global Zone CSI	Target Zones
PokR11Prod	SYSA	Pok R11 Production		SMP.R11PROD.CSI	TARGET1
NYCR12Test			View Modify Copy... Open Deployments <b>Perform Workflows</b> Export as Portable Software Instance Remove... Retrieve Product, Feature and FMID Information Maintenance Reports	SMP.R12TEST.CSI	T3

Total: 2, Selected: 1

Refresh Last refresh: Jul 22, 2009 4:45:58 PM local time (Jul 22, 2009 8:45:58 PM GMT)

Software Management ▶ Software Instances ▶ Perform Workflows

Perform Workflows for PokR11Prod

Workflows

Sequence	Name	Description	Version	Owner	Status	Percent Complete
1	The First Action	This is an actions you should do first	1.0			0 %
2	The Second Action	This is an action you should do second	1.0			0 %
3	The Third Action	This is an action you should do third	1.1			0 %

Total: 3, Selected: 1

Refresh Last refresh: Jul 22, 2009 4:45:58 PM local time (Jul 22, 2009 8:45:58 PM GMT)

A red arrow points from the "Perform Workflows" option in the left-hand menu to the "Perform Workflows for PokR11Prod" page.

## Workflow – Export workflow as printable format

- The z/OSMF Workflows task is enhanced to support a new function called “Export Workflow As Printable Format”, which is to export workflow information and steps information into a readable and printable format HTML page via PH00582

The screenshot shows the 'Workflow Steps' interface in z/OSMF. On the left, a sidebar titled 'Actions' contains various workflow actions: Properties, Accept, Perform, Skip, Status, Override Complete, Resolve Conflicts, Change Called Workflow, Assignment And Ownership, FeedBack, Expand, Collapse, and **Export Workflow as Printable Format**. The 'Export Workflow as Printable Format' option is highlighted with a red box. Below this, there are checkboxes for 'Select All' and 'Deselect All', and links for 'Configure Columns...', 'Hide Filter Row', and 'Clear Search'. A red arrow points from the 'Actions' sidebar to the right-hand export dialog.

**Export This Workflow in a Printable Format**

Export workflow steps:

All steps  
 As filtered

Export Table of Contents:

Include the Table of Contents

Export additional information:

Include JCL, REXX, and UNIX shell contents from templates, and information from REST steps

OK Cancel Help

## [z/OS Release Upgrade Assistance](#)

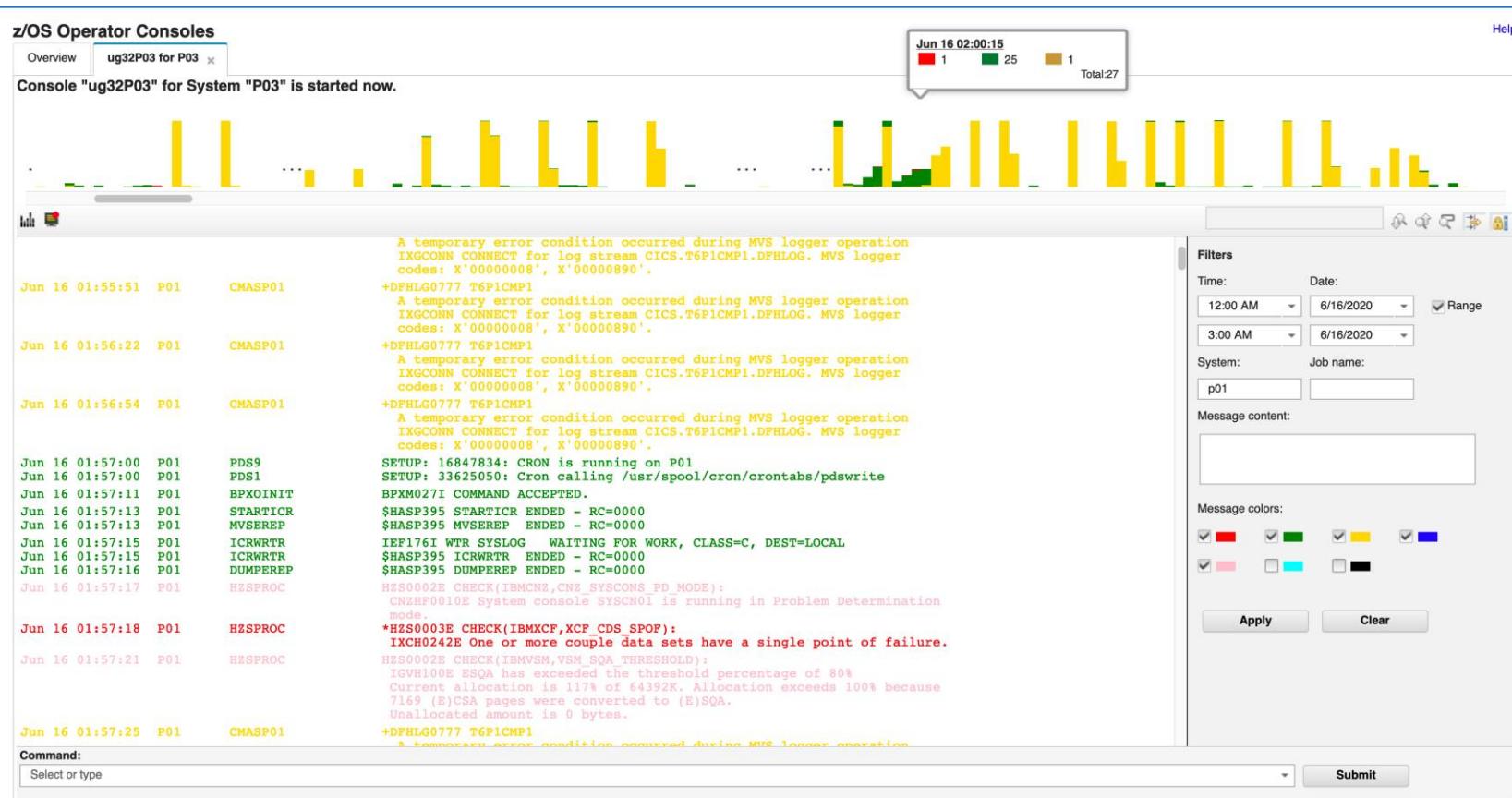
- Generally, the term “migration” will be referred to as “upgrade” as of z/OS V2.4
- z/OSMF z/OS V2.4 *Upgrade Workflow* is planned to be provided from current [github location](#) for V2.2 and V2.3 upgrade paths.
  - This Workflow allows for discovering functions used, tailoring information specific to your systems, and verification of many upgrade actions.
  - IBM Strongly recommends that you become familiar with z/OSMF Workflows to take advantage of these benefits!
- z/OS *Migration* publication in its current form will not be provided.
  - Exported formats for both upgrade paths of the z/OS V2.4 *Upgrade Workflow* is planned to be provided in Knowledge Center for co-location with the rest of the z/OS books. These files will allow for reading, searching, and printing without z/OSMF.
  - Note that these exported files are not tailored for your environment, so determining applicability and tracking status is not possible if you use the exported formats.

## Software Management installation of ServerPac (**CD 1Q20**)

- IBM's delivery of a ServerPac as a Portable Software Instance
  - CICS Transaction Server and associated CICS products, which can be installed with z/OSMF
  - z/OSMF ServerPac availability for IMS and Db2 (**CD 3Q20**)
  - Choosing this option means you will use z/OSMF on your driving system
- Installation method uses a simplified web-based GUI
  - Allocation of data sets, cataloging, and other configuration
- Existing ISPF CustomPac Dialog format will still be offered. Choice is yours
- Both formats offered in internet download or in DVD
- Learn more: <https://www.ibm.com/support/z-content-solutions/serverpac-install-zosmf/>

## Console application

- Support for WTOR/HOLD messages
- Improved handling of large amounts of messages
- Simplified Configuration of console by APAR PH24072 (**CD 2Q20**)



## z/OSMF Updates (CD 4Q19)

- z/OSMF Workflow task will now support parallel-step workflows. One or more automated steps of a parallel-step workflow can run at the same time
- Workflow support for array type variables via PH03053, support creating workflow instances from workflow definitions located in remote systems by the PTF for APAR PH14185.
- The z/OSMF Incident Log task is enhanced to support the CASE parameter in addition to the existing PMR number when sending diagnostic data to the IBM support site. The CASE parameter is a new format for problem management.
- z/OSMF Workflows task is enhanced to support saving job output in a specified zFS directory with APAR PH21919. (CD 2Q20) auto-deletion after a workflow is completed with the PTF for APAR PH24190 . (CD 3Q20)
- OpenAPI1.0 support for most z/OSMF REST APIs

The screenshot shows the z/OSMF interface with various management tasks like Workflows, Notifications, and Incident Log. A large blue arrow points from the 'z/OSMF REST APIs' section in the main menu to the detailed API documentation on the right.

**z/OSMF REST APIs**

Discover REST APIs for z/OSMF

AMS APIs

Console Services APIs

Dataset APIs

default

File APIs

Filesystem APIs

Information APIs

Jobs APIs

Notifications APIs

TSO/E APIs

<code>GET /zosmf/tsoApp/app/{serviceKey}/{appKey}</code>	Start an application in a TSO/E address space
<code>POST /zosmf/tsoApp/app/{serviceKey}/{appKey}</code>	Send messages to an application
<code>PUT /zosmf/tsoApp/app/{serviceKey}/{appKey}</code>	Start or reconnect to a TSO/E address space
<code>POST /zosmf/tsoApp/app</code>	Ping a TSO/E address space
<code>PUT /zosmf/tsoApp/app/ping/{serviceKey}</code>	End a TSO/E address space
<code>DELETE /zosmf/tsoApp/app/{serviceKey}</code>	Receive messages from a TSO/E address space
<code>PUT /zosmf/tsoApp/app/{serviceKey}</code>	Send messages to a TSO/E address space

Workflow APIs

## IBM z/OSMF support for JSON Web Token (CD 4Q19)

- z/OSMF supports JSON Web Token (JWT) by returning JWT token during authentication and accepting JWT token for authorization of z/OSMF services by the PTF for APAR PH12143.

## z/OSMF Remote REST APIs (CD 4Q19)

- REST data set and file service is enhanced to support accessing data sets and files in remote systems by the PTF for APAR PH15263.

## z/OSMF Updated Liberty (CD 1Q20)

- z/OSMF now uses the default path in embedded liberty, delivered via PH17867

## z/OSMF REST JOBS Updates via Apar PH23046 (CD 2Q20)

- New spool Search options, improved spool codepage support, option to retrieve active jobs, return additional data (submit time, system etc)

## z/OSMF REST files and datasets Updates via Apar PH22030 (CD 2Q20)

- Allocate Like, handling carriage returns automatically, compressing large DS

## [z/OSMF Workflow Editor \(CD 2Q20\)](#)

- z/OSMF Workflow Editor is enhanced with APAR PH24190 to use the VS code editor, already included in z/OSMF, when working with large amounts of text. This will provide a large area to do editing as well as standard editor support such as find/replace string, line numbers, and the file overview.
- A new test option allows quick verification of workflows and a path selector option to assist with locating workflows via PTF for APAR PH28532 **(CD 1Q21)**

## [z/OSMF Ansible Support \(CD 2Q20\)](#)

- Ansible is a Red Hat technology for dev/ops automation. z/OSMF now provides z/OSMF Ansible collection "ibm\_zos\_zosmf" in Ansible Galaxy. It integrates Ansible and z/OS without any environment change to z/OS. Refer to the [z/OSMF page](#) in Ansible Galaxy for more details.

