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GSE UK Conference 2018

Better, stronger, faster; The Mainframe….. the Machine!

Technical Introduction to the IBM z14 ZR1 and LinuxONE Rockhopper II – Part 1

Parwez Hamid

6 November 2018

Session **BF**

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ECKD	HyperSwap*	InfiniBand*	PR/SM			

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Introduction

The IBM z14 Family

IBM z14 M0x

IBM z14 LMx

Announcement:

July 17, 2017

General Availability:

September 13, 2017

IBM z14 ZR1

IBM z14 LR1

Announcement:

April 10, 2018

General Availability:

May 31, 2018

Built on the same technology of IBM z14	Addressing new markets	Standardization and Simplicity	One strong platform and family for the future

The IBM LinuxONE Portfolio

IBM LinuxONE Emperor™ II

Machine Type: 3906
Models: LM1, LM2, LM3, LM4, LM5
Up to 171 cores and 32TB

The world's premier Linux systems for highly secured data and cloud serving

Engineered for performance and scale

Foundation for data serving and next generation apps

IBM LinuxONE Rockhopper™ II

Machine Type: 3907
Model: LR1
Up to 30 cores and 8TB

Built on decades of trusted IBM Technology	Built for the cloud with Standardization and Simplicity	Lower cost than x86 for mission critical data serving	Right sized for your business needs

New IBM Z hardware enhancements for the z14 family

IBM z14

GA2

October 2, 2018
Announce

December 3, 2018
General Availability *

* OSA-Express7S 25GbE
GA: April 9, 2019

IBM LinuxONE

IBM z14 and LinuxONE™ Enhanced Driver Maintenance

New GA2 LIC driver updates **from Driver 32 to Driver 36** in support of new features and functions

IBM z14 availability Dates – Driver Level 36

GA2

Planned General Availability (GA2) – December 3rd, 2018

- New features and functions for the IBM z14 GA2 (Type number: 3906)
  - Trusted Key Entry (TKE LIC 9.1, FC 0880) improvements and new Smart Cards (FC 0900)
  - Dynamic Partition Manager (DPM) 3.2 increased feature support
  - Dynamic I/O for Standalone Coupling Facilities
  - HMC and HMC Mobile enhancements
  - New hardware adapters:
    - OSA-Express7S 25GbE (FC 0429) (Available for ordering April 9, 2019)
    - 25GbE RoCE Express2 (FC 0430)
  - Asynchronous Cache Cross-Invalidation (XI) for CF cache structures to improve performance and scalability in a Parallel sysplex
  - Server Time Protocol (STP) Coordinated Timing Network (CTN) split and merge capabilities for Parallel sysplex time management

IBM z14 Redbooks – 2018

- October 20, 2018 – Updated ITSO Redbooks – Draft Versions
  - Updated – IBM z14 Technical Introduction, SG24-8450
  - Updated – IBM z14 Technical Guide, SG24-8451
  - Updated – IBM Z Connectivity Handbook, SG24-5444
  - Updated – IBM Z Functional Matrix, REDP-5157

- August 1st, 2017 – ITSO Redbooks
  - IBM z14 Configuration Setup, SG24-8460

IBM z14 ZR1 Redbooks – 2018

- April 10th, 2018 – ITSO Redbooks
  - New – IBM z14 Model ZR1 Technical Introduction, SG24-8550
  - Updated – IBM Z Connectivity Handbook, SG24-5444 -18
  - Updated – IBM Z Functional Matrix, REDP-5157-03

- April 30, 2018 – ITSO Redbooks Draft Versions
  - New – IBM z14 Model ZR1 Technical Guide, SG24-8651

- May 31, 2018 – ITSO Redbooks – Draft Versions
  - IBM z14 Model ZR1 Configuration Setup, SG24-8560

- June 5, 2018 – ITSO Redbooks
  - Getting Started with z/OS Data Set Encryption, SG24-8410

IBM Z Overview

Continue to build on the IBM Design Thinking and Offering Management

Proof of Concept in early 2015, incorporating customer feedback

IBM received approximately 900 mainframe patents in 2017 and has over 1,500 pending patent applications that relate to mainframe technologies

Collaborated with more than 150 clients for the M01-M05 and IBM LinuxONE Emperor II models and an additional 80 clients for the z14 ZR1 and LinuxONE Rockhopper II

Beginning early GA2 hardware user experience testing with internal and external clients

October 2 GA2 announcement

Pervasive encryption is the new standard

Extending encryption across the enterprise

Exploit the value of real-time data with scale

Integrate analytics and AI into transactions for accelerated insights

Open enterprise platform to extend, connect and innovate

Exploiting open and industry standards with a cloud consumption model

IBM z14 Model ZR1
IBM LinuxONE Rockhopper II

Extending the IBM z14 and LinuxONE Families

Building on the breakthrough technologies and strong 2017 launches

Designed for the Secure Cloud

IBM z14
Machine Type: 3906
Models:
M01, M02, M03, M04, M05

Model	Customer PUs	Max Memory
M05	170	32 TB
M04	141	32 TB
M03	105	24 TB
M02	69	16 TB
M01	33	8 TB
ZR1	4, 12, 24, 30	8 TB

IBM z14
Machine Type: 3907
Model ZR1

IBM LinuxONE Emperor™ II
Machine Type: 3906
Models:
LM1, LM2, LM3, LM4, LM5

Model	Customer PUs	Max Memory
LM5	170	32 TB
LM4	141	32 TB
LM3	105	24 TB
LM2	69	16 TB
LM1	33	8 TB
LR1	4, 12, 24, 30	8 TB

IBM LinuxONE Rockhopper II
Machine Type: 3907
Model LR1

Extending the IBM z14 and LinuxONE product families

GA2

IBM z14

GA2 Content for both IBM Z and LinuxONE

- Crypto Enhancements
- DPM 3.2
- HMC 2.14.1
- OSA-Express7S 25GbE SR
- 25GbE RoCE Express2
- DS8882F Rack Mounted
- Secure Service Container with IBM Cloud Private (Linux)
- IBM Cloud Private (Linux

Statement of Direction for Master on IBM Z

IBM LinuxONE

IBM Z Content for GA2

- zHyperLink Writes
- Dynamic I/O for Standalone Coupling Facility
- New Sysplex Capabilities
- Solution Consumption License Charge
- Zowe
- Db2 AI for z/OS
- AI Infused Analytics & ML on IBM Z
- z/OS Cloud Broker for ICP ***Statement of Direction***

LinuxONE Content for GA2

- IBM Adapter for NVMe
- FCP Express32S

GA2 hardware content for IBM Z and LinuxONE Servers with Driver Level 36

GA2

Enhancements	All z14 GA2 Servers	z13®/z13s® Servers	zEC12/zBC12 Servers	z196/z114 Servers	z10EC/z10BC Servers	Emperor	Emperor II	Rockhopper	Rockhopper II
Crypto Enhancements	X						X		X
IBM Adapter for NVMe							X		X
FCP Express32S							X		X
zHyperLink Writes	X								
DPM 3.2	X						X		X
Dynamic I/O for Standalone Coupling Facility	X								
HMC 2.14.1	X	X	X	X	X	X	X	X	X
New Sysplex Capabilities	X								
OSA-Express7S 25 GbE	X						X		X
25GbE RoCE Express2	X						X		X

IBM Z® Generations (all dates MM/DD/YYYY)

N-4

IBM z10 EC M/T 2097

- Announced 02/26/2008
- GA1 02/26/2008 Driver 73
- GA2 10/28/2008 Driver 76
- GA3 11/20/2009 Driver 79

IBM z10 BC M/T 2098

- Announced 10/21/2008
- GA1 10/28/2008 Driver 76
- GA2 11/20/2009 Driver 79

N-3

IBM zEnterprise 196 M/T 2817

- Announced 07/22/2010
- GA1 09/10/2010 Driver 86
- GA2 09/09/2011 Driver 93

IBM zEnterprise 114 M/T 2818

- Announced 07/12/2011
- GA1 09/09/2011 Driver 93

N-2

IBM zEC12 M/T 2827

- Announced 08/28/2012
- GA1 09/19/2012 Driver 12
- GA2 09/20/2013 Driver 15

IBM zBC12 M/T 2828

- Announced 07/23/2013
- GA1 09/20/2013 Driver 15

N-1

IBM z13 & Emperor M/T 2964

- Announced 01/14/2015
- GA1 03/09/2015 Driver 22
- GA2 03/10/2016 Driver 27

IBM z13s & Rockhopper M/T 2965

- Announced 02/16/2016
- GA1 03/10/2016 Driver 27

N

IBM z14 & Emperor II M/T 3906

- Announced 07/17/2017
- GA1 09/13/2017 Driver 32
- GA2 12/03/2018 Driver 36

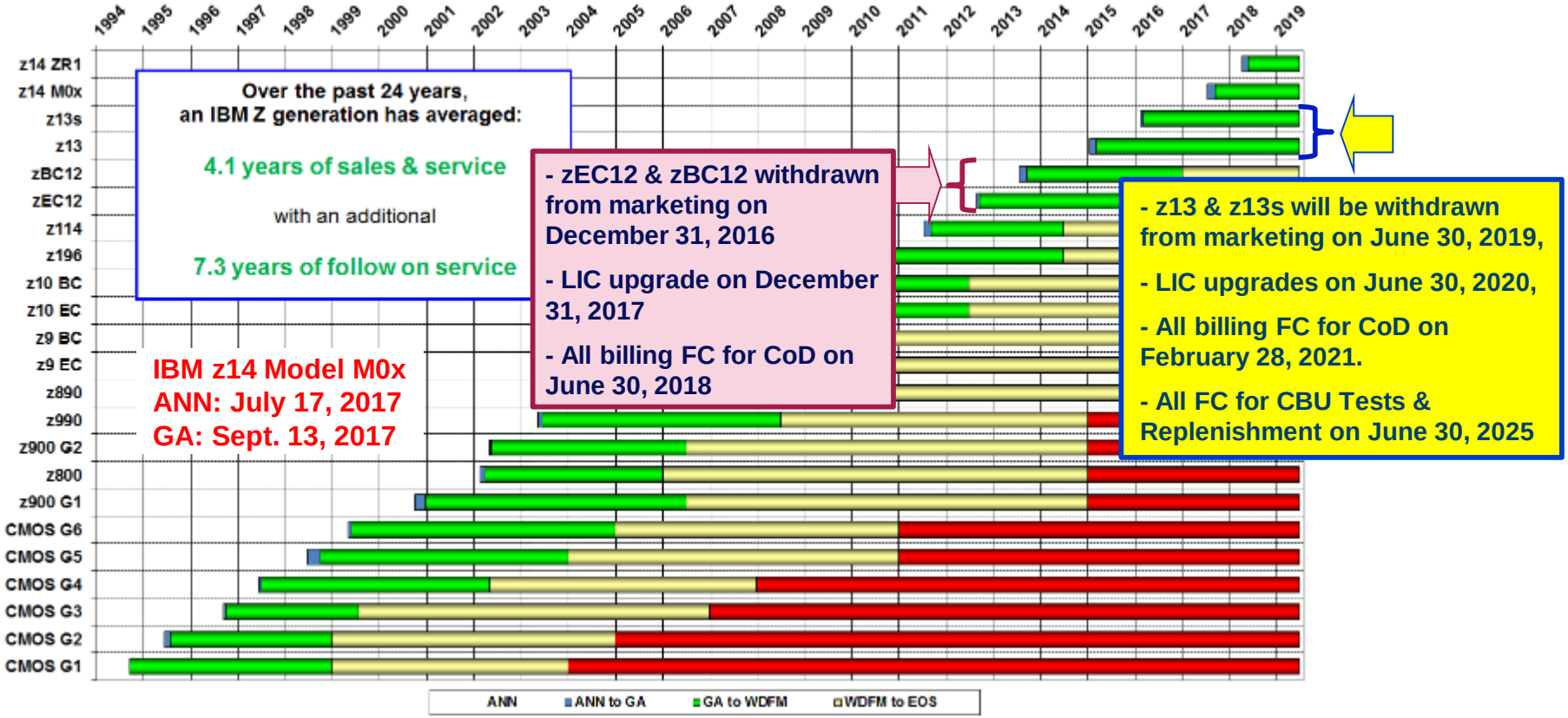
IBM z14 & Rockhopper II M/T 3907

- Announced 04/10/2018
- GA1 05/31/2018 Driver 32
- GA2 12/03/2018 Driver 36

IBM Z Life Cycle History

IBM z14 Model ZR1 & LinuxONE Rockhopper II
ANN: April 10, 2018
GA: May 31, 2018

ANN	Announcement of a new product
GA	Gerenal Availability of a product
WDFM	Withdrawal From Marketing
EOS	End of Service



System Design

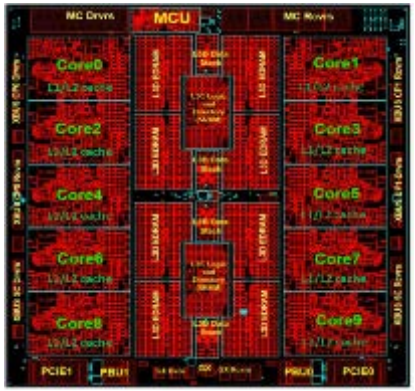
What is new?

