z/OS on IBM® $z15^{TM}$

IBM Education Assistant

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Agenda

- **IBM z15 Overview**
- 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
  - *…Including System Recovery Boost*
- Summary

IBM **z15 8561 T01** Functions & Features

One hardware model, Five Features, 1-4 19" Frame System
z/Architecture Mode <u>ONLY</u>
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 128-way on z/OS V2.1 and later (SMT mode)
Up to 40 TB of Redundant Array of Independent Memory (RAIM) – 1TB Memory Increment – 8TB/Drawer - Max • Up to 4 TB per z/OS LPAR with z/OS V2.1 and later
Changed Node/Cache structure
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 simultaneous multithreading (SMT) for zIIPs, IFLs, and SAPs
New and Enhanced instructions
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
Hardware Instrumentation Services (CPUMF)
Dynamic IO Configuration for SA Coupling Facilities

(z/OS support in blue)

IBM Virtual Flash Memory & CF Exploitation of VFM Up to 12 Features – Feature Size=0.5TB
SORT Accelerator
System Recovery Boost
CF Level 24 •CF Fair Latch Management •Message Path SYID Resiliency Enhancement
Next Gen RoCE 25/10 GbE RoCE-Express2 (CX4)
FICON Express16S EDiF
OSA Express7S (1,10,25 GbE) •   Greater than 16 Features support
zHyperLink®
Crypto Express7S •   Support 16 Crypto cards max for all cards combined (CEX5S, CEX6S, CEX7S) •Support for CCA 5.5/6.3 • ECC and EP11 Protected Key support
IBM Integrated Accelerator for z Enterprise Data Compression (on-Chip Compression)
Architected for up to 85 domains on Crypto Express7S
Integrated Coupling Adapter (ICA-SR) links NB + CF
Coupling Express (CX3) LR, NB + CE LR CF
Coupling CHPIDs increased to 384 from 256 per CEC ICA SR physical link limit increased from 80 to 96. IC Channels (ICP) limit increased from 32 to 64.

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z/OS Support Summary

Release	z10 EC z10 BC **WdfM**	z196 z114 **WdfM**	zEC12 zBC12 **WdfM**	z13 z13s	z14 z14 ZR1	z15[2]	End of Service	Extended Defect Support[1]
z/OS V2.1	X	X	X	X	X	X[1]	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[2]			X	X	X	X	9/24*	9/27*

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
2   Planned General Availability in September 2019

* 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 2.3 and later releases on lower machines will result in WAIT07B-20

Legend

IBM Software Support Services required for z/OS support
Generally supported

Supported z/OS Releases on z15

- 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 End of Service for V2.1.

- **Exploitation Support on z/OS:**
  - **z/OS V2.2 + PTFs**
    - Exploitation support of selected functions
  - **z/OS V2.3 + PTFs**
    - Exploitation support of more selected functions
  - **z/OS V2.4**
    - Even more exploitation

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PSP Buckets and Fix Categories

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

  - Base support is provided by PTFs identified by:
    - **IBM.Device.Server.z15-8561.RequiredService**

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

  - Exploitation of many functions is provided by PTFs identified by:
    - **IBM.Device.Server.z15-8561.Exploitation**

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

  - Recommended service is identified by:
    - **IBM.Device.Server.z15-8561.RecommendedService**

    > 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.

http://www.ibm.com/support/
https://www-01.ibm.com/support/docview.wss?uid=isg3T1027683

PSP Buckets and Fix Categories …

- 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 will be in the base z/OS V2R4
    - FMID HCR77D0 was also a web deliverable for z/OS V2R2 and V2R3 ("web deliverable #18")

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

Using SMP/E Report MISSINGFIX

- Get the latest Enhanced HOLDDATA Full (2-year) file
  - Included when you use RECEIVE ORDER
  - You can also download from the Enhanced HOLDDATA site if you wish:
    - http://service.software.ibm.com/holdata/390holddata.html#download

- Sample command to identify missing fixes:
  - Example: z/OS 2.2 Required, Exploitation and Recommended service for a z15

```
SET BDY(GLOBAL)  .
                 REPORT  MISSINGFIX
                 ZONES(target_zone)
                 FIXCAT(IBM.Device.Server.z15-8561*)  .
```