## [z/OSMF Granular Configuration \(CD 3Q20\)](#)

- z/OSMF is enhanced by the PTF for APAR PH24527 to provide a simple UI to enable or disable most z/OSMF services.
- Simplified settings deployment with a simple JSON file

## [z/OSMF Type Ahead Search \(CD 4Q20\)](#)

- The z/OSMF desktop utilities are enhanced with the PTF for APAR PH28692. The search function is enhanced to provide typeahead capability for searching data sets, UNIX System Services (USS) files, and USS directories.

## [z/OSMF Create Data Set \(CD 4Q20\)](#)

- The PTF for APAR PH30398 also adds the function of “create data set” into the z/OSMF desktop. Clients can create a new physical sequential or partitioned data set based on an existing data set, a predefined template, or fully specified attributes.

## [z/OSMF Start Up Improvements \(CD 4Q20\)](#)

- z/OSMF startup time and resource consumption during startup is improved with the PTFs for APARs PH28921, PH28920, PH28971, PH28990, PH28451, PH29230, PH29243, PH28832, and PH28872. In laboratory measurements of a small z15 LPAR, the startup time improved by 30% elapsed time and 48% CPU time. Results depend on a client's configuration.

## [z/OSMF Request Queueing \(CD 4Q20\)](#)

- z/OSMF REST Data Set and File service is enhanced with the PTF for APAR PH29745 to queue concurrent requests from the same user when the number of Time Sharing Option (TSO) address spaces are exhausted. This can improve the processing when a large number of requests are sent to z/OSMF.
- z/OS CEA is updated with PTF for APAR OA57346 to increase the maximum sessions allowed per user from 10 to 99.

## [z/OSMF Workflow Improvements \(CD 4Q20\)](#)

- z/OSMF Workflow Engine has several enhancements with the PTF for APAR PH28532. The workflow administrator can delete multiple workflow instances at a time. To perform a workflow on a remote sysplex, a single sign-on among z/OSMF instances is no longer strictly required. In the absence of a single sign-on, the request prompts for a user and password, if necessary.
- Search for content of workflow steps via PTF for APAR PH27725 (CD 1Q21)

## [z/OSMF Ansible Collection \(CD 4Q20\)](#)

- z/OSMF Ansible collection, [ibm\\_zos\\_zosmf](#), is enhanced to provide data set and USS file operations. Several sample playbooks by use case as well as a quick configuration approach for z/OSMF dependencies are provided on [Github](#).

## XCF Transport Class Simplification

- Continuing enhancements to earlier work in this space are planned to make XCF transport classes more self-managing and self-tuning, as well as to improve resiliency by avoiding monopolization of message buffer space
  - Vision: Customers will no longer need to define, tune, or manage XCF transport classes when configuring their sysplex. The task of configuring XCF communication in a multi-system sysplex is simplified and reduced to defining the number of XCF signal paths needed to support the workload, which will help avoid badly configured sysplex messaging (and performance issues/outages) as a result.*
- Focus for 2.4 timeframe is autonomic management of transport class “segregation by size” and of the associated message buffer space
  - New automatic \_XCFMGD transport class
  - No need for clients to properly “tune” XCF transport class message sizes to match the signaling workload characteristics, to achieve good results
  - Simplification and improved resiliency – avoid performance and resiliency impacts from poorly-tuned transport class sizes
- IXCMG and IXCYAMDA accounting and measurement changes, and accompanying SMF data changes are provided
  - New/improved statistics for reporting message path utilization, signal counts, and no-buffer conditions
- Resiliency support for management of transport classes for “segregation by XCF group” is a future objective
  - Improved resiliency in the event of “runaway” message senders or “stalled” message receivers, automatically preventing them from monopolizing the available resources in the transport class, protecting other groups that are sharing those transport class resources

## Assembler Exit Reduction

- Add support to SMFLIMxx
  - Memory limits add filters for SAF, and overriding JCL specified memory
  - Memory limits add actions to set dataspace limits and message suppression
- Add Support for JES2 policy based exit reduction
  - Ability to do basic policy based detection and actions
  - Designed to augment existing exits
  - Release independent implementation
- Add support for RACF to validate custom field values with a Rexx program
  - The exit uses system Rexx
  - Existing IRRVAF01 assembler exit support remains
  - Both mechanisms are available for all RACF profile types

## C Header Files

- z/OS 2.4 delivers some C Header files analogous to maclib/modgen mapping macros, in order to facilitate C code development of programs that need to access z/OS data areas.
- The header files are provided in both a data set (SYS1.SIEAHDR.H) and the file system (in /usr/include/zos – a new sub-directory).
- An area of concentration is SMF record mappings, for which header file IFACSMFR is provided. IFACSMFR, via nested includes, provides C mappings for many of the SMF records covered by the IFASMFR macro.

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## Overview, goals & directions

- 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

## AMODE 64 Support / Exploitation

- Exploitation of 64-bit memory, large pages, and non-executable memory
  - RMF Monitor I and II exploitation
  - JES2 Exploitation of 64-bit (post GA deliverable)
  - JES2 Exploitation of read-only and non-executable memory
  - WLM SRM exploitation
  - LE exploitation of read-only and non-executable memory
- Shared storage obtained using IARVSRV no longer requires ESQA
  - Improved scalability of shared storage
- 64-bit obtains (IARV64) now support explicit address with the INORIGIN keyword

## Alternate Subchannel Set for Linux

- In configurations where Linux for Z is running on the same IBM Z server as z/OS and z/VM, many customers traditionally define the entire I/O configuration in z/OS.
- Therefore, HCD (z/OS) needs to be able to define and dynamically activate I/O configurations for any type of OS on the server.
  - With this support, a configuration administrator can define and dynamically activate an I/O configuration for a partition running Linux for Z without losing any capabilities for z/OS or z/VM operating systems.
  - With this support, an HCD/HCM user can define FCP devices to an alternate subchannel set as long as they are not used by z/VM, in order to get relief on usable device numbers in the primary subchannel set.

## IBM Resource Measurement Facility (RMF) (CD 3Q20)

- Display information about System Recovery Boost with the PTFs for APARs OA59852 and OA59321
- With the PTF for APAR OA58726 RMF, CF monopolization avoidance is supported
- With the PTF for APAR OA58727 RMF, reports about storage class memory (SCM) busy percentage on a z15. RMF adds input/output processor (IOP) utilization SCM busy percentage for all IOPs in the I/O Queuing Activity (IOQ) report.
- With the PTF for APAR OA60873, support for transport class statistics (CD 1Q21)

## Improve SVC Dump Capture Time

- SVC Dump processing improved capture times in an unconstrained environment
  - Improved parallelism
  - More aggressive memory usage (CHNGDUMP SDUMP,OPTIMIZE=YES)
- Larger dumps
  - Increase maximum dump size > 200 Gb

## Uncaptured Volume I/O Statistics

- SMF type 42 subtype 5 – added I/O stats, volume contention, cloud data transfers
- SMF type 42 subtype 6 – dataset I/O stats are added by storage subsystem ID
- Can be used to diagnose performance problems

## zHPF VTOC I/O Performance (CD 2Q20)

- Enhancements in DFSMS extend the use of zHPF to VTOC (volume table of contents) I/O done by CVAF and Fast VTOC/VVDS (FVV) services via APAR OA58111.

## Enhanced Capacity management

- z/OS capacity provisioning manager is enhanced with new commands to set and report on LPAR weights

## Larger log stream staging data sets

- Support for IBM zHyperwrite for logger staging datasets and offload datasets

## Allocation throughput improvements

- Enhancements are provided for device availability and serialization when using tape devices

## VSAM exploitation of zHyperLink

- zHyperLink Express® is designed to provide a high-performance data access method on storage subsystems
- Allow VSAM zHyperLink support to be enabled through SMS StorageClass and VARY SMS commands.

\* All performance information was determined in a controlled environment. Actual results may vary. Performance information is provided "AS IS" and no warranties or guarantees are expressed or implied by IBM.

## RMF Updates for Hyperlink

- RMF stores synchronous I/O link statistics on storage controller level in a new data section of SMF 74.8 records (ESS Statistics)
- Cache device related synchronous I/O performance data is collected in SMF 74.5 records (Cache Subsystem Device Activity)
- Reporting on synchronous I/O link statistics per storage controller is added to the RMF Postprocessor ESS report
- Synchronous I/O cache device activity is reported in the RMF Postprocessor CACHE Subsystem Activity report
- New/modified OVW Conditions are provided for synchronous I/O metrics.

## zHyperLink write statistics (**CD 2Q20**)

- Enhancements in DFSMS provide a command to allow users to display zHyperLink write statistics for a data set and optionally clear them. In addition, new SMF fields are created in the SMF type 42 subtype 6 record to show information related to zHyperLink write failures. Support is available on z/OS V2R2 and above with APAR OA57718.

## RMF Enhancements (CD 4Q20)

- RMF reports on z/OS performance and includes the following enhancements:
  - The capability to analyze the performance of recently delivered hardware using callable services, such as Integrated Cryptographic Service Facility (ICSF) format-preserving encryption, Feistel-based encryption, and Quantum Safe digital signatures, is now available with the RMF Postprocessor Crypto hardware report. This is included with the PTF for APAR OA60202.
  - Two remote health check are now available to:
    - Verify the HTTPS (AT-TLS) configuration of the RMF Distributed Data Server (DDS) with the PTF for APAR OA60403.
    - Warn users when SESSION\_PORT(8801) and DM\_PORT(8802) are still being used with the PTF for APAR OA60404. RMF client code no longer uses both ports and IBM recommends removing the options SESSION\_PORT, MAXSESSIONS\_INET, TIMEOUT, DM\_PORT, and DM\_ACCEPTHOST from the GPMSRV## PARMLIB member.

## Inbound Workload Queueing (IWQ) support for IBM z/OS Container Extensions (CD 4Q19)

- z/OS Communication Server's OSA-Express Inbound Workload Queueing support is enhanced to add a new input queue for zCX network traffic.
- The OSA-Express IWQ separation of the zCX traffic from native z/OS traffic provides an optimal Communications Server processing environment for zCX traffic.
  - When IWQ is enabled, the z/OS TCP/IP inbound processing for the zCX traffic becomes zIIP eligible.
  - OSA-Express will direct zCX traffic for protocols TCP and UDP to the zCX input queue. The z/OS IWQ zCX solution will be made available on OSA-Express6S and beyond.
- IWQ zCX is enabled on z/OS V2.4 with PTFs for APARs PH16581 and OA58300.

## 2038/2042

- All application API's should support 2038 or greater
- z/OS still does not support setting the TOD beyond 2042, individual components will support
  - SSL 2038/2042 Updates
- Progress, but not yet at end of job

## Enhanced Transparent Cloud Tiering (CD 4Q19)

- IBM TS7700 Virtualization Engine to be the object storage target for transparent cloud tiering
- This new feature enables DS8000 transparent cloud tiered object data and traditional FICON logical volume data to coexist within the same physical TS7700 cluster
- DFSMShsm supports
  - Migrating data directly from DS8000 disk to TS7700 clusters using transparent cloud tiering and the TS7700 DS8000 object store capability
  - Manages this data the same as cloud object storage data, such that there is no host CPU consumed for data movement and no need for recycle processing
- No additional hardware is required as data movement is done through existing GRID interfaces between the DS8000 and the TS7700, and data is logically partitioned out of the existing resident cache

## Transparent Cloud Tiering Full Volume Dump Support (CD 4Q20)

- z/OS DFSMSdss provides full volume dump support for transparent cloud tiering. This capability is provided with the PTF for APAR OA57526.