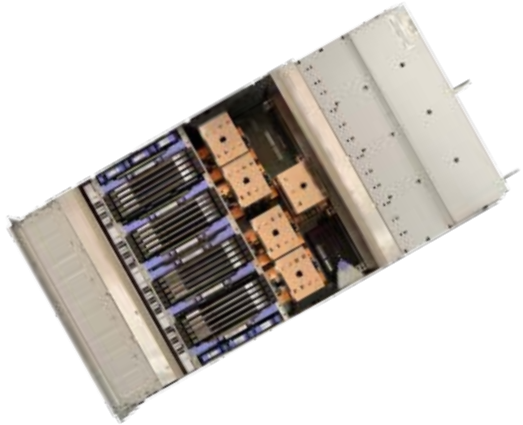
- The IBM z14 Model ZR1 symmetric multiprocessor (SMP) system is the next step in an evolutionary trajectory that began with the introduction of the IBM System/360 in1964. Over time, the design was adapted to the changing requirements that were dictated by the shift toward new types of applications that clients depend on.
- The z14 ZR1 has ultra-high frequency, large high-speed buffers (caches) and memory, superscalar processor design, with enhanced out-of-order core execution, enhanced simultaneous multithreading (SMT) and single-instruction multiple-data (SIMD) execution, and flexible configuration options. It is the next implementation of IBM Z systems to address the challenges of continuously evolving IT environment.
- The microprocessor of z14 ZR1 uses the same design as z14 M0x (M/T 3906). The difference is the frequency - 4.5 GHz vs. 5.2 GHz for z14 M0x.
- The drawer packaging is completely new, as the z14 ZR1 frame is now a 19” rack. The PU chips are air cooled (vs. closed loop water cooled for z14 M0x) as the lower frequency generates less heat.
- In addition to microprocessor evolution (described later in this section), design changes also include:
  - New 19” form factor PCIe+ I/O drawer
  - Rear side of the rack cabling **only** with improved cable management
  - No BPA, no IBF, no HVDC option, single phase AC power only (200 ~ 240 VAC), no EPO switch
  - No InfiniBand fanouts (PCIe only)

z14 ZR1 System Design Changes (M/T 3907)

- 14 nm Processor Lithography with improved SIMD, SMT
- 10 Cores per PU SCM design (active cores: 5, 6, 7, 8, or 9)
- 19 inch rack
- Single CPC Drawer
- 1, 2, or 4 PU SCMs
- Integrated I/O with PCIe Direct Attach
- Single System Controller Chip (SC SCM)

- New PCIe+ I/O Drawer
- Crypto Express6S
- OSA-Express6S
- FICON Express16S+
- 10 GbE RoCE Express2
- IBM zHyperLink Express
- Coupling Express Long Reach
- Operating environment: ASHRAE Class A3



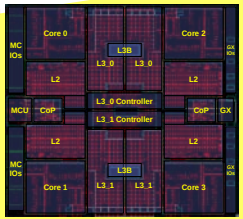


IBM Z Processor Roadmap

45 nm

z196/z114
9/2010

4-core chip



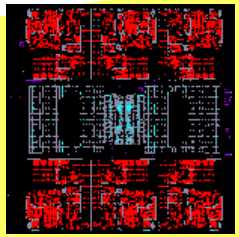
1.4 B transistors

- Top Tier Single Thread Performance, System Capacity
- Accelerator Integration
- Out of Order Execution
- Water Cooling (z196)
- PCIe I/O Fabric
- RAIM
- Enhanced Energy Management

32 nm

zEC12/zBC12
8/2012

6-core chip



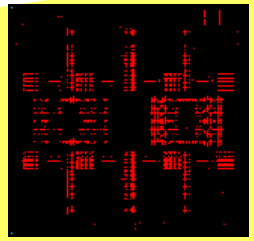
2.75 B Transistors

- Leadership Single Thread, Enhanced Throughput
- Improved out-of-order
- Transactional Memory
- Dynamic Optimization
- 2 GB page support
- Step Function in System Capacity

22 nm

z13/z13s
1/2015

8-core chip



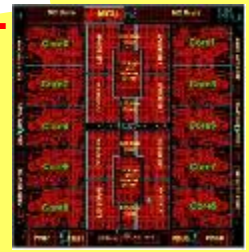
3.99 B Transistors

- Leadership System Capacity and Performance
- Modularity & Scalability
- Dynamic SMT
- Supports two instruction threads
- SIMD
- PCIe attached accelerators
- Business Analytics Optimized

14 nm

z14 M0x/ZR1
7/2017

10-core chip

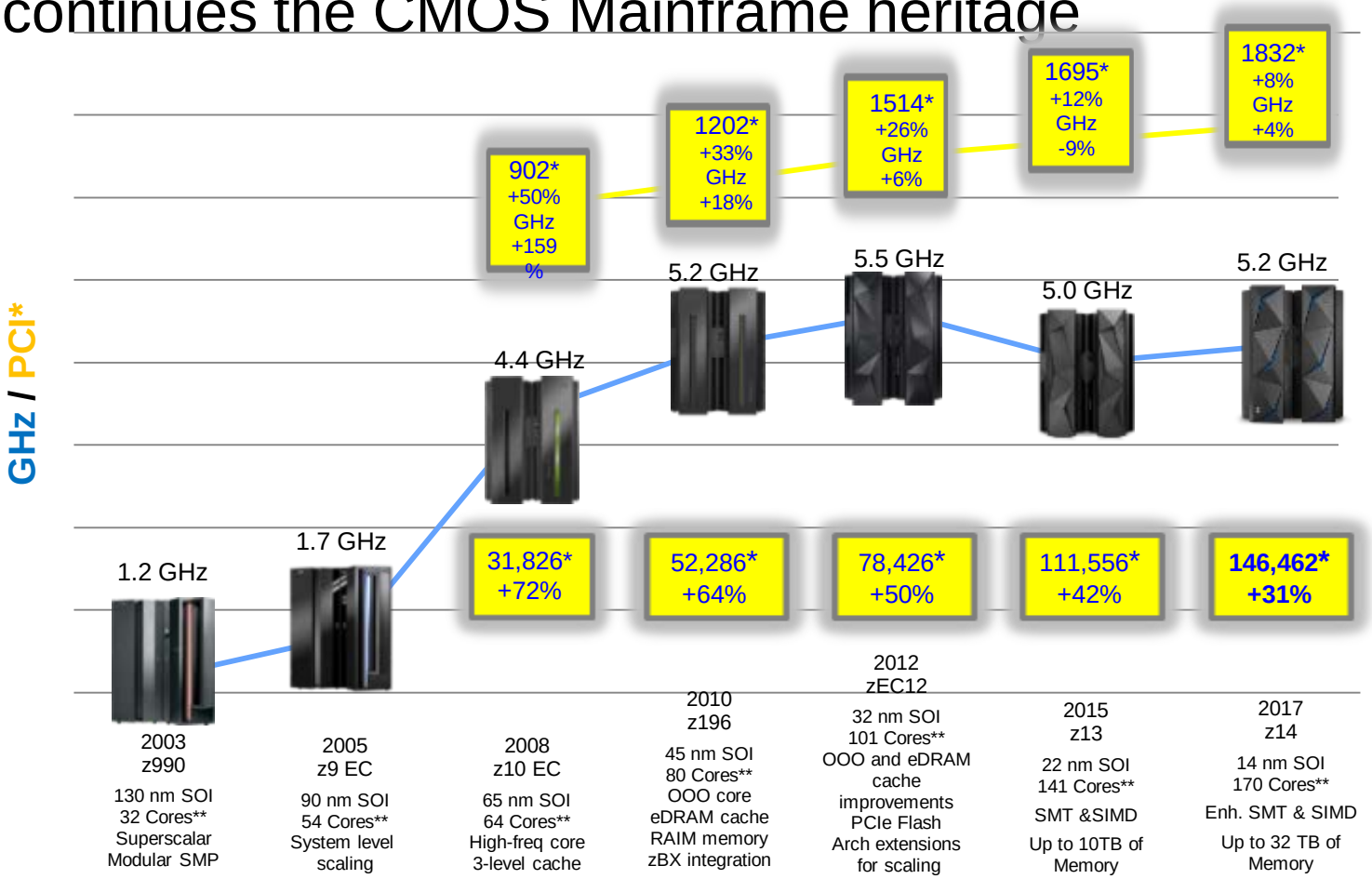


6.1 B Transistors

- Pervasive encryption
- Low latency I/O for acceleration of transaction processing for Db2 on z/OS
- Pause-less garbage collection for enterprise scale JAVA applications
- New SIMD instructions
- Optimized pipeline and enhanced SMT
- Virtual Flash Memory