SMP/E Report MISSINGFIX example for z15…

```
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

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- IBM z14 and IBM z14 Model ZR1 Overview
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  - z14 & ZR1 Upgrade Considerations
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General Upgrade Considerations

- z/OS does not require a z15

- A z15 only requires software identified as "base" or "toleration" support
- A z15 does not require any "functional" or "exploitation" software support
  - However, we recommend installing all z15 service prior to upgrading your hardware

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

- Hardware upgrade considerations from "skipped" levels must still be accommodated.

General Upgrade Documentation (at z15 Announce)

- Typically, z/OS upgrade steps for a higher server had been documented in the latest *z/OS Migration* book.
    - In a section called "Upgrade to an IBM xx Server" for all z/OS release levels.

- For z/OS V2.4, there is no *z/OS Migration* book, as it has been replaced with the **z/OSMF z/OS V2.4 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 will be included in the z/OSMF **z/OS V2.4 Upgrade Workflow –and-** separated into its own Workflow **(z/OS z15 Workflow)** for those not migrating to z/OS V2.4 immediately.
        - If you are only migrating to z15 on your existing z/OS release, it is probably easiest to use the separate **z/OS z15 Workflow** so as not to see the z/OS V2.4 information.

    - In addition, an exported format of the workflows will be provided for printing and searching on Knowledge Center, in case users don't prefer to use z/OSMF.

    - We strongly encourage all GA customers to use the z/OSMF **z/OS z15 Workflow** found here:
      https://github.com/IBM/IBM-Z-zOS/tree/master/zOS-Workflow
        - Advantages: health check of system, discovery of prior hardware server levels, easy to provide optional feedback.

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Unsupported Hardware Features on z15 Servers

- Following hardware features **<u>cannot be</u>** ordered or carried forward to z15 servers:

  - HCA2-O and HCA2-O LR, HCA3, ISC3 Coupling Links.
    - Host Channel Adapter (HCA) for InfiniBand is not supported.
  - 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
    - Integrated Accelerator for zEDC is a new on-chip accelerator for compression, and replaces the zEDC Express adapter.
    - Provides advantages in terms of compression throughput, performance, and cost.
  - Flash Express Adapter, replaced by Virtual Flash Memory (VFM)

New z/Architecture 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
  - HLASM 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 instructions, see:
  http://www.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/PRS5289

IOCP (I/O Configuration Program) for z15

- IOCP provides support for:
  - z15 Base machine definition includes the MCS_1 LPAR
    - Previously, you had to manually define this LPAR for Dynamic I/O Configuration for SA CFs.