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## Overview, goals & directions

- 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 data stored in Filesystems (e.g. zFS, NFS)
- Detect and Mitigate system resource problems
  - Monitor resource consumption and system/sysplex operations in real-time
  - Provide operational insight into anomalies and trends that require attention
  - To mitigate problems quickly, proactively, and autonomically
- Support dynamic modification of shared resources without incurring disruptions in which the resources are temporarily unavailable (“always on”)
- Support state-of-the-art disk replication technologies
  - Data availability (Hyperswap) – locally and at distance
  - Disaster recovery for 2-site, 3-site, and 4-site DR configurations
- Provide support for protecting data against malicious or accidental logical data corruption or deletion, through the use of multiple point-in-time protected copies of the data that can be used to restore or recover the data to its pre-corruption state, either granularly or in aggregate
- 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

## Sick But Not Dead – JES2 Spool Throttling

- JES2 SBND avoidance – SSI provides externals for spool usage resiliency data
- SSI externals can be used by monitoring products for reporting, alerting, etc. in situations where spool resources are nearing their limits

RACF remote sharing VSAM checkpoint files can be relocated or resized dynamically

- New keywords on the TARGET command allow reconfiguration
- Allows for renaming data sets to achieve consistent naming conventions

## TSO/E LOGON Timeout Support

- TSO user at logon screen gets timed out after 5 minutes

## [z/OS Global Mirror \(zGM\) Enhancements](#)

- zGM (aka Extended Remote Copy or XRC) combines hardware and z/OS software for an *asynchronous* remote copy solution that enables critical data to be mirrored between the application and recovery sites while maintaining consistency.
  - Increasing numbers of large enterprises are adopting 4-site DR configurations, with a high availability (HyperSwap) configuration within each region, and some form of DR between regions.
- New XRC enhancements alleviate constraints and allow for more flexible 4-site configurations that enable data center growth while maintaining both high availability and disaster recovery capability without recovery point objective (RPO) increase.

## [Remote Pair FlashCopy \(RPFC\) for XRC](#)

- XRC was enhanced to allow a FlashCopy between primary volumes at the application site which is then mirrored at the recovery site between secondary volumes without disrupting the mirror or consistency at the recovery site.
- Enables production data, production point-in-time copies, and backup data to be available at all sites while maintaining both high availability and disaster recovery capability.

## Logger support for single-system logger for GDPS k-system environment

- GDPS k-systems participate in the sysplex environment, but need to be isolated “as much as possible”
- To this end, System Logger single-system scope Couple Data Sets (LOGRY & LOGRZ CDS) support provide clients with an isolated set of logger CDSes used only on the GDPS-k-system, isolating its logger functionality from the remainder of the sysplex
  - Isolate GDPS k-systems from OPERLOG, LOGREC, and other “sysplex-wide” logstreams used by the rest of the sysplex
  - While preserving the ability to take advantage of pervasive sysplex and z/OS log stream capabilities/technologies, such as OPERLOG, LOGREC, SMF digital signatures and compression, and also to continue to use similar tools/utilities as currently used throughout the sysplex to extract log data, even on the GDPS k-systems.

## Automatic Restart Manager (ARM) support for restarting a system task **(CD 2Q20)**

- Enhancement to IXCARM REGISTER support provided by APAR OA59120, system tasks (for example, ICSF) may register with ARM and be restarted

## Logger transport affinity IBM zAware communication (stack affinity)

- z/OS system logger has been enhanced to allow use of a transport provider name for TCP/IP stack affinity in C-INET configurations when communicating to the IBM zAware server
- This enhancement allows TPNAME(transport-name) to be specified on the z/OS system logger IXGCNFxx ZAI statement
- System logger will use the specified transport-name to set the affinity when establishing the IBM zAware socket communications

## Device-based Management & Multiple Subchannel Sets (MSS)

### Exploitation

- XRC was enhanced to utilize 5 digit device numbers, instead of volsers, to enable MSS exploitation for the volumes in the XRC session.
- Allowed for more flexible and easier to manage configurations and provided constraint relief for 64K device numbers.

## Online zFS to zFS migration

- Introduced in z/OS V2.3, the BPXWMIGF migration tool provided ability to migrate HFS to zFS transparently.
- In z/OS V2.4, it now supports zFS to zFS migration transparently also.
- Useful in migrating zFS file systems from one volume to another volume, without impacting the application.

## zFS High Availability support

- Applications running in a sysplex environment and sharing read-write mounted zFS file systems will no longer be affected by an unplanned outage.
  - Unplanned outages will be transparent to the application on other members of the sysplex and will no longer result in zFS file system I/O errors.
  - Can be specified:
    - as a mount option on individual mount statements to affected individual zFS file systems
    - globally in IOEFSPRM to enable this support for all read-write mounted zFS file systems
    - dynamically to change already mounted zFS file systems.
  - Will be ignored for applications that use zFS file systems in a single system environment.

## Faster Mount of zFS File Systems (CD 2Q20)

- With the PTFs for APAR OA59145, new function is being added to avoid a 65 second wait time when mounting a z/OS file system

## Coupling Facility (CF) Monopolization Avoidance (CD 2Q20)

- New function introduced by coupling facility control code level (CFLEVEL) 24 on z15 servers to prevent a runaway sysplex application from monopolizing a disproportionate share of CF resources.
- APAR OA56774 provides this support.

## Transactional VSAM (TVS) Auto-Commit Support

- TVS is an optional z/OS feature that enables batch jobs and CICS transactions to concurrently update shared recoverable VSAM data sets thus reducing the batch window for CICS and other VSAM applications and improving system availability.
  - Currently, to fully exploit TVS, batch applications must be modified to use z/OS Recoverable Resource Services (RRS) to issue sync point commits in order to avoid holding too many locks which could result in elongated CICS response times.
- With the new TVS Auto-commit support, users can avoid making costly source code changes to batch applications and instead TVS will invoke RRS to issue sync points commits on behalf of eligible batch applications based on specified parameters.
  - Specify the TVSAMCOM parameter in the job step JCL OR
  - Specify a system level commit parameter in the IGDSMSxx member of SYS1.PARMLIB.
  - Note: The JCL value will override the value specified in IGDSMSXX.

## Runtime Diagnostics

- Runtime Diagnostics now has more comprehensive message analysis to pinpoint problems by identifying critical and other outstanding WTORs

## z/OS Workload Interaction Correlator (**CD 1Q20**)

- Generate standardized, synchronized data every 5 seconds
  - High value data with low generation cost
  - Time sequenced short interval summary data enables analytics to establish interval activity baselines for the purpose of detecting anomalies
- Enable entire z/OS and middleware stack analysis through a common analytics engine
- Bucketize workload by software stack dimensions (core type, job size, job priority)
- Support enhanced via PTFs for APAR OA57165 & OA60372 (**CD 1Q21**)
- **New priced feature.** ([Announce](#))

## z/OS Workload Interaction Navigator (**New Product 1Q20**)

- A single interface to analyze Workload Interaction Correlator data. Correlates and recognizes multi-domain anomalous activity with cross-sectional views with exceptional job detail per bucket.
- Dynamically recognize anomalies in a single time interval or analyze two time intervals
  - Anomalous activities are temporally correlated and contextually prioritized for a given time interval to present only the most impactful issues
  - Cause and victim relationships can easily be visualized across disparate activities – reducing root cause identification time
  - Directly comparing the activities across two intervals enables the ability to identify differences, providing validation that workload / software changes have the desired effect
- **New Offering** ([Announce](#))

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## Overview, goals & directions

- Provides system programmer efficiency, confidence, and consistency
  - Consistent z/OS installation platform for IBM & Vendors
    - Packaging, delivery, installation, deployment, configuration, and validation
  - Simplified installation of SMP/E service
  - Improved security integration
    - Detection, validation and correction
  - Focus on common tasks
    - Deliver standard service catalog
    - Capturing site unique activities
    - Can be integrated with change management
    - Optionally self service provisioning (Cloud)
  - Enhanced z/OS release upgrade process
    - More discovery and more automated actions
- Basic facilities to ‘get the job done’
  - Entitled with the operating system
- Enhanced facilities available
  - Features or products (IBM or Vendor)

## [z/OSMF Software Update Task \(CD 3Q20\)](#)

- This new task is available with the PTFs for APAR PH28412 on z/OS V2.3 and V2.4.
- The graphical user interface in Software Update provides a simplified and guided process to install any SMP/E-packaged PTF, regardless of software vendor.
- SMP/E HOLDDATA contained in updates can be difficult to manage, but Software Update enables you to review and track this information in an orderly fashion. All installation output is saved so you can review it at any time.
- There are three options for maintenance
  - Corrective. Install individual software updates to fix a problem. Clients can identify the updates to be installed by name.
  - Recommended. Install all software updates that are recommended by a software vendor. The IBM recommendations are those designated as IBM Recommended Service Upgrade (RSU) fixes.
  - Functional. Install software updates to support new hardware, software, or functions. Software Update identifies the fix categories associated with available updates, and clients can then select fix categories to install all updates associated with those categories.
- Clients can continue to use their existing methods to install SMP/E-packaged software updates, such as with batch jobs, but they might find a simpler experience requiring lesser SMP/E skills by using z/OSMF Software Update instead.
- To learn more about z/OSMF Software Update, including helpful instructions on how to get started, see the [Software Update with z/OSMF](#) web page.

## DFSMS UNIX File Backup

- 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.
- New enhancements to backup and restore individual z/OS UNIX files residing in zFS (z/OS File System) data sets is integrated into existing DFSMSHsm backup / recover and DFMSDss dump / restore capability, allowing for centralized data management across the z/OS platform.
  - The support is intended to subsume the capabilities provided by the existing IBM Tivoli Storage Manager (TSM) z/OS UNIX System Services Backup-Archive Client.
  - DFSMS will **not** provide support for z/OS UNIX files found in Hierarchical File System (HFS) data sets.

## New Automount Function

- Can be configured to create new zFS file systems that will be cataloged in user catalogs instead of the master catalog
- Allows for segregation of catalog entries based on naming conventions and integrates into clients' existing storage management and security policies

## Better administration for zFS

- `zfsadm chaggr` now support wildcard capability via PTF for APAR OA59435 (**CD 1Q21**)

## New support in NFS to help customers migrate from DFS/SMB (CD)

- A new migration health check to help customers identify their usage of DFS/SMB (Distributed File System / Server Message Block)
- To aid in NFS Server configuration, a z/OSMF (documentation only) work flow with step-by-step instructions - especially useful for the first time user.
- New z/OS NFS Client utilities, namely MVSLOGIN and MVSLOGOUT (that allow a non-z/OS client to manage SAF authentication to a z/OS host) and SHOWATTR (that displays the z/OS NFS server attributes) are delivered for the Windows 10 NFS Client.
- Kerberos support has been provided for NFS V3 - the level of protocol supported by Windows 10 to control access to NFS network shares
  - Also allows for integration with Active Directory for UID/GID specification
  - Can enable end-to-end encryption between z/OS and Windows environments
- Multiple NFS servers in a single LPAR (OA 57577)
- New Windows Prefix support improving windows client integration. This is available for z/OS 2.3 and higher with PTF for Apar OA57493 (CD 1Q21)
- **Note:** z/OS V2.3 will be the last release to support the DFS/SMB file-sharing protocol

## NFS Server

- UNICODE conversion support based on mount system attributes.
- Support for sharing of compressed data sets requires no configuration changes to the NFS Server and is transparent to end users.