4.5 GHz for ZR1 vs. 5.2 GHz for M0x

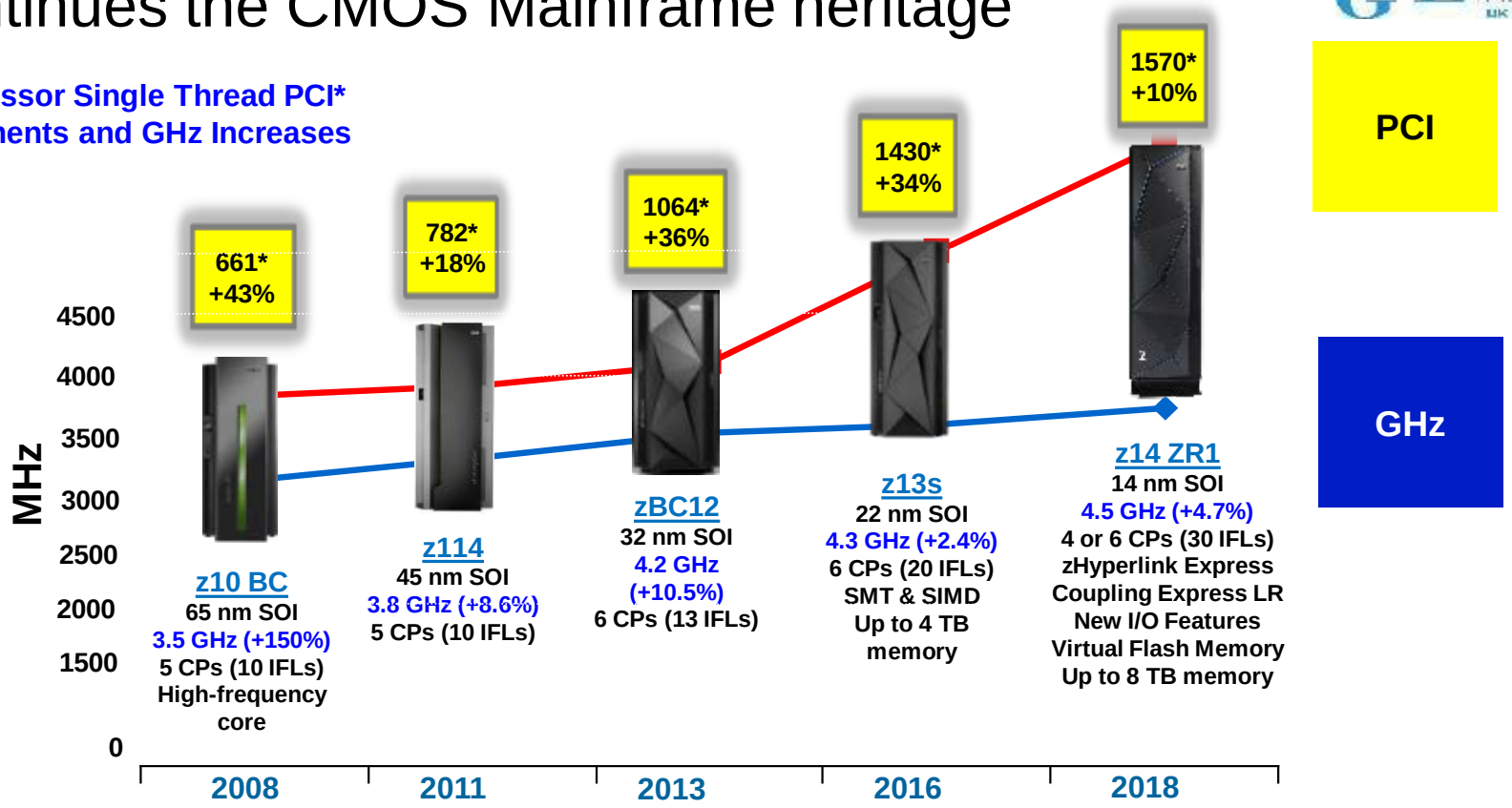
z14 continues the CMOS Mainframe heritage



* MIPS Tables are NOT adequate for making comparisons of IBM Z processors. Additional capacity planning required ** Number of PU cores for customer use

z14 continues the CMOS Mainframe heritage

Uniprocessor Single Thread PCI* Improvements and GHz Increases



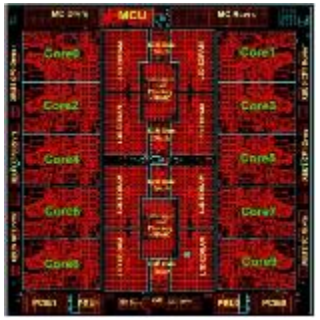
* Capacity and performance ratios are based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload .

* PCI (MIPS) Tables are NOT adequate for making comparisons of IBM Z processors. Use IBM Capacity Planning Tools

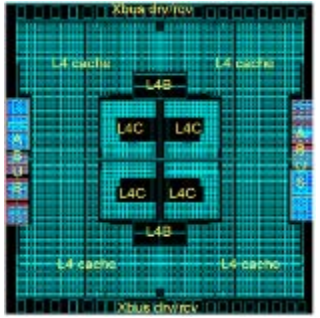
z14 M0x and ZR1 Processor Design

- **Performance Enhancements**
  - Larger L1, L2, and L3 caches
  - New address translation design
  - Branch prediction innovations (z/OS and Linux aware)
  - Instruction pipeline optimizations
  - Increased floating-point compute bandwidth
  - 2nd-generation SMT on zIIP and IFL + SAP support
- **Architecture features**
  - SIMD extensions for decimal operations and analytics
    - Register-based BCD operations (Cobol)
  - Guarded Storage Facility
    - Enables pause-less garbage collection for Java
  - Instruction Execution Protection Facility
    - “No-execute” zones
- **Compression co-processor**
- **Crypto co-processor**

14nm SOI Technology
Up to 10 active cores (PUs) per chip



6.1 billions transistors



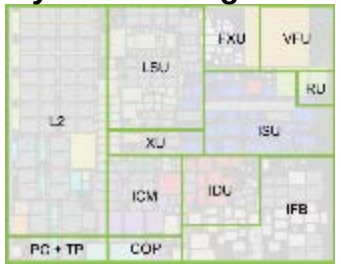
9.7 billions transistors

System Control (SC) chip

z14 M0x and ZR1 Processor Design

- Performance Enhancements
- Architecture features
- **Compression co-processor (CMPSC)**
  - Order-preserving compression
    - Support for compression of DB2 indices
  - Improved compression ratios with Huffman coding
  - Faster compression and expansion (~20% to 30%)
- **Crypto co-processor**
  - True Random Number generator
  - Support for SHA3 standard
  - RSA/ECC acceleration for asymmetric encryption
  - GCM (Galois Counter Mode) acceleration for symmetric encryption
  - Faster encryption and decryption
    - 2X for most usage of AES
    - 6X for GCM

Layout of a single core



System Control (SC) chip

IBM z14 ZR1

IBM z14 Model ZR1 – Built for Digital Trust, Secure Cloud

Platform Simplification
- Standardization across many components – including Industry standard 19” rack
- 16U free space in frame

Processor Units (PUs)
- 8, 16, 28, 34 PU cores per CPC drawer
- Feature based sizing - 4, 6/12, 6/24 or 6/30 CP/PU cores available for characterization
- Up to 2 SAPs per system
- 1 spare designated per system
- 40 LPARs

Memory
- RAIM Memory design - Min of 64 GB - Max to 8 TB
- 64 GB Fixed HSA
- IBM Virtual Flash Memory (replaces Flash Express)

I/O
- New PCIe Gen 3 IBM zHyperLink™ technology
- 16 GBps PCIe Gen 3 I/O Interconnects
- 3 Logical Channel Subsystems (LCSSs) with 3 Sub-channel sets per LCSS

IBM z14 Model ZR1
Machine Type: 3907

Model	Machine Type	Customer PUs	Max Memory
M05	3906	170	32 TB
M04	3906	141	32 TB
M03	3906	105	24 TB
M02	3906	69	16 TB
M01	3906	33	8 TB
ZR1	3907	4, 12, 24, 30	2 – 8 TB

Largest z14 ZR1 provides up to 13% more total z/OS and up to 60% more total Linux® on Z capacity than the largest z13s

z14 ZR1 Functions and Features (Driver Level 32)

System, Processor, Memory
One model, one CPC drawer, four available sizes
10 core 14nm PU SCM (5, 6, 7, 8, or 9 active cores per PU SCM)
Up to 30 configurable PUs as CPs, zIIPs, IFL, ICFs, or optional SAPs (up to 6 CPs)
Increased uni-processor capacity
156 Capacity settings
19” Rack, ASHRAE class A3 (for Data Center requirements relief)
Enhanced SMT (for IFLs and zIIPs only) and SIMD
Enhanced processor / cache design with bigger cache sizes
Up to 8 TB of Memory protected by Redundant Array of Independent Memory (RAIM)
16U Reserved (rack space) feature
Up to 40 LPARs
IBM Dynamic Partition Manager
Secure Service Container
LPAR Group Absolute Capping
CPUMF sampling w/o PE Mode enablement

I/O Subsystem, Parallel Sysplex, STP, Security
Up to eight (8) PCIe Gen3 I/O fanouts with 16 GBps Busses
New PCIe+ I/O Drawer (up to 4 per system, up to 64 PCIe features),
3 LCSSs, 3 Subchannel Sets per LCSS
32K I/O Devices per channel for all FICON features
FICON Express16S+ and FICON Enhancements
zHyperLink Express
10 GbE RoCE Express2
Shared Memory Communications - Direct Memory Access over Internal Shared Memory (ISM) – SMC-D
Virtual Flash Memory (512 GB per feature, up to four features)
CFCC Level 22
Crypto Express6S and Crypto enhancements

RAS, Other Infrastructure Enhancements	
Keyboard Video Monitor Switch, single display console	Ethernet switches replace SCHs
STP Enhancements - Configuration	Rack-Mounted Support Elements (CPC rack)
Key Locks for doors	Tower & Rack-mounted HMCs and TKEs
Support for ASHRAE Class A3 datacenter	TKE 9.0 LICC

z14 ZR1 Functions and Features (Driver Level 36)

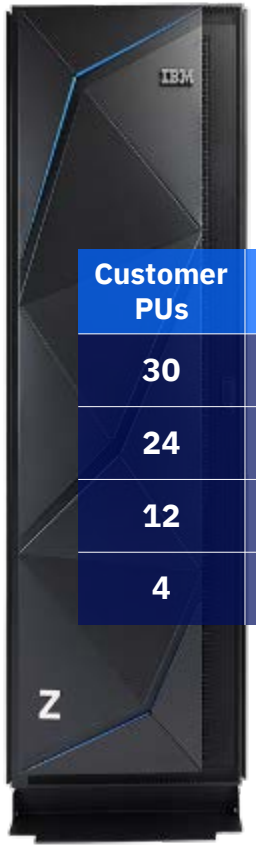
GA2

System, Processor, Memory
One model, one CPC drawer, four available sizes
10 core 14nm PU SCM (5, 6, 7, 8, or 9 active cores per PU SCM)
Up to 30 configurable PUs as CPs, zIIPs, IFL, ICFs, or optional SAPs (up to 6 CPs)
Increased uni-processor capacity
156 Capacity settings
19” Rack, ASHRAE class A3 (for Data Center requirements relief)
Enhanced SMT (for IFLs and zIIPs only) and SIMD
Enhanced processor / cache design with bigger cache sizes
Up to 8 TB of Memory protected by Redundant Array of Independent Memory (RAIM)
16U Reserved (rack space) feature
Up to 40 LPARs
IBM Dynamic Partition Manager
Secure Service Container
LPAR Group Absolute Capping
CPUMF sampling w/o PE Mode enablement

I/O Subsystem, Parallel Sysplex, STP, Security
Up to eight (8) PCIe Gen3 I/O fanouts with 16 GBps Busses
New PCIe+ I/O Drawer (up to 4 per system, up to 64 PCIe features)
3 LCSS, 3 Subchannel sets per LCSS
Next generation FICON Express16S+
32K I/O Devices for all FICON features
25 & 10 GbE RoCE Express2
Integrated Coupling Adapter (ICA SR) and Coupling express LR for coupling links
CFCC Level 23
Crypto Express6S and CMPSC compression and Huffman Coding compression
STP Enhancement - CTN Split and Merge
Virtual Flash Memory (512 GB per feature, up to four features)
IBM zHyperLink Express
OSA-Express7S 25GbE - SR
OSA-Express6S
IBM Dynamic Partition Manager (DPM) V3.2
IBM Secure Service Container

RAS, Other Infrastructure Enhancements	
Keyboard Video Monitor Switch, single display console	Ethernet switches replace SCHs
STP Enhancements - Configuration	Rack-Mounted Support Elements (CPC rack)
Key Locks for doors	Tower & Rack-mounted HMCs and TKEs **HMC 2.14.1 and TKE 9.1**
Support for ASHRAE Class A3 datacenter	**TKE 9.1 LICC and new Smart Cards**

IBM z14 Model ZR1 – Flexible new way to configure



Customer PUs	Max Memory
30	8 TB
24	8 TB
12	4 TB
4	2 TB

Feature	Total PUs	CPs	IFLs	zIIPs	ICFs	Std. SAPs	Add'l SAPs	Spares	IFP*
Max4	8	0-4	0-4	0-2	0-4	2	0-2	1	1
Max12	16	0-6	0-12	0-8	0-12	2	0-2	1	1
Max24	28	0-6	0-24	0-12	0-24	2	0-2	1	1
Max30	34	0-6	0-30	0-12	0-30	2	0-2	1	1