  - New I/O hardware which is only available on z15
    - Increased coupling CHPIDs per CEC from 256 to 384
    - Increased ICA SR physical link limit from 80 to 96.
    - Increased ICP limit from 32 to 64.

- All supported z/OS releases use the same IOCP FMID **HIO1104**
- Required PTFs to support z15 will be available at Announce
- PTF for APAR OA56761 is required

- For an upgrade, it is <u>possible</u> to use a z13/z14 IOCDS if **no** new functions are required for the z15
- Updated publication:
 - *IOCP User's Guide* – SB10-7172-03

HCD Support for z15

- For HCD:
  - z15 base machine definition and activation support
  - All non-DPM mode IOCDSes on z15 will contain MCS_1 LPAR
    - MCS_1 LPAR will be automatically activated during Dynamic I/O operation for SA Coupling Facility
  - Increased limit support
    - Increased coupling CHPIDs per CEC from 256 to 384
    - Increased ICA SR physical link limit from 80 to 96.
    - Increased ICP limit from 32 to 64.

  - HCD 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 new adapter 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.

z15 Compression Modes (IBM Integrated Accelerator for z Enterprise Data Compression)

■ **Synchronous execution in Problem State**

- User application invokes instruction in its virtual address space
- Easy and straightforward exploitation
- No special hypervisor support needed
- Low latency and high bandwidth
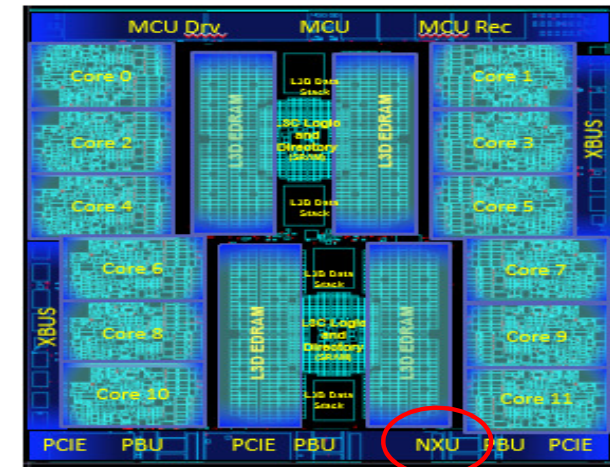
z15

■ **Asynchronous optimization for Large Operations under z/OS**

- Authorized application (e.g. BSAM) issues I/O using EADMF for asynchronous execution
- SAP invokes instruction (synchronously as above) on behalf of the application
- Enables Load Balancing of high compression loads
- Low latency & high bandwidth compared to zEDC
- Transparent implementation for existing authorized users

NXU = Nest Acceleration Unit

zEDC to z15 Upgrade considerations for z/OS

z15

- 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
  - Synchronous executions are not recorded (just an instruction invocation)
  - Asynchronous execution are recorded
    - SMF30 information captured for asynchronous usage
    - SAP utilization updated to include time spent compressing & decompressing
  - RMF considerations follow…
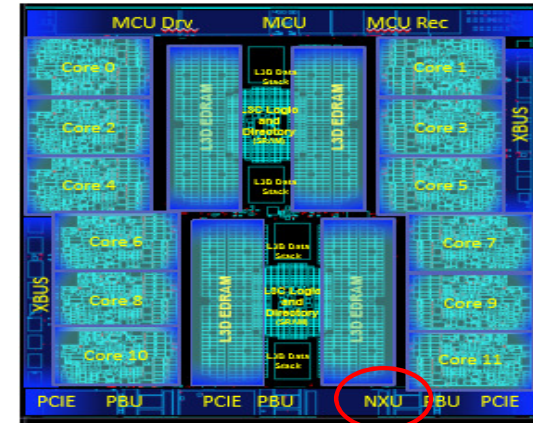
z/OS zEDC Priced features…in a nutshell

- HW:
  - Pre-z15: priced HW feature
  - As of z15: not priced, is now the Integrated Accelerator for zEDC on the processor chip.

- SW:
  - Always: priced SW feature

  - Pre-z15: Need to pay for all zEDC functions

  - As of z15: zlib function can be used without paying for the "ZEDC" SW feature for <u>unauthorized</u> users (i.e. IBM ConnectDirect). Runs asynchronously.

  - As of z15<u>: Authorized </u>users (i.e. BSAM/DSS/HSM/SMF/….) require the priced SW feature. Can run asynchronously or synchronously.

zNXU Compression …

- Requirements
  - z15

- Must install z/OS zlib PTFs for this support prior to Upgrade to 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 devices