## JES2 Enhancements for Migration

- JES3 Statement of Direction will lead to migration to JES2
- JES3 to JES2 migration support
  - Disk reader support now in JES2
  - //ROUTE XEQ JECL support
  - Support for multiple jobs in an NJE job stream
- JES2 will always be installed with z/OS

## JES2 enhancements

- Spool compression and encryption via Apar OA57466 (**CD 2Q20**)
- Checkpoint version improvements (post GA deliverable)
  - Exploit 64 bit storage
  - Improved performance and reduced working set size
- Replace exits with policies
  - JES2 will provide support for conditions and actions
  - Built in to policies that allow actions based on conditions
  - Condition: job name is ABC, action: set job class to Q
  - MAS wide support is updated with the PTF for OA58190 (**CD 3Q20**)

## z/OS Cloud Provisioning and Management

- Entitled part of z/OS that delivers a self service Cloud aligned Provisioning tool for Software including IBM Middleware
- Support for Red Hat OpenShift (**CD 2Q20**) and IBM Cloud Private (ICP)
- Via the IBM z/OS Cloud Broker ([Announcement](#))
- Provision a single item or a composite within a system or Sysplex, or even across Sysplexes (**CD 1Q20**) delivered via UI66660
  - Includes z/OS Cluster support and coordination of networking
  - Deploy several CICS instances for example in an HA configuration
  - DB2 cluster support dependency for DB2 data sharing group workflows
- z/OS Cloud provisioning security and security simplification
  - Support for Users and/or Groups (**CD 1Q20**)
  - Common Security XML Descriptor for Cloud supports ANY security product
- Metering and capping for memory and Disk in addition to CPU (**CD 1Q20**)
  - Providers can monitor memory consumed by any instance or tenant
  - Providers can isolate Disk and apply Disk limits (caps) for a tenant
  - Providers can enforce memory maximums (caps) for a tenant
- The Workflow Editor task enhancements (**CD 1Q20**)
  - The Workflow Editor includes a "toolbox" of IBM-supplied steps
  - The files for a workflow, also support sequential or partitioned data
  - The editor retains long pathnames, has a large editor area, and also edits property files
- Improved user experience with PTF for APAR PH29813 (**CD 1Q21**)
- For additional details about these enhancements, see the [What's new in IBM Cloud Provisioning & Management for z/OS](#) blog.

## Cloud Storage Access for z/OS

- Cloud storage makes it possible to store practically limitless amounts of data, simply and cost effectively and access it from anywhere in the world using internet protocols.
  - Data and its associated metadata are stored as discrete objects with a unique ID in a flat address space designed to be both scalable and flexible.
  - Cloud storage allows users to reduce the complexity of their data storage environments and to minimize total cost of ownership.

## Transparent cloud tiering (TCT) for DS8000

- TCT developed in conjunction with z/OS and DFSMShsm and provides automated, policy-based, server-less movement of archive and backup data directly to a cloud object storage solution using OpenStack Swift or S3-compatible interfaces.
  - DFSMShsm automatic migration supports TCT via SMS management class policy and continues to automatically recall a data set to primary storage when it is referenced without any parameter changes.
  - TCT supports migrate and recall of data to volumes in both simplex and copy services relationships, including 2-site Metro Mirror, FlashCopy, and Global Mirror. Only MTMM and XRC continue to be restricted.
  - TCT supports encryption to provide security of data in flight.
  - TCT DFSMSdss Full volume Dump was delivered in APAR OA57526 (**CD 3Q20**)

## OAM Cloud Tier Support (CD 3Q20)

- With the PTF for APAR OA55700 for z/OS V2.3, and later, OAM's cloud tier support is now available. With this support, DFSMS OAM has added a new cloud tier to its existing storage hierarchy. OAM objects can be managed and stored as objects 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. Also provided is the capability to recall an object stored in the cloud to the disk level of the storage hierarchy. OAM-managed backup copies will continue to be supported as they are today to removable media, typically virtual or physical tape.
- This support satisfies a previously announced statement of direction

## zlsos Extended Processing

- Enhancements have been provided to the zlsos (list open files) utility of z/OS UNIX System Services that show extended processing information, including start time, elapsed time, CPU time, thread number, state of the process read-write open mode, and other related information.
- In addition, the zlsos utility can generate output in JSON (JavaScript Object Notation) format, enabling clients to parse and build reports

## OpenSSH Direct CPACF Support

- Improved performance using direct CPACF instructions
- This function is mutually exclusive with FIPS 140-2 compliance

## True Random Number Generation for z/OS UNIX

- Simplified configuration for random numbers when running on IBM z14

## Hardware Configuration manager (HCM) Performance Improvement

- An option is provided to limit diagram re-painting to improve large configuration displays

## BCPii

- LPAR Group
  - Provides the user with real time information regarding what is currently configured for the group
  - Updates will take effect immediately for all active images associated with the group
- Group Profile
  - These profiles allow the user to provide and alter information that will be used when an image is activated
  - The updates will not take effect until all active CPC images that correspond to the referenced Group Profile are deactivated and then re-activated

## Health Checks

- A number of health checks have been added for various z/OS core components and other system products to run under the IBM Health Checker for z/OS
- For example:
  - CHECK(IBMJES2, JES2\_CKPT\_CONFIG\_nnnnnnnn)
  - CHECK(IBMINFOPRINT, ZOSMIGV2R3\_NEXT\_INFOPRINT\_DYNCFG)
  - CHECK(IBMINFOPRINT, ZOSMIGV2R3\_NEXT\_INFOPRINT\_IPCSSL)
  - CHECK(IBMINFOPRINT, INFOPRINT\_CENTRAL\_SECURE\_MODE)
  - CHECK(IBMISPF, ISPF\_WSA)
  - CHECK(IBMALLOC,ALLOC\_TAPELIB\_PREF)
  - CHECK(IBMUSS, ZOSMIGV2R3\_NEXT\_USS\_SMB\_DETECTED)
  - CHECK(IBMVSM, ZOSMIGV2R3\_NEXT\_VSM\_USERKEYCOMM)
  - CHECK(IBMVSM, VSM\_RUCSA\_THRESHOLD)
  - CHECK(IBMICSF,ICSF\_MIG\_WEAK\_CCA\_KEYS)
  - CHECK(IBMICSF,ICSF\_WEAK\_CCA\_KEYS)
  - <check for withdrawal of VTAM Common Management Information Protocol (CMIP) after V2R4 >
  - ...

## LPA APF Authorization

- Starting in z/OS 2.4 LPA ADD commands such as SETPROG and PROGxx can flag missing APF authorization for specified data sets.

## SMF Dump Utility enhancement

- Add support to the IFASMFDP and IFASMFDL SMF dump utilities to optionally summarize the data processed by record type and subtype.

## Device Allocation enhancements

- Externalize TIOT usage information to allow installations to proactively track and monitor TIOT usage for jobs.
  - TIOT usage information will be available to the IEFACTRT installation exit to allow installations to perform their own monitoring.
  - TIOT usage information will also be included in SMF type 30 records.
- Enhancements to Job Unallocation processing for tape devices
  - Changes to autoswitchable tape device management that will reduce or eliminate job failures when system functions are using a tape device (failures associated with message IEF474I).
  - No JCL updates or system configuration changes are needed for this

## Tape Allocation Enhancements (CD 4Q20)

- a new keyword SMSHONOR is added to the **UNIT** parameter on the DD statement. MVS Allocation would then honor what was specified as long as there was an intersection between what SMStape considered eligible and what was specified on the **UNIT** parameter. Capability to select which devices could be used through SMS constructs (policies). With the PTF for APAR OA59161 for z/OS V2.3, and later, SMSHONOR can be enabled through the SMS tape storage group construct.

## SDSF – System Display and Search Facility

- 18 new tables of information, 31 new columns on existing displays, 24 new actions on displays as well as general usability and functional improvements
- New tables include:

Extended Operator Console Display	OMVS options	Link pack directory
JES subsystems	JES2 resource monitor alerts	Enqueue by datasets
Workload Manager policy information	Workload Manager service classes	Workload Manager report classes
Workload Manager resource groups	Workload Manager workloads	Job memory objects
Job dd names	JES3 Job-class members	JES2 Checkpoint information
Coupling (XCF) members/groups	JES2 Resource usage by job name	JES2 Resource information
- SDSF new general usability enhancements
  - ISPF view support is addition to ISPF browse
  - Ability to hide columns on any table
  - Ability to better control point and shoot field highlighting
  - Improvements to the z/OSMF browser based user interface
- Display for JES2 spool encryption, and resiliency
  - Reporting on encryption
  - Reporting on spool and control block usage
- Coverage in ISPF based user interface, z/OSMF browser based user interface, and SDSF REXX
- SDSF is enhanced with the PTF for APAR PH26552 to display information about System Recovery Boost. **(CD 3Q20)**

## DFSMShsm file mode hosts (CD 2Q20)

- A new FILEMODE for DFSMShsm enables an additional HSMplex to exclusively process UNIX files. Any DFSMShsm requests for UNIX files are automatically directed to the DFSMShsm hosts configured with FILEMODE. This support enables clients with very large existing DFSMShsm environments to add DFSMShsm UNIX data set backup processing without impacting their classic volume and data set environment. This support is available on z/OS V2R3 and higher with APAR OA58870.

## DFSMShsm recover UNIX files to a new directory (CD 2Q20)

- DFSMShsm adds the capability to recover UNIX files to a directory other than the original directory from the time of the backup. This support is available on z/OS V2R3 and higher with APAR OA58612.

## DFSMSrmm Enhancements

- Extend usage of SMS management class with new attributes for retention and volume set management
- Enhance EDGUTIL for repairing some attributes of tape volumes and data sets
  - Attributes include expiration date, retention method, fields related to catalog status, and last reference time
- An easier to use ‘Default Table’ replaces the UXTABLE
- Tape data sets that are expired and no longer retained but reside on a volume that is not scratched can be denied access
- Improvements to warning messages, multi-system parmlib, and searching

## DFSMSrmm plug-in for z/OSMF **(CD 2Q20)**

- In addition to the ISPF dialogs and TSO user interfaces available today for DFSMSrmm (RMM), support for a modern graphical user interface via a z/OSMF plug-in is now available on V2R4 with APAR OA59499.
- PTF for APAR OA59727 makes it possible to use the z/OSMF plug-in to view data sets defined to DFSMSrmm, and to export data to a CSV format file. **(CD 3Q20)**

## Infoprint Server updates

- Dynamic configuration enables configuration changes without stop/restarting of the Infoprint Server daemons
  - Dynamic-Configuration is now the default
- Infoprint Central (web browser application) enhancements
  - Increase message classes up to 36 for PSF and AFP Download Plus work selection criteria
  - Provide predictable UID for Infoprint Central's Apache web server task so WLM can be used to manage the task resources
  - A secure connection to the Apache server will be the expected default (SSL usage and https:)
- Improve diagnostics
  - SAF denied accesses will be logged to the Infoprint Server log
- Improved Administration through ISPF
  - Panels are provided for updating the printer inventory rather than editing a file

## Content (Product Documentation) Changes and Enhancements

- General
  - Timely content refreshes will continue after V2.4 GA with as-needed updates. Subscribe to the z/OS library PDFs to receive notifications about updated content.
  - The Migration guide is replaced by the Upgrade workflow.
  - The "Summary of Message and Interface Changes" (SMIC) is retitled "Release Upgrade Reference Summary" (RURS) and streamlined to contain only the lists of new/changed/deleted messages and the five tables for SMF and SYS1 member changes.
  - New content solutions provide assistance for all phases of the user experience for a function.
    - They can consist of a variety of content, including comprehensive content collections in the Knowledge Center (c3s), videos, z/OSMF workflows, podcasts, and other content.
    - Web solutions help you get started with the function and provide links to all of the related content.
    - A new content solution home page helps you browse and use content solutions.
  - z/Favorites is updated to highlight new function in V2.4.