New ***feature based sizing*** (4, 12, 24, 30) – done at configuration time

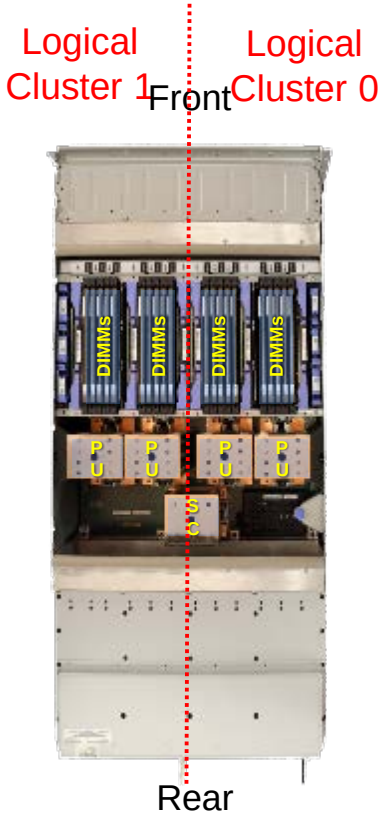
New entry level – 88 MIPS for capacity setting A01

Full Z01 ***uniprocessor running up to 1 570 MIPS*** with z/OS total capacity available over 8 000 MIPS

Same granularity for right sizing – 26 capacity levels x 6 CPs equals 156 settings

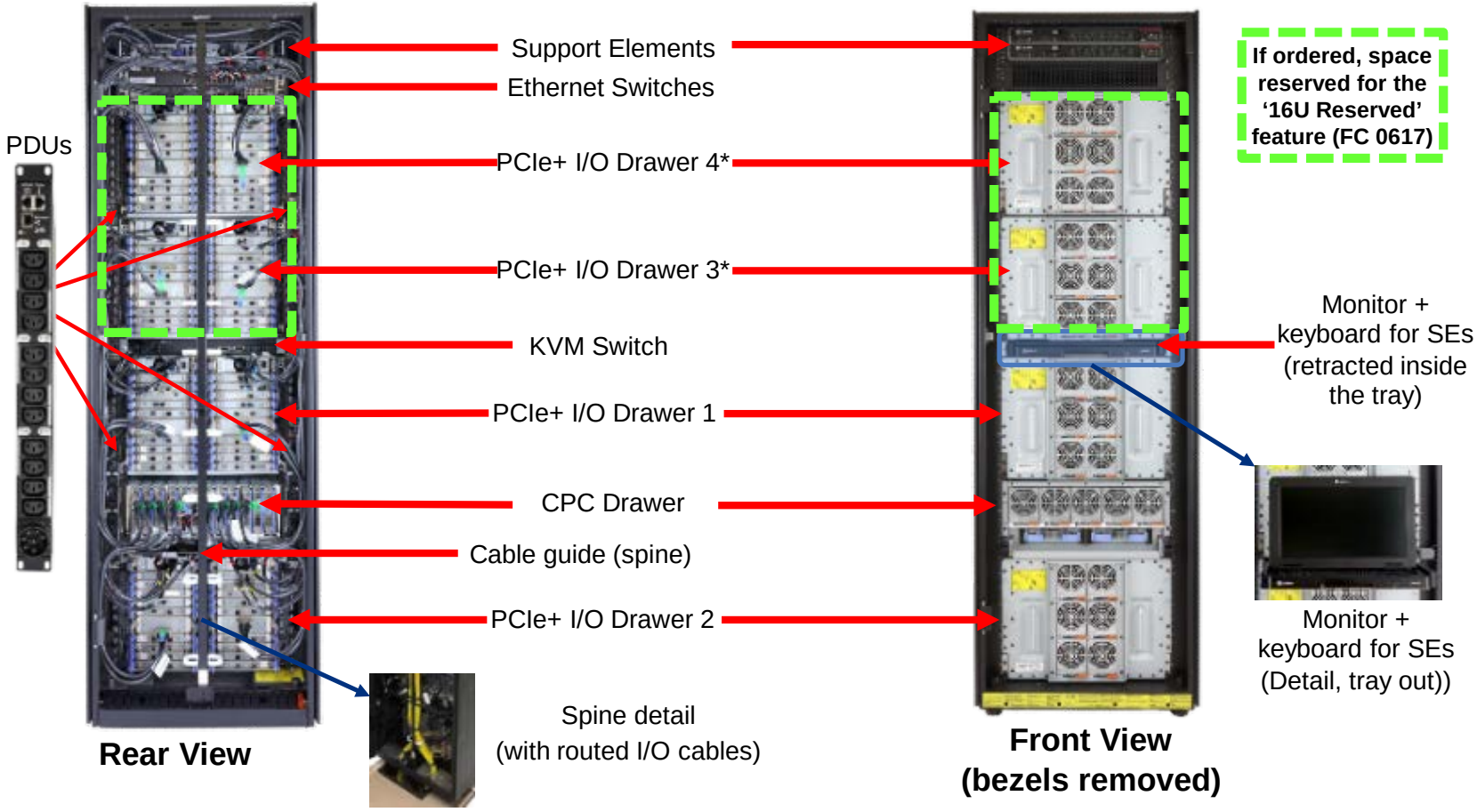
Great economics for ***standalone Coupling Facility*** – PCIe Gen3 technology only – no InfiniBand®

* Integrated firmware processor (IFP) used for infrastructure management of PCIe adapters

