IBM z/OS on z15 Hardware

Marna WALLE and Steve Warren
IBM System Z
Poughkeepsie, New York USA
mwalle@us.ibm.com swarren@us.ibm.com

November 2021

Session 5AV

Agenda

- IBM z15 Functions & Features
- z/OS Support by Release
- PSP Buckets and Fix Categories
- Upgrade Considerations
  - General
  - z15 Upgrade Considerations
  - Sysplex and Multisystem Considerations
- Exploitation Considerations for Select Functions
- Summary

IBM **z15** (**8561**) **Model T01** Functions & Features

One hardware model, Five Features, 1-4 19” Frame System
z/Architecture Mode ONLY
•L1 Private 128K i & 28K d -L2 Private 2MB i & 2MB d •L3 Shared 256 MB / chip -L4 Shared 956 MB / drawer
Up to 190 processors configurable as CPs, zIIPs, IFLs, ICFs or optional SAPs • Up to 190-way on z/OS V2.1 and later (non-SMT mode)
Up to 40 TB of Redundant Array of Independent Memory (RAIM) – 1TB Memory Increment – 8TB/Drawer - Max • Up to 16 TB per z/OS LPAR with z/OS V2.5
256 GB Fixed HSA
Channel Subsystem scalability • Up to 85 LPARs • Up to six (6) Channel Sub Systems (CSSs) • 4 Subchannel Sets per CSS
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)
z/OS V2R4 XL C/C++ ARCH(13) and TUNE(13) exploitation: • New z15 hardware instructions • Aligned Vector Load/Store Hint instructions • Vector Enhancement Facility 2 • Miscellaneous-Instruction-Extension Facility 3

(z/OS support in blue)

IBM Virtual Flash Memory & CF Exploitation of VFM Up to 12 Features – Feature Size=0.5TB
IBM System Recovery Boost
IBM Integrated Accelerator for Z Sort
IBM Integrated Accelerator for z Enterprise Data Compression (on-Chip Compression)
CF Level 24 •CF Fair Latch Manager 2 •Message Path SYID Resiliency Enhancement •DYNDISP Default THIN •CF Monopolization Avoidance
• Coupling CHPIDs increased to 384 from 256 per CEC • ICA SR increased to 96; ICP increased to 64
Integrated Coupling Adapter (ICA-SR) links NB + CF
Coupling Express (CX3) LR, NB + CE LR CF
Next Gen RoCE 25/10 GbE RoCE-Express2.1 (CX4)
FICON Express16SA
OSA Express7S (1,10,25 GbE) • Greater than 16 Adapters support
zHyperLink® Express1.1 (FC 0451) / CF • Maximum 16 Adapters
Crypto Express7S (FC 0899 - 1 HSM, FC 0898 - 2 HSM) • Max 60, Combination of (CEX7S. CEX6S,CEX5S) • Up to 16 (CEX6S and CEX5S) can be Carried Forward but rest must be CEX7 • Support for new CCA 7.1 functions • New ECC Edward Curves support

IBM **z15** (**8562**) **Model T02** Functions & Features

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

(z/OS support in blue)

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

Agenda

- IBM z15 Functions and Features
- **z/OS Support by Release**
- PSP Buckets and Fix Categories
- Upgrade Considerations
  - General
  - z15 Upgrade Considerations
  - Sysplex and Multisystem Considerations
- Exploitation Considerations for Selected Functions
- Summary

z/OS Support Summary

Release	z10 EC z10 BC WdfM	z196 z114 WdfM	zEC12 zBC12 WdfM	z13 Z13s WdfM	z14 z14 ZR1	z15 T01 z15 T02	End of Service	Extended Defect Support[1]
z/OS V2.1[1]	X	X	X	X	X	X	9/18	9/21*
z/OS 2.2	X	X	X	X	X	X	9/20	9/23*
z/OS 2.3			X	X	X	X	9/22*	9/25
z/OS 2.4			X	X	X	X	9/24*	9/27*
z/OS 2.5				X	X	X	9/26*	9/29*

Notes:

1 The IBM Software Support Services for z/OS V2.1 offered, provides the ability for customers to purchase extended defect support service for z/OS V2.1

* Planned. All statements regarding IBM's plans, directions, and intent are subject to change or withdrawal without notice.

WdfM Server has been withdrawn from Marketing

- **Attempt to IPL z/OS on unsupported machines will result in WAIT07B**
- **When running z/OS under IBM z/VM, the z/VM release must be z/VM V6.4 or later**

Legend

IBM Software Support Services required for z/OS support
Will be going end of service 9/20
Generally supported

Supported z/OS Releases on IBM z15

- IBM z15 capabilities differ depending on z/OS Release
- **Toleration Support**
  - **z/OS 2.1 + PTFs** (Must have IBM Software Support Services offering purchased)
    - September 2018 was EoS
- **Exploitation Support on z/OS:**
  - **z/OS V2.2 + PTFs**
    - Exploitation support of select functions
  - **z/OS V2.3 + PTFs**
    - Exploitation support of more select functions
  - **z/OS V2.4 + PTFs**
    - Even more exploitation
  - **z/OS V2.5 + PTFs**
    - Even more exploitation

Agenda

- IBM z15 Functions and Features
- z/OS Support by Release
- **PSP Buckets and Fix Categories**
- Upgrade Considerations
  - General
  - z15 Upgrade Considerations
  - Sysplex and Multisystem Considerations
- Exploitation Considerations for Selected Functions
- Summary

PSP Buckets and Fix Categories (FIXCATs[2])

- Support provided via a combination of PTFs and web deliverables
  - Documented in PSP[1] Bucket: Upgrade = **8561DEVICE**, Subset = **8561/ZOS**
  - Documented in PSP[1] Bucket: Upgrade = **8562DEVICE,** Subset = **8562/ZOS**

  - Base support is provided by PTFs identified by:
    - IBM.Device.Server.z15-8561.RequiredService
    - IBM.Device.Server.z15T02-8562.RequiredService
  - Exploitation of many functions is provided by PTFs identified by:
    - IBM.Device.Server.z15-8561.Exploitation
    - IBM.Device.Server.z15T02-8562.Exploitation
  - Recommended service is identified by:
    - IBM.Device.Server.z15-8561.RecommendedService
    - IBM.Device.Server.z15-8562T02.RecommendedService

Fixes that are required to run z/OS on the IBM z15 servers.

Fixes that are required to exploit the capabilities of the IBM z15 server.

Fixes that are recommended to run z/OS on the IBM z15 server. These fixes are also listed in the Recommended Service section of the hardware PSP bucket.