Find it all at the z/OS Internet Library:

<https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/zosInternetLibrary>

## Content (Product Documentation) Changes and Enhancements

- Search
  - Search catalog function is fully integrated into KC for z/OS V2.4. In addition to searching the entire release, you can search at the element/feature library level or within an individual book.
  - Looking up messages is easier than ever with two new LookAt-based options:
    - The "IBM Z: Look@ Knowledge Center" online tool lets you conduct targeted message searches within or across products in KC.
    - With the new LookAt API, you can look up messages in KC4z using a KC based version of the original LookAt facility.
  - KC4z has a new component that "normalizes" HTML content to improve search.
- KC4z
  - KC4z is upgraded to 2.0 and now has the same look and feel as the online IBM Knowledge Center.
  - V2.4 includes a new workflow to help you provision the KC4z plug-ins that you obtain from the FTP site.
  - The content repository for KC4z is expanded to include several software products.

Find it all at the z/OS Internet Library:

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## Overview, goals & directions

- Exploit platform features and enable efficient network access
  - Support latest OSA and RoCE hardware adapters, HiperSockets, 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
- Application development and workload enablement
  - Enable efficient network access to Linux applications deployed in z/OS Container Extensions (zCX)
- Enhance availability and resilience
  - Enhance application availability in parallel sysplex environments through improved sysplex autonomics

## System SSL and AT-TLS support for TLS V1.3

- Basic support for the latest TLS version standard (RFC8446)
- RACF and PKI support for new signature types
- Improves the security of TLS-protected traffic
- AT-TLS is enhanced to allow new System SSL TLS 1.3 features to be exploited via policy enhancements (transparently to software depending on AT-TLS configuration)
- Exploitation is component specific, check component documentation for support

## TN3270E Telnet Server Express Logon Feature support for Multi-Factor Authentication

- TN3270E Express Logon Feature can use either passticket or a multi-factor authentication token from SAF
  - Note: this function has a dependency on RACF and IBM MFA

## HiperSockets Converged Interface (HSCI)

- HiperSockets Converged Interface (HSCI) allows configuration of HiperSockets on z/OS without defining additional network interfaces.
- Specifying the new AUTOIQDC keyword in the TCP/IP profile dynamically and transparently adds a HiperSockets interface that is converged with the OSA interface, and is treated as one interface by the layers above.
- TCP/IP will automatically use HiperSockets when the peer is co-located on the same CPC and reachable over HiperSockets
- This provides two major benefits:
  - Supports layer 2 connectivity from z/OS to Linux and the z/VM HiperSockets bridge
  - Simplifies the move of a z/OS instance to another CPC by removing the requirement for reconfiguring the HiperSockets interface to match the IP subnet(s) on the new CPC.

## [z/OS Encryption Readiness Technology \(zERT\)](#)

- zERT positions the TCP/IP stack as a central collection point and repository for cryptographic protection attributes for:
  - TCP connections that are protected by TLS, SSL, SSH, IPsec or are unprotected
  - Enterprise Extender connections that are protected by IPsec or are unprotected
- zERT discovers the security sessions and their attributes via:
  - Stream observation (for TLS, SSL and SSH) – the TCP/IP stack observes the protocol handshakes as they flow over the TCP connection
  - Advice of the cryptographic protocol provider (System SSL, zERTJSSE, OpenSSH, TCP/IP's IPsec support)
- Reported through new SMF 119 records via:
  - SMF or
  - New real-time NMI services
- Reduce SMF recording overhead for zERT. Provided by APAR PH24543 **(CD 2Q20)**

## [z/OS Encryption Readiness Technology \(cont.\)](#)

- zERT Discovery – V2.3 base element
  - Attributes are collected and recorded at the connection level
  - SMF 119 subtype 11 “zERT Connection Detail” records – written at each SMF interval
  - These records describe the cryptographic protection history of each TCP and EE connection
  - Measures are in place to minimize the number of subtype 11 records, but very large numbers of these records could still be generated depending on the network traffic into and out of the z/OS system
- zERT Aggregation
  - Attributes collected by zERT discovery are aggregated by security session
  - SMF 119 subtype 12 “zERT Summary” records
  - These records describe the repeated use of security sessions over time
  - Aggregation can greatly reduce the volume of SMF records while maintaining the fidelity of the information – well suited for reporting applications
- zERT Network Analyzer, a new 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
  - Improved database configuration and schema via PH16223 (**CD 1Q20**)

## IBM Configuration Assistant renamed IBM Network Configuration Assistant

### Network Configuration Assistant support for alternate Configurations

- The Network Configuration Assistant is enhanced to support TCP/IP profile alternate configurations
- Alternate configurations can be used for planned or unplanned outages, failover or flexibility in moving z/OS images

### Multiple installation support for Network Configuration Assistant

- The Network Configuration Assistant is enhanced to enable you to install multiple configuration files in a single action.
- With this support, you no longer have to enter and act on a separate installation panel for each file in a group to be installed.
- You can use this new action on any installation panel that has more than one file listed on it.

## Inbound Workload Queueing (IWQ) Support for IPSEC

- In support of OSA-Express6S, z/OS Communication Server's Inbound Workload Queuing (IWQ) support (enabled with INBPERF DYNAMIC WORKLOADQ) for QDIO interfaces (OSD CHPID type) is enhanced to add a new input queue in support of IPSEC network traffic.
- With IWQ enabled, OSA-Express6S will direct IPsec traffic for protocols ESP and AH to the IPsec input queue.
- The OSA-Express6S separation of the IPsec protected traffic from non-IPsec protected traffic provides for an optimal Communications Server processing environment for both types of traffic

## Code page enhancements for CSSMTP

- The Communications Server SMTP (CSSMTP) mail client is enhanced to support multibyte character sets and to provide improved code page support for non-1047 characters in the mail headers.
- Enhancements are intended to facilitate migration from SMTPD to CSSMTP
  - Additional enhancements added via PH18237 (**CD 1Q20**)

## TCP/IP Sysplex Autonomics Enhancements (CD 4Q19)

- Sysplex autonomics support enhanced to monitor health of IPsec infrastructure relative to sysplex traffic
- For use with critical applications that depend on Sysplex Wide Security Associations (SWSA)
- Delay joining the sysplex until IPsec infrastructure ready to go
- Ongoing monitoring once the system joins the sysplex
- Honors existing SYSPLEXMONITOR parameters like RECOVRY, AUTORUN
- Support provided by PH12788 and PH16303

## Sysplex Notification of TCP/IP Stack Join or Leave

- Support for ENF notification when TCP/IP triggers a recovery event (leaving the TCP/IP Sysplex group) as a result of a “sick but not dead” condition, and when/if it rejoins the Sysplex
  - New events for ENF 80 signal
  - Allows middleware/software to perform any needed recovery actions
  - Should only be interesting to any middleware that has specific requirements for coordinated recovery with TCP/IP (most middleware or software will not require awareness)

## Shared Memory Communications Version 2 (SMCv2) multiple IP subnet support (CD 3Q20)

- Currently, SMC for SMC-R and SMC-D is limited to communications for hosts attached to a common IP subnet. SMCv2 defines SMC over multiple IP subnets. The SMCv2 multiple IP subnet support extends SMC capability to additional application workloads that were previously ineligible for SMC. z/OS V2.4 delivers SMCv2 multiple IP subnet capability for SMC-D (SMC-Dv2) with the PTFs for APARs PH22695 and OA59152. 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 the z15.

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## Overview, goals & directions

- Pervasive Encryption
  - Additional support for more data (in flight and at rest)
  - Simplified ability to achieve security compliance
- System hardening
  - Detection of elevating privilege
  - Multi-Factor Authentication advancements
  - Provide password alternatives for APIs
  - Identification of common configuration concerns
- Standards
  - Continue strong encryption support for the platform
    - Evolve ahead of industry standards

## Pervasive Encryption

- z/OS V2.4 plans to continue to drive pervasive encryption efforts within an enterprise:
  - z/OS policy-based encryption options that can help clients protect their critical business data have been enhanced to support additional z/OS data set types, including:
    - PDSE V2 (not including program objects)
    - Basic, large format, and EXCP enhancements for SMS data sets provided by APAR OA56622  
**(CD 3Q20)**
    - RACF remote sharing VSAM checkpoint files
    - JES2 spool encryption
  - These enhancements allow users the ability to encrypt data, in most cases, without application changes and simplify the task of compliance.

## RACF Enhancements

- Improved PassTicket security
  - Today, a PassTicket key can either be masked and stored in the RACF database, or encrypted, and stored in ICSF.
  - Enhancements in RACF provide new capabilities to facilitate the use of encryption with ICSF as the key store for PassTicket keys in order to provide enhanced PassTicket keys security and protection against cyber attacks. The new functions include :
    - Command and programming interfaces to report on the method of protection for PassTicket keys, and, for encrypted keys, the ICSF key label name.
    - A function to convert masked keys to encrypted keys without needing to change the keys.
    - The ability o use pre-existing keys in ICSF for application PassTickets.
- Improved PassTicket security
  - z/OS plans to add additional RACF PassTicket support. This includes:
    - Stronger cryptographic algorithm
    - Configurable expiration time
    - Optionally Expanded character set
    - Improved diagnostics
    - Recording to SMF
    - Co-existence and Migration
  - Available on z/OS 2.3 and up with PTF's for Apar OA59196 and OA59197  
**(CD 1Q21)**

## RACF Enhancements

- Enhanced RACF usability and threat detection
  - RACF is enhanced to enable custom fields to RACF general resource and DATASET class profiles
    - For all profile types, the ability to validate the value of a field using a System Rexx program is provided, removing the need to code the existing IRRVAF01 exit, which is also supported for all profile types, in assembler.
  - RACF is enhanced to allow the retrieval of DATASET class profile fields using the R\_admin callable service (IRRSEQ00) and the IRRXUTIL rexx interface.
    - This capability allows for extensive scripting of security administrator functions using the Rexx programming language.
  - The RACF IRRXUTIL rexx interface is enhanced to allow the retrieval of a general resource class definition from either the static or dynamic Class Descriptor Table (CDT).
    - There is a corresponding "next" function that enables a caller to iterate through CDT entries.
    - The current SETROPTS settings for the class can be optionally requested in the same call.
    - This capability enhances the RACF scripting ability mentioned above.
  - RACF also can detect changes to a user's security environment, including change in privileges.
    - A new message is issued when such a modification is detected.
    - Exceptions can be defined for trusted applications in order to suppress the message for users of such an application.

## Security Standards

- OpenSSH is the predominant secure terminal and file transfer program on open source systems and encrypts all traffic to eliminate eavesdropping, connection hijacking, and other attacks.
- To maintain currency and ensure z/OS clients have the latest enhancements and fixes, z/OS OpenSSH is updated to the openssh.com 7.6p1 level.
- With OpenSSH 7.6p1, significant new features include:
  - Support for new key exchange (KEX) algorithms, including:
    - diffie-hellman-group14-sha256
    - diffie-hellman-group16-sha512
    - diffie-hellman-group18-sha512
    - curve25519-sha256
  - Support for new ssh-ed25519 and ssh-ed25519-cert-v01 key algorithms.
  - Support for the new chacha20-poly1305 cipher.
  - Enhancements to the SMF Type 119 subtype 94 and 95 (ssh / sshd connection started) records will include a section that identifies the IP addresses and ports for the connection.
  - Elliptic-curve DSA (ECDSA) keys are now supported in key rings and in FIPS mode.
  - Key ring keys will now use System SSL for signature creation and verification.
  - A new ssh-proxyc command is added, which can be used by the ssh client to connect through SOCKS5 proxy servers.

## Logger support for more granular security controls for logstreams

- Ability to permit logstream write-only access
- Reading, deleting, or modifying a logstream can be defined with a higher privilege level than basic write-only access
- Enhanced security options for logstream write-only access

## System SSL support for PKCS#7

- System SSL supports the creation of PKCS#7 signed data message with a detached signature
  - This allows the data to reside outside of the PKCS#7 signed message

## User Key Common Requestors update

- z/OS v2.4 no longer allows or supports user-key common storage by default
- A new healthcheck, slip trap, and SMF reporting are available to identify users of user key common storage.
- An enhanced protection mechanism is provided as well as the means to restrict access through SAF security protection
- To continue to use userkey common requires a z/OS priced feature (RUCSA)

## Support for RACF Identity Tokens

- Enhance SAF and RACF authentication processing to support generation and validation of Identity Tokens
- Identity Tokens are in the format of a JSON Web Token (JWT)
  - <https://tools.ietf.org/html/rfc7519>
- Identity Token support will allow z/OS applications and RACF to link together multiple authentication API calls and replay proof of authentication.

