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z/OS Support for IBM zEnterprise EC12 (zEC12) and IBM zEnterprise BC12 (zBC12) Servers

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SHARE in Boston

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Agenda

- **IBM zEnterprise EC12 (zEC12) and IBM zEnterprise BC12 (zBC12) Overview**
- **z/OS Support by Release**
  - Hardware PSP Buckets and Fix Categories
- **Migration Considerations**
  - General
  - For Selected Functions
  - Exploitation Considerations for Selected Functions
- **Migration Paths**
  - General Recommendations and Considerations
  - Recommended Paths for Supported z/OS Releases
- **Summary**
- **Backup**
  - Cryptographic Support

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z/OS Support Summary

Release	z900/ z800 WdfM	z990/ z890 WdfM	z9 EC z9 BC WdfM	z10 EC z10 BC WdfM	z196 CPC	z114 CPC	z196/ z114 w/zBX	zEC12	zBC12	End of Service	Extended Defect Support[1]
z/OS V1.7[2]	X	X	X	X	X					9/08[1]	9/10[1]
z/OS V1.8[2]	X	X	X	X	X	X				9/09[1]	9/11[1]
z/OS V1.9[2]	X	X	X	X	X	X				9/10[1]	9/12[1]*
z/OS V1.10	X	X	X	X	X	X	X	X	X	9/11[1]	9/13[1]*
z/OS V1.11	X	X	X	X	X	X	X	X	X	9/12[1]	9/14[1]*
z/OS V1.12	X	X	X	X	X	X	X	X	X	9/14*	9/16[3]*
z/OS V1.13	X	X	X	X	X	X	X	X	X	9/16*	9/19[3]*
z/OS V2.1[4]*			X	X	X	X	X	X	X	9/18*	9/21[3]*

1 The IBM Lifecycle Extension for z/OS provides the ability for customers to purchase extended defect support for that release of z/OS for up to 24 months after the z/OS release's end of service date
2 See IBM GTS services for additional fee-based extended service
3 Optional extended service is planned to be offered
4 z/OS V2.1 announced as a preview of availability
• 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WdfM – Server has been withdrawn from Marketing

Legend

Out of Lifecycle Extension for z/OS support[2]
Defect support provided with Lifecycle Extension for z/OS
Generally supported

Supported Releases

- **zEC12 and zBC12 capabilities differ depending on z/OS release**
  - Toleration support provided on z/OS V1.10 and z/OS V1.11
    - The Lifecycle Extension for z/OS V1.10 or z/OS V1.11 is required to acquire toleration PTFs and for support
  - Exploitation support provided on z/OS V1.12 and higher
    - z/OS V1.12
      - Exploitation of selected functions
    - z/OS V1.13
      - Exploitation of most functions
    - z/OS V2.1
      - Full exploitation in base

IBM zEC12 System Functions and Features

Five hardware models
Hexa-core 5.5 GHz processor chips
Up to 101 processors configurable as CPs, zAAPs, zIIPs, IFLs, ICFs, or optional SAPs (up to 64-way on z/OS V1.10, 100-way on z/OS V1.11 and higher)
Second generation out of order design
Improvements to pre-fetch instructions
Improved processor cache design
Up to 3TB of Redundant Array of Independent Memory **(**RAIM) – same as z196
Twice the HSA versus z196 (32 GB vs 16 GB)
Decimal-Floating-Point Zoned-Conversion Facility
Flash Express (Storage Class Memory-SCM)
1 MB Pageable Large Pages
Dynamic reconfiguration support for Flash Express
2 GB Large Page Support
Optional PLPA, COMMON page data sets
Crypto Express4S cryptographic coprocessors and accelerators
New support for IBM Enterprise PKCS #11 (EP11) coprocessor
DUKPT for MAC and Data Encryption, Europay, Mastercard, and Visa (EMV) CCA enhancements
New and enhanced instructions
IBM zAware
OSA-Express4S and OSA-Express5S (GbE LX and SX, 10 GbE LR and SR, and 1000BASE-T)

(z/OS support in blue)

(GA2 support in red)

FICON Express8S
24K subchannels for FICON channels
IBM zEnterprise Data Compression (zEDC) capability using zEDC Express
Shared Memory Communications-Remote Direct Memory Access (SMC-R) - 10GbE RoCE Express
Parallel Sysplex InfiniBand (PSIFB) Coupling Links
High Performance FICON for System z
CPU Measurement Facility
CFCC Level 18 and 19 enhancements
Transactional Execution Facility
Exploitation of new hardware instructions – XL C/C++ ARCH(10) and TUNE(10)
CCA 4.4 and other enhancements: RKX Key Export Wrap, UDX Reduction/Simplification, additional EP11 algorithms, expanded EMV support, AP Configuration simplification, CTRACE Enhancements, KDS Key Utilization Stats
Optional Non Raised Floor
Optional water cooling and DC Power
Optional overhead Power and I/O cabling
zBX Model 003 support of: •IBM WebSphere DataPower Integration Appliance XI50 for zEnterprise •Select IBM BladeCenter PS701 Express blades or IBM BladeCenter HX5 blades
zManager enhancements

IBM zBC12 System Functions and Features

2 Models – H06, H13
Hexa-core 4.2 GHz processor chips
Up to 13 processors configurable as CPs, zAAPs, zIIPs, IFLs, ICFs, or optional SAPs
Second generation out of order design
Improvements to pre-fetch instructions
Improved processor cache design
Up to 496 GB RAIM
Twice the HSA versus z114 (16 GB vs 8 GB)
Up to 6 CPs at 26 capacity points
Decimal-Floating-Point Zoned-Conversion Facility
Flash Express (Storage Class Memory-SCM)
1 MB Pageable Large Pages
Dynamic reconfiguration support for Flash Express
2 GB Large Page Support
Optional PLPA, COMMON page data sets
Crypto Express4S cryptographic coprocessors and accelerators
New support for IBM Enterprise PKCS #11 (EP11) coprocessor
DUKPT for MAC and Data Encryption, Europay, Mastercard, and Visa (EMV) CCA enhancements
New and enhanced instructions
IBM zAware
OSA-Express4S and OSA-Express5S (GbE LX and SX, 10 GbE LR and SR, and 1000BASE-T)

(z/OS support in blue + red)

FICON Express8S
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CPU Measurement Facility
CFCC Level 18 and 19 enhancements
Transactional Execution Facility
Exploitation of new hardware instructions – XL C/C++ ARCH(10) and TUNE(10)
CCA 4.4 and other enhancements: RKX Key Export Wrap, UDX Reduction/Simplification, additional EP11 algorithms, expanded EMV support, AP Configuration simplification, CTRACE Enhancements, KDS Key Utilization Stats
Non-raised floor option available
Overhead Cabling and DC Power Options
zBX Model 003 support of: •IBM WebSphere DataPower Integration Appliance XI50 for zEnterprise •Select IBM BladeCenter PS701 Express blades or IBM BladeCenter HX5 blades
zManager enhancements

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zEC12 PSP Bucket and Fix Categories

- **Software requirements differ depending on z/OS release and functions exploited**
  - **Support provided via a combination of web deliverables and PTFs**
  - **zEC12 Required PTFs**
    - **Documented in zEC12 PSP Bucket: Upgrade = 2827DEVICE, Subset = 2827/ZOS**
      - Broken out by z/OS release, identifying required and exploitation
    - **PTFs can be identified by SMP/E commands (REPORT MISSINGFIX, LIST, or APPLY) for the following Fix Categories:**
      - **IBM.Device.Server.zEC12-2827**
      - **IBM.Device.Server.zEC12-2827.Exploitation**
      - **IBM.Function.zEDC**
    - **If you are skipping generations of servers, you need to install all the maintenance and perform required migration actions for the servers that you are skipping:**

Server	UPGRADE	Subset	Fix Category
z114	2818DEVICE	2818/ZOS	IBM.Device.Server.z114-2818*
z196	2817DEVICE	2817/ZOS	IBM.Device.Server.z196-2817*
z10 BC	2098DEVICE	2098/ZOS	IBM.Device.Server.z10-BC-2098*
z10 EC	2097DEVICE	2097/ZOS	IBM.Device.Server.z10-EC-2097*
z9 BC	2096DEVICE	2096/ZOS	IBM.Device.Server.z9-BC-2096*
z9 EC	2094DEVICE	2094/ZOS	IBM.Device.Server.z9-EC-2094*
z890	2086DEVICE	2086/ZOS	IBM.Device.Server.z890--2086*
z990	2084DEVICE	2084/ZOS	IBM.Device.Server.z990-2084*

zBC12 PSP Bucket and Fix Categories

- **Software requirements differ depending on z/OS release and functions exploited**
  - **Support provided via a combination of web deliverables and PTFs**
  - **zBC12 Required PTFs**
    - **Documented in zBC12 PSP Bucket: Upgrade = 2828DEVICE, Subset = 2828/ZOS**
      - Broken out by z/OS release, identifying required and exploitation
    - **PTFs can be identified by SMP/E commands (REPORT MISSINGFIX, LIST, or APPLY) for the following Fix Categories:**
      - **IBM.Device.Server.zBC12-2828**
      - **IBM.Device.Server.zBC12-2828.Exploitation**
      - **IBM.Function.zEDC**
    - **If you are skipping generations of servers, you need to install all the maintenance and perform required migration actions for the servers that you are skipping:**

Server	UPGRADE	Subset	Fix Category
zEC12	2827DEVICE	2827/ZOS	IBM.Device.Server.zEC12-2827*
z114	2818DEVICE	2818/ZOS	IBM.Device.Server.z114-2818*
z196	2817DEVICE	2817/ZOS	IBM.Device.Server.z196-2817*
z10 BC	2098DEVICE	2098/ZOS	IBM.Device.Server.z10-BC-2098*
z10 EC	2097DEVICE	2097/ZOS	IBM.Device.Server.z10-EC-2097*
z9 BC	2096DEVICE	2096/ZOS	IBM.Device.Server.z9-BC-2096*
z9 EC	2094DEVICE	2094/ZOS	IBM.Device.Server.z9-EC-2094*
z890	2086DEVICE	2086/ZOS	IBM.Device.Server.z890--2086*
z990	2084DEVICE	2084/ZOS	IBM.Device.Server.z990-2084*

Other zEnterprise Fix Categories

- Other PTFs related to zEC12 or zBC12 (common to other servers)
  - PTFs can be identified by SMP/E commands (REPORT MISSINGFIX, LIST, or APPLY) for the following Fix Categories:
    - IBM.Device.Server.zEC12-2827.ParallelSysplexInfiniBandCoupling
    - IBM.Device.Server.zEC12-2827.ServerTimeProtocol
    - IBM.Device.Server.zEC12-2827.zHighPerformanceFICON
    - IBM.Device.Server.zEC12-2827.UnifiedResourceManager
    - IBM.Device.Server.zBC12-2828.ParallelSysplexInfiniBandCoupling
    - IBM.Device.Server.zBC12-2828.ServerTimeProtocol
    - IBM.Device.Server.zBC12-2828.zHighPerformanceFICON
    - IBM.Device.Server.zBC12-2828.UnifiedResourceManager
- zBX Required PTFs
  - Documented in zBX PSP Bucket: Upgrade = 2458DEVICE, Subset = 2458/ZOS
    - Broken out by z/OS release, identifying required and exploitation
  - Can be identified by SMP/E commands (REPORT MISSINGFIX, LIST, or APPLY)
    - Fix Categories
      - IBM.Device.Server.zBX-2458

Please note that currently there are NO PTFs listed in this PSP bucket

z/OS Toleration Support for zEC12 and zBC12

- z/OS V2.1
- z/OS V1.13
- z/OS V1.12
- **z/OS V1.11 (No longer generally supported. The IBM Lifecycle Extension for z/OS V1.11 (5657-A01) provides the ability for customers to purchase extended defect support for z/OS V1.11 for up to 24 months after the z/OS V1.11 end of service date)**
  - Required to acquire toleration PTFs available after 9/2012 and support
- **z/OS V1.10 (No longer generally supported. The IBM Lifecycle Extension for z/OS V1.10 (5656-A01) provides the ability for customers to purchase extended defect support for z/OS V1.10 for up to 24 months after the z/OS V1.10 end of service date)**
  - Required to acquire toleration PTFs and for support

z/OS Toleration Support for zEC12 and zBC12

- **Provides same functionality as that on the IBM zEnterprise 196 (z196)**
  - HiperDispatch, OSA-Express4S, FICON Express8S, Parallel Sysplex InfiniBand (PSIFB) Coupling Links, CF Level 17, High Performance FICON for System z (zHPF), CPU Measurement Facility, …
- **Plus for z/OS V1.10 and z/OS V1.11**
  - OSA-Express4S (GbE LX and SX, 1000BASE-T, 10 GbE LR and SR)
  - OSA-Express5S
  - Crypto Express4S toleration
  - GRS FICON CTC toleration
  - New z/Architecture® Instructions (and new OPCODE support)

z/OS Toleration Support for zEC12 and zBC12

Release	Base zEC12 Support	Base zBC12 Support	OSA-Express4S (Gbe LX and SR, 1000BASE-T, 10 Gbe LR and SR)	FICON Express8S (CHPID FC)	IFB Coupling Links	Crypto Express4S Toleration[2]	High Performance FICON (zHPF)	CPU Measurement Facility (HIS)	GRS FICON CTC Toleration	New z/Architecture Instructions	OSA-Express5S	CF Level 18	CF Level 19	Crypto Express4S Exploitation[3]	XL C/C++ ARCH(10)/TUNE(10)	IBM zAware (z/OS Monitoring)	Java exploitation of the Transactional Execution Facility	Flash Express (Storage Class Memory - SCM)	Pageable Large Pages	Dynamic reconfiguration support for Flash Express	2 GB Large Page	Optional PLPA/ COMMON page data set support	24K subchannels for FICON	Coupling thin interrupt support	CF Flash Exploitation[4]	Cryptographic Enhancements	SMC-R - 10GbE RoCE Exploitation	IBM zEnterprise Data Compression (zEDC) using zEDC Express
	zEC12 PSP Bucket – 2827DEVICE 2827/ZOS zBC12 PSP Bucket – 2828DEVICE 2828/ZOS																											
	Base Support											Exploitation Support																
z/OS V1.10[1]	P	P	P	P	P	W P	P	P	P	P	P	N	N	N	N	N	N	N	N	N	N	N	P[6]	N	N	N	P[6]	N
z/OS V1.11[1]	P	P	P	P	P	W P	P	P	P	P	P	N	N	N	N	N	N	N	N	N	N	N	P[6]	N	N	N	P[6]	N

[1] – The Lifecycle Extension for z/OS V1.10 (5656-A01) is required to acquire toleration PTFs and for support. The Lifecycle Extension for z/OS V1.11 (5657-A01) is required for support after September 30, 2012 and to acquire PTFs that become available after that date.

[2] – A Crypto Web Deliverable (HCR7770 or higher) AND a PTF is required for toleration unless CyrptoExpress3 is Carried Forward. Support differs depending on the Crypto Web Deliverable installed

[3] – Crypto Exploitation differs based on the Crypto Web Deliverable installed

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

[5] - z/OS V2.1 announced as a preview of availability

[6] – PTF available for toleration ONLY

[7] – Software decompression only

B – FMID shipped in Base product P – PTF is required W – FMID shipped in a Web Deliverable

z/OS Toleration Support for zEC12 and zBC12

- **z/OS V2.1**
- **z/OS V1.13**
- **z/OS V1.12**
- z/OS V1.11 (No longer generally supported. The IBM Lifecycle Extension for z/OS V1.11 (5657-A01) provides the ability for customers to purchase extended defect support for z/OS V1.11 for up to 24 months after the z/OS V1.11 end of service date)
  - Required to acquire toleration PTFs available after 9/2012 and support
- z/OS V1.10 (No longer generally supported. The IBM Lifecycle Extension for z/OS V1.10 (5656-A01) provides the ability for customers to purchase extended defect support for z/OS V1.10 for up to 24 months after the z/OS V1.10 end of service date)
  - Required to acquire toleration PTFs and for support

z/OS Exploitation Support for zEC12 and zBC12

- **Provides same functionality as that on the IBM zEnterprise 196**
  - IBM zEnterprise Unified Resource Manager, Network and Performance Management, intranode management network (INMN) and intraensemble data network (IEDN), Static Power Save Mode, Three subchannel sets, IPL from alternate subchannel set, zDAC support, OSA-Express3 and OSA-Express4S Inbound Workload queuing (IWQ)
- **Provides zEC12 and zBC12 Toleration Support plus:**
  - **z/OS V1.12 (and higher)**
    - **XES/XCF Support of New Hardware (CF Level 18)**
    - **Crypto Express4S Exploitation**
      - Enterprise Security PKCS11- Hardware Security Module (HSM), DUKPT for MAC and Data Encryption, Cipher Text Translate CCA Verb, PKDS/TKDS Constraint Relief, FIPS Evaluation, Common Criteria, Random Number Cache, FIPS on Demand, Wrapping Keys with Strong Keys
    - **24K subchannels for FICON channels**
    - **CFCC and z/OS support for thin interrupts**
  - **z/OS V1.13 (and higher) only**
    - **Java exploitation of the Transactional Execution Facility**
    - **Exploitation of New Hardware Features - C/C++ Arch(10) / Tune(10)**
    - **IBM zAware (z/OS Monitoring)**
    - **RSM Enhancements**
      - Flash Express Support
      - Pageable 1MB Large Page Support
      - Dynamic reconfiguration support for Flash Express – PTFs UA68169 and UA68170
      - 2 GB Large Page Support - PTFs UA68145 and UA68146
      - Optional PLPA and COMMON page data set support – PTFs UA68145 and UA68146
    - **CF Flash Support***
    - **CCA 4.4 and other cryptographic enhancement support:**
      - RKX Key Export Wrap, UDX Reduction/Simplification, additional EP11 algorithms, expanded EMV support, AP Configuration simplification, CTRACE Enhancements, KDS Key Utilization Stats
  - **z/OS V2.1 (and higher)**
    - **Support the transactional Execution Facility in additional production environments**
    - **IBM zEnterprise Data Compression (zEDC) capability using zEDC Express**
    - **Shared Memory Communications-Remote Direct Memory Access (SMC-R)**
      - **10GbE RoCE Express exploitation**
    - **Support of PNETID for OSD and IQD CHPIDs and PCIe functions (PNETID = names)**
    - Usability and performance improvements for zDAC (also available on z196/z114)

z/OS Exploitation Support for zEC12 and zBC12

Release	Base zEC12 Support	Base zBC12 Support	OSA-Express4S (Gbe LX and SR, 1000BASE-T, 10 Gbe LR and SR)	FICON Express8S (CHPID FC)	IFB Coupling Links	Crypto Express4S Toleration[2]	High Performance FICON (zHPF)	CPU Measurement Facility (HIS)	GRS FICON CTC Toleration	New z/Architecture Instructions	OSA-Express5S	CF Level 18	CF Level 19	Crypto Express4S Exploitation[3]	XL C/C++ ARCH(10)/TUNE(10)	IBM zAware (z/OS Monitoring)	Java exploitation of the Transactional Execution Facility	Flash Express (Storage Class Memory - SCM)	Pageable Large Pages	Dynamic reconfiguration support for Flash Express	2 GB Large Page	Optional PLPA/ COMMON page data set support	24K subchannels for FICON	Coupling thin interrupt support	CF Flash Exploitation[4]	Cryptographic Enhancements	SMC-R - 10GbE RoCE Exploitation	IBM zEnterprise Data Compression (zEDC) using zEDC Express
	zEC12 PSP Bucket – 2827DEVICE 2827/ZOS zBC12 PSP Bucket – 2828DEVICE 2828/ZOS																											
	Base Support											Exploitation Support																
z/OS V1.12	P	P	B	B	B	W P	P	P	P	P	P	P	P	W	N	N	N	N	N	N	N	N	P	P	N	N	P[6]	P[7]
z/OS V1.13	P	P	B	B	B	W P	P	P	P	P	P	P	P	W	P	P	P	W P	W P	W P	W P	W P	P	P	P	W	P[6]	P[7]
z/OS V2.1[4,5]	B	B	B	B	B	B	B	B	B	B	B	B	P	B	B	B	B	B	B	B	B	B	B	B	P	W	B	P

[1] – The Lifecycle Extension for z/OS V1.10 (5656-A01) is required to acquire toleration PTFs and for support. The Lifecycle Extension for z/OS V1.11 (5657-A01) is required for support after September 30, 2012 and to acquire PTFs that become available after that date.