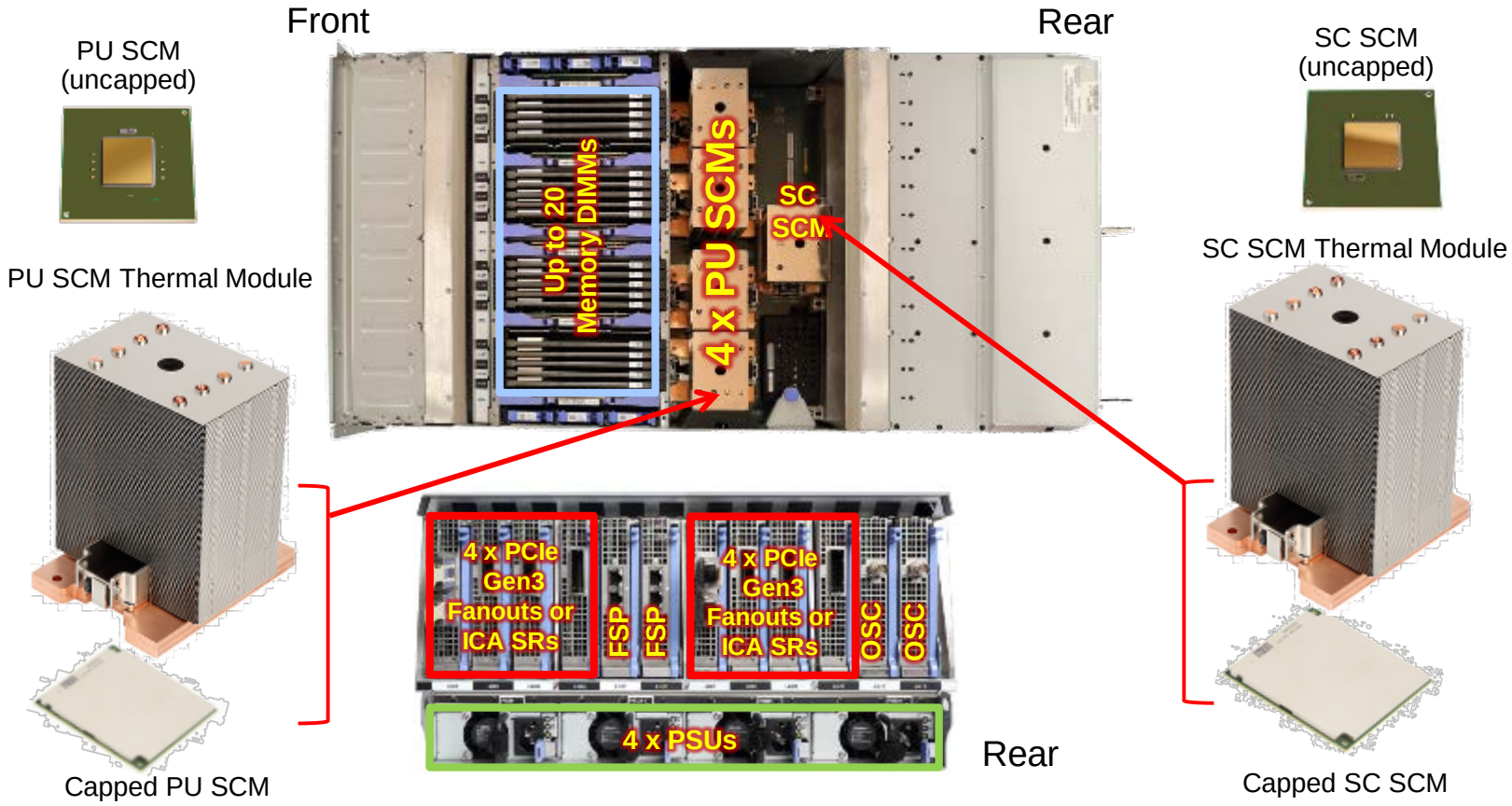


IBM z14 Model ZR1
Machine Type: 3907

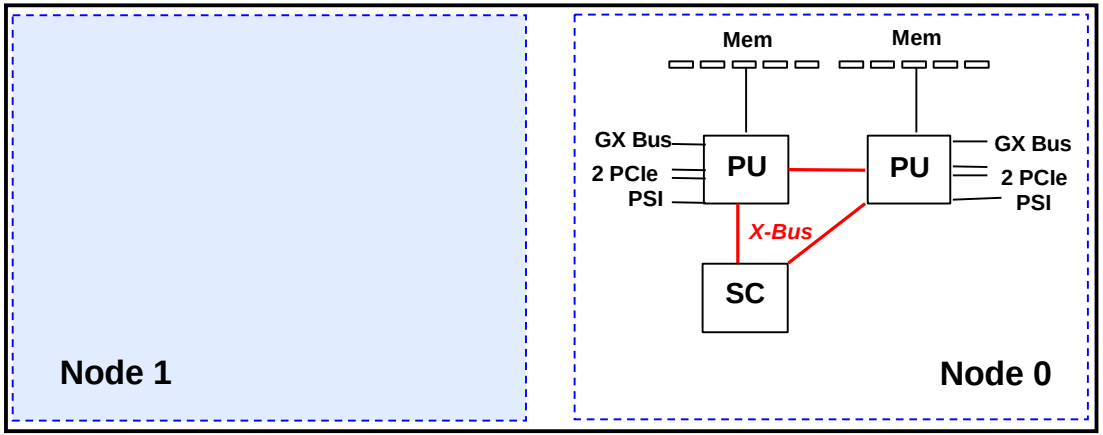
z14 Model ZR1/LR1 Under the Covers



z14 ZR1 CPC Drawer Layout Details

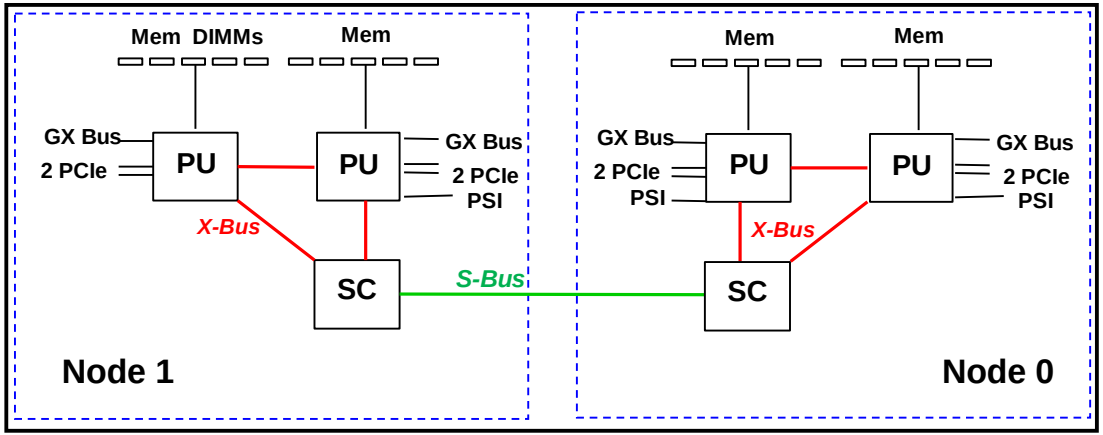


z13s CPC Drawer Topology



Partially Populated Drawer

1 CPC Drawer
1 Node (N10)

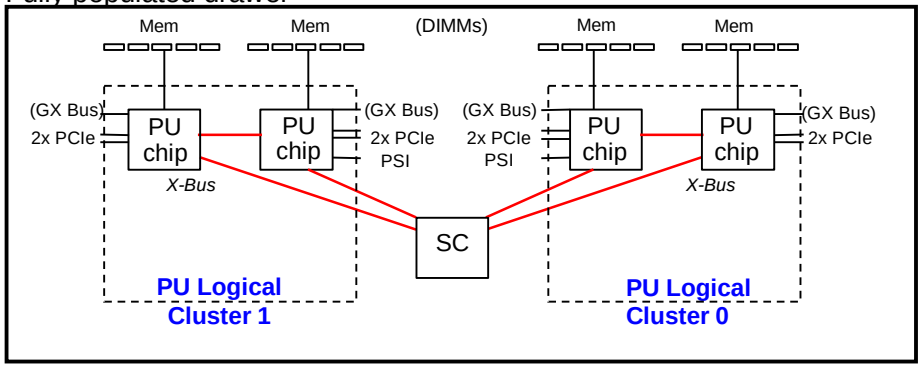


Fully Populated Drawer

1 CPC Drawer
2 Nodes (N20)

z14 ZR1 CPC Drawer Topology

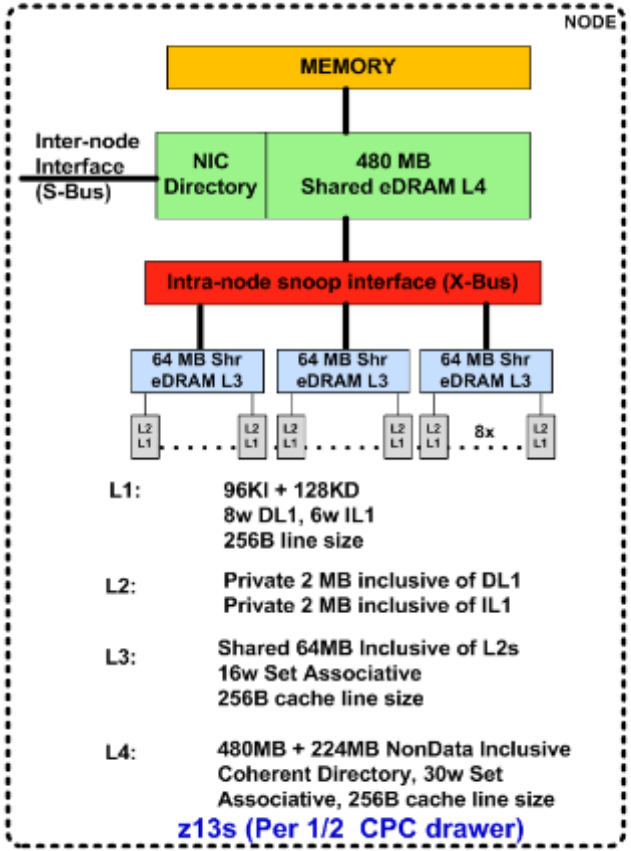
Fully populated drawer*

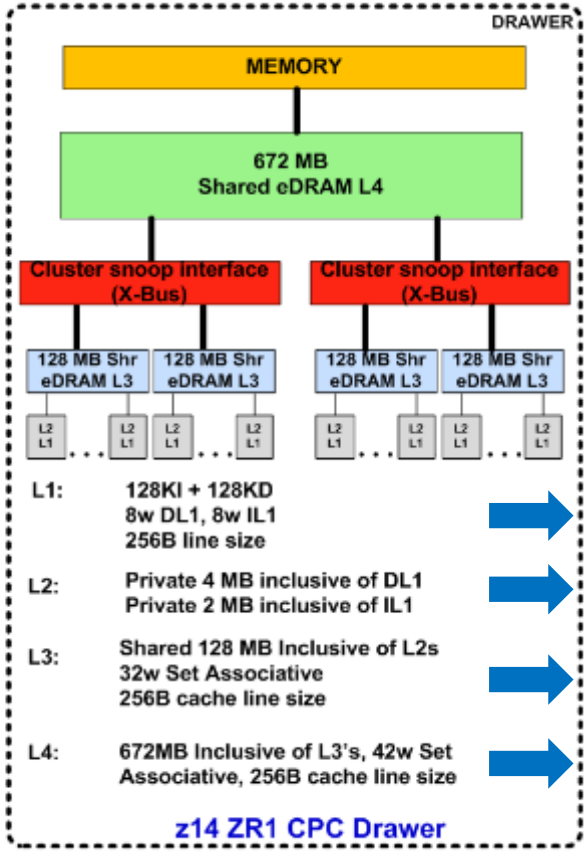


- Chips
  - One, two or four PU chips (installed as Single Chip Modules – SCMs)
  - One SC chip (672 MB L4 cache)
- RAIM Memory
  - One Memory Controller per PU Chip
  - Five DDR4 DIMM slots per Controller, 20 total per drawer*
- SC and PU Chip Interconnects
  - X-bus: SC and PUs to each other

Note: (GX Bus) not used.

IBM z14 model ZR1 Cache topology comparison





+33% L1 instruction cache

Doubled L2 data cache

Doubled L3 cache

+40% L4 cache (vs. ½ z13 drawer)

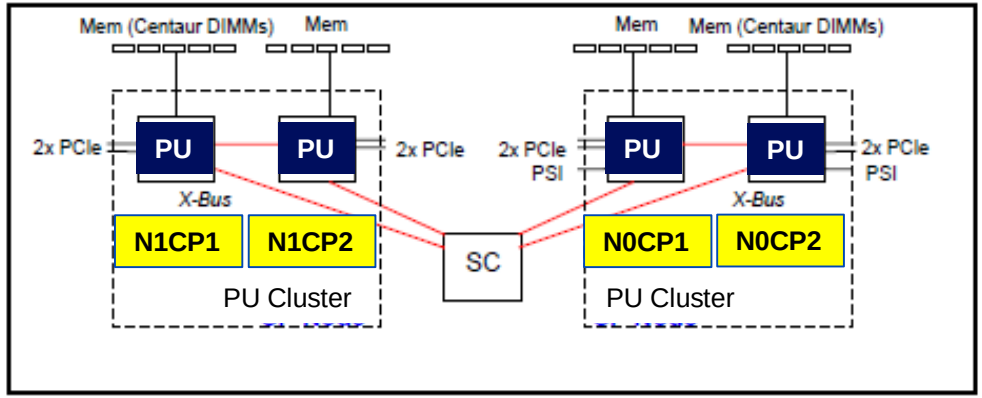
z14 ZR1 / Rockhopper II Drawer Structure and Interconnect

Feature Code 063x must be specified in configuration.

Cores, memory and I/O configuration determine your selection.

Adding a Processing Unit chip to add memory, I/O drawer boundary or processors requires an outage

Fully Populated Drawer



FC / max CPs	N1CP1 # Cores	N1CP2 # Cores	N0CP1 # Cores	N0CP2 # Cores	Max cores	Customer Characterizable Cores	PCIe+ I/O Drawers / Max CPC Fanouts
0636 / 4				8	8	Max 04	1 / 2
0637 / 6			7	9	16	Max 12	2 / 4
0638 / 6	6	5	8	9	28	Max 24	4 / 8
0639 / 6	8	9	8	9	34	Max 30	4 / 8

z14 ZR1 / Rockhopper II Drawer Structure and Interconnect

Choose the Feature Code carefully.

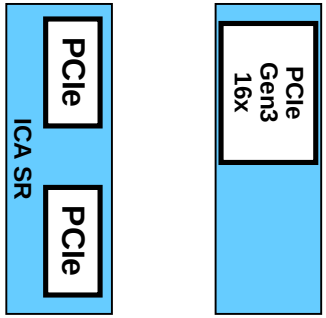
0636 Max 04 | 0637 Max 12 | 0638 Max 24 | 0639 Max 30

Adding a Processing Unit chip to add memory, I/O drawer boundary or processors requires an outage.

FC / max CPs	N1CP1 # Cores	N1CP2 # Cores	N0CP1 # Cores	N0CP2 # Cores	Max cores	Customer Characterizable Cores	PCIe+ I/O Drawers / Max CPC Fanouts
0636 / 4				8	8	Max 04	1 / 2
0637 / 6			7	9	16	Max 12	2 / 4
0638 / 6	6	5	8	9	28	Max 24	4 / 8
0639 / 6	8	9	8	9	34	Max 30	4 / 8

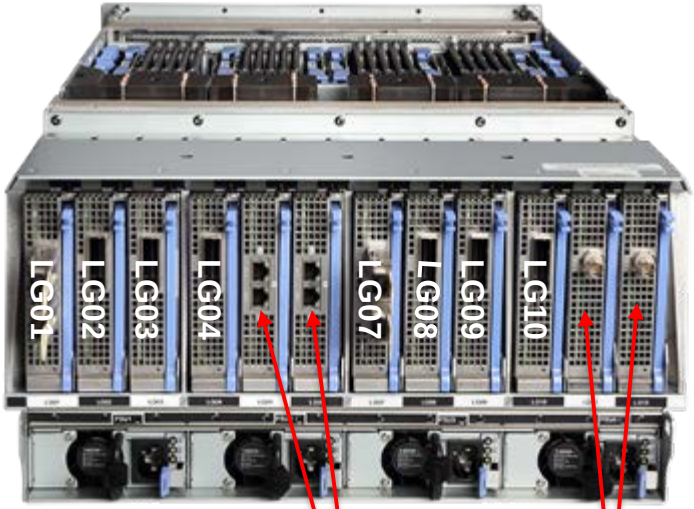
z14 ZR1 Processor (CPC) Drawer Connectivity

- 2, 4, 8 PCIe Fanout slots
- ICA SR two-port 8 GBps PCIe Gen3 fanout 150 meter fiber optic coupling link
- PCIe Gen3 one-port 16 GBps PCIe fanout connects to a switch card for an 8-slot PCIe I/O domain (Plugs in pairs to PCIe+ I/O Drawer)



To PCIe+ I/O Drawers

No InfiniBand fanouts.
No coupling between the z14 ZR1 and zEC12/zBC12.



Up to 8 PCIe Fanouts.
LG01, 02, 03, 04, 07, 08, 09, 10.
Concurrent add/repair.

2 Oscillators & PPS ports
Concurrent add/repair.

2 FSP Fanouts
Flexible Support Processor

z14 ZR1 Purchased Memory Offering Ranges and Increments

Model	Standard Memory GB
Max4	64 - 1984
Max12	64 - 4032
Max24	64 - 8128
Max30	64 - 8128

- Purchased Memory – Memory available for assignment to LPARs
- Hardware System Area – Standard 64 GB of addressable memory for system use outside customer memory
- Standard Memory – Provides minimum physical memory required to hold customer purchase memory plus 64 GB HSA
- Preplanned Memory – Provides additional physical memory needed for a concurrent upgrade (LIC CC change only) to a preplanned target customer memory
- **Note:** z/OS V2.3 LPARs required a minimum of 8 GB of memory.