## MCS passphrases

- z/OS Console Services is enhanced to enable the use of MCS logon passphrases (long passwords) through security policy profile specification.

## LDAP RACF back-end (SDBM) enhancement

- LDAP is enhanced to eliminate the 4096 restriction on the number of RACF entries returned on a search request
- Enhanced search filters allow more standard queries of RACF information

## PDUU (Problem Diagnostic Upload Utility) Enhancements

- PDUU is enhanced to support HTTPS protocols to transfer service documentation to IBM.
- Sending service documentation via HTTPS provides additional secure options for customers

## TSO/E LOGON Special Character Support

- Allows line mode LOGON to accept special characters, exploiting full character set supported by Security product

## RMF Monitor III support for Crypto

- New RMF Crypto activity reports
  - Hardware overview, accelerator activity, co-processor activity
- Available in 3270 , DDS Server & browser

## NAS (Kerberos)

- Support Flexible Authentication Secure Tunneling (FAST)
- Support new SHA2 encryption types

## PKI Services

- Support for Enrollment over Secure Transport (EST)
- Support the generation of certificates for TLS 1.3
- Support synchronous certificate generation from the web page interface

## Data Privacy for Diagnostics **(CD 3Q20)**

- Support redacting sensitive data in dumps
- Mark sensitive memory areas and remove from a dump before sending to IBM or a vendor
- New z/OS Diagnostics Analyzer adds an additional post processing step that detects and redacts additional sensitive data in previously untagged pages **(CD 4Q20)**
- All without impacting the dump capture time.
- Required and available maintenance for Data Privacy for Diagnostics:
  - Fix Category (IBM.Function.DataPrivacyForDiagnostics)
  - Keyword (DPFD/K) R2.3

## IBM SMF Quantum Safe Signatures (CD 4Q19)

- z/OS V2.4 extends the digital signature support for SMF records written to log streams to optionally include a second digital signature. When enabled, the second signature uses a quantum safe algorithm to provide an alternative to current algorithms that have been deemed at risk in a quantum computing environment
- SMF 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 through a PTF for APAR OA57371 and requires Cryptographic Support for z/OS V2.2 - V2.4 (HCR77D1) and IBM z15.

## Improved auditability (CD 3Q20)

- Support is added to the password syscall to include the caller's Port of Entry IP address when calling the System Authorization Facility (SAF)
- The security product can include this IP address in SMF Type 80 records.
  - Improving logging and auditing
- This support is available on z/OS V2.3, and later, with the PTF for APAR OA59444.

## [z/OS Authorized Code Scanner \(New Feature 2Q20\)](#)

- The IBM z/OS Authorized Code Scanner is a new, optional priced feature to z/OS that provides automated system integrity testing in a dev/test environment as part of DevSecOps modernization. It scans for Program Calls (PCs) and Supervisor Calls (SVCs) available to all address spaces on a z/OS image and generates a series of tests that dynamically scan them for integrity.
- The output of this scan provides in-depth diagnostics whenever a potential vulnerability is found to facilitate remediation in order to further strengthen the security posture of the client's configuration of z/OS.
- **New Feature Announce** ([Announce](#))

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## Overview, goals & directions

- 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
- 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
  - OpenSSH, Xvfb
  - WAS Liberty
- Exploitation of IBM Z-specific technology (including HW) to further advantage application deployment on our platform

## Web enablement toolkit

- New sample program for JSON text-rendering
- HWTJDEL service enables JSON deletion
- HTTP proxy support has been enhanced to provide both basic authentication to “authenticating” proxy servers and AT-TLS interoperability support for proxy users
- The JSON parser can now parse and perform various other services on text in Unicode. The parser will auto-detect if the text is in EBCDIC (codepage IBM-1047) or UTF-8 (codepage IBM-1208) encoding and process the text appropriately.
- New HWTJSENC service can be used to manually set the encoding.
- New HWTJGENC service can be used to retrieve the encoding used to parse the document.
- The user application can now limit the search scope of a JSON text by using the new SearchType value, HWTJ\_SEARCHTYPE\_SHALLOW
- “Patch” & “Options” added to Web Enablement Toolkit **(CD 2Q20)**
- Server Name Indication (SNI) when System SSL usage is specified, and support for TLS 1.3 **(CD 2Q20)**
- Enhanced tracing to help with debugging using environment variables. **(CD 2Q20)**
- Support provided by APAR OA58707 **(CD 2Q20)**

## Upgraded X-Windows Virtual Frame Buffer

- An upgraded version of X-Windows Virtual Framebuffer (Xvfb) has been provided. Formerly included in IBM Ported Tools for z/OS product, this delivers Xvfb X11R6.9 and is now included as part of the z/OS program product. Xvfb is an in-memory display server and enables a customer to run graphical applications without a physical display device. It is especially useful when testing an X-Windows server without using real hardware.

## Program Management Binder

- New option called STRIPSEC=IGNEXP (Ignore Export) will remove unreferenced sections (CSECTs) even though they are in the exported symbols table. This has the potential of reducing the size of the program object or load module.
- COMPAT helps with program object compatibility
  - A new sub-option can be specified on the COMPAT option, that will allow the PM Binder to select the minimum PM level that supports the features actually in use for the current bind. This new function is especially useful for software vendors or anybody building and distributing programs to other customers/sites/locations where valuable information needs to be preserved in the PO (problem determination attributes, compression, etc...).

## Language Environment Improvements

- CEEDUMP and IPCS LEDATA Verbexit improvements show full service level information in the traceback section, when users use the SERVICE compiler option to specify the service level string of COBOL, PL/I or XL C/C++ programs.
- Language Environment-enabled applications can now be rolled back when they are terminated using a POSIX-defined terminating signal and when there are no registered signal handlers. This allows applications to no longer commit in-progress updates in situations with unhandled terminating signals.
- Taking advantage of the Instruction Execution Protection Facility (IEPF) introduced in z14 family of servers, Language Environment has added a new non-executable heap storage to the 31-bit environment used for variable buffer allocation. In addition, the entire 64-bit library heap is allocated as non-executable memory. The use of non-executable memory is enabled by default and can be turned off by a new run-time option called CEENXSTG.

## iconv Utility

- New -B option allow for the removal of the BOM (Byte-Oriented Mark) from the beginning of Unicode (UTF-8, UTF-16 and UTF-32) byte streams, useful when converting data from Unicode to other CCSIDs.

## Unicode Services

- New utility called CUNMITG4 has been provided
- Allows user to create the binary files associated with user-defined conversion tables with composition characters on both sides (the "from" and the "to" sides) of the table.
- Will allow customers to implement solutions that meet certain regional IT standards associated with surnames and first names.

## VSAMDB

- New data store for BSON and JSON objects in VSAM KSDS
- Sysplex data sharing via VSAM RLS
- Includes indexing with VSAM alternate keys

## cp Utility Enhancements

- Copy load modules and program objects from MVS data sets to UNIX directories and vice versa while maintaining ALIAS information

## WebSphere Application Server

- WAS Liberty for embedders is updated with the latest upgrades and service

## TSO/E LISTDSI support

- Reports additional information about datasets (PDSE version and Encryption information)

## New Japan Era (Reiwa) Support

- On May 1, 2019, a new era named Reiwa, reflecting a change to the Japanese imperial reign, went into effect.
- IBM provided support across multiple elements/components of z/OS including Language Environment, Unicode Services and z/OS Font Collection
- A new ligature (symbol) has been defined representing the Reiwa era.



- IBM is adding a new Japanese era ligature to three font families:
  - WorldType fonts
  - AFP Raster fonts
  - AFP Outline fonts

## DFSORT Enhancements

- Support
  - Regular expressions in INCLUDE and OMIT statements
  - Unicode data formats UTF-8, UTF-16 & UTF-32 in OMIT and INCLUDE statements
  - ASCII free format numeric data in SORT, MERGE, INCLUDE and OMIT statements
  - Encrypted PDSE data sets
- Exploit
  - System Z High Performance Ficon (ZHPF) for sort work files

## XML Toolkit for z/OS V1.11 (separate offering)

- Updated to the XML4C V5.8.3 version
- Updated to IBMXSLT4C V1.12

## OAM support for Db2 stored procedures (CD 2Q20)

- DFSMSdfp OAM is providing a new sample, CBROSRSP, available in SYS1.SAMPLIB, that can invoke the OAM OSREQ API in a Db2 stored procedure environment.
- Managing multiple Db2 connections within a single stored procedure, to access different databases without having to create multiple programs.
- Support is available on z/OS V2R2 and above with APAR OA57837.

## Cryptographic hash utilities (CD 3Q20)

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

## IBM SDK for Java 8.0.6.0 (SR6)

- General performance optimizations to deliver up to 20% average throughput improvements on IBM z15 over IBM z14 with Java 8.0.5.0 (SR5)
- Exploitation of 30+ new z15 instructions to accelerate Sort, String, Data Access (DAA) and cryptographic Java APIs
- Transparent acceleration of java/util/zip/\* APIs with on-chip Integrated Accelerator for z Enterprise Data Compression
  - Existing IBM SDK for Java 8 will exploit z15 Integrated Accelerator on z/OS transparently. Improved buffering / performance with IBM SDK Java 8 SR6.
- Improved Pause-less Garbage Collection (GC) for more consistent response times for large heap applications with response-time sensitive SLAs
- Automated JVM adaptation for changing system resource and capacity, optimized for System Recovery Boost
  - Dynamic scaling of Garbage Collection and JIT compilation threads based on available CP resources
  - Shared classes improvements - Up to 30% faster JVM startup and application ramp up over Java 8.0.5.0 (SR5)

## XL C/C++ Support

- To increase application performance on IBM Z, the best way is to stay current with compiler technologies
- z/OS V2.4 XL C/C++ compiler fully exploits the Vector Enhancements Facility 2 and Miscellaneous-Instruction-Extensions Facility 3 in IBM z15
- MASS (Mathematical Acceleration Subsystem) libraries that include a set of scalar and vector mathematical elementary functions that serve as a higher performance alternative to the standard math library and are optimized and highly tuned for IBM z15
- Performance Benefits:
  - *z/OS V2R4 XL C/C++ can reduce CPU usage by an average of 16% and up to 22% on z15, over the same set of key numerically intensive double-precision floating-point applications built by z/OS V2R3 XL C/C++ running on z14.*
  - *z/OS V2R4 MASS high-performance mathematical library functions, built with z/OS V2R4 XL C/C++, reduce CPU usage by an average of 7.1x and up to 91x on z15 over the corresponding z/OS V2R4 C/C++ Runtime Library functions on z14.*

\* All performance information was determined in a controlled environment. Actual results may vary. Performance information is provided "AS IS" and no warranties or guarantees are expressed or implied by IBM.

## New z/OS XL C/C++ compiler adds support to help IBM z/OS UNIX users port applications from distributed platforms (CD 4Q19)

The IBM z/OS XL C/C++ V2.4.1 web deliverable for z/OS V2.4 delivers C11, C++11, and C++14 language standards support, and hardware exploitation capabilities, including exploitation of the latest IBM z15. It is the integration of IBM advanced XL optimization technologies with the LLVM open source Clang infrastructure that gives the IBM z/OS XL C/C++ V2.4.1 web deliverable more current language standards support, ease in migrating apps from distributed platforms, and z/Architecture exploitation capabilities.