[2] – A Crypto Web Deliverable (HCR7770 or higher) AND a PTF is required for toleration unless CyrptoExpress3 is Carried Forward. Support differs depending on the Crypto Web Deliverable installed

[3] – Crypto Exploitation differs based on the Crypto Web Deliverable installed

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

[5] - z/OS V2.1 announced as a preview of availability

[6] – PTF available for toleration ONLY

[7] – Software decompression only

B – FMID shipped in Base product P – PTF is required W – FMID shipped in a Web Deliverable

Supported z/OS Releases and ICSF Levels

- **z/OS V1.10 Crypto customers can run with:**
  - HCR7750 – Base z/OS V1.10[1]
  - HCR7751 – Cryptographic Support for z/OS V1.8 through z/OS V1.10 and z/OS.e V1.8[1]
  - **HCR7770 – Cryptographic Support for z/OS V1R9-V1R11**
  - **HCR7780 – Cryptographic Support for z/OS V1R10-V1R12**
- **z/OS V1.11 Crypto customers can run with:**
  - HCR7751 – Base z/OS V1.11[1]
  - **HCR7770 – Cryptographic Support for z/OS V1R9-V1R11**
  - **HCR7780 – Cryptographic Support for z/OS V1R10-V1R12**
  - **HCR7790 – Cryptographic Support for z/OS V1R11-V1R13**
- **z/OS V1.12 Crypto customers can run with:**
  - **HCR7770 – Base z/OS V1.12**
  - **HCR7780 – Cryptographic Support for z/OS V1R10-V1R12**
  - **HCR7790 – Cryptographic Support for z/OS V1R11-V1R13**
  - **HCR77A0 – Cryptographic Support for z/OS V1R12-V1R13**
- **z/OS V1.13 Crypto customers can run with:**
  - **HCR7780 – Base z/OS V1.13**
  - **HCR7790 – Cryptographic Support for z/OS V1R11-V1R13**
  - **HCR77A0 – Cryptographic Support for z/OS V1R12-V1R13**
  - **HCR77A1 – Cryptographic Support for z/OS V1R13-z/OS V2R1**
- **z/OS V2.1 Crypto customers can run with:**
  - **HCR77A0 – Base z/OS V2.1**
  - **HCR77A1 – Cryptographic Support for z/OS V1R13-z/OS V2R1**

1 - unless CyrptoExpress3 is Carried Forward

z/OS Support for zEC12 and zBC12

- **Base support is provided by PTFs**
- **Exploitation of many functions is provided by PTFs**
- **Exploitation of Crypto Express4S requires a web deliverable on z/OS V1.12 and higher**
  - **Exploitation of CCA 4.4 and other cryptographic support requires a different web deliverable on z/OS V1.13 or higher**
- **Exploitation of RSM Enhancements, including Flash Express exploitation, requires the z/OS V1R13 RSM Enablement Offering web deliverable, installed on z/OS V1.13**
  - Available since December 14, 2012
  - PTFs UA68145, UA68146, UA68169 and UA68170 now available

Agenda

- IBM zEnterprise EC12 (zEC12) and IBM zEnterprise BC12 (zBC12) Overview
- z/OS Support by Release
  - Hardware PSP Buckets and Fix Categories
- **Migration Considerations**
  - **General**
  - **For Selected Functions**
  - Exploitation Considerations for Selected Functions
- Migration Paths
  - General Recommendations and Considerations
  - Recommended Paths for Supported z/OS Releases
- Summary
- Backup
  - Cryptographic Support

General Migration Considerations

- **Software Changes**
  - z/OS releases do not require zEC12 or zBC12 servers
  - zEC12 or zBC12 servers ONLY require software identified as 'base' support
    - Minimal toleration support needed depending on z/OS release
    - zEC12 or zBC12 servers do NOT require any 'functional' software
- **Very few new migration issues identified**
  - z990, z890, z9 EC, z9 BC, z10 EC, z10 BC, z196, and z114 server migration actions "inherited"
  - New multisystem considerations
  - Many functions are enabled/disabled based on the presence or absence of the required hardware and

Migration Considerations for Select Functions

- **New z/Architecture Machine Instructions**
  - New mnemonics
  - Use of XL C/C++ ARCH(10) and TUNE(10) options
- **Sysplex and Multisystem Considerations**
  - "Inherited" Sysplex Considerations
    - Server participation restriction in a Parallel Sysplex
    - Evaluate Coupling Links requirements
      - ICB-4 Coupling Links not supported
    - Evaluate Sysplex Timer environment
      - ETR not supported
        - » A mixed CTN configuration IS supported:
          z10 servers using ETR or STP and zEC12 or zBC12 servers using STP
        - » zEC12 and zBC12 will be the last servers to support connections to an STP Mixed CTN
  - GRS Ring ESCON CTC not supported on zEC12 or zBC12 Servers

New z/Architecture Machine Instructions

- **The new mnemonics may collide with (be identical to) the names of Assembler macro instructions you use**
  - If you write programs in Assembler Language, you should compare the list of new instructions to the names of Assembler macro instructions you use and/or provide
  - If a conflict is identified, take one of these actions:
    - Change the name of your macro instruction.
    - Specify a separate assembler OPCODE table
      - via PARM= , ASMAOPT, or '*PROCESS OPTABLE….' in source
- **Use a coding technique that permits both use of a new instruction and a macro with the same name in an assembly**
- **Use of XL C/C++ ARCH(10) and TUNE(10) options**
  - See later chart

z/OS XL C/C++ Exploitation of New Machine Instructions

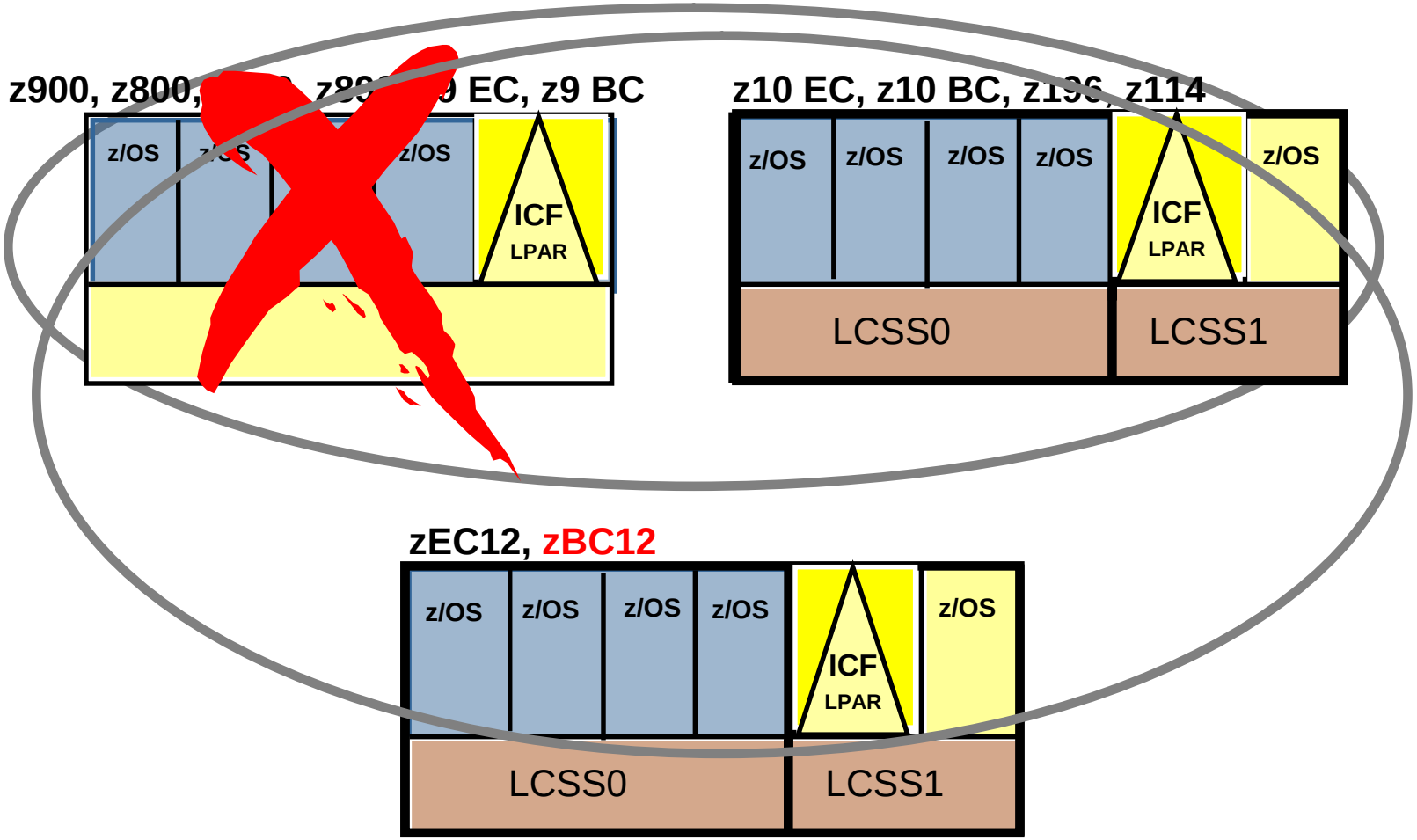
- **C/C++ ARCH(10) and TUNE(10) options:**
  - The ARCHITECTURE C/C++ compiler option selects the minimum level of machine architecture on which your program will run.
    - ARCH(10) exploits instructions available on a zEC12 server
    - The TUNE compiler option allows you to optimize your application for a specific machine architecture within the constraints imposed by the ARCHITECTURE option
      - The TUNE level has to be at least the ARCH level
      - If the TUNE level is lower than the specified ARCH level, the compiler forces TUNE to match the ARCH level or uses the default TUNE level, whichever is greater.
      - For more information on the ARCHITECTURE and TUNE compiler options refer to the z/OS XL C/C++ User's Guide.
- **Exploitation Restriction:**
  - Code compiled with the C/C++ ARCH(10) option can only run on zEC12 servers, otherwise an operation exception will result
  - This is a consideration for programs running on different level servers during development, test, production, and during fallback or DR

Server Participation in a Parallel Sysplex

- **zEC12 or zBC12 servers do not support active participation in the same Parallel Sysplex with:**
  - IBM System z9 Enterprise Class (z9 EC), IBM System z9 Business Class (z9 BC)
  - IBM eServer zSeries 990 (z990), IBM eServer zSeries 890 (z890),
  - IBM eServer zSeries 900 (z900), IBM eServer zSeries 800 (z800),
  - and older System/390 Parallel Enterprise Server systems

  This means:
  - Configurations with z/OS on one of these servers can't add a zEC12 or zBC12 server to their sysplex for either a z/OS image or a CF image
  - Configurations with a CF on one of these servers can't add a zEC12 or zBC12 server to their sysplex for either a z/OS image or a CF image
- **zEC12 and zBC12 servers do not support ICB-4 Coupling Links**
  - Customers should plan their coupling link technology
- **zEC12 and zBC12 servers do not support connection to an ETR**
  - A mixed CTN configuration IS supported
    - z10 servers using ETR or STP and zEC12 or zBC12 servers using STP
    - zEC12 and zBC12 will be the last servers to support connections to an STP Mixed CTN

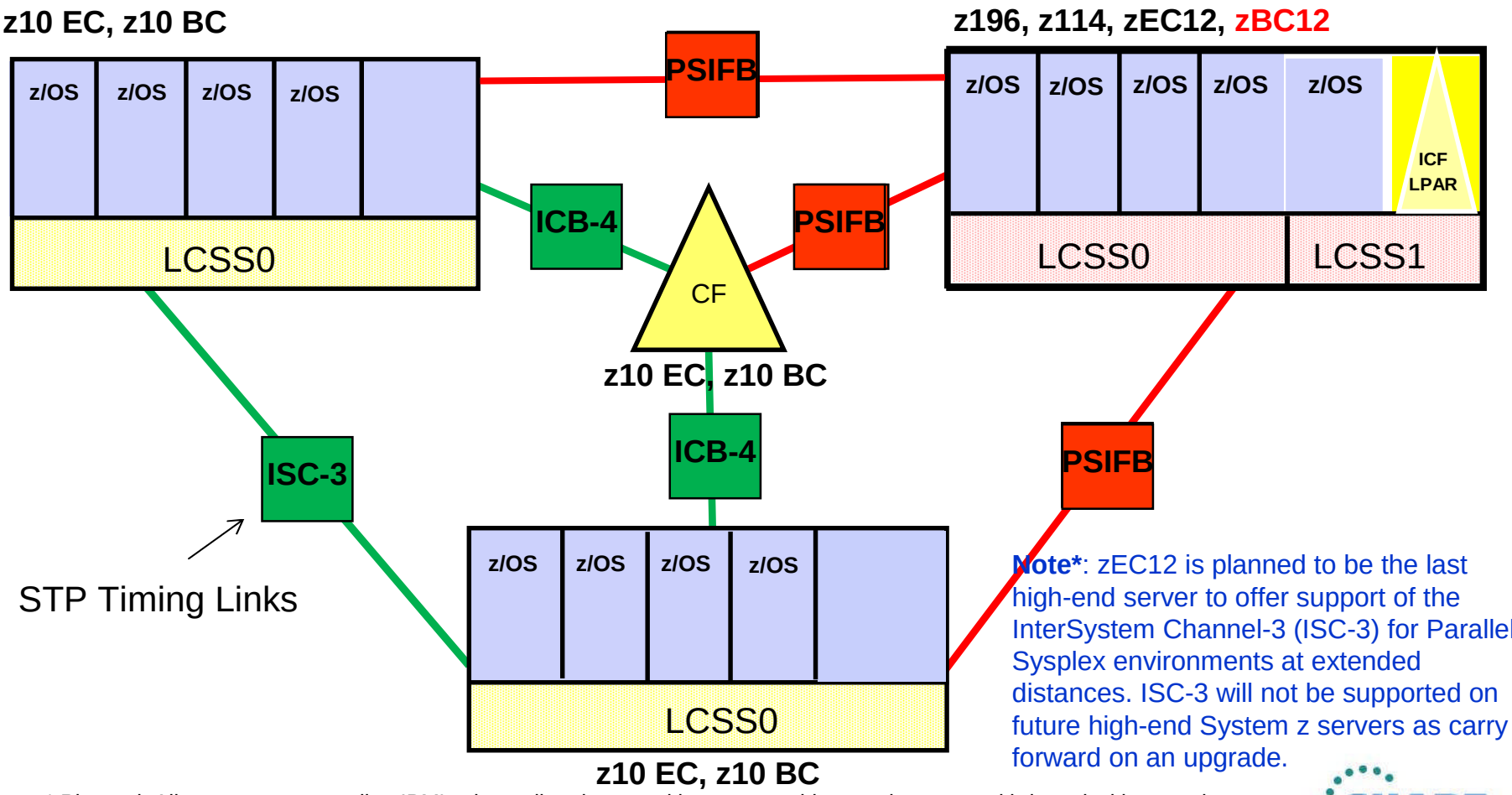
Server Participation in a Parallel Sysplex



Parallel Sysplex (No ICB-4 Link Support)

The "intermediate" CFs can provide a 'bridge' to connect to z196, z114, zEC12, or zBC12 servers

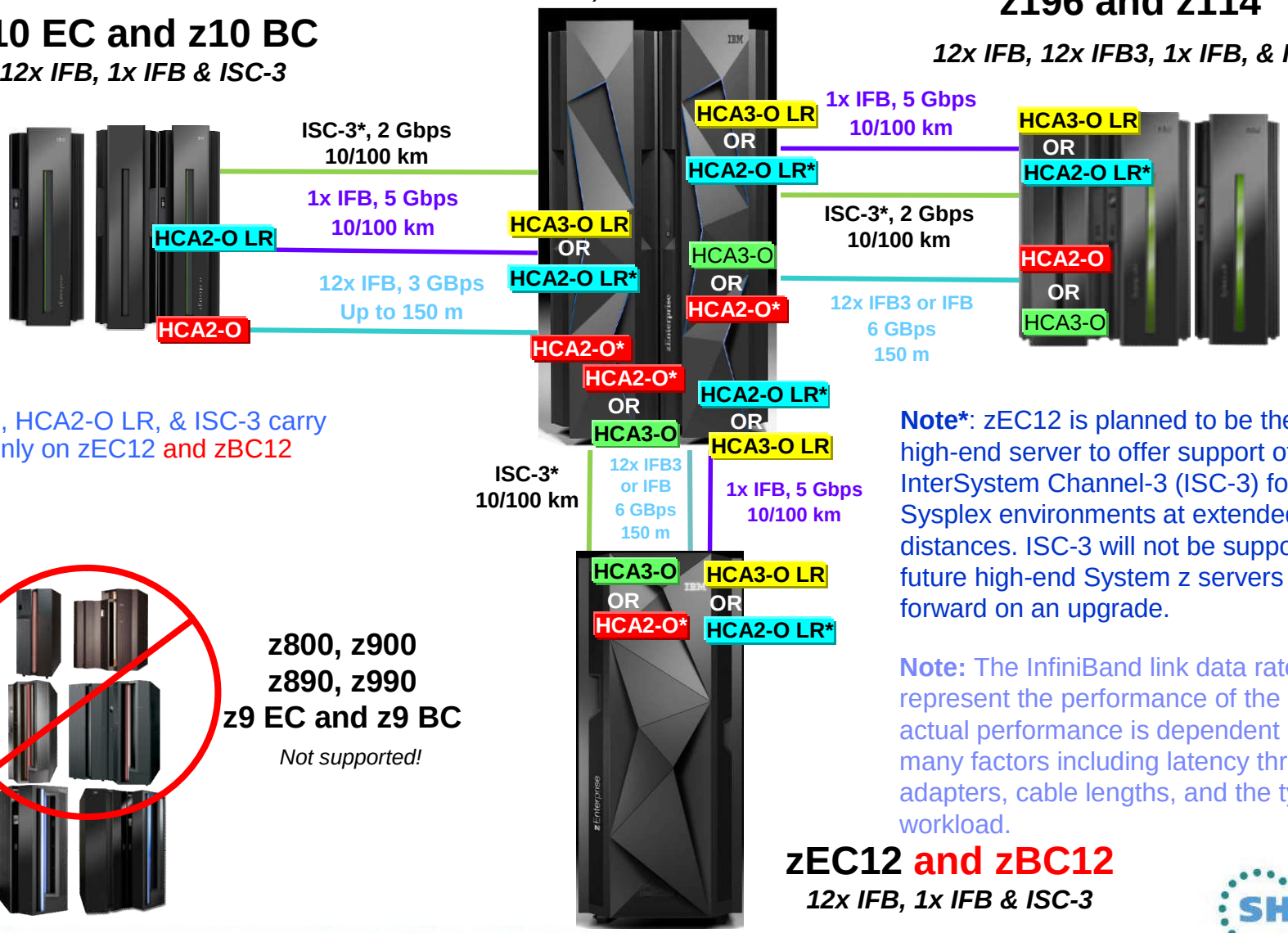
- No IBC-4 Links to z196, z114, zEC12, or zBC12
- Can intermix existing ICB4 and PSIFB link technology if using z10 Coupling Facilities



Note*: zEC12 is planned to be the last high-end server to offer support of the InterSystem Channel-3 (ISC-3) for Parallel Sysplex environments at extended distances. ISC-3 will not be supported on future high-end System z servers as carry forward on an upgrade.