    - As there will be no zEDC on z15, no compression or decompression will occur
  - MAXSEGMENTS option in IQPPRMxx will be ignored since it is not relevant
  - DEFMINREQSIZE and INFMINREQSIZE will have their defaults adjusted based on performance measurements
  - Applications that use zlib will no longer require **READ** access to SAF class **FPZ.ACCELERATOR.COMPRESSION**

- zBNA will be updated to provide usage estimation for zNXU

RMF Upgrade Action

Associated with z15 Compression:

• Before z15, RMF clients used PCIE reports to monitor the usage of the zEDC devices.

• When running on z15, compression activity data can now be found in the I/O Queuing Activity and EADM Activity reports instead.

　• PCIE reports no longer contain any information about compression when running on z15.

　• RMF EADM reporting enhanced (RMF 74.10) with asynchronous execution information

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  - **Sysplex and Multisystem Considerations**

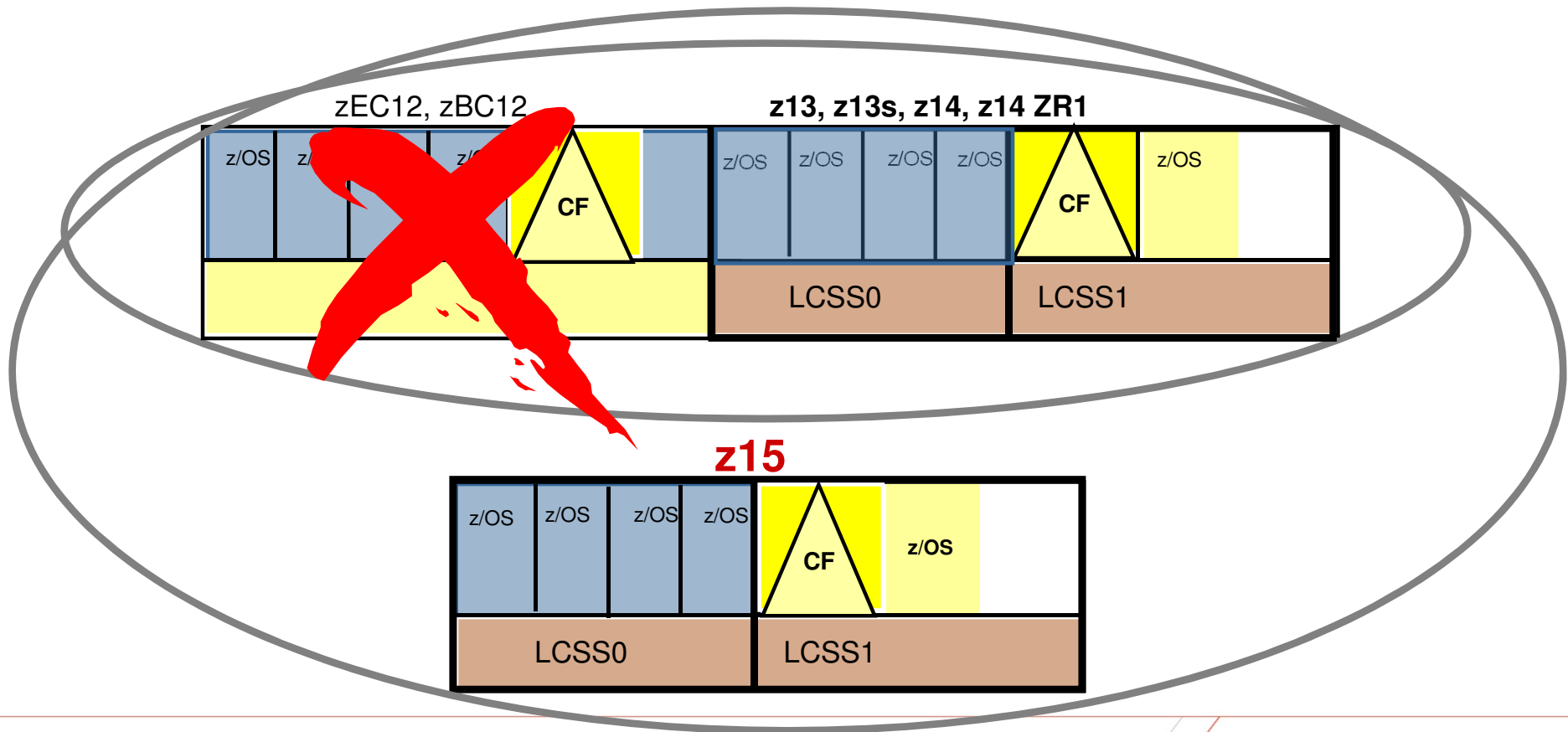- Exploitation Considerations for Selected Functions

- Summary

Server Participation in a Parallel Sysplex

- z15 servers support active participation in the same Parallel Sysplex with these servers:

  - IBM® z14™ ,IBM z14 Model ZR1
  - IBM z13™ IBM z13s

- 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

Remember: z13 and z14 servers can only connect to z15 if they have been moved off of Infiniband coupling links technology, as shown later.

Server Participation in a Parallel Sysplex …

zEC12, zBC12

z13, z13s, z14, z14 ZR1

z/OS	z/OS	z/OS

CF

z/OS	z/OS	z/OS	z/OS

CF

z/OS

LCSS0

LCSS1

z15

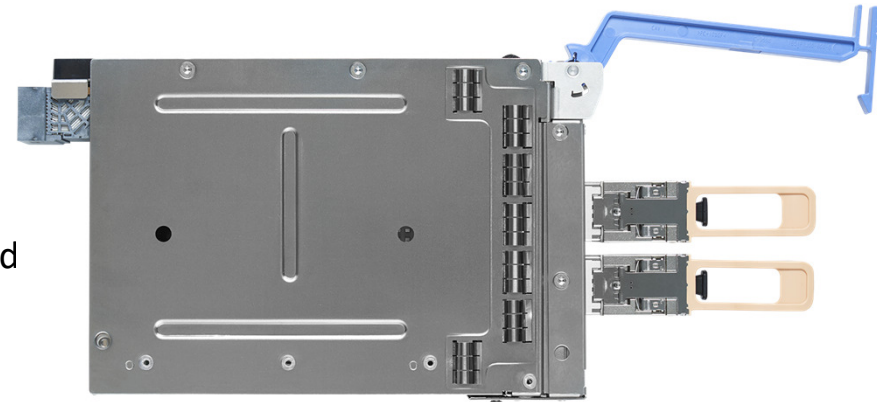| z/OS	z/OS	z/OS	z/OS

CF

z/OS

LCSS0

LCSS1

Parallel Sysplex Coupling Links

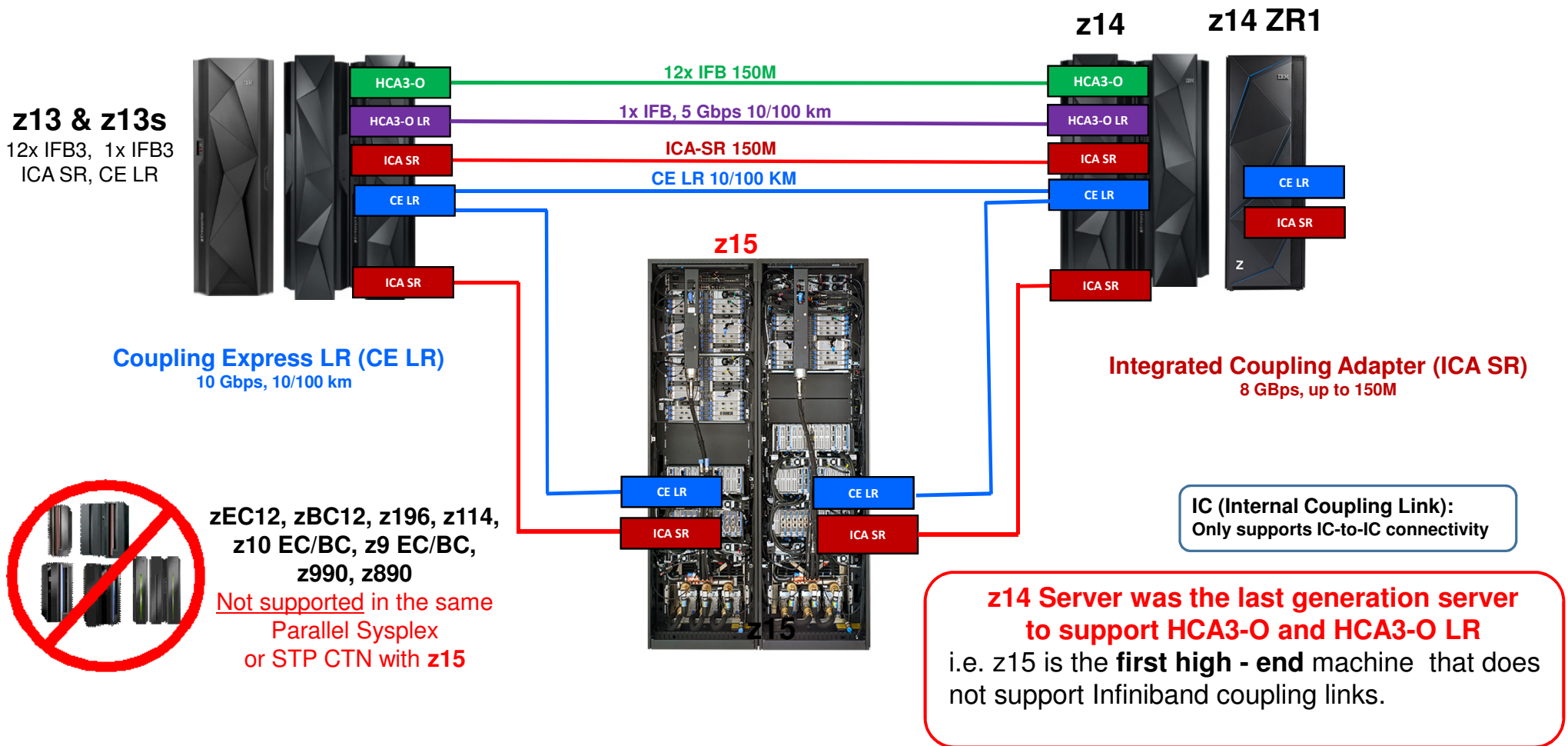- **IBM Integrated Coupling Adapter (ICA SR)**
- *Coupling Connectivity into the Future (Short Distance)*
- Coupling CHPID CS5, Performance similar to Coupling over InfiniBand 12X IFB3 protocol
- PCIe Gen3, Fanout in the CPC drawer, 2-ports per fanout, 150m;
- Up to 4 CHPIDs per port, 8 buffers (i.e. 8 subchannels) per CHPID
- z13 GA1 availability

- **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): same adapter as 10GbE RoCE Express but with Coupling Optics and Firmware
- 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
- Point-to-Point
- Retrofitted on z13 GA2
- **Last date** to MES CE LR on **z13, z13s** was June 30, 2019

Parallel Sysplex Coupling Connectivity

z14   **z14 ZR1**

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

12x IFB 150M — HCA3-O

1x IFB, 5 Gbps 10/100 km — HCA3-O LR

ICA-SR 150M — ICA SR

CE LR 10/100 KM — CE LR

z15

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 Server was the last generation server
to support HCA3-O and HCA3-O LR**
i.e. z15 is the **first high - end** machine that does
not support Infiniband coupling links.

NOTE: The link data rates do not represent the performance of the links. The actual performance is dependent upon many factors including latency through the adapters, cable lengths, and the type of workload.