[1] http://www-01.ibm.com/support/docview.wss?uid=isg1_8561DEVICE_8561-ZOS
[2] https://www-01.ibm.com/support/docview.wss?uid=isg3T1027683

Web Deliverables

- Exploitation of some functions requires installation of web deliverable
  - Full exploitation of Crypto Express7S (**FMID HCR77D1**) on z/OS V2R2, z/OS V2R3, and z/OS V2R4 requires the ***Cryptographic Support for z/OS V2R2 - z/OS V2R4*** web deliverable
    - FMID HCR77D0 is in the base z/OS V2R4
    - Was previously delivered as web deliverable #18

    - Cryptographic Support Downloads:
      https://www.ibm.com/servers/resourcelink/svc00100.nsf/pages/cryptographicSupportDownloads?OpenDocument

Planned future ICSF functions are intended to be delivered in PTFs, with the associated hardware FIXCAT, And not in Web deliverables.

Using SMP/E REPORT MISSINGFIX

- REPORT MISSINGFIX command identifies fixes associated with particular fix categories that have not yet been installed and identifies whether any SYSMODs are available to satisfy those missing fixes
- Get the latest Enhanced HOLDDATA
  - Included when you use RECEIVE ORDER
  - You can also download it from the Enhanced HOLDDATA site if you wish:
    - http://service.software.ibm.com/holdata/390holddata.html#download
- Sample Command to identify missing fixes for:
  - Example: z/OS 2.4 Required, Exploitation and Recommended service for an IBM z15

```
SET BDY(GLOBAL) .
    REPORT  MISSINGFIX
        ZONES(target_zone)
        FIXCAT(IBM.Device.Server.z15*)
        NOPUNCH .
```

SMP/E Report MISSINGFIX …

```
MISSING FIXCAT SYSMOD REPORT FOR ZONE ZO4T100
                              HOLD      MISSING   HELD          RESOLVING SYSMOD
 FIX CATEGORY          FMID   CLASS     APAR      SYSMOD        NAME     STATUS   RECEIVED

 IBM.Device.Server.z15-8561.Exploitation
                       HRM77C0         AA56682   HRM77C0       UJ00591  GOOD     YES
                                       AA56684   HRM77C0       UJ00597  GOOD     YES
 IBM.Device.Server.z15-8561.RecommendedService
                       HIO1104         AA56761   HIO1104       AA56761  GOOD     YES
                                                               UA99143  GOOD     YES
 IBM.Device.Server.z15-8561.RequiredService
                       HBB77C0         CA55887   HBB77C0       UJ00451  GOOD     YES
                                       CA58311   HBB77C0       UJ00794  GOOD     YES
                       HCS77C0         AA56146   HCS77C0       UA99155  GOOD     YES
                                       AA56147   HCS77C0       UJ00505  GOOD     YES
                       HIO1104         AA56761   HIO1104       AA56761  GOOD     YES
```

Agenda

- IBM z15 Functions and Features
- z/OS Support by Release
- PSP Buckets and Fix Categories
- **Upgrade Considerations**
  - **General**
  - z14 & ZR1 Upgrade Considerations
  - Sysplex and Multisystem Considerations
- Exploitation Consideration for Selected Functions
- Summary

General Upgrade Considerations

- z/OS does not require a z15 T01 or T02

- A z15 only requires software identified as “base” or “toleration” support
  - Install prior to using z15 in the sysplex: z/OS or CF image.
- A z15 does not require any “functional” or “exploitation” software support
    - However, it is recommended to install all z15 service prior to upgrading your hardware
    - Required to install on all z/OS sysplex images, before exploiting sysplex new functions.

- Recommendations:
  - Avoid migrating to new software releases and servers at the same time
    - Keep quantity of change smaller
    - Less-complex back out, if you do need to back out
  - Review restrictions and migration considerations when creating your upgrade plan

General Upgrade Documentation

- For z/OS V2.4 and beyond, there is **no** ***z/OS Migration*** book, as it has been replaced with the **z/OSMF z/OS Upgrade Workflow.** Therefore, inclusion of "Upgrade to an IBM z15 Server" into the book cannot be done
  - The "Upgrade to an IBM z15 Server" information is included in the z/OSMF **z/OS Upgrade Workflow** ***and*** separated into its own Workflow **(z/OS z15 Workflow)** for those not migrating to z/OS immediately
  - In addition, an exported format of the workflows is provided for printing and searching on IBM Documentation, in case uses don't prefer to use z/OSMF https://www.ibm.com/docs/en/zos/2.4.0?topic=SSLTBW_2.4.0/com.ibm.zos.v2r4.e0zm100/Export_of_the_z15_zOS_Upgrade_Workflow.htm
  - We strongly encourage customers to use the z/OSMF **z/OS z15 Workflow** found here, or install the PTF for APAR OA60711 and look in /usr/lpp/bcp/upgrade/ or https://github.com/IBM/IBM-Z-zOS/tree/master/zOS-Workflow
    - Advantages: health check of system, discovery of prior hardware server levels, easy optional feedback

Agenda

- IBM z15 Functions and Features
- z/OS Support by Release
- PSP Buckets and Fix Categories
- **Upgrade Considerations**
  - General
  - **z15 Upgrade Considerations**
  - Sysplex and Multisystem Considerations
- Exploitation Considerations of Selected Functions
- Summary

Unsupported Hardware Features on z15 Servers

- Following hardware features **cannot be** ordered or carried forward to z15 servers:
  - HCA2-O and HCA2-O LR, ISC3 Coupling Links
  - HCA3-O and HCA3-O LR
  - CHPID Type OSN (OSA Express for NCP) is not supported on OSA-Express5S GbE LX
  - OSA Express4S 1G SX/LS, 10G SX/LX
  - Crypto Express3 and Crypto Express4S
  - FICON Express4
  - zEDC Express
  - Flash Express Adapter

New z/Architecture and z15 Machine Instructions

- OPTABLE option now supports ZS9 or z15
  - The assembler loads and uses the operation code table that contains the mnemonics for the machine instructions specific to z/Architecture and z15 instructions
  - APAR PH00902 required on all supported z/OS releases on z15
- These mnemonics may collide with the names of Assembler macro instructions you have
  - If you code Assembly Language macros, you should compare the list of new instructions to the names of you Assembler macros
  - If a conflict is identified, then either:
    - Rename your affected macros
    - Specify a separate assembler OPCODE table – PARM=,ASMOPT, or '*PROCESS OPTABLE' insource
      - ***See HLASM Programmer's Guide***
    - Use a coding technique that permits both use of a new instruction and a macro with the same name in an assembly such as HLASM's mnemonic tag (:MAC :ASM)
      - ***See HLASM Language Reference***
- For assistance in identifying assembler macros which conflict with z15 hardware instructio
  http://www.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/PRS5289