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

Parallel Sysplex Coupling Connectivity



*HCA2-O, HCA2-O LR, & ISC-3 carry forward only on zEC12 and zBC12

z800, z900
z890, z990
z9 EC and z9 BC

Not supported!

Note*: zEC12 is planned to be the last high-end server to offer support of the InterSystem Channel-3 (ISC-3) for Parallel Sysplex environments at extended distances. ISC-3 will not be supported on future high-end System z servers as carry forward on an upgrade.

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

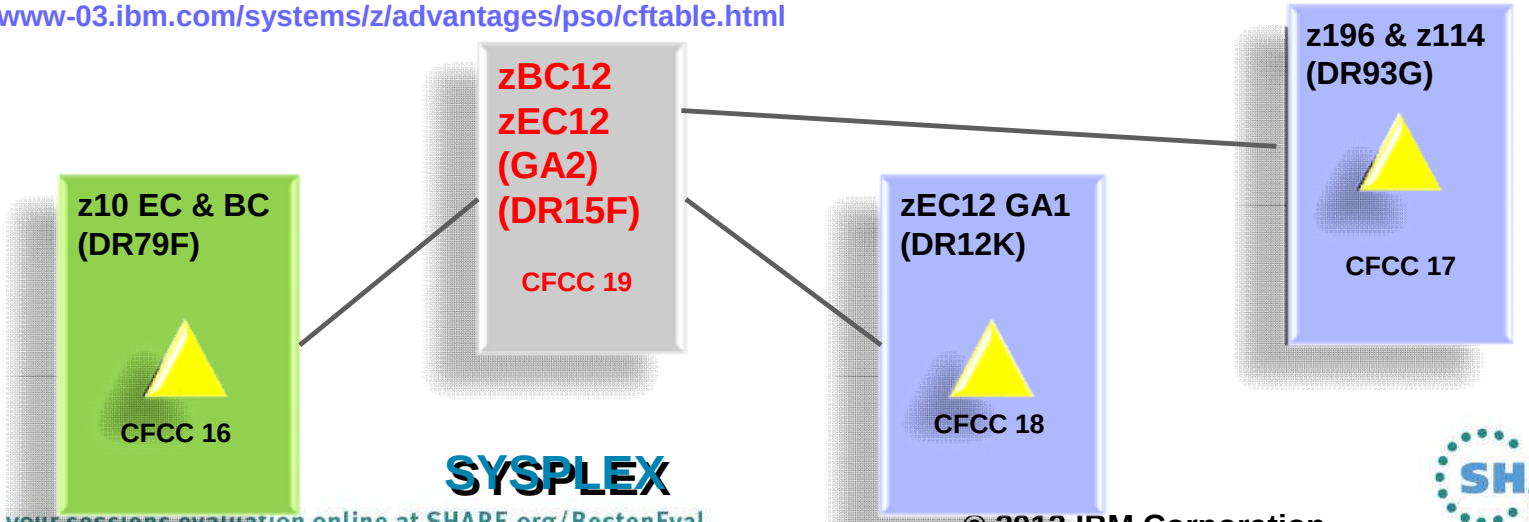
zEC12 and zBC12
12x IFB, 1x IFB & ISC-3

Supported CFCC Levels for zBC12 and zEC12 (GA2)

- **The following MCL and CFCC levels are recommended when coupling with a EC12 GA2 or zBC12.**
- **z10 (2097 or 2098)**
  - Release 16.00 / Service level – 4.06 Driver 79 Bundle 60 MCL N24403.013
- **z196 (2817)**
  - Release 17.00 / Service level – 10.25 Driver 93 Bundle 54 MCL N48162.018
- **z114 (2818)**
  - Release 17.00 / Service level – 10.25 Driver 93 Bundle 54 MCL N48162.018
- **zEC12 GA1 (2827)**
  - Release 18.00 / Service level 0.37 Driver 12 Bundle 25 MCL H09167.008

Refer to the latest Exception Letter

For latest recommended levels see the current exception letter published on Resource Link:
https://www-304.ibm.com/servers/resourcelink/lib03020.nsf/pages/exceptionLetters?OpenDocument
http://www-03.ibm.com/systems/z/advantages/pso/cftable.html

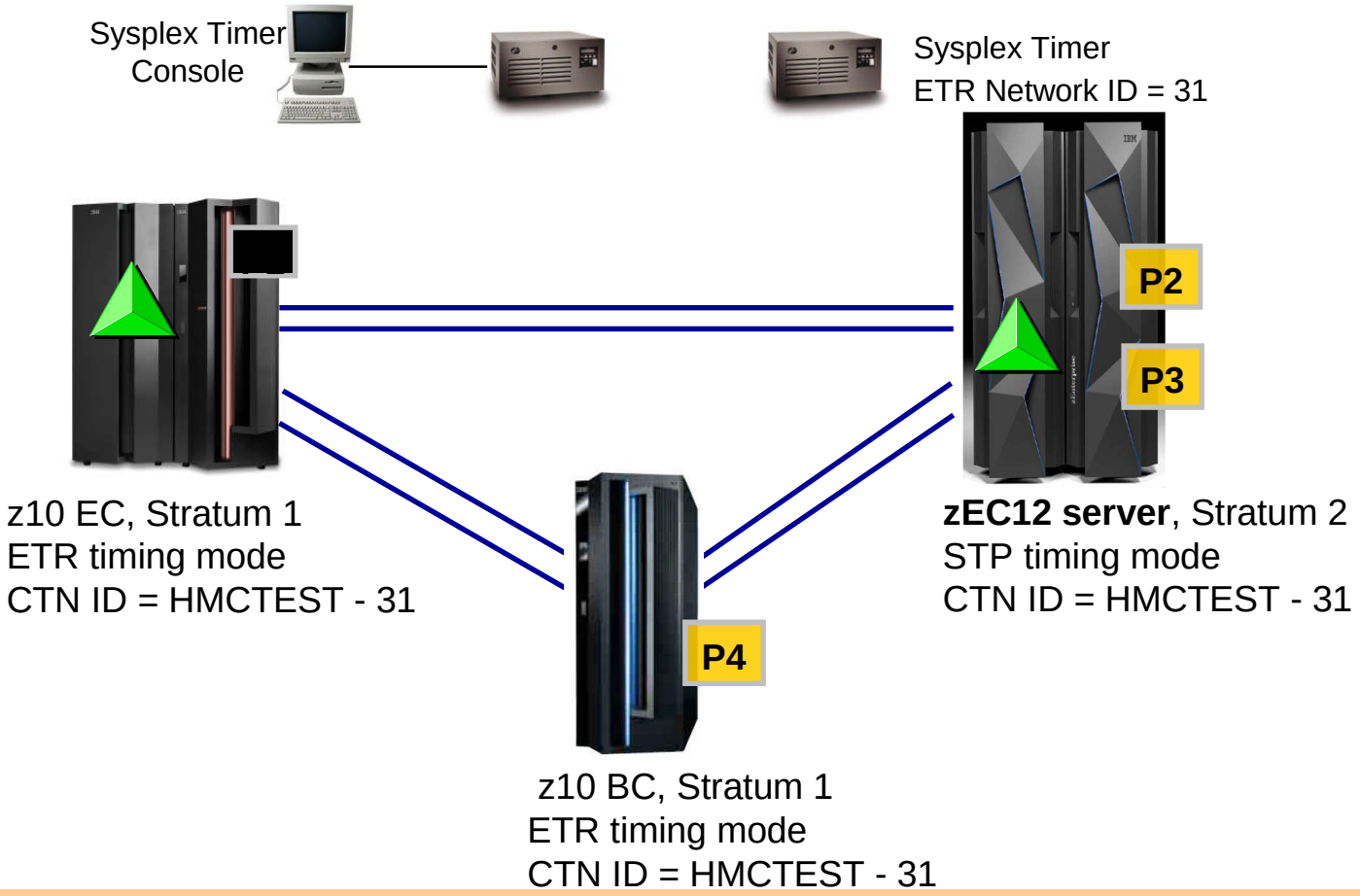


STP Configurations

- **Two types of Coordinated Timing Network (CTN) configurations possible:**
  - Mixed CTN
    - Allows servers/CFs that can only be synchronized to a Sysplex Timer (ETR network) to coexist with servers/CFs that can be synchronized with CST in the “same” timing network
    - Sysplex Timer provides timekeeping information
    - CTN ID format
      - STP network ID concatenated with ETR network ID
    - zEC12 and zBC12 are planned to be the last System z servers to support connections to an STP Mixed CTN*
  - STP-only CTN
    - All servers/CFs synchronized with CST
    - Sysplex Timer is NOT required
    - CTN ID format
      - STP network ID only

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

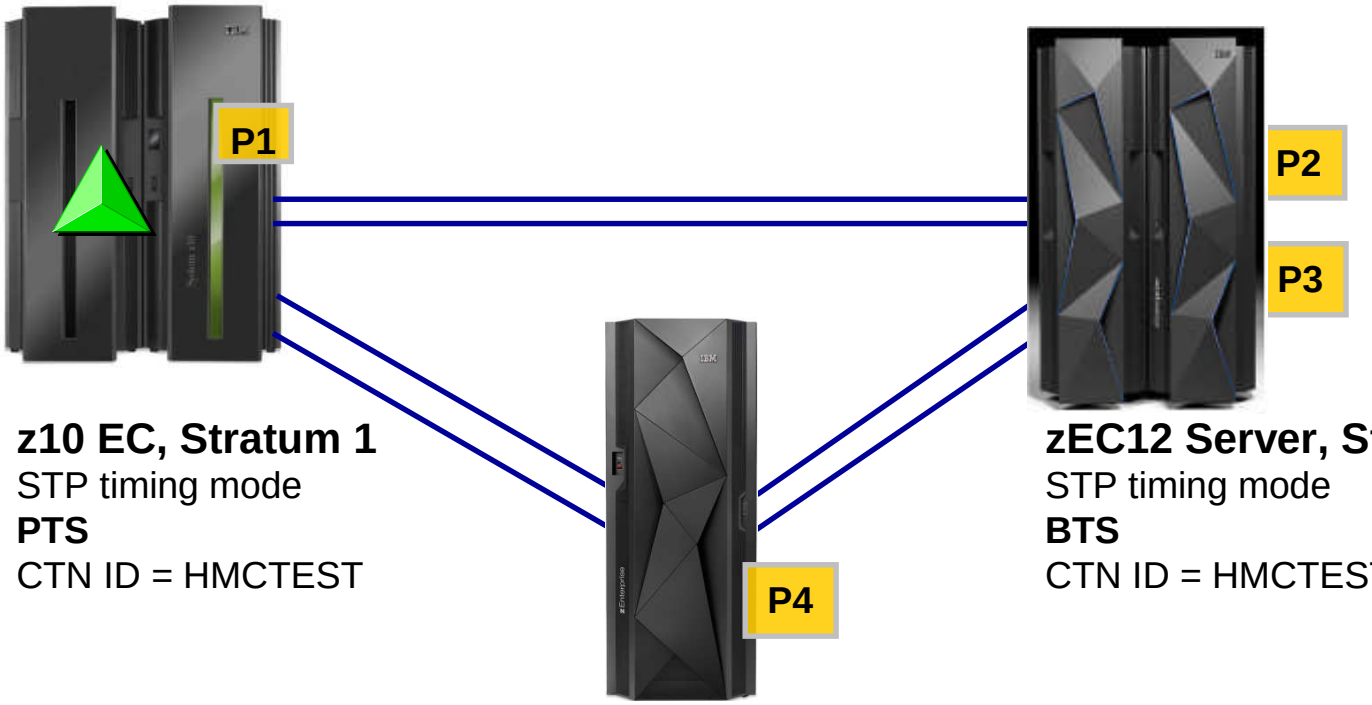
Mixed CTN Example with System zEC12 server



Strong recommendation: Configure at least two Stratum 1 servers before configuring a zEC12 server as S2 – to avoid a single point of failure

zEC12 is planned to be the last high-end System z server to support connections to an STP Mixed CTN*

STP-only CTN Example with System zEC12/zBC12 Servers



z10 EC, Stratum 1
STP timing mode
PTS
CTN ID = HMCTEST

zEC12 Server, Stratum 2
STP timing mode
BTS
CTN ID = HMCTEST

zBC12, Stratum 2
STP timing mode
Arbiter
CTN ID = HMCTEST

New zEC12 and zBC12 Multisystem Considerations

- **zEC12 and zBC12 do NOT support ESCON**
- **Previously, GRS could not directly manage FICON CTCs**
- **Two unrecommended GRS Ring configurations are affected**
  - GRS Ring complex that is larger than one sysplex
  - GRS Ring that doesn't utilize sysplex signaling
- **Migration Options:**
  - Convert to a Parallel Sysplex exploiting GRS Star
    - GRS star is recommended over GRS Ring
  - Convert to a Basic Sysplex exploiting XCF signaling for GRS Ring
    - Sysplex communications recommended over GRS-managed CTCs
  - Install zEC12/zBC12 maintenance to provide toleration for FICON CTCs
    - This support does not enhance the robustness of GRS-managed CTCs
    - The toleration must be installed across GRS complex

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New MACHMIG Statement in LOADxx for Server Migrations

- **MACHMIG**
  - Identifies one or more facilities that you do not want z/OS to use at this time because migration to another processor, z/OS release, or both is underway.
  - Code the MACHMIG statement as follows:
    - Column Contents
      - 1-7 MACHMIG
      - 10-72 A list of facilities not to use. When more than one facility is listed, separate each from the previous by one or more blanks or commas. The following facilities may be specified in upper, lower, or mixed case:
        - » EDAT2 - the hardware-based enhanced-DAT facility 2
        - » TX - the hardware-based transactional-execution facility
  - A maximum of 3 MACHMIG statements are allowed
  - Default: None.
    - If you do not specify a MACHMIG statement, the system does not limit its use of machine facilities.

New MACHMIG Statement in LOADxx for Server Migrations

- **Example**
  - The following example shows a MACHMIG statement that tells the system not to use the transactional execution facility and the enhanced DAT facility 2.

```
----+----1----+----2----+----3----+----4----+----5----+----6---
MACHMIG TX,EDAT2
```

- **New operands on DISPLAY IPLINFO**
  - DISPLAY IPLINFO,LOADXX,MACHMIG command
    - Displays all the relevant MACHMIG statements from the LOADxx PARMLIB member, or indicates that there were none.

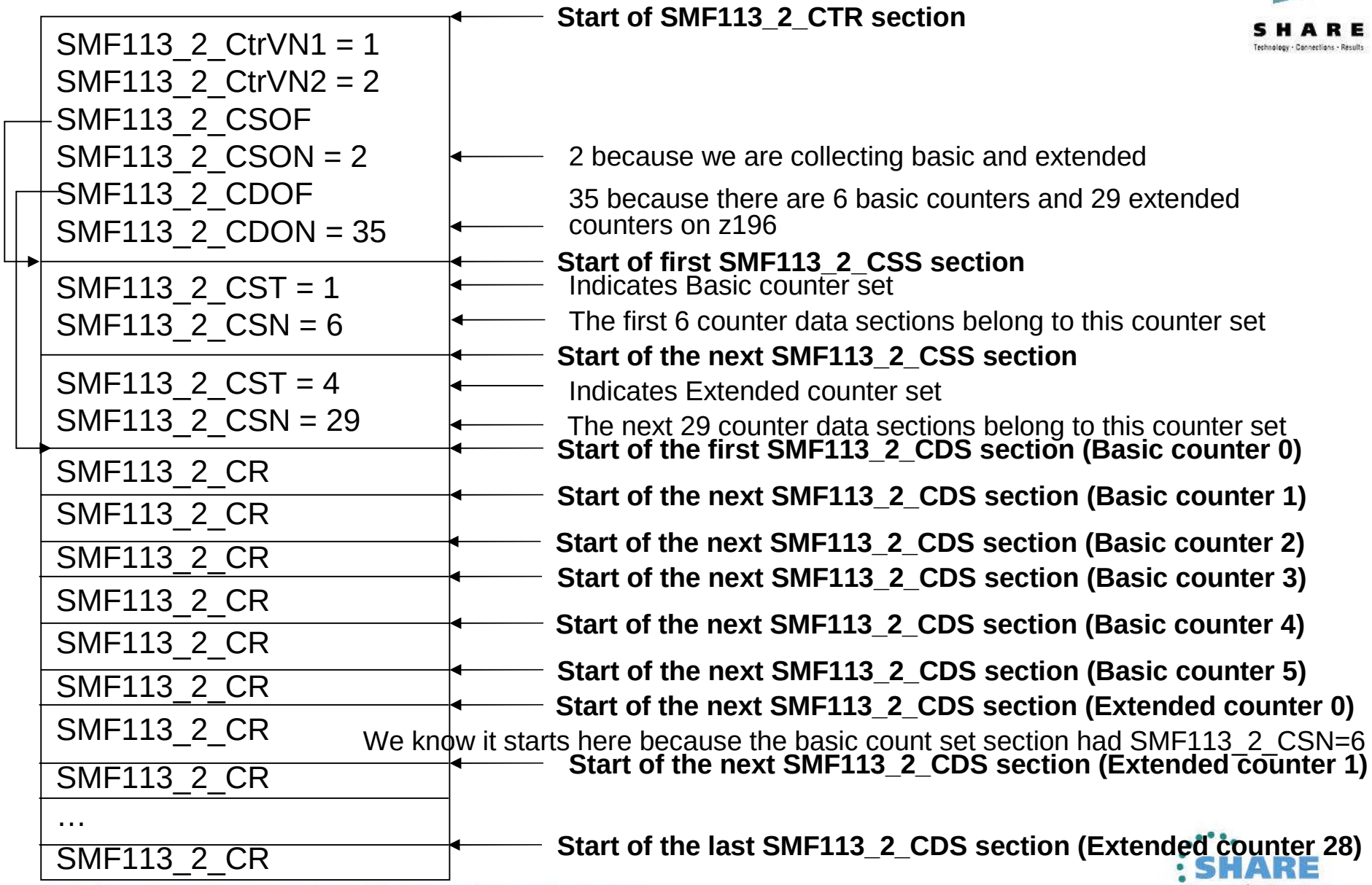
Hardware Instrumentation

- **The number of counters for zEC12 and zBC12 is increased to 80**
  - More Extended counters means more internal storage is required
    - By applying the PTF for HIS support, you increase the amount of common storage used by 128 bytes
- **The structure of the SMF 113 Record Subtype 2 does not change**
  - The values, interpretations, and frequency of certain sections will change – therefore current tools using the data need to be updated for zEC12 or zBC12
- **As of z/OS V2.1**
  - You can now use the HISSERV service to create your own profilers for customized collection and processing of instrumentation data. It allows you to
    - Collect/process sampling data
    - Collect/process event (counter) data
    - React to certain system state-change events
    - More than one profiler can be active at the same time
  - New SMF Type 113 Subtype 1
    - Counter values are delta values (subtype 2 is absolute)
    - Can produce ZOS counter set counter data (not supported in subtype 2)
    - Counter data can be either 4 bytes or 8 bytes (subype 2 is always 8 bytes)
    - More intuitive record layout (hopefully)
    - **Future enhancements will be made only to SMF 113 subtype 1 records.**