- The z/OS XL C/C++ V2.4.1 compiler supports EBCDIC and ASCII execution character sets, and generates AMODE 64 code, making it ideal for z/OS UNIX users porting applications from distributed platforms.
- The XL C/C++ V2.4.1 web download is a no-charge add-on feature for clients that have enabled the XL C/C++ compiler (an optionally priced feature) on z/OS V2.4.
  - It coexists with, and does not replace, the base XL C/C++ V2.4 compiler. XL C/C++ V2.4 and V2.4.1 compilers are both designed to be used independently and are also serviced and supported independently.
- The z/OS XL C/C++ V2.4.1 web deliverable will be available on December 13, 2019, from the [z/OS Downloads](#) website.

## z/OS Requirements

- z/OS accepts requirements through Request for Enhancements (RFE)
  - Any customer can open a requirement on any part of the operating system at this URL <https://www.ibm.com/developerworks/rfe/>
- You can also search and vote on RFE's at that location
  - You need an IBM ID
  - Go to the search tab
  - Brand: Servers and System Software, z Software, z/OS
- z/OS also accepts requirements through user groups like SHARE

धन्यवाद

Hindi

多謝

Traditional Chinese

ขอบคุณ

Thai

Спасибо

Russian

Bedankt

Nederlands

شكراً

Arabic

Thank You

English

Danke

German

Obrigado

Brazilian Portuguese

Gracias!

Spanish

多谢

Simplified Chinese

Dziękuję

Polish

நன்றி

Tamil

ありがとうございました

Japanese

Merci

French

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## Continuous Delivery

- z/OS embraces continuous delivery through new function APARs
- Get weekly emails when APARs close with MyNotification: 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>

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**Note:** *The statements of direction in this presentation have been edited for brevity.*

**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.

**March 2021** - In the future, IBM intends to extend zERT to support policy-based rules that describe different levels of cryptographic protection along with optional actions to take when TCP connections match those rules. Since z/OS V2.3, zERT has provided a detailed view of the cryptographic protection attributes used on connections that terminate on the z/OS TCP/IP stack. The zERT policy-based enforcement feature would enable immediate notification through messages, auditing through SMF records, and even automatic connection termination when questionable or unacceptable cryptographic protection is used. IBM plans to enable z/OS network security administrators to create and manage zERT enforcement rules and actions through the z/OSMF Network Configuration Assistant and the z/OS Communications Server policy agent.

**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** - IBM intends to enhance pervasive encryption through RACF support for the use of an encrypted VSAM data set as its data base in specific configurations.

**March 2021** - With the rapidly growing need to derive AI insights from data in critical business workloads, IBM is planning to optimize z/OS by introducing highly performing AI functionality targeted for clients' critical business workloads. These enhancements are planned to be delivered iteratively and are intended to enable IBM Z as a highly competitive AI inferencing platform. Areas of focus would include:

- Native z/OS solutions providing AI capabilities that would be tightly integrated with z/OS workloads
- Utilizing z/OS Container Extensions that broadly expand the AI libraries and tools ecosystem, including, but not limited to, technologies such as TensorFlow and ONNX
- Optimizations that would be focused on ensuring AI libraries and runtimes can utilize the latest IBM Z hardware capabilities
- Guidance and content that would be focused on accelerating the path to adoption of AI technology

These capabilities are planned to further strengthen z/OS position as the premier platform for enterprise computing.

**March 2021** - On April 30, 2021, IBM is planning to remove support for Transport Layer Security (TLS) 1.0 and TLS 1.1 from the IBM software download servers. The affected servers are used for downloading files for the following z/OS software offerings:

- PTFs and HOLDDATA ordered using the SMP/E RECEIVE ORDER command
- PTFs ordered using Shopz
- PTFs ordered using ServiceLink
- Products in ServerPac and CBPDO offerings ordered using Shopz
- Products in CustomPac offerings

If clients currently download files for any of the listed offerings directly to their z/OS system using the HTTPS protocol, they will not be affected. However, if the FTPS protocol is used to download any of the listed offerings directly to their z/OS system, they might be affected and should take action now to ensure that the capability to download software products and fixes is not impacted.

More specifically, on April 30, 2021, the IBM software download servers will require download operations to connect to the server using TLS 1.2 or higher. Connection attempts using TLS 1.0 or TLS 1.1 will no longer be accepted. The SMP/E HTTPS client used for download operations will automatically use TLS 1.2 when connecting to the server. However, the z/OS Communications Server FTP client program will use TLS 1.2 only if configured to implement TLS using AT-TLS. Therefore, if clients currently use FTP as the download protocol, they must do one of the following to ensure that they can continue to download from the IBM software download servers:

- Use HTTPS instead as the download protocol. IBM recommends clients consider using HTTPS instead of FTPS, as this method often alleviates network, proxy, and firewall issues in an enterprise typical of using FTPS, and it is currently in use by many clients.
- Verify that the FTP client program is configured to implement TLS using AT-TLS (the TLSMECHANISM statement in FTP.DATA indicates ATTLS).

To learn more about using the HTTPS download protocol and how to indicate which download protocol SMP/E will use, see the [Preparing for secure Internet delivery](#) web page.

For information on configuring an IBM z/OS Communications Server FTP client, see the [TLSMECHANISM \(FTP client and server\) statement](#) webpage.

**March 2021** - To ensure that clients can install Shopz-orderable software in the future, it is recommended that clients take steps to prepare their driving system for z/OSMF-based installations. For an overview of ServerPac with z/OSMF Software Management and the steps to follow, see the [ServerPac Installation using z/OSMF content solution](#) website. Here, clients can find a sample portable software instance that can be used to verify that their z/OS driving system is operational for installing a CICS, IMS, Db2, or z/OS ServerPac.

Care is advised when clients plan to install z/OS V2.5, because the delivery choices are expected to change in Shopz in January 2022. At the general availability of z/OS V2.5, except for z/OS V2.4, and prior to January 2022, IBM intends to make all IBM z/OS software on Shopz orderable as a ServerPac, and installable as a portable software instance or by using the CustomPac dialog. It is not intended that z/OS V2.4 ServerPac will be offered as a portable software instance. Prior to January 2022, all other software (CICS, IMS, Db2, z/OS V2.5, and licensed programs) are planned to be offered as ServerPac orders deliverable through z/OSMF or the CustomPac dialog.

In January 2022, the CustomPac dialog delivery option is planned to be removed for all software, including CICS, IMS, Db2, z/OS V2.5, and all licensed programs. Thereafter, it is planned that all software that is orderable as a ServerPac must be installed with z/OSMF Software Management.

Although it is planned that z/OSMF will become a driving system requirement, it would be a requirement only for the system in a client's enterprise from which software installation activities are performed. However, clients might find that using z/OSMF throughout their enterprise offers tremendous benefits. If clients cannot meet the z/OSMF driving system requirements for ServerPac, the Customized Offerings Driver (5751-COD) is available on Shopz. It provides a z/OS system with z/OSMF, which will be activated at z/OS V2.5 availability.

**December, 2020** – IBM intends to discontinue monthly service refreshes to the Software Information Base file in the first quarter of 2022. Any existing Software Information Base file can continue to be used as input to PMA, however, usage of z/OSMF Software Management reports is encouraged to be used instead to view current data.

**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 its features are planned to be supported until the discontinuance of support for the next z/OS release.

**September, 2020** – For more than a decade, IBM has been strongly recommending that SDSF security definitions use SAF resources, such as RACF and other security programs, rather than the SDSF-specific ISFPARMS/ISFPRMxx method. Using SAF has the benefit of placing security controls in the hands of the security administrator, reducing the manual task of reassembly of ISFPARMS during each upgrade, and elimination of maintenance of security definitions outside the external security manager. In the release after z/OS V2.4 IBM plans to require the use of SAF based security for the SDSF feature. In the case where a client is using ISFPARMS/ISFPRMxx-based security, there will be a required migration to SAF based security. The SDSF feature plans migration documentation and tooling to assist in the conversion. In preparation for this removal for those affected, IBM recommends clients start their conversion to SAF based security on their current z/OS release.

**September, 2020** – In all supported releases of z/OS, IBM has stopped using SVC 111 (module IGC111), replacing previous use of SVC 111 (x'6F') with other functions. In the release after z/OS V2.4, IBM plans to remove module IGC111 from z/OS so that an expected error will occur if the SVC is invoked. If a client is using SVC 111, they will have to change to another method of giving control to an exit routine in an authorized state. IBM offers to work with any clients using SVC 111 to understand why they are using it and to help identify alternative approaches to what is currently being done.

**September, 2020** – z/OS V2.4 is planned to be the last release to support Sysplex Distributor optimized connection load balancing with the Cisco MNLB router function. This removal does not affect any other Sysplex Distributor functions, only configurations that have SERVICEMGR specified on the VIPADEFINE statement in the TCP/IP profile. In the future, the SERVICEMGR keyword will be ignored and all load balancing processing will be performed by the Sysplex Distributor.

**September, 2020** – z/OS V2.4 is planned to be the last release to support the RACF TSO help command. IBM recommends using the [z/OS Internet Library](#), specifically the [z/OS Version 2 Release 4 Security Server RACF Command Language Reference](#) for RACF command syntax support.

**Delivered** – The IBM Customized Offerings Driver (5751-COD) is a prebuilt, stand-alone driving system that can be used to install z/OS ServerPac, z/OS SystemPac (in dump-by-dataset format, where available), and z/OS Custom-Built Product Delivery Offering (CB PDO) packages when clients do not have a driving system or one that meets the minimum requirements for IBM z/OS installation.

IBM intends to update the Customized Offerings Driver to include a subset of a z/OS V2.3 system, including selected functions in z/OSMF and IBM 64-bit SDK for z/OS, Java Technology Edition, V8.0 that can run on any IBM Z processor that is supported by z/OS V2.3, and later. This addition of some z/OSMF functions and IBM Java SDK enhances the installation capability of the Customized Offerings Driver.

**September, 2020** - Today, SMC for both SMC-R and SMC-D is limited to communications for hosts attached to a common IP subnet. SMCv2 defines SMC over multiple IP subnets. The SMCv2 multiple IP subnet support extends SMC capability to additional application workloads that were previously ineligible for SMC. z/OS V2.4 delivers SMCv2 multiple IP subnet capability for SMC-D (SMC-Dv2). See details in the [Description](#) section. IBM plans to make SMCv2 multiple IP subnet capability available for SMC-R exploiting "routable RoCE" (RoCEv2) in a future z/OS deliverable. IBM is working with Linux distribution partners to provide SMCv2 support for Linux on IBM Z and IBM LinuxONE.

**September, 2020** – z/OS V2.4 (ICSF FMID HCR77D0) and the Web deliverable Cryptographic Support for z/OS V2.2 - z/OS V2.4 (ICSF FMID HCR77D1) are planned to be the last releases that support CCA redirection to a regional cryptographic service. In the future, ICSF intends to restrict use of regional cryptographic services to the PKCS #11 interfaces only. Because these callable services for redirection of CCA requests to a network attached regional cryptographic server were not, to IBM's knowledge, ever exploited, IBM does not anticipate any client impact in their removal.

**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.

**June, 2020** – In an ongoing effort to modernize how system programmers manage their z/OS environments, IBM intends to extend z/OSMF with the z/OS Management Services Catalog framework. This framework 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. In the future, experienced z/OS system programmers will be able to create a catalog of customized services, each written with unique institutional knowledge, protocols, and processes.