IOCP (I/O Configuration Program) for z15

- IOCP provides support for:
  - z15 T01 and T02 Base machine definition including the MCS_1 LPAR
  - New I/O hardware which is only available on z15 (T01 and T02)
    - Increased coupling CHPIDs per CEC from 256 to 384
    - Support for increased ICA-SR to 96 and ICP to 64

- z/OS pre-V2.5 use the same IOCP FMID **HIO1104,** z/OS V2.5 uses IOCP FMID **HIO1105**
- Required PTFs to support z15 are available

- For an upgrade, it is possible to use a z13/z14 IOCDS if **no** new functions are required for the z15

- Updated publication:
  - *IOCP User's Guide* – SB10-7172-03

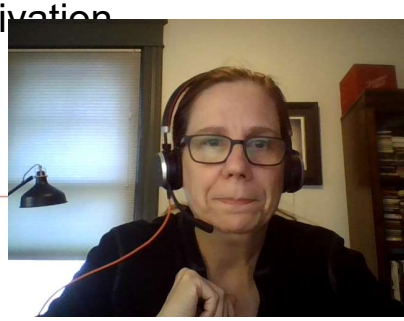
IBM

HCD Support for z15

- For HCD:
  - z15 T01 and T02 base machine definition and activation support
  - All non-DPM mode IOCDSes on z15 contain MCS_1 LPAR
    - MCS_1 LPAR is automatically activated during Dynamic I/O operation for SA Coupling Facility
    - Support for increased coupling CHPIDs per CEC from 256 to 384
    - Support for increased ICA-SR from 80 to 96 and ICP from 32 to 64

  - APAR OA56146 is required to write an IOCDS on a z15
  - Hardware can be defined on any supported OS version and server
  - Dynamic activation of new server and any new adapters types can only be done on a z15 server
  - Support for z/OS 2.1 and later

  - **Note:** HCD service needs to be installed on all systems used for HCD definition and activation



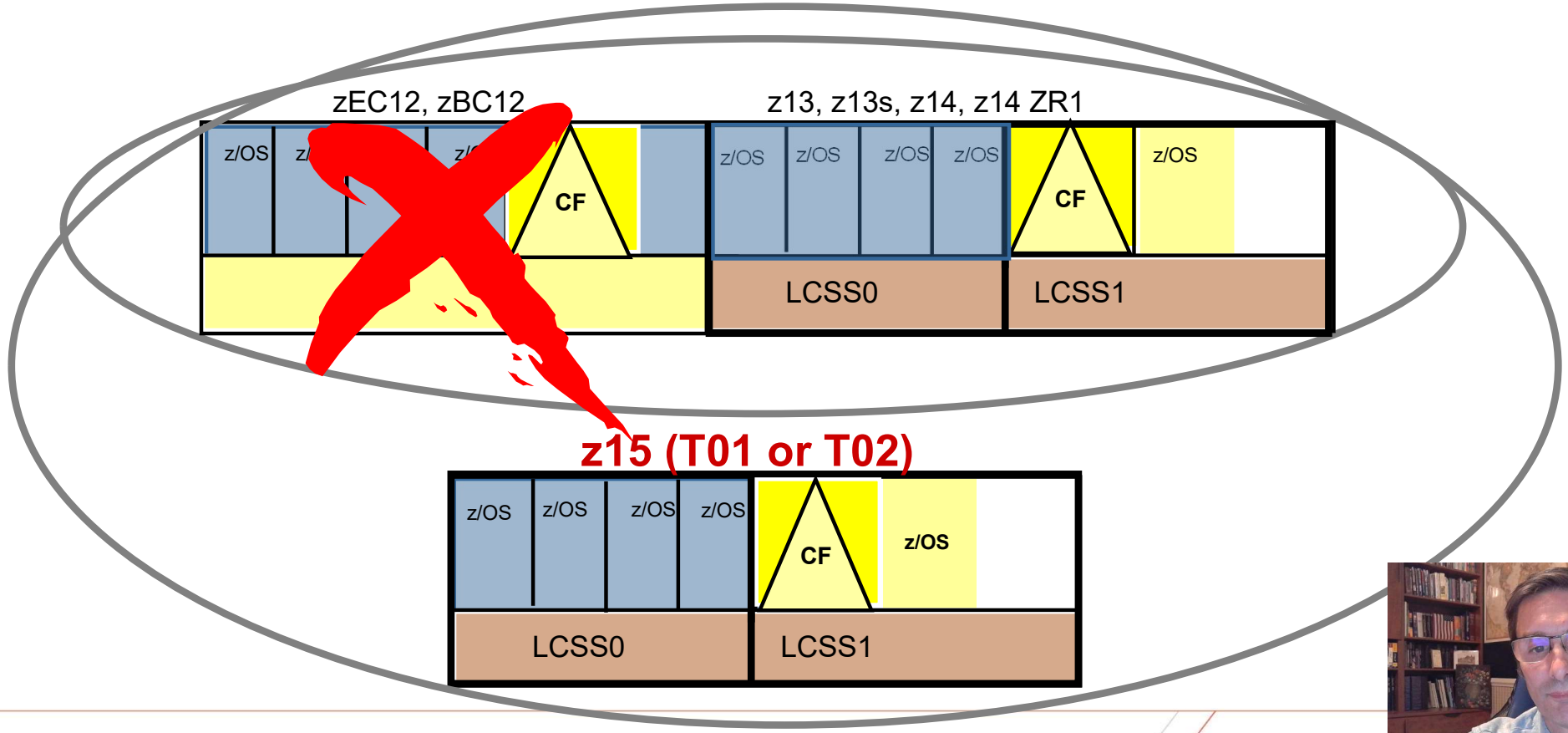
Agenda

- IBM z15 Functions and Features
- z/OS Support by Release
- PSP Buckets and Fix Categories
- **Upgrade Considerations**
  - General
  - z15 Upgrade Considerations
  - **Sysplex and Multisystem Considerations**
- Exploitation Considerations for Selected Functions
- Summary

Server Participation in a Parallel Sysplex

- IBM z15 servers support active participation in the same Parallel Sysplex with these servers:
  - IBM® z14™ ,IBM z14 Model ZR1
  - IBM z13™ IBM z13s
  - z15 can participate in a sysplex with these down level systems ONLY when those down level systems have been migrated to use ICA SR or CE LR coupling links
- Which means:
  - Configurations with z/OS on one of these servers can add a z15 server to their Sysplex for either a z/OS or a Coupling Facility image
  - Configurations with a Coupling Facility on one of these servers can add a z15 server to their Sysplex for either a z/OS or a Coupling Facility image