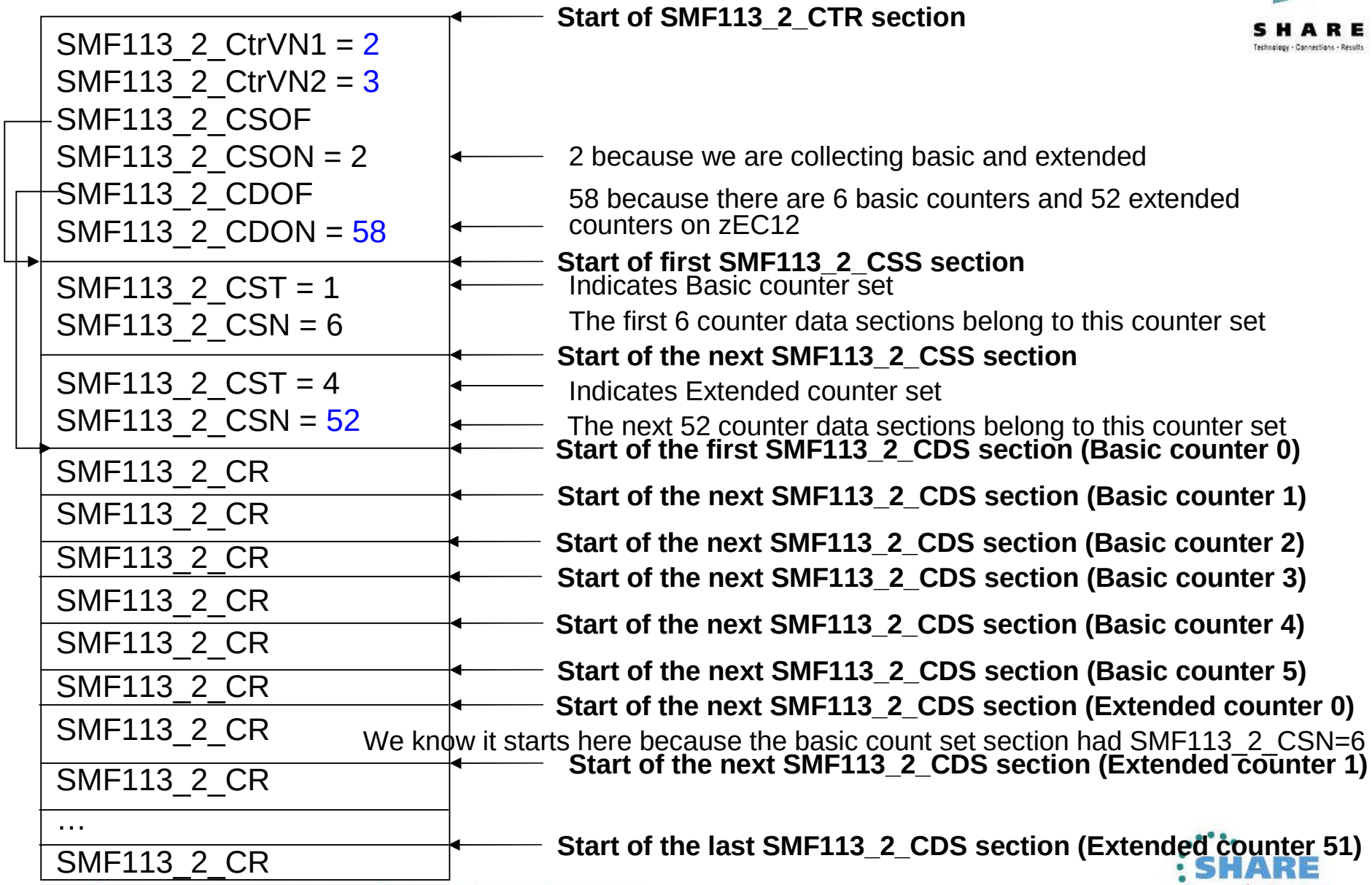
Hardware Instrumentation Details

- **The structure of the SMF 113 Record does not change.**
  - However the values, interpretations, and frequency of certain sections do change. The noteworthy fields are:
    - SMF113_2_CtrVN1 identifies how to interpret the Basic and Problem counter sets. As described in SA23-2260 this will be set to **1** (z10/z196/z114) or **2** (zEC12/zBC12)
    - SMF113_2_CtrVN2 identifies how to interpret the Crypto and Extended counter sets. As described in SA23-2260 this will be set to 1 (z10), **2** (z196 or z114) or **3** (zEC12/zBC12)
    - The number of counter set sections (SMF113_2_CSS) depends on what you specified for the collection run (which counter sets and the values in SMF113_2_CtrVN1 and SMF113_2_CtrVN2.
      - How these sections are interpreted relies on knowledge of what you're running on (i.e. the SMF113_2_CtrVN1 and SMF113_2_CtrVN2 fields).

HIS - z196 run with CTR=(B,E) might produce this record



HIS - zEC12 run with CTR=(B,E) might produce this record



SMF Type 113 Subtype 1

- **Four sections:**
  - **SMF113_1_CTR: Main Section**
    - SMF113_1_CSOF: Offset to counter set sections
    - SMF113_1_CSLN: Length of counter set section
    - SMF113_1_CSON: Number of counter set sections
  - **SMF113_1_CSS: Counter Set Section**
    - SMF113_1_CSType: Counter Set Type (Basic, Problem, Crypto, Extended, zOS)
    - SMF113_1_CSUseLCDS: Bit, when on, use 8 byte counter (otherwise 4 byte counter)
    - SMF113_1_CDOF: Offset to counter data sections for this counter set
    - SMF113_1_CDLN: Length of counter data section
    - SMF113_1_CDON: Number of counter data sections for this counter set
  - **SMF113_1_SCDS: Short Counter Data Section (4 bytes)**
  - **SMF113_1_LCDS: Long Counter Data Section (8 bytes)**

IBM System z Advanced Workload Analysis Reporter (IBM zAware)

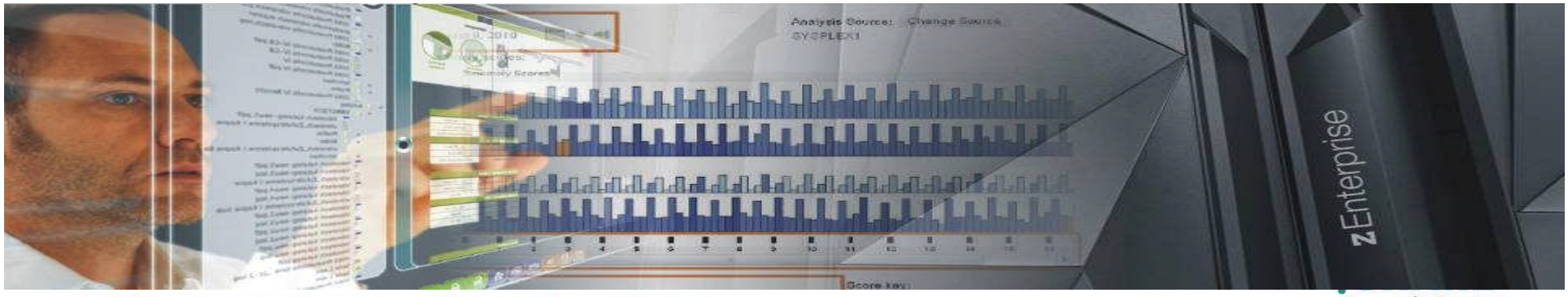
- z/OS provides the capability of having specific log stream data sent "out-of-band" to the IBM zAware (z/OS Monitoring) server.
- The initial data being sent to the IBM zAware (z/OS Monitoring) server for analysis is the log data within the OPERLOG logstream.
- This allows the IBM zAware (z/OS Monitoring) server to provide analytical monitoring and machine learning of z/OS health for purposes of availability management.
- It detects things typical monitoring systems miss due to:
  - Message suppression (message too common)
    - Useful for long-term health issues
  - Uniqueness (message not common enough
    - Useful for real-time event diagnostics
- Color coded easy to use GUI via web browsers
- Output can be queued up to existing monitoring systems.

Ability to drill down for details on anomalies

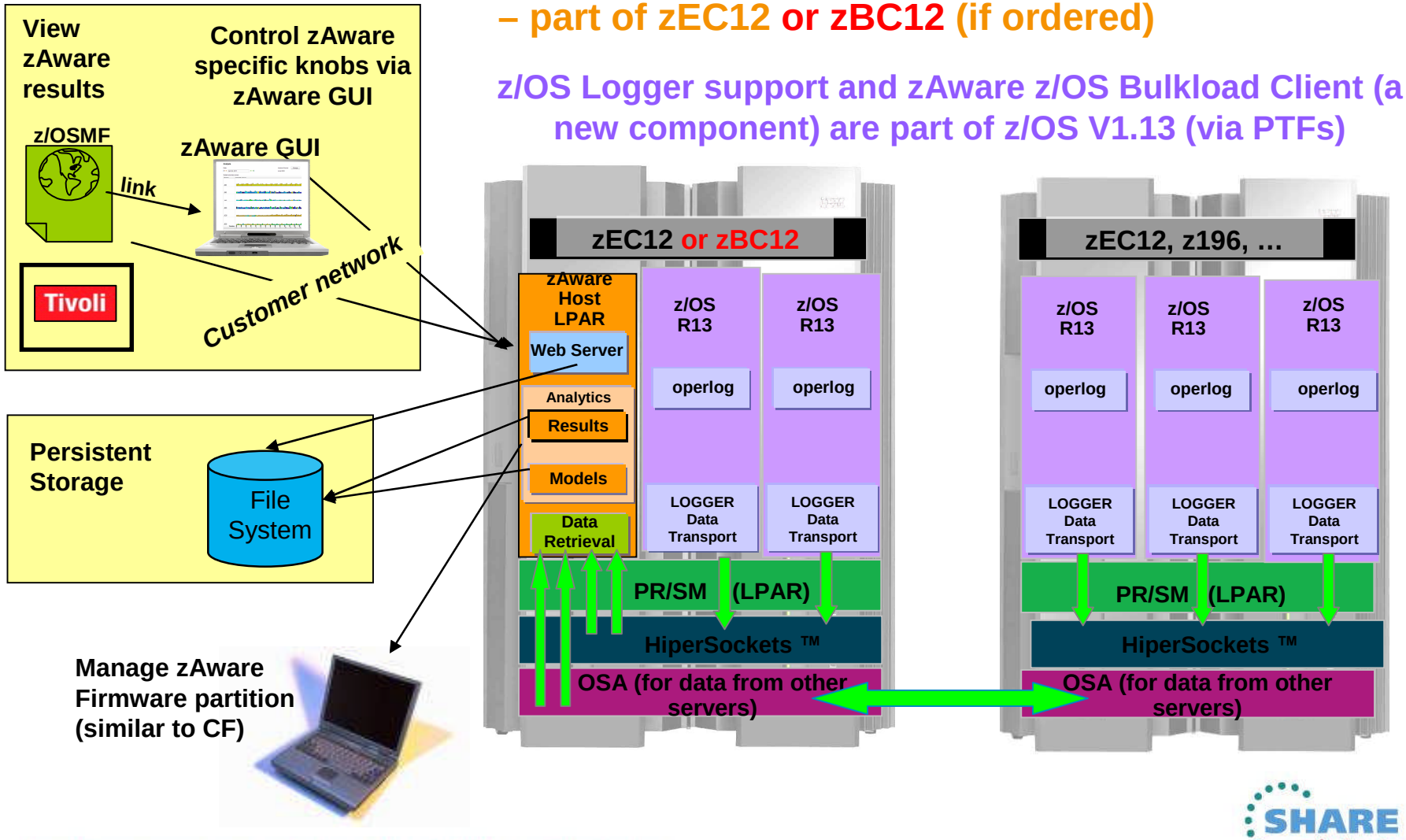
IBM zAware …

From a z/OS perspective,

- **IBM zAware server**
  - **Firmware instance (in a separate PR/SM LPAR)**
  - **Receives data from each z/OS image**
    - Can monitor operating system images on same CPC or from other CPCs which are running z/OS V1.R13 (with PTFs installed)
- **z/OS is an IBM zAware monitored client**
  - **z/OS sends data to IBM zAware server for analysis/monitoring**
  - **z/OS IBM zAware monitored client**
    - **z/OS does this via log streams**
      - z/OS IBM zAware log stream client
    - **z/OS system logger uses term**
      - z/OS ZAI logstream client



IBM zAware …



zAware Partition and contents are Firmware – part of zEC12 or zBC12 (if ordered)

z/OS Logger support and zAware z/OS Bulkload Client (a new component) are part of z/OS V1.13 (via PTFs)

IBM zAware Operating Requirements

- **zEC12 or zBC12 server for IBM zAware host system (1 of 3)**
  - **Processor**
    - In general, an average customer configuration requires only a partial processor.
    - Large customer configurations might require up to two processors.
    - The use of IFLs is preferable, especially for dedicated use, because IFLs are less costly than central processors
  - **Memory**
    - Your installation must assign a minimum of 4 gigabytes (GB) of memory to activate the IBM zAware partition and support up to six monitored clients.
    - If your installation plans to connect more than six monitored clients, you need to assign an additional 256 megabytes (MB) of memory for each monitored client. Use the following formula for determining the amount of memory to assign to the partition.
      - 4GB + (.25GB * (number of clients))

IBM zAware Operating Requirements

- **zEC12 or zBC12 Server for IBM zAware host system (2 of 3)**
  - **Network**
    - OSA OSD CHPIDs to gather instrumentation data and to provide outbound alerts
      - Need dedicated IP address for partition
      - The IBM zAware server supports the following types of network options
        - » A customer-provided data network that provides Ethernet connectivity through an OSA channel.
        - » A HiperSockets subnet within the zEC12 or zBC12 CPC.
        - » The intraensemble data network (IEDN) on the zEC12 or zBC12 CPC.

IBM zAware Operating Requirements

- **zEC12 or zBC12 Server for IBM zAware host system (3 of 3)**
  - **External DASD Storage**
    - IBM zAware uses Extended Count Key Data (ECKD) direct-access storage devices (DASD) for persistent storage of analytical data for each monitored client.
      - Because of the way IBM zAware uses storage, your installation can select a combination of small volumes or volumes of different sizes to satisfy storage requirements.
      - These volumes cannot be SMS-managed volumes.
    - Storage requirements vary depending on the number of monitored systems that you plan to connect to IBM zAware.
      - Start with 500 GB of storage for IBM zAware to use.
      - If you increase the number of monitored clients, you need to configure 4-5 GB of storage for each monitored system.
      - If you increase the retention times of instrumentation data, training models, or analysis results, you also might need to increase the amount of persistent storage that IBM zAware can use.

  Note: Because of the way that the IBM zAware server uses storage, you need to configure these devices such that no other partitions can use them.
    - This requirement applies to LPARs on the host system and on any other System z servers that have access to the storage devices.
    - When you assign persistent storage through the IBM zAware GUI, the IBM zAware server formats the storage devices before using them.
    - If other LPARs are using these storage devices, data will be lost or overwritten.
    - To avoid this potential loss of data, you must use the explicit device candidate list to allow only the IBM zAware partition to access the device.

IBM zAware Monitored Client System

- System z servers supported as IBM zAware monitored clients
  - zEC12 or zBC12
  - IBM zEnterprise 196 (z196) or z114,
  - IBM System z10 EC or BC
  - Prior generations that meet the operating system and configuration requirements
  - IBM zAware supports z/OS systems that run in z/OS partitions or as z/VM guests.
- Running z/OS 1.13 + PTFs
  - APAR OA38747/PTF UA66494
  - APAR OA38613/PTF UA66195
  - APAR OA39256/PTF UA66522
- Configured as a single-system sysplex (monoplex), a system in a multisystem sysplex, or a member of a Parallel Sysplex.
- Using the operations log (OPERLOG) as the hardcopy medium.
- The system name and sysplex name must uniquely identify the system to be monitored

IBM zAware Customization Considerations …

- Configure network connection to zAware
  - TCP/IP profile, DNS, Resolver, firewall settings
- **D XCF** to confirm MONOPLEX or MULTISYSTEM
- **D CONSOLES** to confirm OPERLOG hardcopy
  - set in CONSOLxx
- Configure z/OS logger to send data to zAware
  - Give IXGLOGR a z/OS UNIX segment for TCP/IP connectivity
    - ADDUSER IXGLOGR OMVS(UID(xxxx) HOME('/'))
  - From a user with SAF update access to IXGZAWARE_CLIENT resource in the FACILITY class
- Create **IXGCNFxx** PARMLIB member for logger
- Add **IXGCNF=xx** to IEASYSxx PARMLIB member

IBM zAware Customization Considerations …

- **IXGCNFxx PARMLIB** member contains system logger values. The **ZAI** statement contains parameters for IBM zAware:
  - **SERVER(***host_name|IP_address***)**
    - Specifies the host name or IP address of IBM zAware server
  - **PORT(***number***)**
    - Port number IBM zAware server is using. Port must be **2001**
  - **LOGBUFMAX(***value***)**
    - Maximum amount of storage buffers (GB) to be used by system logger to manage data that is being sent to the IBM zAware server
  - **LOGBUFWARN(***nn***)**
    - Percent of used buffer space to trigger warning message
  - **LOGBUFFULL(**MSG|QUIESCE**)**
    - Action system logger is to take when the log stream buffers are full

  Sample in SYS1.SAMPLIB(IXGCNFXX)
- **Update the OPERLOG log stream to add:**
  - **ZAI(YES)**
  - **ZAIDATA('OPERLOG')**

z/OS Monitored System - Logger Configuration

- **SET IXGCNF=xx** to dynamically pick up the logger settings
- **DISPLAY LOGGER,STATUS,ZAI,VERIFY** to verify the config

```
ZAI LOGSTREAM CLIENTS: AVAILABLE
BUFFERS IN USE: 00 GB 0000 MB
ZAI VERIFY INITIATED, CHECK FOR MESSAGES IXG37X, IXG38X
...
IXG380I ZAI LOGSTREAM CLIENT ESTABLISHED
FOR DISPLAY ZAI,VERIFY
```

- **Start sending to zAware. Also, defines the *plex.system* to zAware**

SETLOGR FORCE,ZAICONNECT,LSNAME=SYSPLEX.OPERLOG

```
IXG651I SETLOGR FORCE ZAICONNECT COMMAND ACCEPTED FOR
LOGSTREAM=SYSPLEX.OPERLOG
IXG386I ZAI LOGSTREAM CLIENT CONNECT ATTEMPT IN PROGRESS FOR
  LOGSTREAM
SYSPLEX.OPERLOG
STATUS: ATTEMPTING SOCKET CREATE
. . .
IXG380I ZAI LOGSTREAM CLIENT ESTABLISHED FOR LOGSTREAM
  SYSPLEX.OPERLOG
```