Memory Increment (GB)	Offered Memory Sizes (GB)
8	64, 72, 80, 88, 96
32	128, 160, 192, 256, 288, 320, 352, 384
64	448, 512, 576
128	704, 832, 960
256	1216, 1472, 1728, 1984, 2240, 2496, 2752, 3008, 3264, 3520, 3776, 4032
512	4544, 5056, 5568, 6080, 7104, 7616, 8128

IBM Virtual Flash Memory (VFM) Feature Code 0604

- IBM Virtual Flash Memory
  - Replacement for IBM Flash Express I/O features – same use cases.
  - Saves at least two PCIe I/O Drawer Slots
  - Less power consumption
  - During upgrade, Feature Conversion for IBM Flash Express
  - VFM Concurrent Add if physical memory is available

- Increment Size
  - Up to four features/increments
    - 0.5 TB | 1.0 TB | 1.5 TB | 2.0 TB

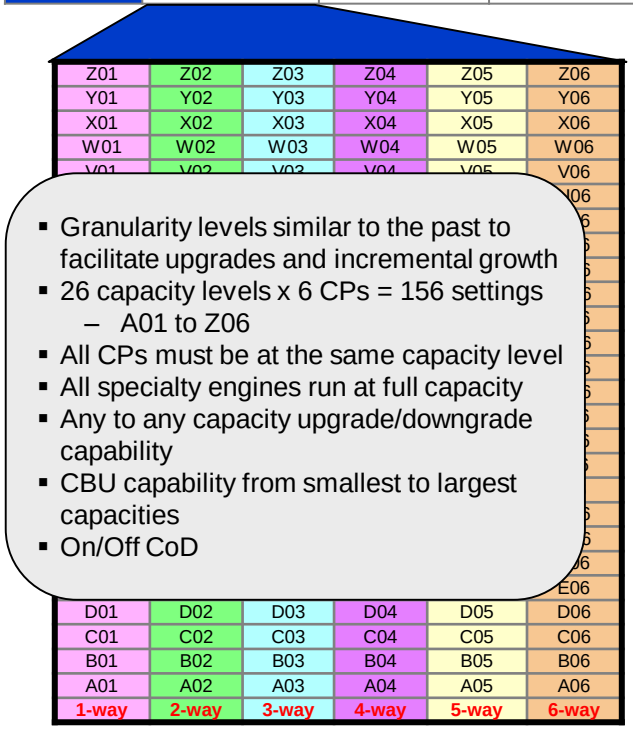
Customer ordered memory + HSA (64 GB) +
VFM (n x 0.5 TB) + RAIM (add 20%)
= minimum physical memory installed.

Use Cases for VFM:
- Large Page/DB2/Java
- SVC and SA Dumps
- MQ objects stored in a Coupling Facility

Performance

z14 ZR1 Model Structure

Model	CPs	IFLs	zAAPs	zIIPs	ICFs	Std. SAPs	Add'l SAPs	Spares	IFP
ZR1	0-6	0-30	N/A	0-12	0-30	2	0-2	1	1



- Model structure based on feature code selection
  - FC 0636, FC 0637, FC 0628, FC 0639
  - Linux only and ICF only servers available
  - Processor Value Unit for IFL: 100 (No change since z10 BC)
- A minimum of one CP, IFL or ICF must be purchased.
- Two zIIPs can be purchased for each CP purchased.
- IFP – internal firmware processor. The IFP is standard and not defined by the customer (used for infrastructure management of some PCIe I/O features).
- Capacity:
  - 1-way - Model A01: **88 PCI** (+10% vs. z13s A01)
  - 1-way - Model Z01: **1,570 PCI** (+10% vs. z13s Z01)
  - 6-way - Model Z06: **8,036 PCI** (+13% vs. z13s Z06)
  - 30-way IFLs: **29,493 PCI ST** (+61% vs. z13s w/ 20 IFLs)

Critical Migration Action

- Before and after CPU MF Counters data will be critical to determine the source of variation for workloads that do encounter it
  - Ensure the CPU MF data is captured and kept for analysis
  - For z/VM “Before” and “After” peak hour data must be written to disk
- Critical Migration Action for every z14 Model ZR1 candidate (z/OS and z/VM)
  - CPU MF Counters must be enabled on their **current** processor
  - CPU MF Counters must be enabled on their new z14 Model ZR1 processor
- Take Action to Validate CPU MF is implemented or get a plan started to implement CPU MF
  - See *CPU MF Counters Enablement Resources* for detailed step by step instructions
  - **Minimal overhead – Encourage Customers to Run Continuously**

CPU MF Counters Enablement Resources

- CPU MF Webinar Replays and Presentations
  - **http://www.ibm.com/support/techdocs/atsmastr.nZR1/WebIndex/PRS4922**
- z/OS CPU MF - “Detailed Instructions” Step by Step Guide
  - **http://www.ibm.com/support/techdocs/atsmastr.nZR1/WebIndex/TC000066**
- z/VM Using CPU Measurement Facility Host Counters
  - **http://www.vm.ibm.com/perf/tips/cpumf.html**

IBM Z Batch Network Analyzer

- A no charge, “as is” tool to analyze batch windows
- Available to Customers, Business Partners and IBMers
- PC based, and provides graphical and text reports
  - Including Gantt charts and support for Alternate Processors
- Available from WSC IBM Z CPS Development
  - **IBMers:**
    - http://w3-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/PRS5126
  - **IBM BP’s:**
    - https://www.ibm.com/partnerworld/wps/servlet/mem/ContentHandler/tech_PRS5133
  - **Customers:**
    - http://www-03.ibm.com/support/techdocs/atsmastr.nsf/WebIndex/PRS5132

Why use zBNA?

- Fewer, Faster CPs
  - High priority workloads see great benefits
  - Have the ability to monopolize a CP
  - On a migration a previously limited workload can now use more capacity
    - Control with WLM resource groups
  - Availability Issues

- More, Slower CPs
  - More work units are active
  - **Can limit a task's throughput**
  - Increased parallelism
  - Limits the impact of a workload which monopolizes a CP
  - Can trade-off slower CP speeds with a reduction in CPU queue delay

- zBNA provides a list of batch jobs most impacted by **"More, Slower CPs"**
  - Use "Top Pgm PCT" or "GCP Time" filters

zBNA Identifies zEDC BSAM/QSAM Compression Candidates

- Post-process customer provided SMF records, to identify jobs and their BSAM/QSAM data sets which are **zEDC compression candidates** across a specified 24 hour time window, typically a batch window
- Help estimate **utilization of a zEDC feature** and help size number of features needed from a capacity perspective
  - Consider availability requirements to determine number of features to order
- Generate **a list of data sets by job which already do hardware compression** and may be candidates for zEDC
- Generate a list of data sets by job **which may be zEDC candidates** but are not in **extended format**

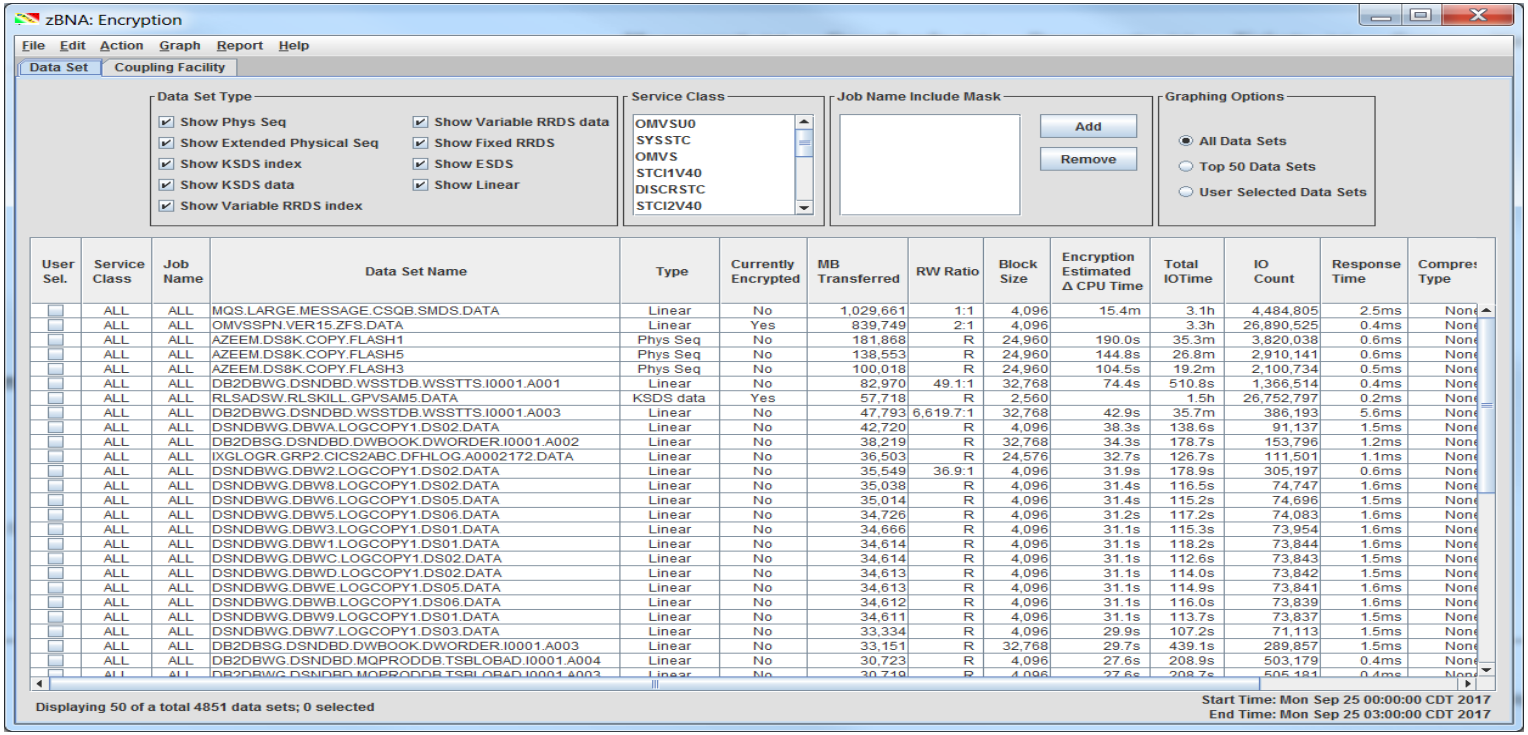
zBNA Encryption Support – New Application Available (v1.8.1d)

- DFSMS Data Set Encryption Support
  - Candidate list of data sets selectable by Data Set Type, Service Class, and Job Name filters
  - Filter by date and time
  - Estimate the CPU cost of encrypt / decrypt activities for candidate data sets
- z/OS Coupling Facility Structure Encryption Support
  - Candidate list of cache and list structures selectable by CF and structure type filters
  - Filter by date and time
  - Estimate the CPU cost of encrypt / decrypt activities for candidate structures
- Generate customer reports with text and graphs to show encryption potential across time
- Export the zBNA Encryption data to CSVs for additional off-line analysis
- Provide support to aggregate zBNA LPAR results into CPC level views
- A new version of CP3KEXTR (v3.62) and PTFs required to perform this analysis:
  - z/OS 2.1: UA92434
  - z/OS 2.2: UA92435, UA92533
  - z/OS 2.3: UA91802