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Firmware levels for the N-2 Parallel Sysplex CEC Connectivity

- The IBM z15 (8561 T01) can be coupled to the following servers with these MCL requirements:

- **z14 (MT 3906/MT 3907) at Driver 36**
    - CFCC Level 23 – Service Level 0.13
    - Bundle S13 / MCL P41419.003 (February 2019)

- **z13/z13s (MT 2964/MT 2965) at Driver 27**
    - CFCC Level 21 – Service Level 2.20
    - Bundle S82 / MCL P08416.008 (February 2019)

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  - *…Including System Recovery Boost*

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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++ ARCH(13) and TUNE(13)
- Cryptographic support
- OSA Express7S and RoCE Express2
- System Recovery Boost Overview

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

- CF Enhancements:
  - CF Fair Latch Manager 2
    - Intended to improve work management efficiency to contribute to better CF scaling as well as arbitration for internal CF serialization of resources.
  - Message Path SYID Resiliency Enhancement
    - Intended to improve resiliency of message path connectivity through new transparent recovery processing for certain types of link initialization errors that can occur as z/OS images are IPLed into the sysplex.

HiperDispatch Enhancement

- 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

- SRM reversed the direction to find processors for I/O enablement:
  - 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 will be 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 storage key change and take diagnostic action:
  - Dump
  - Trace

- z/OS V2R4 will support 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, for new options:
  - *z/OS MVS System Command Reference:* SLIP Command

z/OS Timer Display ETR enhancement for PTP on z15

- Z15 SOD intended to support the industry standard Precision Time Protocol (PTP) that synchronizes CEC TOD clock to the sub-microseconds
- z/OS Timer needs to recognize an external PTP server is managing the clock
- z/OS Timer will enhance the response from DISPLAY ETR to include external time source

- z/OS V2R4, z/OS V2R3 and z/OS V2R2 will support this function when running on **z15**
- Customers need to setup and use PTP external server
  - Required z/OS PTFs will be available at announce
  - No z/OS setup is required

- Publications updated:
  - *z/OS MVS System Commands*
  - *z/OS MVS System Messages*

New Counters, Sampling for HIS

- HIS support:
  - Add new extended and crypto counters
  - Add new sample type

- z/OS V2R2 and later releases will provide this support when running on **z15**
  - No toleration support is required
  - Required PTFs for this support will be available at announce
  - 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 will be 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 planned to be 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++ will have 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 will allow the compiler to tune for any z15 micro-architecture