Priming zAware – Bulk Load from z/OS

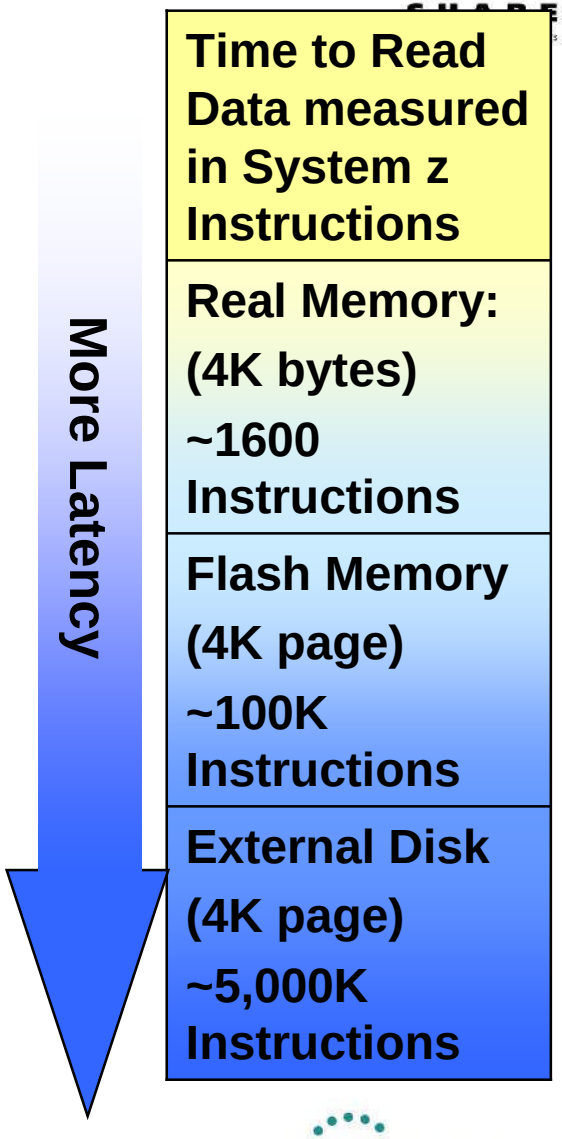
- **Prior SYSLOG data may be sent to IBM zAware**
  - Reduces the time to build a model, and begin analysis
  - Data sets should not exceed 90 days earlier than today
  - Bulk load may be run from any z/OS system configured for IBM zAware
  - Copy SYS1.SAMPLIB(AIZBLK) JCL to your JCL and modify
    - See instructions in the file
  - Copy SYS1.SAMPLIB(AIZBLKE) REXX to your SYSEXEC
  - Run bulk load for a small set of data to verify config
  - Run bulk load for one plex at time

IBM zAware Fallback Considerations …

- **If you are running fully enabled, have logstreams with ZAI(YES), then run on system that is not enabled:**
  - Connection attempts to logstream with ZAI(YES) will succeed, but no IBM zAware (z/OS Monitoring) client activity will occur for the log stream.
  - Inventory attempts to define logstreams using a LIKE(like-logstream) with ZAI(YES) will result in the new definition failure rc8, rsn8E3 (IxgRsnCodeLogstreamNotSupported).
    - For this situation, installation will need to either:
      - Use a different like-logstream reference or specify all the appropriate parameters on the specific define logstream request; or
      - to avoid the above issue, before the fallback, first run IXCMIAPU DATA TYPE(LOGR) UPDATE LOGSTREAM NAME(logstream) ZAI(NO) on enabled release system to get the log stream "cleaned up" before defining another logstream that points to like-logstream with the ZAI(YES).

Introducing System z Flash Express

- **Flash Express is intended to improve System z availability**
  - Slash latency delays from paging
  - Make your start of day processing fast
  - Eliminate frustrating delays from SVC dump processing
- **zEC12 and zBC12 will offer optional System z Flash Express memory cards**
  - Supported in PCIe I/O drawer with other PCIe I/O cards
  - Pairs of cards for availability
  - No HCD/IOCP definition required
- **Assign flash memory to partitions like main memory**
  - Assignment is by minimum/maximum memory amount, not by feature
  - Each partition's flash memory is isolated like main memory
  - Dynamically increase the partition maximum amount of flash
  - Dynamically configure flash memory into and out of the partition
- **Options to solve many different problems**
  - Flash Memory is much faster than spinning disk
  - Flash Memory is much slower than main memory
  - Flash Memory takes less power than either
- **The system z Software Stack has a staged plan to exploit flash memory**
  - z/OS 1.13 plus PTFs,
  - z/OS V1.13 Language Environment
  - Java SDK7 and by extension
  - WAS Liberty Profile V8.5
    - DB2 V10
    - IMS V12
    - A future release of CICS Transaction Server*
  - IMS V12 Common Queue Server



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

RSM Enhancements

- **RSM Enhancements delivered in the z/OS V1R13 RSM Enablement Offering Web Deliverable (FMID JBB778H) for z/OS V1.13**
  - Flash Express Support - Exploits Storage Class Memory (SCM) technology for z/OS paging and SVC dump
  - Pageable 1MB Large Page Support
    - Is expected to yield substantial improvements in SVC dump data capture time, and removes the requirement for PLPA and Common page data sets when used for cold start (CLPA) IPLs.
    - It can also be used to remove the requirement for non-VIO local page data sets when the configuration includes enough SCM to meet peak demands.
      - However, local page data sets remain required for VIO, and when needed to support peak paging demands that require more capacity than provided by the amount of configured SCM.
  - Dynamic reconfiguration support for Storage Class Memory (SCM) – PTFs UA68169 and UA68170
  - 2 GB Large Page Support - PTFs UA68145 and UA68146
  - Optional PLPA and COMMON page data set support – PTFs UA68145 and UA68146

RSM Enhancement Considerations

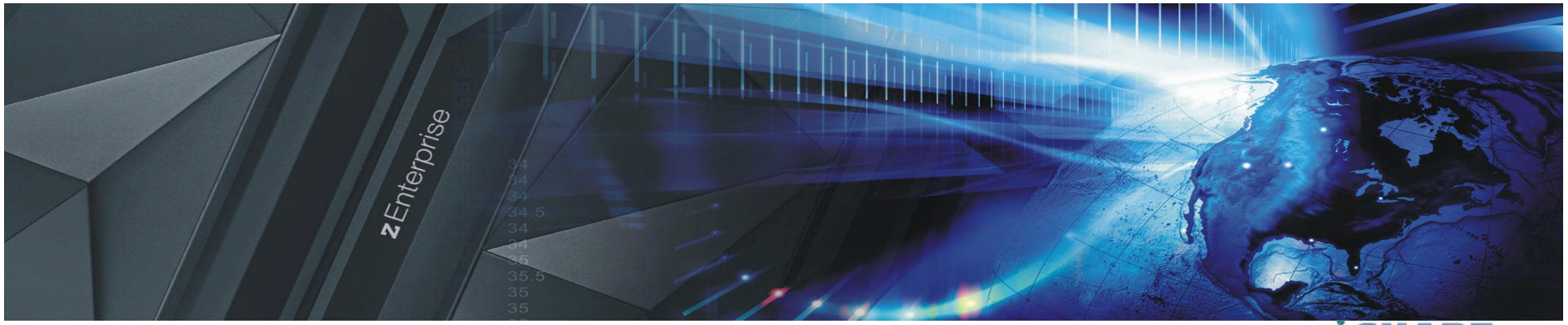
- **Installation of the z/OS V1R13 RSM Enablement Offering Web Deliverable (JBB778H) will:**
  - Increase the size of the Nucleus by approximately 380K above the 16MB line
    - You may need to analyze your private storage usage
  - Increase of 24K (6 pages) in ESQA per CPU per LPAR
    - This increase in ESQA per CPU includes general purpose CPs, zIIPs, and zAAPs.

Flash Express Exploitation Considerations

- **New IEASYSxx parameter - PAGESCM**
  - Enables the use of Storage Class Memory (SCM) for paging, specifies the minimum amount of storage class memory to be reserved for paging
  - Value may be specified in units of M, G, or T
  - If Flash Express is installed but is not to be used for paging, then PAGESCM=NONE should be specified
  - Defaults to **ALL**
- **Command changes**
  - D M=SCM command changes
  - D ASM command changes
- **Specification of PLPA and COMMON paging data set is now optional**
  - PLPA/COMMON (*NONE*)

Flash Express Exploitation - RMF Considerations

- **RMF Page Data Set Activity (Monitor I and Monitor II):**
  - New entry for SCM space in report and SMF records
- **RMF Paging Activity (Monitor I):**
  - SCM Paging Block data added to report and SMF records
- **RMF Monitor III STORM Storage Memory Objects Data Table is enhanced to display SCM information**



2 GB Large Pages

- **Increase TLB coverage without proportionally enlarging the TLB size by using 2 GB large pages:**
  - A 2 GB page is a memory page that is
    - (2048 times) larger than a Large page and
    - (524,288 times) larger than an ordinary base page
  - 2 GB Large Pages allow for a single TLB entry to fulfill many more address translations than either a large page or ordinary base page
  - 2 GB Large Pages will provide exploiters with much better TLB coverage, and therefore provide
    - Better performance by decreasing the number of TLB misses that an application incurs
    - Less time spent converting virtual addresses into physical addresses
    - Less real storage used to maintain DAT structures

2 GB Large Pages Exploitation Considerations

- **Enhanced IEASYSxx parameter - LFAREA**
  - Enhanced to support the use of 2 GB large pages
  - The LFAREA parameter can be specified as:
    - LFAREA = ([1M=req] [,2 GB=req] [,prompt | noprompt])
  - Note: The old form of the LFAREA keyword is still supported:
    - LFAREA = (xx% | mmmmmmM | gggggG | tttttT)

- **Usage Enhancements**
  - IARV64 GETSTOR enhanced to support the request for 2 GB large pages

Flash vs Disk Placement Criteria

Data Type	Data Page Placement
PLPA	At IPL/NIP time PLPA pages will be placed both on Flash and disk.
VIO	VIO data will always be placed on disk (First to VIO accepting datasets with any spillover flowing to nonvio datasets)
Pageable Large Pages	If contiguous Flash space is available, pageable large page will be written to Flash. If Flash is not available in the system configuration pageable large pages will be backed with 4k page frames.
All other data	If available space exists on both Flash and disk then make a selection based on response time.

New hardware data compression accelerator can reduce CPU and storage

Every day 2.5 quintillion bytes of data are created

Compress your data 4X*

(efficient system data compression)

Up to 118X reduction in CPU and up to 24X throughput improvement when zlib uses zEDC **

zEnterprise Data Compression:

Efficiently compress active data by providing a low CPU, high performance, dedicated compression accelerator

Industry standard compliance compression for cross platform data distribution **

Typical Client Use Cases:

Significant disk savings with trivial CPU cost for large BSAM/QSAM sequential files***

More efficiently store audit data in application logs

Reduce the amount of data needed for data migration and backup/restore ***

Transparent acceleration of Java compressed applications ***

NEW **zEDC Express feature for zEC12 and zBC12**

NEW **z/OS V2.1 zEDC feature**

NEW **z/VM 6.3 for z/OS guest support *****

* The amount of data sent to an SMF logstream can be reduced by up to 75% using zEDC compression – reducing logger overhead

** These results are based on projections and measurements completed in a controlled environment. Results may vary by customer based on individual workload, configuration and software levels

*** All statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

z/OS Exploitation of zEDC Express

- Authorized device driver support
- RMF Reports
- SMF will use zEDC compression services to compress records before writing to log streams for greater record throughput
  - Exploitation involves writing SMF records and reading SMF records
- DFSMS (BSAM/QSAM) introduces a new type of compression for non-VSAM extended format data sets (using zEDC compression) (planned 1Q2014)*.
- DFSMSdss and DFSMShsm use of zEDC for dumping and restoring data (planned 3Q2014)*
- Unauthorized device driver including exploitation by Java*

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

z/OS Exploitation of zEDC Express

- **Requires**
  - z/OS V2.1
  - zEC12 GA2 or zBC12
  - zEDC Express hardware feature
  - z/OS V2.1 zEDC software feature
    - z/OS Exploitation of zEDC Express enabled prior to IPL (IFAPRDxx)

      PRODUCT OWNER('IBM CORP')
      NAME('z/OS')
      ID(5650-ZOS)
      FEATURENAME(ZEDC)
      VERSION(*) RELEASE(*) MOD(*)
      STATE(ENABLED)
  - FUNCTION Definition in IOCP (defined by HCD or HCM)
  - z/OS exploitation enablement (subsequent slides)
    - SMF logstreams
    - DFSMS BSAM and QSAM*
    - Java*
    - DFSMSdss and DFSMShsm*

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

RMF Reports

- **New support in RMF will provide per device information about the zEDC devices with updates to the SMF74(9) record including:**
  - I/O Queue Time
  - I/O Execution Time
  - Busy time percentage
  - Compression rate (bytes per second)
  - Decompression rate (byte per second)
  - Buffer pool utilization
- **New Postprocessor Report**

"Native PCIe" FUNCTION definition, assignment and mapping

- **Conceptually similar to channel (CHPID) definition with different rules**
- **FUNCTION Definition in HCD or HCM to create IOCP input**
  - Uniquely identified by a hexadecimal FUNCTION Identifier (FID) in the range 00 – FF
  - NOT assigned to a Channel Subsystem so ANY LPAR can be defined to a FUNCTION.
  - Has a PARTITION parameter that dedicates it to ONE LPAR or allows reconfiguration among a group of LPARs. (A FUNCTION can NOT be defined as shared.)
  - If the intended PCIe hardware supports multiple partitions, has a decimal Virtual Function Identifier (VF=) in the range 1 – n, where n is the maximum number of partitions the PCIe feature supports.
    For Example, a zEDC Express feature supports up to 15 partitions.
  - May have other parameters specific to the PCIe feature.
    For Example, 10GbE RoCE Express requires a Physical Network Identifier (PNETID=).

Sample IOCP FUNCTION statements AFTER Mapping to PCHIDs

zEDC Express Functions for LPAR LP14, Reconfigurable to LP01:

```
FUNCTION FID=05,VF=1,PART=((LP14),(LP01)),PCHID=100
FUNCTION FID=06,VF=1,PART=((LP14),(LP01)),PCHID=12C
```

zEDC Express Functions for LPAR LP15, Reconfigurable to LP02:

```
FUNCTION FID=07,VF=2,PART=((LP15),(LP02)),PCHID=100
FUNCTION FID=08,VF=2,PART=((LP15),(LP02)),PCHID=12C
```

10GbE RoCE Express Function for LPAR LP14, Reconfigurable

```
FUNCTION FID=10,PART=((LP14),(LP03,LP04,LP12,LP22)),          *
         PNETID=(NET1,NET2,N3,),PCHID=11C
FUNCTION FID=11,PART=((LP14),(LP03,LP04,LP12,LP22)),          *
         PNETID=(NET1,NET2,N3,),PCHID=144
```

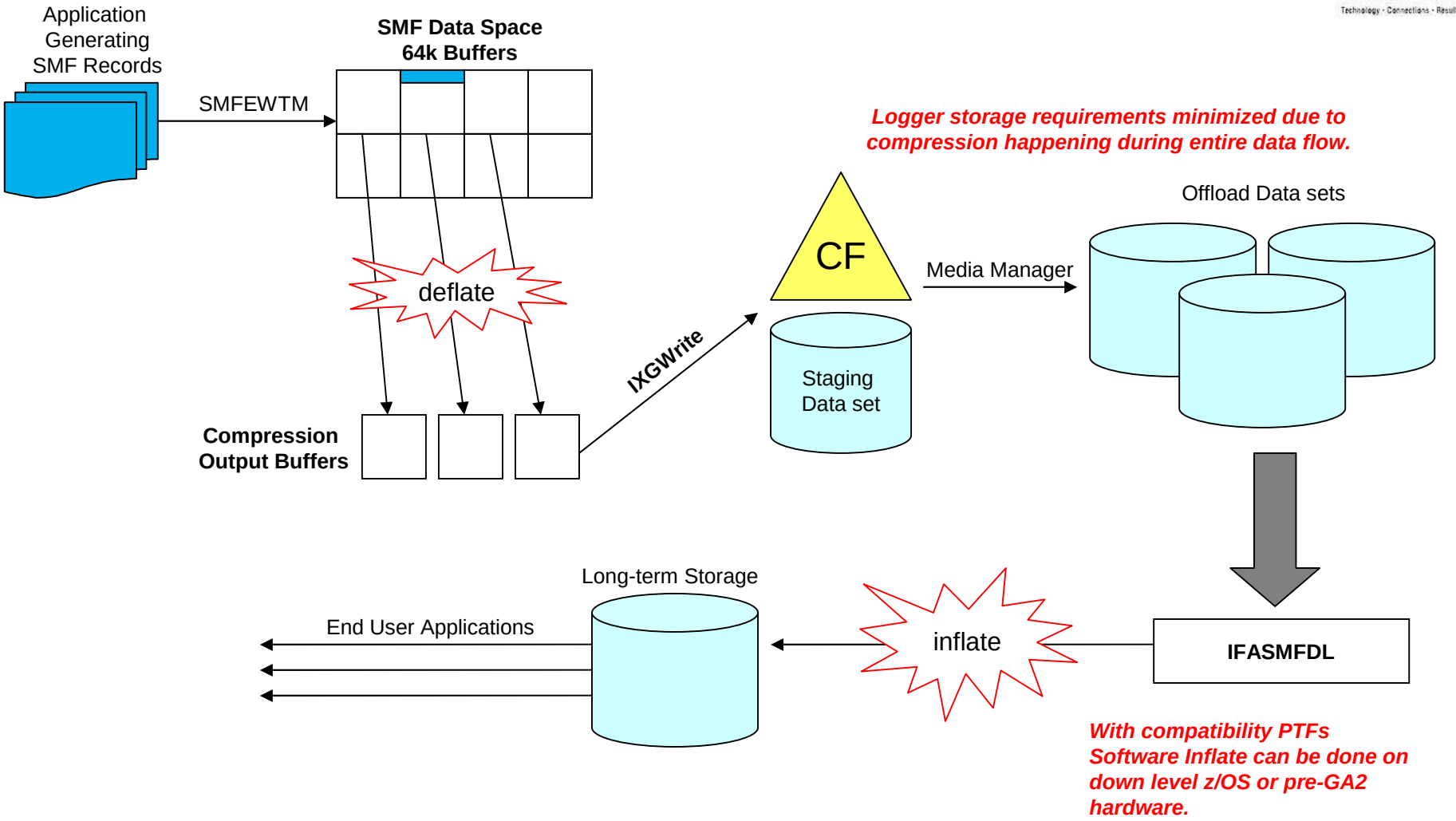
- **A FUNCTION is identified by a FUNCTION Identifier (FID) hex 00 – FF**
- **FUNCTIONs can be dedicated or reconfigurable, not shared – One LPAR in Access List**
- **For multiple LPAR support by a zEDC Express feature, define multiple FUNCTIONs for its** PCHID **with different Function IDs (FIDs) and different** Virtual Function numbers (VFs)
- **A 10GbE RoCE Express feature does not support multiple LPARs, so** VF **is not valid.**
- Physical Network Identifier (PNETID) **is needed to set up SMC-R communication**
- **Note that LP14 has access to each type of hardware in both Resource Groups**