Data Set Encryption Support

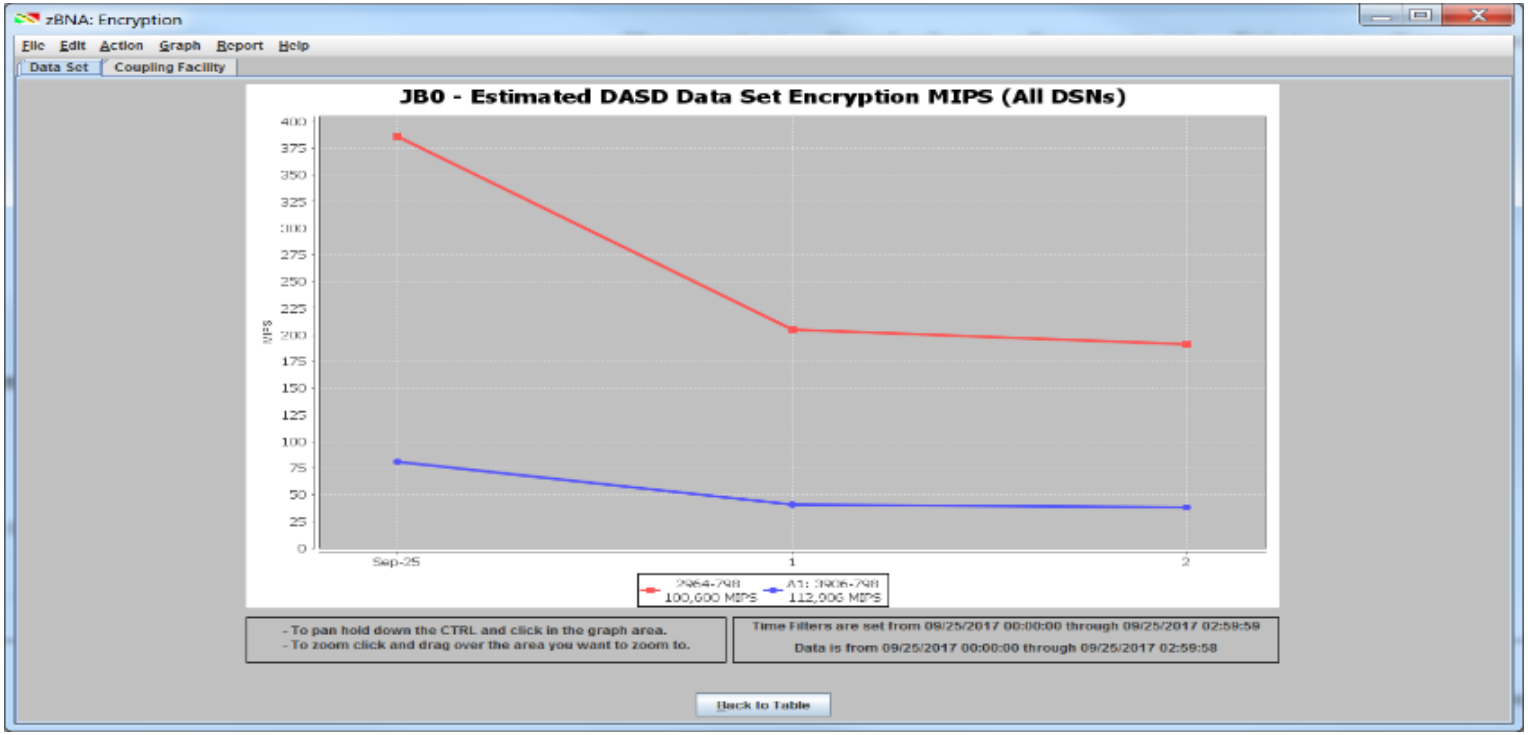
- DFSMS Data Set Encryption will be supported for the following types of data sets:
  - Sequential extended format data sets
    - Accessed through BSAM or QSAM
  - VSAM extended format data sets
    - KSDS, ESDS, RRDS, VRRDS, LDS
    - Accessed through VSAM or VSAM/RLS
  - Encrypted data sets must be SMS-managed extended format
  - Encrypted data sets can be in compressed or non-compressed format
  - Refer to the Pervasive Encryption presentation for additional usage information
- Covers Db2, IMS, zFS, middleware, logs, batch, and ISV solutions making use of VSAM, QSAM or BSAM access methods
- Ensure required maintenance is applied to all systems in a sysplex

zBNA Encryption – Data Set Candidate List

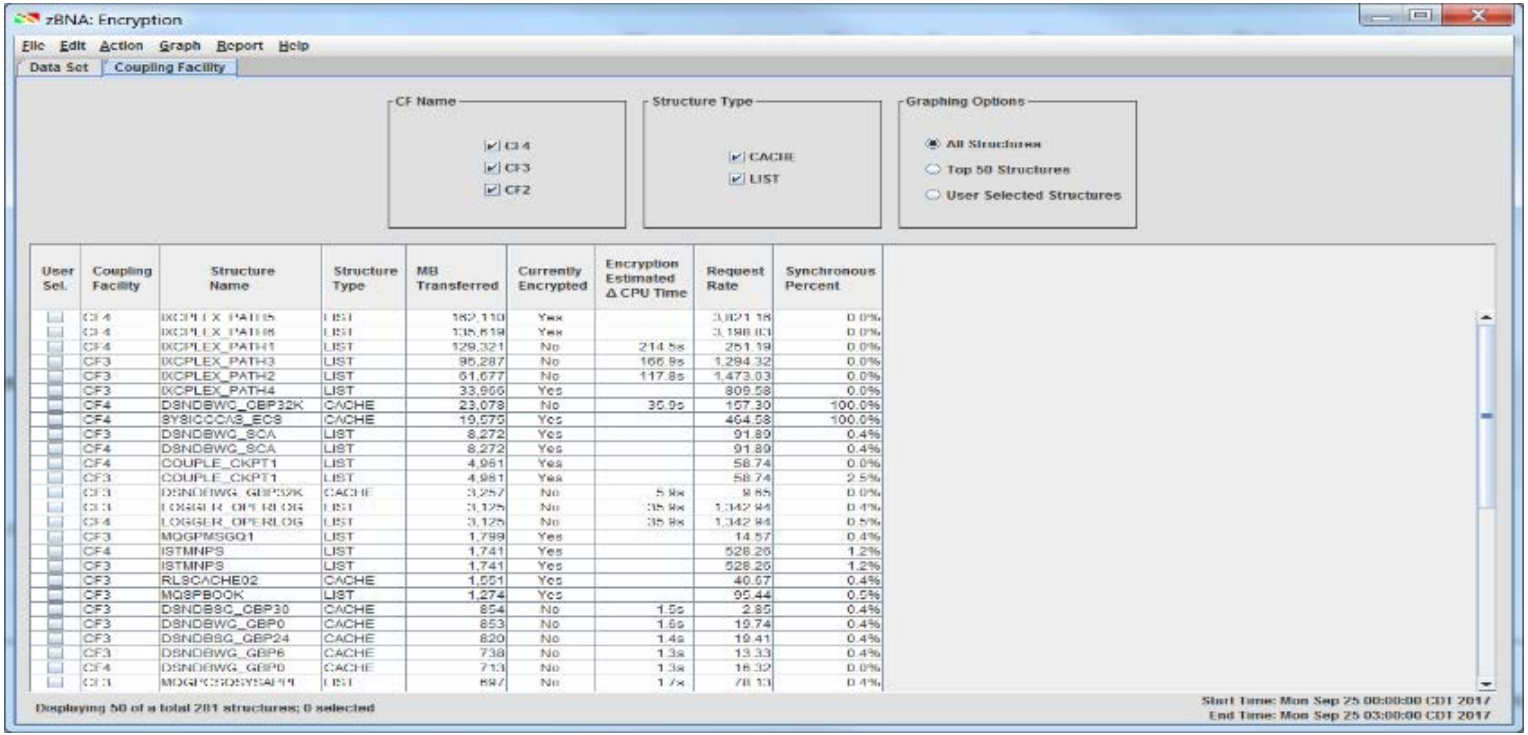


User Sel.	Service Class	Job Name	Data Set Name	Type	Currently Encrypted	MB Transferred	RW Ratio	Block Size	Encryption Estimated Δ CPU Time	Total IOTime	IO Count	Response Time	Compres Type
	ALL	ALL	MQS.LARGE.MESSAGE.CSQB.SMDS.DATA	Linear	No	1,029,661	1:1	4,096	15.4m	3.1h	4,484,805	2.5ms	Non
	ALL	ALL	OMVSSPN.VER15.ZFS.DATA	Linear	Yes	839,749	2:1	4,096		3.3h	26,890,525	0.4ms	Non
	ALL	ALL	AZEEM.DS8K.COPY.FLASH1	Phys Seq	No	181,868	R	24,960	190.0s	35.3m	3,820,038	0.6ms	Non
	ALL	ALL	AZEEM.DS8K.COPY.FLASH5	Phys Seq	No	138,553	R	24,960	144.8s	26.8m	2,910,141	0.6ms	Non
	ALL	ALL	AZEEM.DS8K.COPY.FLASH3	Phys Seq	No	100,018	R	24,960	104.5s	19.2m	2,100,734	0.5ms	Non
	ALL	ALL	DB2DBWG.DSNDBD.WSSTDB.WSSTTS.I0001.A001	Linear	No	82,970	49.1:1	32,768	74.4s	510.8s	1,366,514	0.4ms	Non
	ALL	ALL	RLSADSW.RLSKILL.GPVSAM5.DATA	KSDS data	Yes	57,718	R	2,560		1.5h	26,752,797	0.2ms	Non
	ALL	ALL	DB2DBWG.DSNDBD.WSSTDB.WSSTTS.I0001.A003	Linear	No	47,793	6,619.7:1	32,768	42.9s	35.7m	386,193	5.6ms	Non
	ALL	ALL	DSNDBWG.DBWA.LOGCOPY1.DS02.DATA	Linear	No	42,720	R	4,096	38.3s	138.6s	91,137	1.5ms	Non
	ALL	ALL	DB2DBSG.DSNDBD.DWBOOK.DWORDER.I0001.A002	Linear	No	38,219	R	32,768	34.3s	178.7s	153,796	1.2ms	Non
	ALL	ALL	IXGLOGR.GRP2.CICS2ABC.DFHLOG.A0002172.DATA	Linear	No	36,503	R	24,576	32.7s	126.7s	111,501	1.1ms	Non
	ALL	ALL	DSNDBWG.DBW2.LOGCOPY1.DS02.DATA	Linear	No	35,549	36.9:1	4,096	31.9s	178.9s	305,197	0.6ms	Non
	ALL	ALL	DSNDBWG.DBW8.LOGCOPY1.DS02.DATA	Linear	No	35,038	R	4,096	31.4s	116.5s	74,747	1.6ms	Non
	ALL	ALL	DSNDBWG.DBW6.LOGCOPY1.DS05.DATA	Linear	No	35,014	R	4,096	31.4s	115.2s	74,696	1.5ms	Non
	ALL	ALL	DSNDBWG.DBW5.LOGCOPY1.DS06.DATA	Linear	No	34,726	R	4,096	31.2s	117.2s	74,083	1.6ms	Non
	ALL	ALL	DSNDBWG.DBW3.LOGCOPY1.DS01.DATA	Linear	No	34,666	R	4,096	31.1s	115.3s	73,954	1.6ms	Non
	ALL	ALL	DSNDBWG.DBW1.LOGCOPY1.DS01.DATA	Linear	No	34,614	R	4,096	31.1s	118.2s	73,844	1.6ms	Non
	ALL	ALL	DSNDBWG.DBWC.LOGCOPY1.DS02.DATA	Linear	No	34,614	R	4,096	31.1s	112.6s	73,843	1.5ms	Non
	ALL	ALL	DSNDBWG.DBWD.LOGCOPY1.DS02.DATA	Linear	No	34,613	R	4,096	31.1s	114.0s	73,842	1.5ms	Non
	ALL	ALL	DSNDBWG.DBWE.LOGCOPY1.DS05.DATA	Linear	No	34,613	R	4,096	31.1s	114.9s	73,841	1.6ms	Non
	ALL	ALL	DSNDBWG.DBWB.LOGCOPY1.DS06.DATA	Linear	No	34,612	R	4,096	31.1s	116.0s	73,839	1.6ms	Non
	ALL	ALL	DSNDBWG.DBW9.LOGCOPY1.DS01.DATA	Linear	No	34,611	R	4,096	31.1s	113.7s	73,837	1.5ms	Non
	ALL	ALL	DSNDBWG.DBW7.LOGCOPY1.DS03.DATA	Linear	No	33,334	R	4,096	29.9s	107.2s	71,113	1.5ms	Non
	ALL	ALL	DB2DBSG.DSNDBD.DWBOOK.DWORDER.I0001.A003	Linear	No	33,151	R	32,768	29.7s	439.1s	289,857	1.5ms	Non
	ALL	ALL	DB2DBWG.DSNDBD.MQPRODDB.TSBLOBAD.I0001.A004	Linear	No	30,723	R	4,096	27.6s	208.9s	503,179	0.4ms	Non
	ALL	ALL	DB2DBWG.DSNDBD.MQPRODDB.TSBLOBAD.I0001.A003	Linear	No	30,719	R	4,096	27.6s	208.7s	505,181	0.4ms	Non