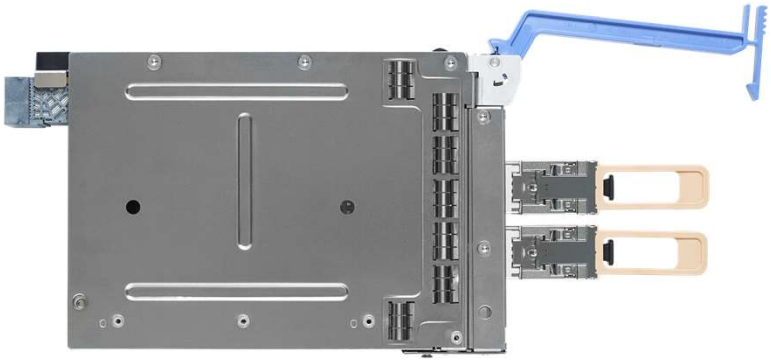
Server Participation in a Parallel Sysplex …



IBM

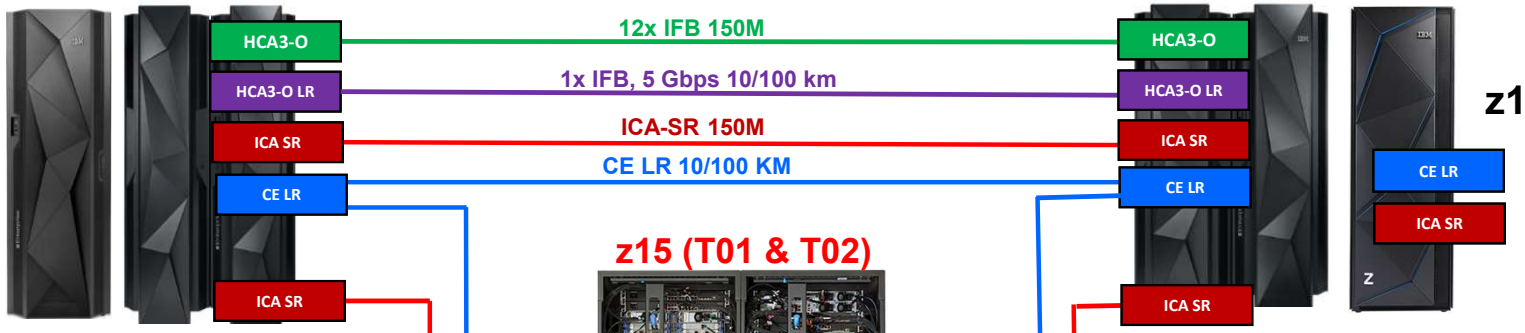
Parallel Sysplex Coupling Links

- **IBM Integrated Coupling Adapter SR1.1 (ICA SR1.1)**
  - **Coupling Connectivity into the Future (Short Distance)**
  - Coupling CHPID CS5, Performance similar to Coupling over InfiniBand 12X IFB3 protocol
  - PCIe Gen3, Fanout in the CPC drawer, 2-ports per fanout, 150m;
  - Up to 4 CHPIDs per port, 8 buffers (i.e. 8 subchannels) per CHPID
  - Maximum 48 Adapters (96 Ports) per CEC



- **Coupling Express LR (CE LR)**
  - **Coupling Connectivity into the Future (Long Distance)**
  - Coupling CHPID CL5, Performance similar to Coupling over InfiniBand 1x
  - PCIe+ I/O drawer required for CL5 adapter
  - Adapter (2-port card): Maximum 32 Adapters (64 Ports)
  - 10 Gbps, Up to 4 CHPIDs per port, 32 buffers (i.e. 32 subchannels) per CHPID
  - Distance: 10 KM Unrepeated; up to 100 KM with qualified DWDM
  - Retrofitted on z13 GA2

Parallel Sysplex Coupling Connectivity



z13 & z13s
12x IFB3, 1x IFB3
ICA SR, CE LR

z14 & z14 ZR1

Coupling Express LR (CE LR)
10 Gbps, 10/100 km

Integrated Coupling Adapter (ICA SR)
8 GBps, up to 150M

zEC12, zBC12, z196, z114, z10 EC/BC, z9 EC/BC, z990, z890
Not supported in the same Parallel Sysplex or STP CTN with **z15**

IC (Internal Coupling Link):
Only supports IC-to-IC connectivity

z14 Servers were the last g
to support HCA3-O an

NOTE: The link data rates do not represent the performance of
upon many factors including latency through the adapters, cable

Firmware levels for the N-2 Parallel Sysplex CEC Connectivity

- The following MCL and CFCC levels are recomended minimum when coupling with z15 (T01 & T02). PE always recommends the highest available MCL level for best performance and availability
- Find current CF Level information: https://www.ibm.com/downloads/cas/EEGKM5OM

August 25, 2021

CPC models	Coupling facility code level					
	Level 24	Level 23	Level 22	Level 21	Level 20	Level 19
8561 - z15™ T01 8562 - z15 T02	D41c ec P46603 mcl 006					
3907 z14®-ZR1		D36c ec P41419 mcl 008				
3906 z14		D36c ec P41419 mcl 008	D27i ec P08416 mcl 009	N/A	N/A	N/A

Agenda

- IBM z15 Functions and Features
- z/OS Support by Release
- PSP Buckets and Fix Categories
- Upgrade Considerations
  - General
  - z15 Upgrade Considerations
  - Sysplex and Multisystem Considerations
- Exploitation Considerations for Select Functions
- Summary

Exploitation Considerations for Select Functions

- CFCC Level 24
- HiperDispatch Enhancements
- z/OS SLIP enhancement on z15
- HIS support
- Exploitation of new hardware instructions – XL C/C++
- Cryptographic support
- OSA Express7S
- RoCE Express2.1
- IBM Integrated Accelerator for zEDC
- System Recovery Boost
- Precision Time Protocol (PTP) IEEE 1588

CFLEVEL 24 Exploitation

- Structure and Coupling Facility Storage Sizing with CF Level 24
  - May increase storage requirements when moving from:
    - CF Level 23 (or below) to CF Level 24
    - CFSizer Tool recommended
    - http://www.ibm.com/systems/z/cfsizer
  - As in prior CF Levels, ensure that the CF LPAR has at least 512 MB storage for CFCC µcode
- Coupling Facility Enhancements:
  - CF Fair Latch Manager 2
  - Message Path SYID Resiliency Enhancement
  - Shared engine default is DYNDISP=THIN
  - CF Monopolization Avoidance