IBM plans to provide an initial set of services to help z/OS system programmers of all skill levels get started, demonstrate accepted practices, and simplify information sharing. These services are expected to help system programmers spend less time on routine tasks and more time leveraging their z/OS environment. In addition, the z/OS Management Services Catalog intends to offer these capabilities:

- Powerful graphical interface for creating new services, editing IBM-provided services, and updating existing services
- Step-by-step guidance for completing z/OS management tasks
- Overview of all services submitted to run on a system

To prepare for the release of the z/OS Management Services Catalog, IBM encourages z/OS system programmers to start creating their own workflow assets, with the plan that the z/OS Management Services Catalog will help maintain and manage workflows in the future. You can learn more and watch for future developments on the release at the [z/OS Management Services Catalog content page](#).

**June, 2020**– z/OS DFSMSdss and DFSMShsm plan to provide full volume dump support for transparent cloud tiering. This capability will enable 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 while performing this offload, an initial full volume FlashCopy can be performed which can then be dumped to the object store. Because all of the I/O for the FlashCopy is also completed within the DS8000, this will provide a point-in-time full volume dump to TS7700, with none of the data passing through the z/OS host. DFSMShsm also plans to integrate this capability into the FRBACKUP / FRRECOV functions, utilized by Db2 BACKUP / RESTORE SYSTEM.

**June, 2020** – z/OS V2.4 is planned to be the last release of the operating system to provide the transport utility, IEWTPORT. This program management binder utility converts a program object in a PDSE into a "transportable program file" in a sequential (nonexecutable) format and conversely can also reconstruct the program object from a transportable program file and store it back into a PDSE. The use of this utility has been discouraged for a number of years, as documented in the *z/OS MVS Program Management: User's Guide and Reference*. The appropriate utility for copying load modules and program objects is IEBCOPY.

**Delivered** – As previously announced, IBM and other leading industry software vendors have been collaborating on a variety of installation-related improvements. These improvements are intended to make z/OS-platform software installation, configuration, and deployment consistent for our client community. As part of that initiative, IBM also previously announced, the intention to offer an IBM ServerPac packaged as a z/OSMF Software Management Portable Software Instance. Following on the additional delivery offering in Shopz of CICS products in a Portable Software Instance, IBM intends to continue this packaging roll-out with subsequent subsystems of IMS and Db2 before the end of 2020. IBM recommends clients become with the z/OSMF Software Management deployment process and take advantage of these improvements to simplify software installation.

**March, 2020** – z/OS V2.4 is planned to be the last release to support z/OSMF mobile notification services for z/OSMF notifications. The mobile notification services are planned to be removed in z/OS V2.5. All of the rest of z/OSMF notification services, including the z/OSMF Notification task and email notification services, remain unaffected. The removal of z/OSMF mobile notification services includes removing the browser user interface screens for "Mobile Configuration", removing the "z/OSMF mobile application" entry in the "User" panel for Notification Settings, and removing the Notification REST service APIs related to z/OSMF mobile notification.

**Delivered** – One of the more challenging tasks that new z/OS-platform system programmers face is having to update software with fixes. IBM intends to provide a new web-based application that will assist with that task. This new application, z/OSMF Software Update, is intended to guide you through the installation of SMP/E-packaged fixes (PTFs). Whether these fixes are supplied by IBM or other vendors, for operating system, middleware, or licensed programs, the Software Update application is planned to simplify the process with an intuitive interface. The fix installation process is designed to allow you to organize, review, and resolve any applicable information needing attention (SMP/E HOLDDATA), yet not clutter your work task with unnecessary information. Of course, should you need a complete set of installation information, that is planned to still be available. The first planned use case for updating z/OS software is installing corrective service.

Updating z/OS software is a substantial part of the z/OS platform-wide installation strategy IBM shares with other leading software vendors. This strategy encompasses the entire software lifecycle, from software packaging, acquisition, installation, configuration, deployment, and servicing through end of service.

**December, 2019** – IBM z/OS V2.4 is planned to be the last release to support the z/OSMF classic-style user interface (the tree mode interface) and in future releases will only support the desktop-style user interface. The z/OSMF desktop-style user interface supports all the functions that the traditional tree mode interface does, and provides a more modernized and personalized UI, by displaying the z/OSMF tasks in a desktop style with task icons, taskbar, and other desktop elements that can be user tailored, which allows users to interact with z/OS using a familiar interface that is similar to other operating environments. The desktop UI also has more capabilities, such as the ability to search for data set names, quickly locate a task, group tasks in a folder, and perform similar actions.

**Delivered** – IBM intends to deliver a new feature of z/OS to scan Program Call (PC) and Supervisor Call (SVC) routines to further strengthen the integrity of the z/OS solution stack and simplify compliance requirements.

**Delivered** – Today, user interfaces for DFSMSrmm (RMM) include TSO and ISPF dialogs. RMM intends to provide support for a modern graphical user interface via a z/OSMF plug-in. The plug-in would augment the existing TSO and ISPF dialog support with an easy-to-use graphical interface.

**December, 2019** – z/OS V2.4 is planned to be the last release of z/OS to support DFSMSrmm (RMM) Web Services. Today, RMM provides support for remote Java applications to connect to the RMM application programming interface (API) running on a z/OS system over the internet via a package that is deployed on a web server such as z/OS WebSphere Application Server or Apache Tomcat. Use of the RMM API, which accesses the RMM control data set to obtain information about RMM managed resources, would still be available to applications using either high-level or assembler languages.

**July, 2019** – z/OS V2.4 is planned to be the last release in which the z/OS TN3270E Telnet server, FTP server, and Digital Certificate Access Server (DCAS) will support direct invocation of System SSL APIs for TLS/SSL protection. In the future, the only TLS/SSL protection option for these servers will be Application Transparent Transport Layer Security (AT-TLS). The direct System SSL support in each of these components is functionally outdated and only supports TLS protocols up through TLSv1.1. IBM recommends converting your TN3270E Telnet, FTP server, and DCAS configurations to use AT-TLS, which supports the latest System SSL features, including the TLSv1.2 and TLSv1.3 protocols and related cipher suites. Note that while native TLS/SSL support for z/OS FTP client is not being withdrawn at this time, no future enhancements are planned for that support. IBM recommends using AT-TLS to secure FTP client traffic.

**July, 2019** – z/OS V2.4 is planned to be the last release of z/OS to allow specifying service coefficients in the Workload Manager (WLM) service definition on the Service Definition Details page. The IBM recommended values are CPU=1, SRB=1, MSO=0, and IOC=0, which will be the default values in a later release. IBM recommends that you adjust your service coefficients before upgrading to a later release.

***Note:*** *If you do adjust your service coefficients, you may have to recalculate the duration of your service class periods, and your accounting procedures.*

**July, 2019** – z/OS V2.4 is planned to be the last release to support EIM (Enterprise Identity Mapping) and OCSF (Open Cryptographic Services Facility), and all of its plug-ins, such as OCEP (Open Cryptographic Enhanced Plug-ins) and PKITP (PKI Services Trust Policy). These components have not been widely utilized nor enhanced for several releases of z/OS. IBM recommends using other applications such as ICSF (Integrated Cryptographic Services Facility) and System SSL for comparable functionality.

**July, 2019** – IBM intends to leverage Kubernetes clustering in the future for the orchestration and management of z/OS Container Extensions with compatible cloud platforms.

**July, 2019** – z/OS V2.4 will be the last release that the Network Configuration Assistant (NCA) z/OSMF plug-in supports the policy data import function, which allows you to import existing Policy Agent configuration files into the Network Configuration Assistant. After z/OS V2.4, import of policy configuration files will no longer be supported for AT-TLS, IPSec, PBR, and IDS technologies.

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

**July, 2019** – z/OS V2.4 is the last release to support Sysplex Distributor target controlled distribution to DataPower Gateway products. This feature is deprecated in the DataPower Gateway. IBM recommends that you implement another solution for workload balancing that might be through an external load balancer. This removal does not impact any other Sysplex Distributor functions, only configurations that have TARGCONTROLLED specified on the VIPADISTRIBUTE statement.

**February, 2019** – z/OS V2.4 is planned to be the last release in which JES2 will support the z11 level for checkpoint data sets. z22 mode was introduced in z/OS V2.2. IBM recommends you migrate to z22 mode if you have not already done so.

**February, 2019** – In Software Announcement [217-246](#), dated July 17, 2017, IBM announced that JES2 is the strategic Job Entry Subsystem (JES) for the z/OS Operating System and that JES3 would continue to be supported and maintained. To date, IBM has made significant investment in JES2 by delivering unique functions such as email support in JCL, spool migration and merge, and dynamic checkpoint expansion and tuning to make management easier. In z/OS V2.4, IBM plans to deliver in JES2 Spool Encryption and a new user exit alternative based on defining policies that allow exit programs to be implemented in a parameterized rule-based approach. To help JES3 to JES2 migration efforts, JES2 has added functionality, including dependent job control, deadline scheduling, 8-character job classes, and interpreting JES3 JECL control statements. For z/OS V2.4, additional function to aid in migrations is planned, including Disk Reader capability and enhanced JES3 JECL support in JES2 (ROUTE XEQ). Today, as a result of our strategic investment and ongoing commitment to JES2, as well as continuing to enhance JES3 to JES2 migration aids, IBM is announcing that the release following z/OS V2.4 is planned to be the last release of z/OS that will include JES3 as a feature.

If you are one of the clients who remains on JES3, IBM encourages you to start planning your migration. For questions, contact [jes3q@us.ibm.com](mailto:jes3q@us.ibm.com).

**Delivered** – IBM's first delivery of a ServerPac in z/OSMF Software Management portable software instance format is planned for CICS Transaction Server and associated CICS products. Initially, IBM intends to allow you to choose to order ServerPac for CICS and associated products in either the new z/OSMF portable software instance format or the existing CustomPac Dialog-based format. The z/OSMF portable software instance format is designed to be installed using z/OSMF Software Management. The requirements for using the CustomPac Dialog-based format remain unchanged, and this is the first of many offerings that are planned to be delivered in the PSI format. For both formats, IBM plans to continue to offer delivery via internet download or on DVD. This initial offering of an IBM ServerPac in a z/OSMF portable software instance represents the next step in IBM's collaboration with other leading z/OS platform software vendorsto deliver a consistent package format intended to be used with z/OSMF software management as a common installer.

**Delivered** – IBM intends to add 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.

**February, 2019** – z/OS V2.4 is planned to be the last release to support the VTAM Common Management Information Protocol (CMIP). CMIP services is an API that enables a management application program to gather various types of SNA topology data from a CMIP application called the topology agent that runs within VTAM. IBM recommends using the SNA network monitoring network management interface (NMI) to monitor SNA Enterprise Extender and High Performance Routing data.

**February, 2019** – z/OS V2.4 is planned to be the last release to support the ISPF Workstation Agent (WSA), also known as the ISPF Client/Server Component. WSA is an application that runs on your local workstation and maintains a connection between the workstation and the ISPF host. It is primarily used to transfer files between the workstation and the host. IBM recommends using more current file transfer solutions such as those provided by the Zowe Dataset Explorer, z/OSFTP, and similar file transfer mechanisms. These solutions have more capabilities, including the ability to provide secure communications.

**Delivered** – IBM intends to deliver a new cloud tier to OAM's existing storage hierarchy, which will provide the ability to store and manage primary copies of OAM objects on cloud storage, via public or private cloud infrastructures supporting the Amazon S3 API, and the ability to recall an object stored in the cloud to the disk level of the storage hierarchy. OAM managed backup copies will continue to be supported as they are today to removable media, typically virtual or physical tape.

**February, 2017** - z/OS V2.4 is planned to be the last release of the operating system to support the HFS (Hierarchical File System) data structure used by the z/OS UNIX environment. IBM has provided equivalent if not superior functionality with the z/OS File System (zFS). Customers should migrate from HFS to zFS using the utilities provided in the operating system to convert their entire file system hierarchy.

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