- Vector programming support will be extended for **z15** to provide direct/indirect access to the new instructions introduced by the VEF 2
- One new Built In Function will be 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 V2R4 XL C/C++ compiler can be used to generate code for the older levels of z/OS running on **z15**

New Cryptographic Support

*ICSF Web Deliverable **HCR77D1*** *- Cryptographic Support for z/OS V2R2 – z/OS V2R4 (WD#19)*

- Support for the new Crypto Express7S adapter, configured as a CCA coprocessor, EP11 coprocessor, or as an accelerator.

- Use CPACF for certain clear key ECC operations.
    - ICSF can now call CPACF instructions to perform ECC key generation, key derivation, and digital signature generation and verification using a subset of the NIST curves.
    - The CPACF on IBM z15 also supports the ed448 and ec25519 curves.

- Support for Common Cryptographic Architecture (CCA) 5.5 and CCA 6.3 (and rolled back to HCR77D0 with APAR OA57089)
    - New services in support of ANSI TR-34 Remote Key Loading .
    - PCI HSM Compliance for AES and RSA keys.
    - Additional AES based financial services.

- Quantum safe algorithms for sign and verify operations.
    - Includes the ability to generate and store new keys.
    - These algorithms will be clear key only and available via the PKCS#11 interfaces.

New Cryptographic Support

*ICSF Web Deliverable **HCR77D1** - Cryptographic Support for z/OS V2R2 – z/OS V2R4 (WD#19)*

- Coexistence
  - Systems running HCR77C1 will require an APAR if their CKDS or PKDS are shared with a HCR77D0 system and contains AES or RSA keys that are PCI HSM tagged
  - Systems running ICSF prior to HCR77D0 will require APAR to run on a **z15** with Crypto Express7 coprocessor
  - ICSF FMIDs prior to HCR77D1 will use a Crypto Express7 as if it was a Crypto Express6 or prior coprocessor
    - This is typical for all new coprocessor releases going back to Crypto Express2

- Hardware and Software Fallback
  - AES and RSA Keys that are PCI HSM tagged will be unusable

- Enablement and disablement actions
  - A TKE Workstation is required to enable/disable Access Control Points associated with new EP11 and CCA functions
  - A TKE Workstation is required to move a coprocessor in and out of PCI HSM compliance mode

ICSF Supported Releases

FMID/WD#	GA	9/14 EOS	9/16 EOS	9/18 EOS	9/20 EOS	9/22 EOS	9/24 EOS
		V1R12	V1R13	V2R1	V2R2	V2R3	V2R4
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 (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

RoCE Express2

- RoCE Express2 25GbE was previously made available on z14 GA2
- RoCE Express2 provides hardware serviceability updates on z15:
  - Optics as a Field Replaceable Unit (FRU)
  - Universal Spare support

SORT Accelerator (zSORT)

- **z15** hardware will provide an accelerated sort capability. This new capability provides a means to sort multiple sets of unsorted-input data into one or more sets of sorted-output data