HiperDispatch Enhancement

- Currently, processors are enabled for I/O from highest configured CPU ID to lowest
- LPAR weight changes can cause I/O enabled VHs/VMs to be converted to VLs and immediately parked by HiperDispatch, because LPAR always pushes the VHs and VMs to the lowest configured online processors
- Starting with IBM z15, the order in which processors are enabled for I/O interrupts is reversed
  - SRM enables processors for I/O interrupts from lowest configured CPU ID to highest configured CPU ID
- This enhancement keeps VH or VM processors enabled for I/O interrupts after processor topology changes
- This enhancement is available on z/OS 2.4
  - For z/OS V2R2 and z/OS V2R3, PTF for OA55935 needs to be installed

z/OS SLIP enhancement support on z15

- z/OS SLIP to monitor an address or range for a key change and take diagnostic action:
  - Dump
  - Trace
- z/OS V2R4 supports this function on z15
  - No toleration support is required on lower release levels
- To enable, Set SLIP command with new options ….. SLIP SET[,options],END
- To disable, issue SLIP command …. SLIP DEL[,options]
- Updated publication:
  - *z/OS MVS System Command Reference:* SLIP Command

New Counters, Sampling for HIS

- HIS support:
  - Added new extended and crypto counters
  - Added new sample type
- z/OS V2R2 and later releases provide this support when running on **z15**
  - No toleration support is required
  - Required PTFs for this support are available
  - To enable, you must have setup HIS on z/OS
    - Start HIS, issue MODIFY HIS command to collect extended or crypto counters or diagnostic sampling
    - To stop, issue MODIFY HIS command to stop collecting extended, crypto counters or diagnostic sampling
- Publications updated:
  - *The CPU-Measurement Facility Extended Counters Definition for z10, z196/z114* …….
  - *The Load-Program-Parameter and the CPU-Measurement Facilities*

z/OS V2R4 XL C/C++

- **z15** support is for z/OS V2R4 XL C/C++ compiler only
  - One can use **z15** support from the V2R4 C/C++ compiler and target older z/OS releases
- New z15 facilities that are supported by z/OS V2R4:
  - Vector Enhancement Facility 2
  - Miscellaneous-Instruction-Extension Facility 3
  - Aligned Vector Load/Store Hint instructions
  - Some limited exploitation of Vector Packed Decimal Enhancement Facility

z/OS V2R4 XL C/C++ ARCH(13) TUNE(13)

- z/OS V2R4 XL C/C++ has sub-option 13 under ARCH and TUNE option for targeting **z15** instructions
  - ARCH(13) compiler option will allow the compiler to exploit any new z15 instructions where appropriate
    - As an example the use of Aligned Vector Load/Store Hint instruction
  - The TUNE(13) compiler option allows the compiler to tune for any z15 micro-architecture
- Vector programming support is extended for **z15** to provide direct/indirect access to the new instructions introduced by the VEF 2
- One new BIF for the Miscellaneous-Instruction-Extensions Facility 3 for **z15**
- **Prior levels of z/OS XL C/C++ compilers will not provide z15 exploitation**
  - However, the z/OS XL C/C++ compiler can be used to generate code for the older levels of z/OS running on **z15**

z15 T01 and T02 Cryptographic Support

- Greater than 16 Crypto Express adapters support
  - z15 T01 now supports up to 60 crypto hardware security modules (HSMs), supporting 85 domains, which provides over 5,100 virtual HSMs for ultimate scalability.
  - z15 T02 now supports up to 40 crypto HSMs, supporting 40 domains, which provides over 1,600 virtual HSMs.
  - If all CEX7, Maximum 60 HSMs on T01 (30 Adapters FC 0898) and 40 HSMs on T02
    - If you carry forward CEX5 and CEX6, cannot exceed 16 Adapters and rest must be CEX7
  - ICSF base support was delivered in FMID HCR77D1 (WD#19) with z15 GA1
  - Rollback of support on older ICSF releases via APAR OA56965
- Support for CCA Release 7.1 functions:
  - New ECC Edwards Curves
  - ECC Protected Key
  - Quantum Safe Algorithms
  - TR-31 HMAC Keys exchange
- ICSF updates for EMV services in support of new Visa requirements
  - Software support only
  - Needed by customers prior to October to retain Visa compliance
  - New “New Cryptogram Version” number CVN 18

z15 T01 GA 1.5 and T02 Cryptographic Support …
CEX7 CCA 7.1: Quantum-Safe Signatures

- With the increased processing power of quantum computers, we need to start moving to Quantum Safe crypto algorithms if we are to keep our data safe
- This item will add support for the Dilithium CRYSTALS (Cryptographic Suite for Algebraic Latttices) signatures algorithm with the largest key sizes (MODE=3)
  - Public Key size: 1760 bytes
  - Private Key Size: 3856 bytes
  - Signature Size: 3366 bytes
- Dilithium keys will be protected by the 256-bit AES MK
  - The Dilithium key has a security strength of 128 bits
- Customers can begin digitally signing documents now and those signatures will still be secure into the Quantum age

Note: Dilithium Support previously added to the PKCS#11 interface
Support for storing Dilithium keys in the PKDS will be in a future release

z15 T01 GA and T02 Cryptographic Support …

- Hardware support will only be functional on z15 T01 GA1.5 and T02, but the EMV (Europay, MasterCard, Visa) update will run anywhere
- This SPE will be applied to ICSF FMID HCR77D1 (WD#19)
- APAR OA56965 is required on older ICSF levels to handle the new key types associated with the ECC and Quantum-Safe
  - Required if >16 Crypto Adapters are deployed on the machine
- RMF Support
- RMF enhances the Monitor I Crypto Activity data gatherer and Monitor III Crypto data gatherer to recognize and exploit data for up to 85 crypto cards, which is supported with z15 GA1.5/T02 GA
- RMF obtains crypto activity data via (CHSC SCM) command interface
  - RMF Postprocessor Crypto activity report
  - Monitor III gatherer table CRYG3
  - RMF Monitor III sysplex reports Crypto hardware overview (CRYOVW), Crypto accelerator activity (CRYACC), and Crypto PKCS11 Coprocessor Activity (CRYPKC)

ICSF Supported Releases (Reference Chart)

		9/14 EOS	9/16 EOS	9/18 EOS	9/20 EOS	9/22 EOS	9/24 EOS	9/26 EOS
FMID/WD#	GA	V1R12	V1R13	V2R1	V2R2	V2R3	V2R4	V2R5
HCR77D2	9/2021							X
HCR77D1 (WD#19)	10/2019				X	X	X	
HCR77D0 (WD#18)	12/2018				X	X	X[b]	
HCR77C1 (WD#17)	9/2017			X	X	X		
HCR77C0 (WD#16)	10/17/2016 (3Q17)		T(7A1)	X	X	X[b]		
HCR77B1 (WD#15)	11/2/2015	T(7A0)	X	X	X			
HCR77B0 (WD#14)	2/2015 (2H2015)	T(780)	X	X	X[b]			

x[b] Support in base z/OS release

WD remains in service as long as the z/OS release on which it runs. That is, HCR77B0 will be in service until z/OS V2R2 goes EOS.