SMF Exploitation of zEDC Express

Setup Requirements

- **SMF records must be directed to a CF or DASD log stream**
- **Specify the new COMPRESS option on one or more log stream definitions (LSNAME) or DEFAULTLSNAME**
  - Option to specify amount of memory to permanently fix for performance
  - Note: For testing purposes, the same SMF record can be directed to multiple log streams and compression can be enabled on one of them.
- **IFASMFDL requirements**
  - No changes required if zEDC devices are available; they will be used automatically
  - Specify the SOFTINFLATE option to process compressed data when there are no zEDC devices available
    - Requires z/OS PTF to provide software inflate (decompression) capability for z/OS 1.12 and 1.13 systems
  - If the SOFTINFLATE option is not specified on a system without zEDC devices an error will occur and no records will be deleted from the SMF logstream
- **Enable the following SMF records to collect performance information:**
  - SMF 23 – SMF buffer usage, number of records written etc.
  - SMF 88 - System logger log stream size, frequency of offlload

SMF Data Flow Overview



SMF Customization Considerations for zEDC Express

- **Enablement**
  - Down level systems should install coexistence PTFs before compression is used
  - SMFPRMxx must specify COMPRESS on the LSNAME parameter to enable support (or remove the parameter to disable)
  - IFASMFDL jobs at z/OS V2.1 will need to specify REGION=4M (or 0M)
  - IFASMFDL jobs may want to specify SOFTINFLATE to read compressed records in a fallback or toleration situation
    - Hardware deflation is recommended for performance and CPU usage
  - IFASEXIT will return an error for compressed data and zEDC can not be used to read compressed SMF records

DFSMS (BSAM/QSAM) Exploitation of zEDC Express*

- **If not on zEC12 GA2/zBC12 or no zEDC Express features installed, DFSMS optionally can create zEDC compressed format data sets based on user options (in Data Class or PARMLIB).**
- **When writing on a zEC12 GA2/zBC12 or no zEDC Express features installed, BSAM/QSAM will write data non-compressed.**
  - Requires coexistence PTFs on z/OS V1.12 or z/OS V1.13
- **When reading on a zEC12 GA2/zBC12 or no zEDC Express features installed, BSAM/QSAM will decompress existing compressed data via software inflate.**
  - Requires the same coexistence PTFs on z/OS V1.12 or z/OS V1.13

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

DFSMSdss Exploitation of zEDC Express*

- **DFSMSdss**
  - During backup users of DFSMSdss must specify a new ZCOMPRESS(REQUIRED|PREFERRED) keyword to use the new function
    - System Administrators can disable all usage of ZCOMPRESS by specifying ZCOMPRESS(NONE) on the installation options exit routine (ADRUIXIT)
    - System administrators can optionally protect the usage of the keyword on DUMP with a new RACF Facility Class Profile (STGADMIN.ADR.DUMP.ZCOMPRESS)
      - If the profile doesn't exist, anyone can use the ZCOMPRESS option
    - During restore user data is automatically decompressed using either zEDC adapter or the software inflate

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

DFSMShsm Exploitation of zEDC Express*

- **DFSMShsm**
  - DFSMShsm users will have the option to use the zEDC Compression function through new SETSYS keywords to be specified for the backup and migration functions.
    - The new keyword is SETSYS ZCOMPRESS(YES|NO). The default is set to NO.
      - Since DFSMSdss is the datamover for DFSMShsm, the DFSMShsm functions that invoke DFSMSdss DUMP will pass the parameter to determine if zEDC compression is to be used.
      - Only DASD usage will be supported.
      - If zEDC compression is not available then DFSMShsm will use the SETSYS COMPACT settings to determine what type of software compaction is used for the migration or backups.
      - During RECALL / RECOVER / RECOVER from DUMP and FRRECOV from DUMP processing, DFSMSdss will automatically decompress the compressed data set for DFSMShsm.
    - DFSMShsm will not use zEDC compression for data sets that do not use DFSMSdss as the datamover
      - eg. PDS's, uncataloged data sets and the DFSMShsm CDSes

zlib and Java Exploitation of zEDC Express

Setup Requirements

- **Provide SAF access to zlib exploiting applications**
  - Read access to new resource FPZ.ACCELERATOR.COMPRESSION in the FACILITY class
- **Assign the correct number of I/O buffers to be used by zlib requests**
  - IQPPRMxx parmlib BUFMAX parameter
- **Re-link applications to use the IBM provided zlib (zlib only requirement)**
  - Functions signatures are compatible – no code changes required
  - Archive file in Unix file system, can be statically linked into applications
- **Provide adequately sized input buffers in your applications**
  - zEDC will be used only if minimum size is TDB
- **Note: by default, zEDC compression is used. New Unix environmental variable can be used to force S/W compression.**
  - _HZC_COMPRESSION_METHOD

zEDC Compatibility Situations
Authorized Device Driver

Hardware	Software	zEDC Express	z/OS ZEDC Feature[1]	Decompression	Compression
zEC12 GA2 or zBC12	**z/OS 2.1**	**Active**	**Enabled**	**Hardware**	**Hardware**
zEC12 GA2 or zBC12	**z/OS 2.1**	**Active**	**Disabled**	**Software**	**None**
zEC12 GA2 or zBC12	**z/OS 2.1**	**Not Active**	**Enabled or Disabled[2]**	**Software**	**None**
Pre-zEC12 GA2	**z/OS 2.1**	**n/a**	**Enabled or Disabled[2]**	**Software**	**None**
Any	**z/OS V1.13 or z/OS V1.12**	**n/a**	**n/a**	**Software (via toleration APARs)**	**None**

Notes:
1 – The z/OS zEDC feature can NOT be dynamically enabled. It requires an IPL to change
2 – There is a charge if the z/OS zEDC feature is enabled even if the zEDC Express card is not installed

zEDC Compatibility Situations

Unauthorized Device Driver (zlib)

Hardware	Software	zEDC Express	z/OS ZEDC Feature[1]	Decompression	Compression
zEC12 GA2 or zBC12	**z/OS 2.1**	**Active**	**Enabled**	**Hardware[3]**	**Hardware[3]**
zEC12 GA2 or zBC12	**z/OS 2.1**	**Active**	**Disabled**	**Software**	**Software**
zEC12 GA2 or zBC12	**z/OS 2.1**	**Not Active**	**Enabled or Disabled[2]**	**Software**	**Software**
Pre-zEC12 GA2	**z/OS 2.1**	**n/a**	**Enabled or Disabled[2]**	**Software**	**Software**
Any	**z/OS V1.13 and below**	**n/a**	**n/a**	**Software**	**Software**

Notes:

1 – The z/OS zEDC feature can NOT be dynamically enabled. It requires an IPL to change.

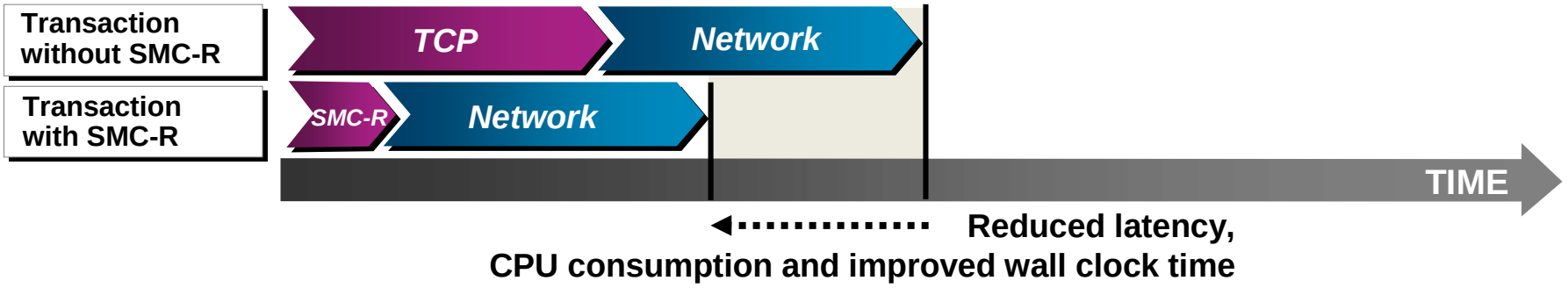
2 – There is a charge if the z/OS zEDC feature is enabled even if the zEDC Express card is not installed

3 - Assuming all prerequisites are met

SMC-R Key Attributes

- **Optimized Network Performance (leveraging RDMA technology)[1]**
- **Transparent to (TCP socket based) application software**
- **Preserves existing network security model**
- **Resiliency (dynamic failover to redundant hardware)**
- **Transparent to Load Balancers**
- **Preserves existing IP topology and network administrative and operational model**

✓ ***[1]Latency and CPU savings are based on workload type (latency focus for interactive workloads while CPU savings is on bulk traffic).***



Network latency ***reduced up to*** *80%* ***for z/OS TCP/IP multi- tier OLTP workloads such as*** *web based claims and payment systems **

* Based on internal IBM benchmarks of modeled z/OS TCP sockets-based workloads with request/response traffic patterns using SMC-R vs TCP/IP. The actual throughput that any user will experience will vary.

SMC-R Requirements

- **Hardware:**
  - **zEC12 GA2 or zBC12**
  - **PCIe based RoCE Express**
    - Dual port 10GbE adapters, maximum of 16 RoCE Express 10GbE cards per CPC
      - Only one port per FID can be used at any time – whichever is configured first
  - **HCD / IOCDS (PCIe function ID / RoCE configuration with PNet ID)**
  - **Requires QDIO Mode OSA connectivity between z/OS LPARs**
    - Only valid for OSD mode OSA TCP traffic that is Layer 2 adjacent.
  - **Ethernet Switches (not routers) - Requires standard 10GbE Switch (CEE enabled switch is not required)**
    - If the IBM 10GbE RoCE Express features are connected to 10 GbE switches, the switches must support:
      - An OM3 50 micron multimode fiber optic cable rated at 2000 Mhz-km terminated with an LC Duplex connector to the selected 10 GbE switch or to the 10GbE RoCE Express feature
      - The maximum cable distance between systems or between switches is 300 meters.
    - The switch must have:
      - Global Pause function enabled
      - Priority Flow Control (PFC) disabled.
    - No firewalls, no routing and no IEDN.
      - Layer 2 LAN
  - **Adapter must be dedicated to a single z/OS LPAR**
    - Virtualization/sharing (SR-IOV) is deferred, but intent is to provide in future offerings
  - **SMC-R cannot be used in IEDN at this time due to lack of VLAN enforcement capability**

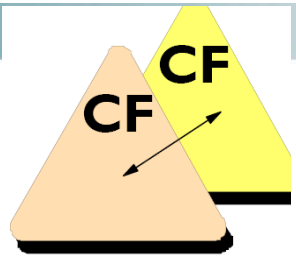
SMC-R Requirements …

- **Software**
  - **z/OS V2.1**
    - support for z/OS to z/OS (same CEC or CEC to CEC) traffic patterns (TCP workloads)
  - z/VM support for guest exploitation (SoD)*
- **Configuration**
  - **Specify GLOBALCONFIG SMCR parameter**
    - Must specify at least one PCIe function ID (PFID) value
      - A PFID represents a specific RDMA network interface card (RNIC) adapter
      - Maximum of 16 PFID values can be coded
    - Up to eight TCP/IP stacks can share the same PFID in a given LPAR
  - **Start IPAQENET or IPAQENET6 INTERFACE with CHPIDTYPE OSD**
    - SMC-R is enabled by default for these interface types
    - SMC-R is not supported on any other interface types
  - **SMC-R function is now enabled!**

Physical network (PNet) ID concepts

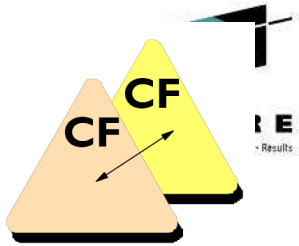
- **Customer-defined value for logically grouping OSD interfaces and RNIC adapters based on physical connectivity**
  - Customer defines PNet ID values for both OSA and RNIC interfaces in HCD
  - z/OS Communications Server gets the information dynamically
    - Learns the definitions during activation of the interfaces
    - Associates the OSD interfaces with the RNIC interfaces that have matching PNet ID values
- **If you do not configure a PNet ID for the RNIC adapter, activation fails**
- **If you do not configure a PNet ID for the OSA adapter, activation succeeds, but the interface is not eligible to use SMC-R**

System z CFCC Level 18



- **Improved Serviceability**
  - Non-disruptively capture and collect extended diagnostic structure data for CF structures that have encountered an error
  - DB2 conditional write to a group buffer pool (GBP) cache which allows selected entries be written around the cache to disk to reduce overhead*
  - Verification of local cache controls for a CF cache structure connector
    - Rolled back to CFCC Level 17 on a z196 or z114
- **Performance Enhancements**
  - Elapsed time improvements when dynamically altering the size of a cache structure
  - CF cache structures to avoid flooding the CF cache with changed data and avoid excessive delays and backlogs for cast-out processing
- **Reporting and Monitoring Improvements**
  - Additional information provided for Coupling over Infinband (CIB) CHPID types.
  - RMF exploits changed XES interface and obtains new channel path characteristics. The new channel path characteristics is:
    - Stored in a new channel path data section of SMF record 74 subtype 4
    - Added to the Subchannel Activity and CF To CF Activity sections of the RMF Postprocessor Coupling Facility Activity report
    - Provided on the Subchannels Details panel of the RMF Monitor III Coupling Facility Systems report.
- **Structure and CF Storage Sizing with CFCC level 18**
  - May increase storage requirements when moving from:
    - CF Level 17 (or below) to CF Level 18
    - CF Sizer Tool recommended
      - http://www.**ibm.com**/systems/z/cfsizer/
  - Similar to CF Level 17, ensure that the CF LPAR has at least 512MB of storage

Parallel Sysplex CFCC level 19



- **Performance Improvement**
  - **Coupling thin interrupt support**
    - The interrupt causes a shared logical processor coupling facility partition to be dispatched by PR/SM, if it is not already dispatched, allowing the request or signal to be processed in a more timely manner. The coupling facility will give up control when work is exhausted or when PR/SM takes the physical processor away from the logical processor.
    - Use controlled by a new DYNDISP specification
    - May make use of shared logical processors acceptable in more production coupling facilities
- **Resiliency Improvements (SoD)***
  - IBM intends to provide exploitation of the Flash Express feature on zEC12 and zBC12 servers with CFLEVEL 19 for certain coupling facility list structures in the first half of 2014.
  - This new function is designed to allow list structure data to be migrated to Flash Express memory as needed when the consumers of data do not keep pace with its creators for some reason, and migrate it back to real memory to be processed.
  - When using WebSphere MQ for z/OS Version 7 (5655-R36), this new capability is expected to provide significant buffering against enterprise messaging workload spikes and provide support for storing very large amounts of data in shared queue structures, potentially allowing several hours' data to be stored without causing interruptions in processing.
  - Also, z/OS V2.1 RMF is planned to provide measurement data and reporting capabilities for Flash Express when it is used in conjunction with coupling facilities.
- **Structure and CF Storage Sizing with CFCC level 19**
  - May increase storage requirements when moving from CF Level 18 (or below) to CF Level 19
  - Use of the CF Sizer Tool is recommended: http://www.ibm.com/systems/z/cfsizer/
  - Similar to CF Level 17 and 18, ensure that the CF LPAR has at least 512MB of storage

‘Thin Interrupt’ Exploitation

- **Provides hardware, firmware, and software support for Coupling Facility “thin interrupts” to be generated when events such as the following occur:**
  - a CF command is received by a shared-engine CF image (e.g. arrival of a primary CF command that needs to be processed)
  - a CF signal is received by a shared-engine CF image (e.g. arrival of a secondary message duplexing signal that needs to be processed)
  - Completion of a secondary message sent by the CF (e.g. completion of a secondary message duplexing signal sent by the image)
  - a CF signal is received by a z/OS image (e.g. arrival of a secondary message LN signal from another system)
  - an asynchronous CF operation completes on a z/OS image
- **The interrupt causes the shared-engine partition to be dispatched by LPAR, if it is not already dispatched, allowing the request or signal to be processed in a timely manner**
- **Once dispatched, existing “poll for work” logic in both CFCC and z/OS can be used as-is to locate and process the work – the new interrupt simply expedites the re-dispatching of the partition**
- **CF will give up control when work is exhausted (or when LPAR kicks it off the shared processor)**

‘Thin Interrupt’ Support

- **Requires:**
  - **CFLEVEL 19**
    - DYNDISP=THININT to be specified
  - **z/OS V1.12 with PTFs, z/OS V1.13 with PTFs, or z/OS V2.1 with PTFs**
    - Enablement in z/OS is via a function switch controlled by both SETXCF command and COUPLExx PARMLIB member (default = enabled)
    - DISPLAY CF command will indicate whether or not the this facility is installed and enabled on a CF
    - D XCF, COUPLE command will be updated to show whether or not the facility is installed and enabled on a given z/OS image
    - z/OS health check for a CF running with shared processors will take into account the existence of this facility
    - Also reported externally in the XESDATA FACILITY IPCS report output
    - z/OS will interrogate each CF to determine if the facility is installed and enabled on it
      - z/OS will pass this info along on the ADPLX command so a CF will know if its peer has the facility enabled

zBC12 and zEC GA2 Enhancements

- **IBM Enterprise Public Key Cryptography Standards #11(EP11) LIC**
  - Support for PKCS #1 v2.1 PSS
  - Domain Parameter Generate
  - Support for Diffie-Hellman and Elliptic Curve Diffie-Hellman
- **IBM Common Cryptographic Architecture (CCA) 4.4 LIC**
  - EMV enhancement: Diversified Key Generation TDES CBC support
  - DUKPT Initial PIN Encrypting Key (IPEK) Derivation
  - Export/Import TDES key under AES transport key
  - RKX key wrapping support
  - Integrate specific UDX functions into CCA:
    - Recover PIN from Offset (PFO)
    - Symmetric Key Export with Data verb (SXD)
    - Authentication Parameter Generate (APG)
- **Trusted Key Entry (TKE) 7.3 (FC #0872) LIC**
  - Requires TKE Workstation Hardware 7.3 (FC #0842) or 7.2 (FC #0841) (TKE 7.3 LIC ships installed on TKE Workstation Hardware 7.3)
  - EP11 full function migration wizard
  - Workstation setup wizard
  - Support for PCI-HSM compliance
  - Set Master Key from the TKE
  - Increased strength of TKE session keys

Customization / Activation for Crypto

- **Crypto Toleration**
  - **Toleration PTFs are required on z/OS V1.10 - z/OS V1.13**
    - Even if a web deliverable is installed
- **Crypto Exploitation (software installation)**
  - **Initial ICSF web deliverable support for zEC12 (GA1)**
    - Cryptographic Support for z/OS V1R12-V1R13 Web deliverable (HCR77A0)
      - ***NOT*** integrated in ServerPac (even for new z/OS V1.13 orders)
        - » ***IS*** integrated in z/OS V2.1 ServerPac orders
      - Only required to exploit new the following zEC12 function
        - » Enterprise Security PKCS11- Hardware Security Module (HSM), DUKPT for MAC and Data Encryption, Cipher Text Translate CCA Verb, PKDS/TKDS Constraint Relief, FIPS Evaluation, Common Criteria, Random Number Cache, FIPS on Demand, Wrapping Keys with Strong Keys
      - All systems in a sysplex that share a PKDS/TKDS must be at HCR77A0 (or higher) to exploit the new PKDS/TKDS Coordinated Administration support
  - **zEC12 GA2/zBC12 ICSF web deliverable support**
    - **Cryptographic Support for z/OS V1R13-z/OS V21R1 web deliverable (HCR77A1)**
      - ***NOT*** **integrated in ServerPac (even for new z/OS V2.1 orders)**
      - **Only required to exploit new the following functions**
        - » **RKX Key Export Wrap, UDX Reduction and Simplification, additional EP11 algorithms, expanded EMV support, AP Configuration simplification, CTRACE Enhancements, KDS Key Utilization Stats**

Customization / Activation for Crypto Exploitation

- **If you are using Trusted Key Entry (TKE) to manage CryptoExpress4S adapters on your host system, then you must migrate to TKE 7.2 or higher prior to IPLing:**
  - z/OS V1.12 or z/OS V1.13 with the Cryptographic Support for z/OS V1R12-V1R13 Web deliverable (FMID HCR77A0) installed
  - z/OS V2.1 (which includes HCR77A0)
  - z/OS V2.1 with the Cryptographic Support for z/OS V1R13-z/OS V2R1 Web deliverable (FMID HCR77A1) installed.
    - If you do not upgrade the TKE, your crypto adapters will still work however you will not be able to manage those adapters, including not being able to load new or change master keys.