- DFSORT will exploit this new **z15** HW function
  - Expected to provide significant improvements to the overall performance of jobs using DFSORT and potentially reduce CPU usage
    - This could help alleviate constraints of batch window

- Support will be provided for DFSORT on z/OS 2.2 and later releases on **z15**

DFSORT FMID	DFSORT Release	APAR
HSM1M00	z/OS DFSORT V2R2	TBD
HSM1N00	z/OS DFSORT V2R3	PH03207
HSM1P00	z/OS DFSORT V2R4	TBD

SORT Accelerator

- If HW support is not available, DFSORT will use the regular sort path (non-accelerated)
- If SW support is not available, then no exploitation of HW will occur
- No other software dependencies outside of DFSORT
- No toleration support is required
- No changes required from the end-user of DFSORT for both JCL or program invoked sorts

- DFSORT has the capability (TBD whether or not to externalize) to turn ON or OFF the exploitation of zSORT instructions at system level as well as Individual jobs

- Publications:
  - *z/OS DFSORT Installation and Customization Guide (SC23-6881-30)*
  - *z/OS DFSORT Application Programming Guide (SC23-6878-30)*

zNXU Compression

- In **z15**, the zEDC functionality is moving into the CPU, which is referred to as Nest Acceleration Unit (NXU)

- 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 will be available on z/OS V2R1, z/OS V2R2, z/OS V2R3 and z/OS V2R4 when running on **z15**
  - No toleration support is required

- Data compressed with zEDC can be decompressed with zNXU
- The software inflate routine is being updated to be RFC compliant
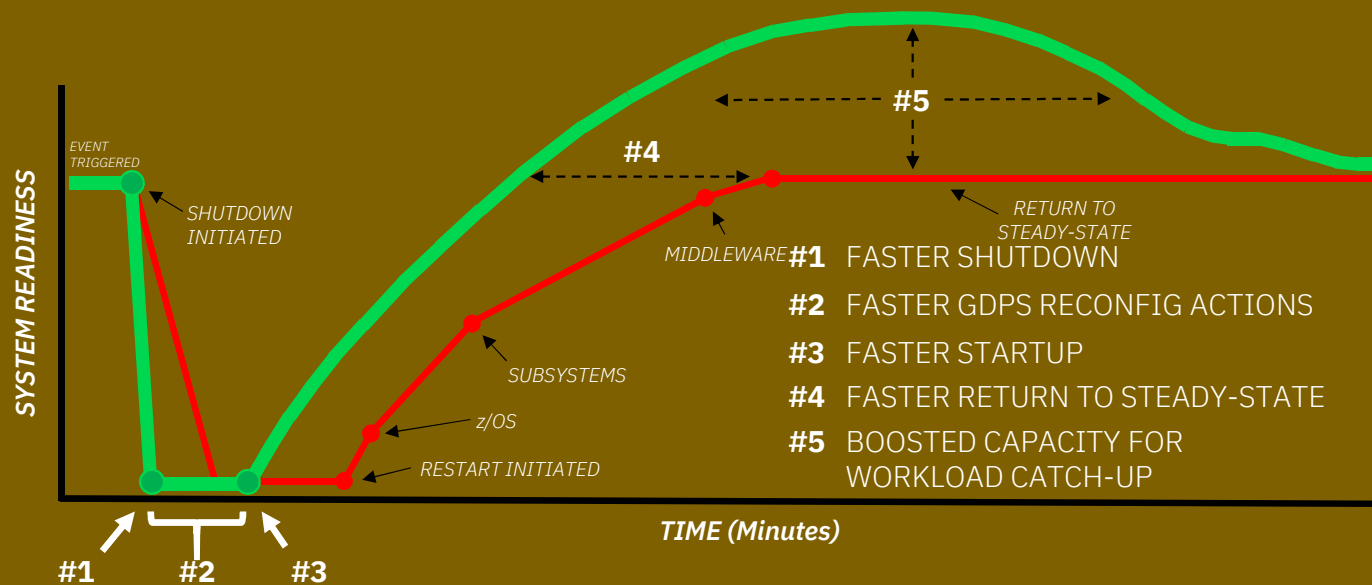 - This is to handle fall back scenarios with NXU compressed data to be decompressed on z14 and below

z15
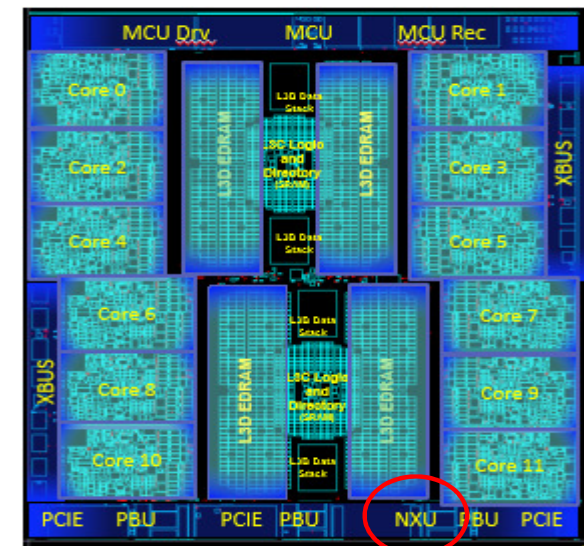
System Recovery Boost on z15

BENEFITS:

ANATOMY OF A PLANNED OUTAGE
WITH SYSTEM RECOVERY BOOST

SYSTEM READINESS

EVENT TRIGGERED

SHUTDOWN INITIATED

#4

#5

RETURN TO STEADY-STATE

MIDDLEWARE

SUBSYSTEMS

z/OS

RESTART INITIATED

#1 FASTER SHUTDOWN

#2 FASTER GDPS RECONFIG ACTIONS

#3 FASTER STARTUP

#4 FASTER RETURN TO STEADY-STATE

#5 BOOSTED CAPACITY FOR WORKLOAD CATCH-UP

#1   #2   #3

TIME (Minutes)

System Recovery Boost on z15

- System Recovery Boost is intended for both planned and unplanned service disruptions, for both single-system and multiple-systems.
    - Expedites planned system shutdown processing, system IPL, middleware/workload restart and recovery, and the client workload execution that follows,
    - Can assist with automated activities during a planned or unplanned DR site switch, for instance.

- Accomplishes this by a variety of methods:
    - 1. **Temporarily boosting the processing capability of GPs** on subcapacity models to run as if they were full-capacity, only on those images experiencing a boost
        - This temp capacity is not visible for pricing purposes, so does not lead to IBM SW licensing cost increases for consumption-based pricing metrics.
        - It does, of course, allow more GP processing capacity to be consumed in a shorter period of time as work is accelerated.