OSA Express7S

- OSA-Express7S is primarily a technology refresh
- The following OSA-Express7S features are provided on **z15**:
  - OSA-Express7S 1000BASE-T
  - OSA-Express7S GbE
  - OSA-Express7S 10GbE
  - OSA-Express7S 25GbE SR1.1 FC 0449 (previously delivered on z14 GA2)
- **z15** OSA-Express7S support:
  - z/OS V2R2 and z/OS V2R3 Communications Server[1]: APARs PI95703 and OA55256 required
  - CHPID type OSX is no longer supported
  - CHPID type OSM (Ensemble environment) is no longer supported[2]

[1] The z/OS APARs were previously released (required) for OSA-Express7S 25GbE. All z15 variations of OSA-Express7S require the same APARs (primarily display updates)

[2] OSM is supported in a DPM (Dynamic Partition Manager) environment

z/OS IWQ for zCX

- New input queue for zCX traffic (zCX DVIPA)
  - zCX traffic serviced on its own thread on zIIP
  - Processing of zCX queue is optimized for packets destined for zCX server DVIPAs
  - Enabled with IWQ and when using zCX DVIPAs
  - Enabled with OSA-Express7S or 6S on z14 GA2 or later servers
  - Available on z/OS V2R4 with PTFs UJ01511 and UI66733

- **Value:** Separation of zCX traffic from z/OS native traffic allows z/OS TCP/IP to optimize the zCX related processing including performing the zCX processing on a zIIP

RoCE Express2.1

Description	Feature Code	Ports	Max. Features per system (IBM z15)
RoCE Express2.1 25GbE	0450	2	**16 (32 ports)**
RoCE Express2.1 10GbE	0432	2	**16 (32 ports)**

- RoCE Express2 25GbE was previously made available on z14 GA2
- RoCE Express2.1 25 GbE provides hardware updates on IBM z15:
  - Optics as a FRU
  - Universal spare support
  - Virtualization - 63 Virtual Functions per port (126 VFs per feature)
  - Improved RAS - ECC double bit correction

RoCE Express Updates

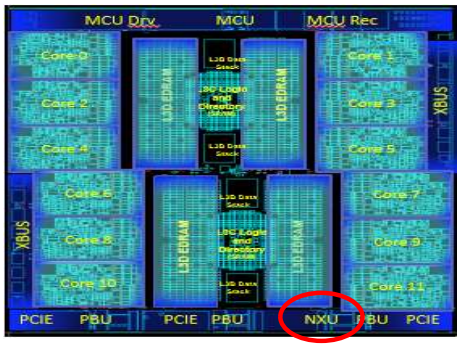
- Shared Memory Communications (SMC) Version 2
  - Enables “multiple IP subnet” support for SMC-D and SMC-R
    - IP subnet is no longer part of the SMC connection criteria (for SMC V2)
  - SMC V2 defines both SMCDv2 and SMCRv2
- SMC V2 is planned to be delivered in two stages
  - SMCDv2 requires ISMv2 (IBM z15 GA 1.5) with z/OS CS PTFs
  - SMCRv2 requires RoCEv2 (routable RoCE Express2 on z14 and z/OS CS PTFs)
- SMCDv2 and IBM z15 ISMv2
  - Install z/OS CS 2.4 PTFs and Upgrade to z15 GA 1.5
  - Define EID – enables SMC V2 (GlobalConfig in TCP/IP profile[1]) for existing users
  - For New users: Define ISM VCHIDs/FIDs[2] and enable SMCD in TCP/IP GlobalConfig profile then (**and**) Define EID - enables SMC V2 (GlobalConfig in TCP/IP profile[1])

[1]There will be two types of EIDs; User Defined EIDs and System Defined EIDsSystem defined EIDs are for SMCDv2 / ISMv2 only and are

[2] New SMC users deploying SMCDv2 can elect to define ISM VCHIDs without a PNet ID This type of ISM VCHID is not associated with any PNet or IP for V2 connections only

IBM Integrated Accelerator for z Enterprise Data Compression

- In IBM **z15**, the zEDC functionality is moving into the CPU, and is known as IBM Integrated Accelerator for z Enterprise Data Compression
- The z/OS APIs, both authorized and zlib will transparently enable all existing software exploitation on **z15** which is already enabled on z14 and below with zEDC
- Support available on z/OS V2R1 and higher when running on **z15**
  - No toleration support is required
- Data compressed with zEDC can be decompressed with accelerator **-or-** compressed with accelerator can be decompressed with zEDC
- The software inflate routine is being updated to be RFC compliant
  - This is to handle fall back scenarios with accelerator compressed data to be decompressed on z14 and below



z15

IBM Integrated Accelerator for z Enterprise Data Compression…

- Requirements
  - IBM z15 (8561) T01 and IBM z15 (8562) T02

- Must install z/OS zlib PTFs for this support prior to upgrade to IBM z15
  - z/OS APAR OA56143 is required, re-linked software with updated zlib
  - If PTFs are not installed, z/OS will attempt to find zEDC Express devices
    - As there will be **no** zEDC Express on z15, no compression or decompression will occur
  - MAXSEGMENTS option in IQPPRMxx is ignored since it is not relevant
  - DEFMINREQSIZE and INFMINREQSIZE will have their defaults adjusted based on performance measurements
  - Applications that use zlib, no longer require **READ** access to SAF class **FPZ.ACCELERATOR.COMPRESSION**

- zBNA is updated (zBNA v2.0.2) to provide usage estimation for IBM Integrated Accelerator Compression for z Enterprise Data Compression
  - http://ibm.com/support/techdocs/atsmastr.nsf/WebIndex/PRS5132

zEDC to z15 Upgrade considerations for z/OS

- All z/OS configurations stay the same
  - No change is required when z/OS is migrated from a z14 to **z15**
- Hardware Fall-back
  - Customers can transparently fall back to z14 with zEDC
- Software Fall-back
  - Existing software inflate module is updated to support all DEFLATE compliant data
- Fail-over and DR should be reviewed
  - Ensure enough zEDC capacity on z13 and z14 systems
- Performance Metrics
  - No more RMF PCIE reporting for zEDC
  - Synchronous executions are not recorded (just an instruction invocation)
  - Asynchronous execution are recorded
    - SMF30 information captured for asynchronous usage
    - RMF EADM reporting enhanced (RMF 74.10) with information
    - SAP utilization updated to include time spent compressing & decompressing

z/OS Software Feature for Exploitation of zEnterprise Data Compression

z14

Chargeable:
zEDC Hardware I/O feature required.