Migration and Coexistence for Crypto

- **Installation of the Cryptographic Support for z/OS V1R13-z/OS V2R1 web deliverable introduces migration considerations for the following functions:**
  - AP Configuration simplification
  - CCF Removal
  - CTRACE Enhancements
  - KDS Key Utilization Stats – only if implemented
  - UDX (User Defined eXtension)
- **In addition, new coexistence support is needed to:**
  - Permit the use of a PKDS with RSA private key tokens encrypted under the ECC master key
  - Support for installation options data sets which use the keyword BEGIN(fmid).
  - Ensure that key tokens with fixed-length payloads are properly handled
  - Recognize a KDS is in the new format and fail gracefully.
- **SMP/E Fix Categories created**
  - IBM.Coexistence.ICSF.z/OS_V1R12-V1R13-HCR77A0
  - IBM.Coexistence.ICSF.z/OS_V1R13-V2R1-HCR77A1

Crypto Migration Considerations (1 of 4)

- **Installation of the Cryptographic Support for z/OS V1R13-z/OS V21R1 web deliverable introduces the following considerations**
  - **Adjunct Processors (AP) Configuration simplification**
    - The new Adjunct Processors (AP) configuration processing will compare each master key verification pattern (MKVPs) present in the CKDS/PKDS or TKDS to the corresponding MKVP for a given processor, if supported by that processor. If any do not match, the processor will not become active and available for work.
      - In previous releases, if a subset of the master keys matched, the coprocessor could become active.
      - A migration health check ICSFMIG77A1_CCA_COPROCESSOR_ACTIVE will be implemented for HCR7770, HCR7780, HCR7790 and HCR77A0. The health check warns the user when master key configuration of crypto devices does not match the active key data stores which could result in crypto devices not being activated after migration to HCR77A1.
  - **CCF Removal (removes support for the z800 and z900 machines)**
    - Migration actions are required by the user to accommodate this change due to:
      - Removal of services which are no longer supported by the hardware
      - Removal of BHAPI support
      - Removal/renaming of field names
      - The DATAXLAT key type is no longer supported (KGN, SKI, or KGUP) requires CCF system.
    - A migration check ICSFMIG77A1_UNSUPPORTED_HW will be created to check that the current hardware will be able to start ICSF FMID HCR77A1. If not, the migration check will indicate that HCR77A1 will not be able to start. The message will be:
      - CSFH0017I Processor will not be supported by ICSF after migration
    - In addition, any customer that has z800/z900 servers and zEC12/zBC12 (with the Cryptographic Support for z/OS V1R13-z/OS V21R1 web deliverable installed, will need to maintain 2 software stacks
      1. One with the level of ICSF prior to the Cryptographic Support for z/OS V1R13-z/OS V21R1 web deliverable
      2. One with the Cryptographic Support for z/OS V1R13-z/OS V21R1 web deliverable installed

Crypto Migration Considerations (2 of 4)

- **Installation of the Cryptographic Support for z/OS V1R13-z/OS V21R1 web deliverable introduces the following considerations:**
  - **CTRACE Enhancements**
    - Previously, ICSF supported the TRACEENTRY option in the Options dataset, which allowed the user to configure the maximum number of CTRACE records in the ICSF buffer.
      - This option is deprecated, but will not prevent ICSF initialization.
    - Now, ICSF supports the CTRACE(CTICSFxx) option in the Options dataset, which provides the name of a PARMLIB member containing ICSF's CTRACE options.
    - **No action is required to take advantage of this new function.**
      - If the TRACEENTRY option is present, it will merely cause a JOBLOG message (CSFO0212) and the value will be ignored.
      - If the CTRACE option is not present, ICSF will behave as if CTRACE(CTICSF00) was specified.
        - » If the PARMLIB member specified (or CTICSF00 if defaulted) is not present, ICSF will select a reasonable set of options (the same options present in the CTICSF00 sample installed via SMP/E).
      - The TRACEENTRY option can remain in the Options dataset, especially if it is shared across multiple ICSF instances.
        - » The presence of the option will not adversely affect HCR77A1.
        - » Additionally, the CTRACE option can be added and bracketed with BEGIN(HCR77A1)/END if settings other than the defaults in CTICSF00 are desired on HCR77A1 systems.

Crypto Migration Considerations (3 of 4)

- **Installation of the Cryptographic Support for z/OS V1R13-z/OS V21R1 web deliverable introduces the following considerations:**
  - **KDS Key Utilization Stats – only if implemented**
    - **KDS Key Utilization Stats will introduce a new format of KDS records.**
    - The Cryptographic Support for z/OS V1R13-z/OS V21R1 web deliverable is compatible with old versions of the KDS. Only the TKDS is affected incompatibly.
      - The web deliverable will support a new format of KDS records.
      - It will be compatible with old versions of the KDS.
      - There will be a utility to migrate a KDS in the old format to the new format.
        - » Once in the new format a KDS cannot be converted back to the earlier format.
      - Prior releases will not be able to run with a KDS in the new format.
        - » There will be a toleration APAR for earlier releases so the they recognize a KDS is in the new format and fail gracefully.
      - When the web deliverable level is using a KDS in the old format it will not perform any of the new functions associated with this line item.
      - A new migration Health Check ICSFMIG77A1_TKDS will be created to check the TKDS to ensure it can be migrated to the format required for KDS Key Utilization function.

Crypto Migration Considerations (4 of 4)

- **UDX (User Defined eXtension)**
  - Extends the functionality of IBM's CCA (Common Cryptographic Architecture) application program
    - Customized cryptographic verb controls per customer
  - UDX interfaces using hardware control blocks and ICSF control blocks
    - Therefore if hardware platform changes, or ISCF level changes, or both, then
      - UDX must updated for the new control blocks
        - » If a customer has UDX, they would already know this
  - Starting with the Cryptographic Support for z/OS V1R13-z/OS V21R1 web deliverable some user defined extensions are shipped with the web deliverable.

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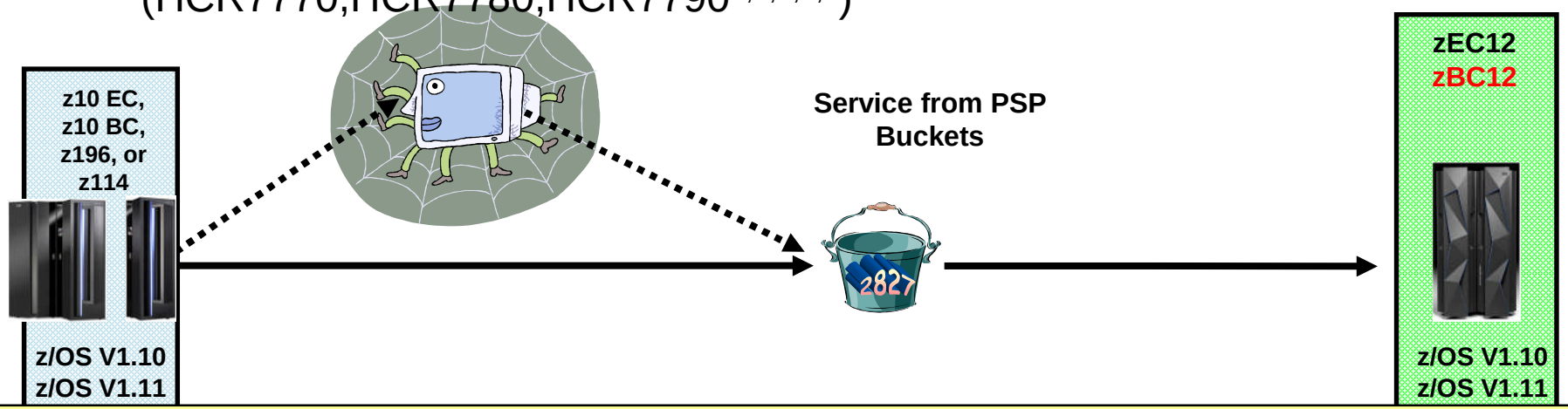
General Recommendations and Considerations

- **zEC12 and zBC12 servers are based on existing System z technology**
  - z/Architecture (z900/z800)
  - Multiple Logical Channel Subsystems (z990/z890)
  - OSA-Express2, FICON Express4, Crypto Express2 (z9 EC/z9 BC)
  - HiperDispatch, Large Page, zHPF (z10 EC, z10 BC)
  - Ensembles, native PCIe-based I/O – FICON Express8S and OSA Express4S (z196, z114)
- **zEC12 and zBC12 capabilities differ depending on z/OS release**
  - Web deliverables are needed for some functions on some releases
- **Don't migrate software releases and hardware at the same time**
- **Migrate off of ESCON CTCs for GRS Ring communication**
- **Keep members of the sysplex at the same software level other than during brief migration periods**
- **Review any restrictions and migration considerations prior to creating upgrade plan**

Typical z/OS V1.10 - z/OS V1.11 Migration Path

Cryptographic Support for z/OS VR10
through z/OS V1R12 Web Deliverable
(HCR7770,HCR7780,HCR7790[1,2,3,4,5])



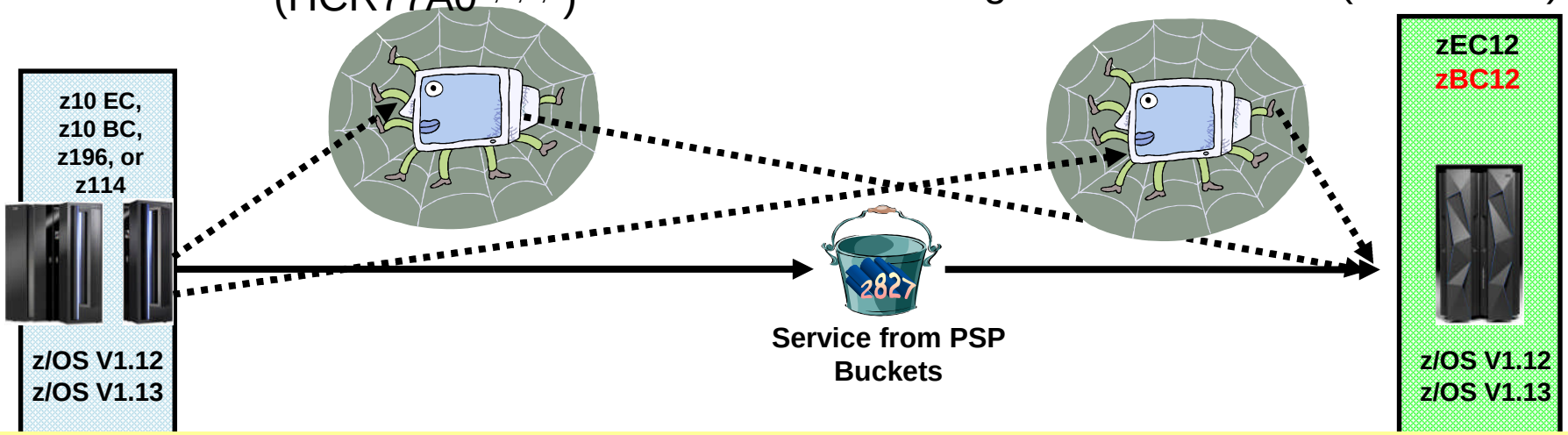
Notes:

1. A Web Deliverable and toleration PTF is needed for lower ICSF levels (HCR7770 or higher), unless CyrptoExpress3 is Carried Forward
2. For z/OS V1.10, if you require Support for 13- thru 19-digit Personal Account Numbers, ICSF Query Algorithms, or Key Token Policy support then you must install the Cryptographic Support for z/OS V1.8 through z/OS V1.10 and z/OS.e V1.8 Web deliverable (or higher)
3. For z/OS V1.10 or z/OS V1.11, if you require protected key CP Assist for Cryptographic Function, new Crypto Express3 or Crypto Express3 -1P, then you must install the Cryptographic Support for z/OS V1R9-V1R11 Web deliverable (or higher)
4. For z/OS V1.10 or z/OS V1.11, if you require X9.8 Pin, 64 Bit, HMAC, CKDS Constraint Relief, PCI Audit, ECC HW Support, CBC Key Wrap, and PKA RSA OAEP with SHA-256 algorithm, then you must install the Cryptographic Support for z/OS V1R10-V1R12 Web deliverable (or higher)
5. For z/OS V1.11 or higher, if you require Expanded key support for AES algorithm, enhanced ANSI TR-31 Secure Key Exchange, PIN block decimalization table protection, PKA RSA OAEP with SHA-256 algorithm, or additional Elliptic Curve Cryptography (ECC) functions then you must install the Cryptographic Support for z/OS V1R11-V1R13 Web deliverable

Typical z/OS V1.12 - z/OS V1.13 Migration Path

Cryptographic Support for z/OS VR12 through z/OS V1R13 Web Deliverable (HCR77A0[1,2,3,4])

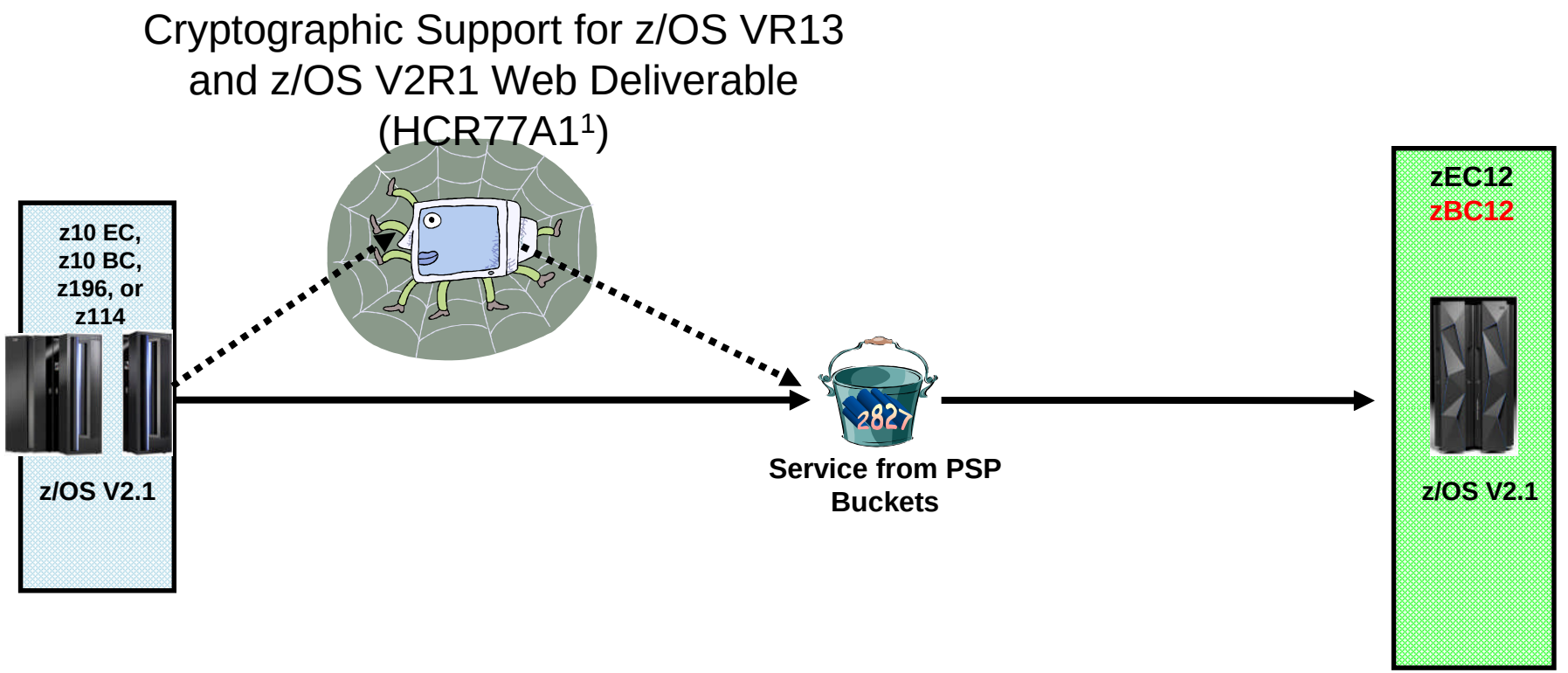
z/OS V1R13 RSM Enablement Offering Web Deliverable (JBB778H[5])



Notes:

1. For z/OS V1.12, if you require X9.8 Pin, 64 Bit, HMAC, CKDS Constraint Relief, PCI Audit, ECC HW Support, CBC Key Wrap, and PKA RSA OAEP with SHA-256 algorithm, then you must install the Cryptographic Support for z/OS V1R10-V1R12 Web deliverable (or higher)
2. If you require Expanded key support for AES algorithm, enhanced ANSI TR-31 Secure Key Exchange, PIN block decimalization table protection, PKA RSA OAEP with SHA-256 algorithm, or additional Elliptic Curve Cryptography (ECC) functions then you must install the Cryptographic Support for z/OS V1R11-V1R13 Web deliverable
3. If you require Enterprise Security PKCS11- Hardware Security Module (HSM), DUKPT for MAC and Data Encryption, Cipher Text Translate CCA Verb, PKDS/TKDS Constraint Relief, Random Number Cache, FIPS on Demand, Wrapping Keys with Strong Keys then you must install the Cryptographic Support for z/OS V1R12-V1R13 Web deliverable
4. If you want to exploit the Cryptographic Express4S enhancement support including: RKX Key Export Wrap, UDX Reduction and Simplification, additional EP11 algorithms, expanded EMV support, AP Configuration simplification, CTRACE Enhancements, KDS Key Utilization Stats, you need to install the Cryptographic Support for z/OS V1R13 and z/OS V2R1 Web Deliverable.
5. If you require Flash Express support (including Pageable Large Pages) or 2 GB Large Page support, then you must install the RSM Enhancements for z/OS V1.13 Web deliverable.