    - **2. On the boosting system with zIIPs, increase parallelism**, capacity, and acceleration by temporarily allowing GP workload to run on zIIPs during the boost period. (This **"blurs" GP and zIIPs**.)
        - A. Using already entitled GPs and zIIPs, -and-
        - B. **Optionally via a priced Boost temporary capacity record and "Turbo" offering** (feature codes #6802 and #9930) to enable temporary activation of additional physical zIIPs
            - This uses unused cores on the machine to provide even more zIIP processing capacity for the boosting image.   For example, up to 20 additional zIIPs can become available for up to 6 hours.
            - Accommodate this additional zIIP capacity in pre-defined reserved logical zIIP capacity in the PR/SM image profile, so they can be brought online.
    - 3. **GDPS exploitation** for reconfiguration
        - Expediting and parallezing GDPS reconfiguration actions that may be part of a customers' restart and recovery process.
    - 4. **Stand-Alone Dump (SADMP) will support boosting** of GPs on subcapacity models only. (no exploitation of zIIP boost).
        - To provide additional processor capacity for use in capturing diagnostic information for system failures.
        - For the entire duration of the dump (not limited to the 60 minute boosts).

…And, doing all this without increasing the 4 hour rolling average IBM software billing cost or MSU consumption costs associated with the customer's workload during these Boosts!

System Recovery Boost on z15

- z/OS Exploitation via z/OS 2.4 and 2.3 with PTFs
- GDPS exploitation via GDPS 4.2
- Firmware support delivered on z15

- IEASYSxx control for configuring whether a system will opt-in for zIIP boost (60 minute period)
  - `BOOST=SYSTEM|ZIIP|SPEED|NONE parameter`
- SMF 30, 70.1, 72.3, 89 will contain information about the boosted zIIP capacity.
  - SCRT does not report on zIIP usage or consumption for pricing purposes.
- New system proc, IEASDBS, to be used to indicate beginning of a planned shutdown for Boost purposes.

- HMC/SE shows images that are currently opted-in for Boost
  - No z/OS DISPLAY command provided.
- zIIP SMT mode is not affected by GP speed boost, as SMT does not apply to GPs.

- Refer to the planned White Page on System Recovery Boost for more details.

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

| Release | IBM.Device.Server.z15-8561.RequiredService | | | | | | IBM.Device.Server.z15-8561.Exploitation | | | | | | | | Max Memory/LPAR |
	Base Support	CPU Measurement Facility (HIS)	FICON Express 16S+	z15 Assembler Support	OSA-Express7S	Fair Latch Manager	System Recovery Boost	Nest Acceleration Unit Compression	Crypto Express7S	RoCE Express2	z/OS V2R4 XL C/C++	CF Level 24	FICON Express16S EDIF	Quantum Safe	TB
z/OS V2.1^S	P		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	Y	Y	P	P	W^{D1}	Y	Y	P	P	P,W^{D1}	4

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

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/