z/OS software feature required for exploitation of:

- **z/OS SMF Logstream**
- **z/OS QSAM/BSAM**
- **z/OS DFHSM / DFDSS**
- **Db2 for z/OS V12 LOBs**
- **z/FS in V2R3**
- IBM Java
- Cobol
- C
- IBM Content Manager OnDemand
- IBM Encryption Facility
- IBM Sterling Connect:Direct®
- z/OS HTTP Server
- OpenSSH
- IBM MQ for z/OS

z15

No Charge:
Integrated Accelerator for zEDC hardware Built-in processor chips.

z/OS software feature required for exploitation of:

- **z/OS SMF Logstream**
- **z/OS QSAM/BSAM**
- **z/OS DFHSM / DFDSS**
- **Db2 for z/OS V12 LOBs**
- **z/FS in V2R3**

No z/OS software feature required for exploitation of:

- IBM Java
- Cobol
- C
- IBM Content Manager OnDemand
- IBM Encryption Facility
- IBM Sterling Connect:Direct®
- z/OS HTTP Server
- OpenSSH
- IBM MQ for z/OS

IBM System Recovery Boost

Unleash your capacity to maximize your availability

Restore service and recover workloads substantially faster than on previous IBM Z® generations, with ***zero increase in IBM software licensing costs***

Faster shutdown

Accelerate image shutdown to prepare for planned shutdown activities

Faster startup

Restart and recover images, middleware environments, and client workloads substantially faster than any prior Z machine, to get your systems back to the “steady state”

Faster GDPS® automation actions

Drive faster and more efficient GDPS automation actions to reconfigure and recover your environment quicker

Boosted capacity for workload catch-up

Deliver higher processor capacity for a limited time following an IPL, during a “boost period,” so client workloads can catch up and work through a backlog after downtime

IBM

IBM System Recovery Boost …

Unleash additional processing capacity using your already-entitled Central Processors and zIIPs during a fixed-duration performance increase known as, "the boost period."

- ✓ *Faster shutdown (planned events only).*
- ✓ *Faster startup (IPL)*
- ✓ *Faster middleware and workload restart*
- ✓ *Faster system recovery and workload execution*
- ✓ *Faster and parallelized GDPS reconfiguration and orchestration actions*.

The boost period can be used twice per IPL:
30-minute boost for shutdown
60-minute boost for startup

1 **Speed Boost**

Enables general-purpose processors on sub-capacity machine models to run at full-capacity speed in the boosting image(s).

Supported by z/OS®, z/TPF, z/VM® & SADMP

2 **zIIP Boost**

Provides additional capacity and parallelism by enabling general-purpose workloads to run on zIIP processors that are available to the boosting image(s).

Supported by z/OS. Requires defined zIIPs

3 **GDPS enhancements**

Increases the speed at which GDPS drives hardware actions, along with the speed of the underlying hardware services.

Supported by z/OS

IBM System Recovery Boost Upgrade (IBM z15 T01 Only)

Maximize performance and parallelism during the boost period

Build upon the base functionality with System Recovery Boost Upgrade, an optional capacity-on-demand offering that lets you **unlock additional zIIP capacity when you need it the most.**

Benefits

- ✓ Unlock up to 20 additional zIIP processors for up to 6 hours.
- ✓ Use in conjunction with one or more of the base functionality zIIP boosts.
- ✓ Initial limit of 30 activations with the option for automatic replenishment during the annual subscription period.
- ✓ Simple activation, with no additional capacity planning required.

How to order

System Recovery Boost Upgrade requires two IBM z15™ hardware feature codes to activate:

FC 9930 – SRB Upgrade Authorization

Drives necessary contracts to use the SRB Upgrade Record. Required to enable the ordering of System Recovery Boost Record.

FC 6802 – SRB Upgrade Record

Enables temporary activation of additional physical zIIP processors to be used in conjunction with the base functionality.

IBM System Recovery Boost Upgrade …

- Priced and Prepaid
  - Based on an annual subscription model for “recharging” the record indefinitely during that period.
    - Activates zIIP processors only
- Number of Activations
  - **T**he record has a ***fixed number of activations (30)***, but this can be “recharged” dynamically based on the Annual Subscription
- Designated Time Period
  - Each activation has a ***fixed 6-hour time period –*** the record supports planned change activity windows of up to 6 hours during which one or more system shutdown/startup actions are being performed
- Number of zIIPs
  - Each activation can activate **up to 20 zIIPs**, and it could permit the violation of the 2:1 ratio rule between zIIPs and CPs
- Auto Deactivation
  - Automatic deactivation will occur at the end of the time period the record is configured for (it could be deactivated sooner, if desired)

IBM System Recovery Boost …

- z/OS 2.4 and z/OS 2.3 required service
  - OA57326 - BCP/SUP/SADMP
  - OA56055 - WLM
  - OA57478 - CIM
  - OA57552 - CPM
  - OA56683 – RMF

- Support
  - z/OS fully exploits both Speed Boost for CPs and zIIP boost, 60-minute boost period
  - SADMP exploits Speed Boost for CPs for up to 60 minutes during dump; no exploitation of zIIP Boost

  - All System Recovery Boost PTFs can be found with SMP/E FIXCAT `IBM.Function.SystemRecoveryBoost`

IBM System Recovery Boost for z15 T02

- System Recovery Boost on z15 T02 provides all the same “base functionality” as z15 T01
  - CP Speed Boost, zIIP Boost, GDPS Enhancements
- In all the same contexts:
  - System image shutdown and System image startup
  - “Catch-up” phase after image startup
  - Planned, Unplanned, Single-system, Multi-system, DR site switch scenarios
- However:
  - **z15 T02 does NOT provide the SRB Upgrade capability** to add additional “temporary capacity” zIIP processors for additional capacity
    - z15 T02 therefore does not offer the SRB Upgrade Feature Codes 9930 and 6802
  - Depending on the sub-capacity model, z15 T02 may have **substantially higher** sub-cap to full-cap performance ratios (e.g. 10x, 15x, or more). For low-end sub-cap clients, the potential speedup benefit from CP speed boost may be **much larger** than is possible on T01.
  - Similarly, since zIIP processors always run at full-cap speed, the potential benefit from zIIP boost (general-purpose work running on zIIP processors at full speed) may be **much larger** than is possible on T01
    - Could be an incentive to purchase additional zIIP engines on z15 T02