Typical z/OS V2.1 Migration Path



Notes:

1 – The web deliverable is only needed if you want to exploit Cryptographic Express4S enhancement support including: RKX Key Export Wrap, UDX Reduction and Simplification, additional EP11 algorithms, expanded EMV support, AP Configuration simplification, CTRACE Enhancements, KDS Key Utilization Stats

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Summary: z/OS Software Support for IBM zEC12 and zBC12 Servers

- **Provides same functionality as that on the IBM zEnterprise 196 (z196)**
  - HiperDispatch, FICON Express8S, Parallel Sysplex InfiniBand (PSIFB) Coupling Links, High Performance FICON for System z (zHPF), CPU Measurement Facility, …
- **Plus for z/OS V1.10 and z/OS V1.11**
  - OSA-Express4S (GbE LX and SX, **1000BASE-T**, 10 GbE LR and SR)
  - **OSA-Express5S**
  - Crypto Express4S toleration
  - GRS FICON CTC toleration
  - New z/Architecture Instructions (and new OPCODE support)
- **z/OS V1.12 (and higher)**
  - **XES/XCF Support of New Hardware (CF Level 18)**
  - **Crypto Express4S Exploitation**
    - Enterprise Security PKCS11- Hardware Security Module (HSM), DUKPT for MAC and Data Encryption, Cipher Text Translate CCA Verb, PKDS/TKDS Constraint Relief, FIPS Evaluation, Common Criteria, Random Number Cache, FIPS on Demand, Wrapping Keys with Strong Keys
  - **24K subchannels for FICON channels**
  - **CFCC and z/OS support for thin interrupts**
- **z/OS V1.13 (and higher) only**
  - **Java exploitation of the Transactional Execution Facility**
  - **Exploitation of New Hardware Features - C/C++ Arch(10) / Tune(10)**
  - **IBM zAware (z/OS Monitoring)**
  - **RSM Enhancements**
    - Flash Express Support
    - Pageable 1MB Large Page Support
    - Dynamic reconfiguration support for Flash Express – PTFs UA68169 and UA68170
    - 2 GB Large Page Support - PTFs UA68145 and UA68146
    - Optional PLPA and COMMON page data set support – PTFs UA68145 and UA68146
  - **CF Flash Support***
  - **Cryptographic Express4S Enhancement support:**
    - **RKX Key Export Wrap, UDX Reduction and Simplification, additional EP11 algorithms, expand EMV support, AP Configuration simplification, CTRACE Enhancements, KDS Key Utilization Stats**
- **z/OS V2.1* (and higher)**
  - **Support the transactional Execution Facility in additional production environments**
  - **IBM zEnterprise Data Compression (zEDC) capability using zEDC Express**
  - **RDMA (Remote Direct Memory Access) support for z/OS over Converged Enhanced Ethernet**
  - **Support of PNETID for OSD and IQD CHPIDs and PCIe functions (PNETID = names)**
  - Usability and performance improvements for zDAC (also available on z196/z114)

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

Summary: z/OS Software Support for IBM zEC12 and zBC12 Servers

zEC12 PSP Bucket – 2827DEVICE 2827/ZOS
zBC12 PSP Bucket – 2828DEVICE 2828/ZOS

	Base Support											Exploitation Support																
Release	Base zEC12 Support	Base zBC12 Support	OSA-Express4S (Gbe LX and SR, 1000BASE-T, 10 Gbe LR and SR)	FICON Express8S (CHPID FC)	IFB Coupling Links	Crypto Express4S Toleration[2]	High Performance FICON (zHPF)	CPU Measurement Facility (HIS)	GRS FICON CTC Toleration	New z/Architecture Instructions	OSA-Express5S	CF Level 18	CF Level 19	Crypto Express4S Exploitation[3]	XL C/C++ ARCH(10)/TUNE(10)	IBM zAware (z/OS Monitoring)	Java exploitation of the Transactional Execution Facility	Flash Express (Storage Class Memory - SCM)	Pageable Large Pages	Dynamic reconfiguration support for Flash Express	2 GB Large Page	Optional PLPA/ COMMON page data set support	24K subchannels for FICON	Coupling thin interrupt support	CF Flash Exploitation	Cryptographic Enhancements	SMC-R - 10GbE RoCE Exploitation	IBM zEnterprise Data Compression (zEDC) using zEDC Express
z/OS V1.10[1]	P	P	P	P	P	W P	P	P	P	P	P	N	N	N	N	N	N	N	N	N	N	N	N	P[6]	N	N	N	P[6]	N
z/OS V1.11[1]	P	P	P	P	P	W P	P	P	P	P	P	N	N	N	N	N	N	N	N	N	N	N	N	P[6]	N	N	N	P[6]	N
z/OS V1.12	P	P	B	B	B	W P	P	P	P	P	P	P	P	W	N	N	N	N	N	N	N	N	N	P	P	N	N	P[6]	P[7]
z/OS V1.13	P	P	B	B	B	W P	P	P	P	P	P	P	P	W	P	P	P	W P	W P	W P	W P	W P	W P	P	P	P	W	P[6]	P[7]
z/OS V2.1[4,5]	B	B	B	B	B	B	B	B	B	B	B	B	P	B	B	B	B	B	B	B	B	B	B	B	B	P	W	B	P

[1] – The Lifecycle Extension for z/OS V1.10 (5656-A01) is required to acquire toleration PTFs and for support. The Lifecycle Extension for z/OS V1.11 (5657-A01) is required for support after September 30, 2012 and to acquire PTFs that become available after that date.

[2] – A Crypto Web Deliverable (HCR7770 or higher) AND a PTF is required for toleration unless CyrptoExpress3 is Carried Forward. Support differs depending on the Crypto Web Deliverable installed

[3] – Crypto Exploitation differs based on the Crypto Web Deliverable installed

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

[5] - z/OS V2.1 announced as a preview of availability

[6] – PTF available for toleration ONLY

[7] – Software decompression only

B – FMID shipped in Base product P – PTF is required W – FMID shipped in a Web Deliverable

Summary: z/OS Support for zEC12 and zBC12

- **Base support for zEC12 and zBC12 is provided by PTFs for releases z/OS V1.10 – z/OS V1.13**
- **Exploitation of many functions is provided by PTFs for z/OS V1.13 (and some for z/OS V1.12)**
- **Exploitation of Crypto Express4S requires a web deliverable on z/OS V1.12 and higher**
  - **Enhancements to Crypto Express4s support requires the Cryptographic Support for z/OS V1R13-z/OS V21R1 Web deliverable**
- **Exploitation of RSM Enhancements, including Flash Express exploitation, requires the z/OS V1R13 RSM Enablement Offering web deliverable on z/OS V1.13**
  - Available since December 14, 2012
  - PTFs UA68145, UA68146, UA68169 and UA68170 now available
- **Most support (all except ICSF exploitation) is planned to be included in the base of z/OS V2.1**

Thank you for attending this session!

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Additional Information

- z/OS Home Page
  http://www.ibm.com/servers/eserver/zseries/z/OS/
- zFavorites for System z
  http://www.ibm.com/servers/eserver/zseries/z/OS/zfavorites/
- z/OS Internet Library
  http://www.ibm.com/servers/eserver/zseries/z/OS/bkserv/
- IBM System z
  http://www.ibm.com/systems/z/
- IBM Resource Link
  https://app-06.www.ibm.com/servers/resourcelink/hom03010.nsf
- IBM Redbooks – How-To Books (also Redpieces)
  http://www.redbooks.ibm.com/
- Preventive Service Planning buckets
  http://www14.software.ibm.com/webapp/set2/psp/srchBroker
- Enhanced HOLDDATA
  http://service.boulder.ibm.com/390holddata.html

OSA-Express CHPID Types to Control Operation

CHPID type	Purpose / Traffic	Operating Systems
OSC 1000BASE-T[1] zEC12, z196, z114, z10, z9 z990, z890	OSA-Integrated Console Controller (OSA-ICC) Supports TN3270E, non-SNA DFT to IPL CPCs & LPs	z/OS, z/VM z/VSE
OSD All OSA features zEC12, z196, z114, z10, z9, zSeries	Supports Queue Direct Input/Output (QDIO) architecture TCP/IP traffic when Layer 3 (uses IP address) Protocol-independent when Layer 2 (uses MAC address)	z/OS, z/VM z/VSE, z/TPF Linux on System z
OSE 1000BASE-T[1] zEC12, z196, z114, z10, z9, zSeries	Non-QDIO; for SNA/APPN/HPR traffic and TCP/IP “passthru” traffic	z/OS, z/VM z/VSE
OSM 1000BASE-T[1] zEC12, z196, z114	OSA-Express for Unified Resource Manager Connectivity to intranode management network (INMN) from zEC12, z196, or z114 to Unified Resource Manager functions	z/OS, z/VM Linux on System z
OSN[2] GbE, 1000BASE-T zEC12, z196, z114, z10, z9	OSA-Express for NCP Appears to OS as a device supporting CDLC protocol Enables Network Control Program (NCP) channel-related functions Provides LP-to-LP connectivity OS to IBM Communication Controller for Linux (CCL)	z/OS, z/VM z/VSE, z/TPF Linux on System z
OSX 10 GbE zEC12, z196, z114	OSA-Express for zBX Connectivity and access control to intraensemble data network (IEDN) from zEC12, z196, or z114 to zBX	z/OS, z/VM, z/VSE 5.1, Linux on System z

[1] – 1000BASE-T is not available using OSA-Express4S on z196 and z114

[2] - CHPID type OSN (OSA-Express for NCP) is not available for OSA-Express4S GbE SX and LX or OSA-Express5S GbE SX and LX

Note: zEC12 is planned to be the last high-end System z server to offer support for the Open System Adapter-Express3 (OSA-Express3)*

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

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- IBM zEnterprise EC12 (zEC12) and IBM zEnterprise BC12 (zBC12) Overview
- z/OS Support by Release
  - Hardware PSP Buckets and Fix Categories
- Migration Considerations
  - General
  - Foror Selected Functions
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- **Backup**
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z/OS Crypto Toleration Support (1 of 2)

z/OS Release	Crypto Web Download	FMID	Comments
z/OS V1.10[1]	N/A – In z/OS base product	HCR7750	Prior release plus: 4096-bit RSA keys, ISO-3 PIN Support, CPACF support for SHA-394 and SHA-512, Reduced support of retained private key in ICSF
	[11/2008] Cryptographic Support for z/OS V1.8 through z/OS V1.10 and z/OS.e V1.8 web deliverable	HCR7751	Support for 13- thru 19-digit Personal Account Numbers, ICSF Query Algorithms, Key Token Policy support, and Secure Key AES
	[11/2009] Cryptographic Support for z/OS V1R9-V1R11 Web deliverable	HCR7770	Protected Key CP Assist for Cryptographic Function and new Crypto Express3 and Crypto Express3 -1P
	[9/2010] Cryptographic Support for z/OS V1R10-V1R12 Web deliverable	HCR7780	X9.8 Pin, 64 Bit, z196/z114 CPACF, HMAC*, CKDS Constraint Relief, AP Interrupt, PCI Audit, ECC HW Support, CBC Key Wrap, and PKA RSA OAEP with SHA-256 algorithm
z/OS V1.11[1]	N/A – In z/OS base product	HCR7751	Prior release plus: Support for 13- thru 19-digit Personal Account Numbers, ICSF Query Algorithms, Key Token Policy support, and Secure Key AES
	[11/2009] Cryptographic Support for z/OS V1R9-V1R11 Web deliverable	HCR7770	Protected Key CP Assist for Cryptographic Function and new Crypto Express3 and Crypto Express3 -1P
	[9/2010] Cryptographic Support for z/OS V1R10-V1R12 Web deliverable	HCR7780	X9.8 Pin, 64 Bit, z196/z114 CPACF, HMAC*, CKDS Constraint Relief, AP Interrupt, PCI Audit, ECC HW Support, CBC Key Wrap, and PKA RSA OAEP with SHA-256 algorithm
	[9/2011] Cryptographic Support for z/OS V1R11-V1R13 Web deliverable	HCR7790	Expanded key support for AES algorithm, enhanced ANSI TR-31 Secure Key Exchange, PIN block decimalization table protection, PKA RSA OAEP with SHA-256 algorithm, and additional Elliptic Curve Cryptography (ECC) functions.

[1] The IBM Lifecycle Extension for z/OS is required for support after general support is withdrawn

z/OS Crypto Exploitation Support (1 of 3)

z/OS Release	Crypto Web Download	FMID	Comments
z/OS V1.12	N/A – In z/OS base product	HCR7770	Prior release plus: Protected Key CP Assist for Cryptographic Function and new Crypto Express3 and Crypto Express3 -1P
	[9/2010] Cryptographic Support for z/OS V1R10-V1R12 Web deliverable	HCR7780	X9.8 Pin, 64 Bit, z196/z114 CPACF, HMAC*, CKDS Constraint Relief, AP Interrupt, PCI Audit, ECC HW Support, CBC Key Wrap, and PKA RSA OAEP with SHA-256 algorithm
	[9/2011] Cryptographic Support for z/OS V1R11-V1R13 Web deliverable	HCR7790	Expanded key support for AES algorithm, enhanced ANSI TR-31 Secure Key Exchange, PIN block decimalization table protection, PKA RSA OAEP with SHA-256 algorithm, and additional Elliptic Curve Cryptography (ECC) functions.
	[10/2012] Cryptographic Support for z/OS V1R12-V1R13 Web deliverable	HCR77A0	Enterprise Security PKCS11- Hardware Security Module (HSM), DUKPT for MAC and Data Encryption, Cipher Text Translate CCA Verb, PKDS/TKDS Constraint Relief, Random Number Cache, FIPS on Demand, Wrapping Keys with Strong Keys

z/OS Crypto Exploitation Support (2 of 3)

z/OS Release	Crypto Web Download	FMID	Comments
z/OS V1.13	N/A – In z/OS base product	HCR7780	Prior release plus: X9.8 Pin, 64 Bit, z196/z114 CPACF, HMAC, CKDS Constraint Relief, AP Interrupt, PCI Audit, ECC HW Support, CBC Key Wrap, and PKA RSA OAEP with SHA-256 algorithm
	[9/2011] Cryptographic Support for z/OS V1R11-V1R13 Web deliverable	HCR7790	Expanded key support for AES algorithm, enhanced ANSI TR-31 Secure Key Exchange, PIN block decimalization table protection, PKA RSA OAEP with SHA-256 algorithm, additional and Elliptic Curve Cryptography (ECC) functions.
	[10/2012] Cryptographic Support for z/OS V1R12-V1R13 Web deliverable	HCR77A0	Enterprise Security PKCS11- Hardware Security Module (HSM), DUKPT for MAC and Data Encryption, Cipher Text Translate CCA Verb, PKDS/TKDS Constraint Relief, Random Number Cache, FIPS on Demand, Wrapping Keys with Strong Keys
	[TBD] Cryptographic Support for z/OS V1R13-z/OS V2R1 Web deliverable	HCR77A1	Prior release plus: RKX Key Export Wrap, UDX Reduction and Simplification, additional EP11 algorithms, expanded EMV support, AP Configuration simplification, CTRACE Enhancements, KDS Key Utilization Stats

z/OS Crypto Exploitation Support (3 of 3)

z/OS Release	Crypto Web Download	FMID	Comments
z/OS V2.1*	N/A – In z/OS base product	HCR77A0	Prior release plus: Enterprise Security PKCS11-Hardware Security Module (HSM), DUKPT for MAC and Data Encryption, Cipher Text Translate CCA Verb, PKDS/TKDS Constraint Relief, Random Number Cache, FIPS on Demand, Wrapping Keys with Strong Keys
	[TBD] Cryptographic Support for z/OS V1R13-z/OS V2R1 Web deliverable	HCR77A1	Prior release plus: RKX Key Export Wrap, UDX Reduction and Simplification, additional EP11 algorithms, expanded EMV support, AP Configuration simplification, CTRACE Enhancements, KDS Key Utilization Stats

Deliverable Name	FMID	Applicable z/OS Releases	Avail	EoM
z/OS or z/OS.e V1.3 or V1.4	HCR7706	z/OS V1.3 and z/OS V1.4	3/2002	9/2004
z990 Cryptographic CP Assist Support for z/OS V1.3[1]	HCR7708	z/OS V1.3	6/2003	10/2003
z/OS V1.4 z990 Compatibility Support or z/OS.e z990 Coexistence	HCR7708	z/OS V1.4	6/2003	10/2003
z/OS V1.4 z990 Exploitation Support or z/OS.e Coexistence Update feature	HCR7708	z/OS V1.4	10/2003	12/2006
z990 Cryptographic Support [2]	HCR770A	OS/390 V2.10, z/OS 1.2, z/OS 1.3, z/OS V1.4, any z/OS V1.4 features, and z/OS V1.5	9/2003	5/2004
z/OS or z/OS.e V1.5	HCR7708	z/OS V1.5	3/2004	9/2004
z/OS or z/OS.e V1.6	HCR770A	z/OS V1.6	9/2004	10/2005
z990 and z890 Enhancements to Cryptographic Support [3]	HCR770B	OS/390 V2.10, z/OS V1.2, z/OS V1.3, z/OS V1.4 and z/OS V1.5	5/2004	TBD
ICSF 64-bit Virtual Support for Z/OS V1.6 and z/OS.e V1.6 [4]	HCR7720	z/OS V1.6	12/2004	9/2005
z/OS or z/OS.e V1.7	HCR7720	z/OS V1.7	9/2005	10/2006
Cryptographic Support for z/OS V1R6/R7 and z/OS.e V1R6/R7[5]	HCR7730	z/OS V1.6 and z/OS V1.7	9/2005	5/2006
Enhancements to Cryptographic Support for z/OS and z/OS.e V1R6/R7[6]	HCR7731	z/OS V1.6 and z/OS V1.7	5/2006	11/2007
z/OS or z/OS.e V1.8	HCR7731	z/OS V1.8	9/2006	10/2007
z/OS V1.9	HCR7740	z/OS V1.9	9/2007	10/2008
Cryptographic Support for z/OS V1R7-V1R9 and z/OS.e V1R7-V1R8 web deliverable[7]	HCR7750	z/OS V1.7, z/OS V1.8 and z/OS V1.9	9/2007	10/2011
z/OS V1.10	HCR7750	z/OS V1.10	9/2008	10/2009
Cryptographic Support for z/OS V1.8 through z/OS V1.10 and z/OS.e V1.8 web deliverable[8]	HCR7751	z/OS V1.7*, z/OS V1.8, z/OS V1.9, z/OS V1.10	11/2008	11/2009
z/OS V1.11	HCR7751	z/OS V1.11	9/2009	10/2010
Cryptographic Support for z/OS V1R9-V1R11 Web deliverable[9]	HCR7770	z/OS V1.9, z/OS V1.10, z/OS V1.11	11/2009	9/2010
z/OS V1.12	HCR7770	z/OS V1.12	9/2010	10/2011
Cryptographic Support for z/OS V1R10-V1R12 Web deliverable[10]	HCR7780	z/OS V1.10, z/OS V1.11, z/OS V1.12	9/2010	TBD
z/OS V1.13	HCR7780	z/OS V1.13	9/2011	2H/2013*
Cryptographic Support for z/OS V1R11-V1R13 Web deliverable[11]	HCR7790	z/OS V1.11, z/OS V1.12, z/OS V1.13	9/2011	TBD
Cryptographic Support for z/OS V1R12-V1R13 Web deliverable[12]	HCR77A0	z/OS V1.12, z/OS V1.13	9/2012	TBD
z/OS V2.1	HCR77A0	z/OS V2.1	9/2013	2H2015*
Cryptographic Support for z/OS V1R13-z/OS V21R1 Web deliverable[13]	HCR77A1	z/OS V1.13, z/OS V2.1	9/2013	TBD

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

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