IBM System Recovery Boost – Sysplex Recovery Enhancements

- Initial support for System Recovery Boost provided recovery acceleration via additional processor capacity and parallelism, but only during image-level events like image Shutdowns and re-IPLs
  - IPL and Shutdown boosts
    - Speed boost and/or zIIP boost
    - GDPS orchestration enhancements
    - Up to 60 minutes of boost at IPL and up to 30 minutes of boost at shutdown
    - Optional, priced SRB Upgrade temporary capacity for zIIP Boost
- New support extends this to provide recovery boosts for smaller-scope, occasional sysplex recovery activities, that introduce small-scale disruptions when they occur
  - Boosts automatically initiated when these events occur
  - And on the relevant set of systems in the sysplex where the recovery is taking place
  - Short-term boost periods, limited in total amount (30 minutes per LPAR per day)
- Sysplex recovery activities that are boosted include:
  - Sysplex Partitioning – planned or unplanned removal of a system from the sysplex
  - CF Structure Recovery – recovery from CF or CF structure problems that require structure-level rebuild or duplexing recovery
  - CF Datasharing Member Recovery – recovery from disconnect or failure of a CF locking datasharing member with locking resources held
  - HyperSwap – planned or unplanned HyperSwaps from primary to secondary disk sets
- No increase in IBM software licensing costs!

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

Precision Time Protocol (PTP) IEEE 1588

- PTP is a new timing standard, similar to Network Time Protocol (NTP), but with the potential for much greater timing precision and accuracy
- In the future, IBM plans to introduce PTP as an external time source for IBM Z Server Time Protocol (STP) for an IBM Z Coordinated Timing Network (CTN)
- The initial implementation is for PTP connectivity on z15 is via the IBM Z HMC/SE
- There is no change to the use of STP CTNs for time coordination, other than the potential to use a PTP-based external time source
- Future implementation is planned to include full connectivity of an external PTP time source directly to the IBM Z CPC, and re-introduction of the concept of a mixed CTN, with support for traditional STP and native PTP implementations

z/OS Timer Display ETR enhancement for PTP on z15

- z15 supports the industry standard Precision Time Protocol (PTP) that synchronizes CEC TOD clock to the sub-µseconds
  - PTP firmware stack is added to the z15 SE
  - The SE will forward the time sent via PTP over customer network to STP running on the CEC
    - Similar to the way it forwards time obtained from NTP
- z/OS Timer recognizes an external PTP server is managing the clock
- z/OS Timer has enhanced the response from **DISPLAY ETR** to include **ETS ID** in IEA386I
- z/OS V2R4, z/OS V2R3 and z/OS V2R2 will support this function
- Customers need to setup and use PTP external server
  - Function shipped as OA55887 and z/OS PTFs are available
  - No z/OS setup is required
- Publications updated:
  - *z/OS MVS System Commands and z/OS MVS System Messages*

Summary: z/OS Support for IBM **z15**

Release	IBM.Device.Server.z15-8561.RequiredService IBM.Device.Server.z15T02-8562.RequiredService						IBM.Device.Server.z15-8561.Exploitation IBM.Device.Server.z15T02-8562.Exploitation								Max Memory/ LPAR
	Base Support	CPU Measurement Facility (HIS)	FICON Express 16SA	z15 Assembler Support	System Recovery Boost	OSA-Express7S	RMF	IBM Integrated Accelerator for z Enterprise Data Compression	Crypto Express7S	RoCE Express2.1	z/OS V2R4 XL C/C++	CF Level 24	FICON Express16SA	Quantum Safe Signatures	TB
z/OS V2.1[S]	P		P	P		P		P		P		P			4
z/OS 2.2	P	P	P	P		P	P	P	W[D1]	P		P	P	P,W[D1]	4
z/OS 2.3	P	P	P	P	P	P	P	P	W[D1]	P		P	P	P,W[D1]	4
z/OS 2.4	Y	P	Y	P	P	Y	P	P	W[D1]	Y	Y	P	P	P,W[D1]	4
z/OS 2.5	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	16

Notes:

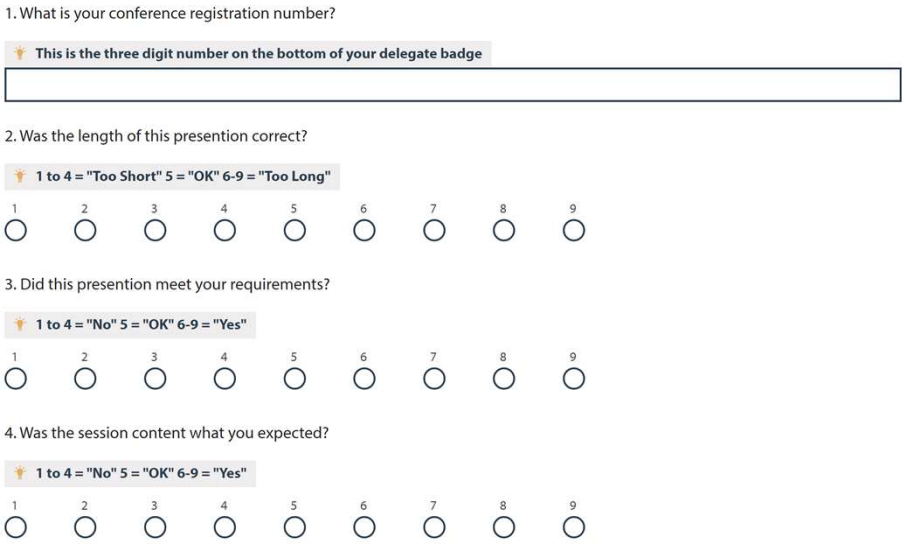
S IBM Software Support Services required for extended support
P PTF is required, use SMP/E FIXCAT for identification
Y Support is in the base
C Coexistence support is required, if exploited
• Dependent upon the specific function. There could be partial support on lower levels. Full support in z/OS V2.4
D1 Requires the ICSF web deliverable for FMID HCR77D1 minimally.
W A web deliverable is required, available at http://www-03.ibm.com/systems/z/os/zos/downloads/

thank you!

Please submit your session feedback!

- Do it online at https://conferences.gse.org.uk/2021/feedback/5AV

- This session is 5AV



GSE GUIDE SHARE EUROPE UK REGION