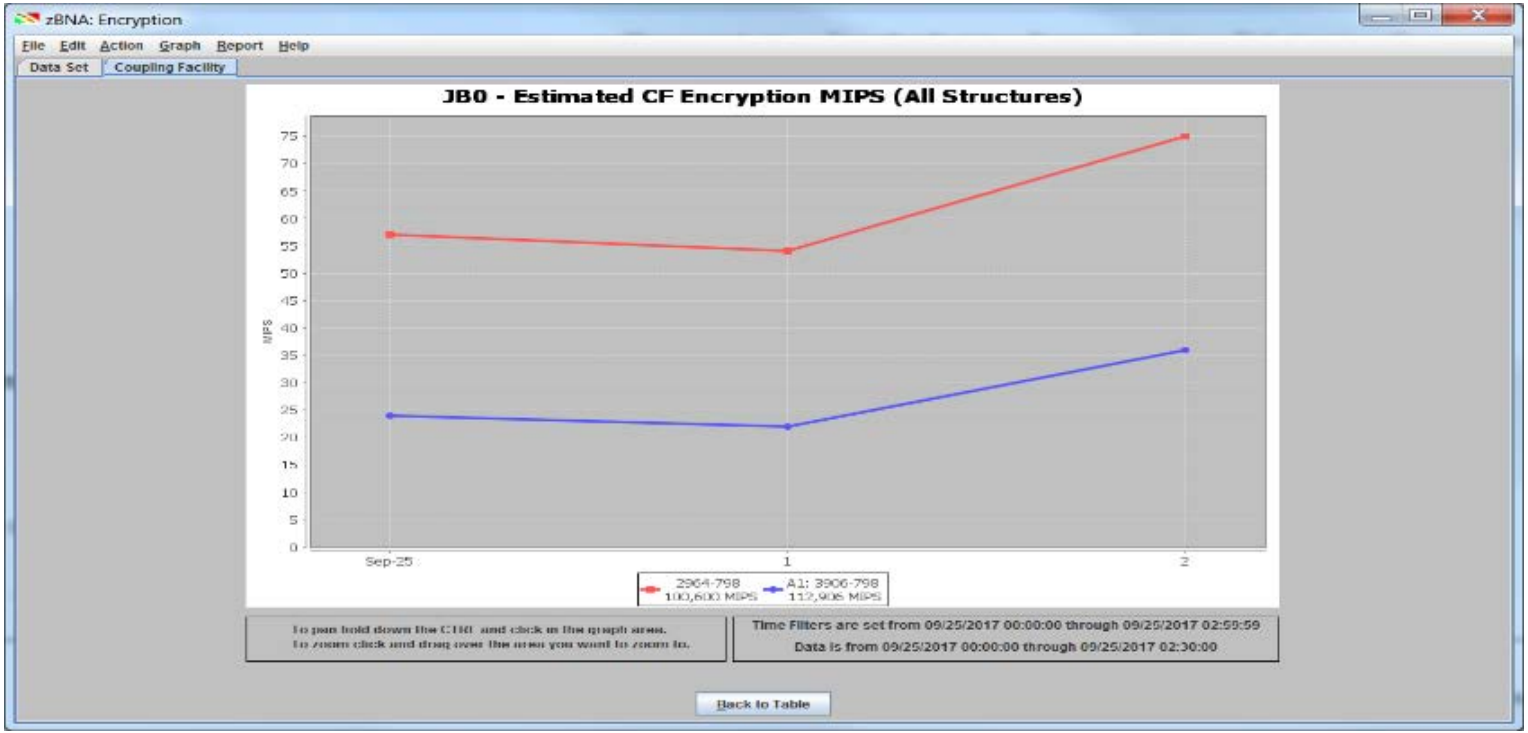
zBNA Encryption – Graph Estimated Data Set Encryption MIPS



zBNA Encryption – CF Structure Candidate List



zBNA Encryption – Graph Estimated CF Encryption MIPS



zBNA zHyperLink Support for z14 – Future New Application

- zHyperLink Support (planned for late 1Q2018)
  - Candidate list of data sets
  - Filter by date and time
  - Estimate the benefit of using zHyperLink
- Generate customer reports with text and graphs to show zHyperLink benefit
- Provide support to aggregate zBNA LPAR results into CPC level views
- A new version of CP3KEXTR and PTFs will be required to perform this analysis
  - z/OS 2.1: UA93434
  - z/OS 2.2: UA93435
  - z/OS 2.3: UA93445

Improved speed for development and applications on z14

Compilers

- **COBOL v6.2** fully support the Packed Decimal Facility to reduce CPU usage for decimal intensive applications by up to ***38%***[1] and on average ***19%***[1]
- Automatic Binary Optimizer v1.3 reduces CPU usage of applications built with COBOL v4 (and below) without source recompilation by up to ***47%***[2]
- **z/OS 2.3 XL C/C++** reduces CPU usage of compute intensive applications on average ***13%***[3]

Java SDK 8 SR5

- **Faster user response times for Java**
- ***4.2x***[4] improvement to AES-GCM crypto to enable best-of-breed security for the API-economy using Java
- **Pause-less garbage collection** baked into the processor, reducing pause times by up-to ***3x***[5]for predictable high-perform transaction processing at-scale
- **50+ new instructions** on the z14 co-designed and exploited by Java

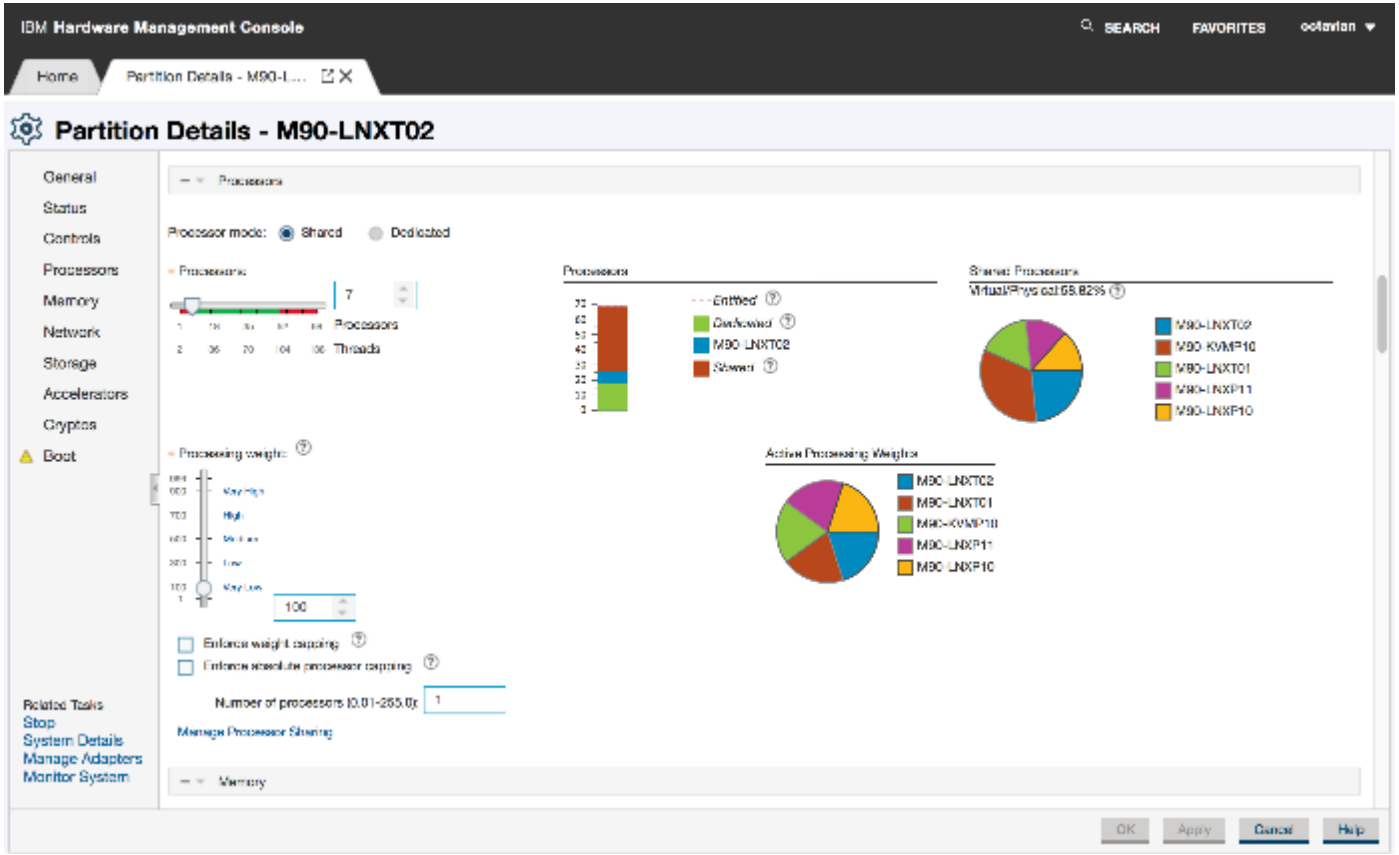
[1]COBOL v6.2 fully support the Packed Decimal Facility to reduce CPU usage for decimal intensive applications by up to 38%, and on average 19%
[2]Automatic Binary Optimizer v1.3 reduces CPU usage of applications built with COBOL v4 (and below) without source recompilation by up to 47%
[3]z/OS 2.3 XL C/C++ reduces CPU usage of compute intensive applications on average 13%
[4]z14 z/OS WAS Liberty with GCM Mode Encryption: Customers running WebSphere Liberty for z/OS, using clear key encryption AES_128_GCM cipher, can get up to 4.2X improvement in throughput per core with IBM Java 8 SR5 on z14 compared to Java 8 SR3 on z13)
[5]Performance results based on IBM internal tests running Java Store Inventory and Point-of-Sale in COMPOSITE mode application benchmark on standalone dedicated IBM z14 and z13 machines using z/OS 2.2 2 with APAR OA51643 and no other workloads running in the LPAR under test. Both z14 and z13 were configured with 1CP and 8 SMT zIIPs with total 17 hardware threads. Capacity projections were done to estimate the benefit of moving from z13 z/OS 2.2 Java 8 SR3 to z14 z/OS 2.2 Java 8 SR5 with Pause-less garbage collection enabled by java option -Xgc:concurrentScavenge. The response-time constrained Service Level Agreements (SLAs) metric used for this claim was based on geometric mean of (throughput @ 10ms, 25ms, 50ms, 75ms and 100ms response time SLAs). Hardware instrumentation data was collected and analyzed on all benchmarks to verify performance results. IBM 64-bit SDK for z/OS Java Technology Edition, Version 8 SR3 on z13 was used as the baseline. IBM 64-bit SDK for z/OS Java Technology Edition, Version 8 SR5 is scheduled to GA September 2017.

Dynamic Partition Manager (DPM)

IBM Dynamic Partition Manager (DPM)

- DPM is a new administrative mode, introduced for managing Linux-based deployments for IBM z14 M0x and ZR1, IBM z13, IBM z13s, IBM LinuxONE Emperor II (Emperor II), IBM LinuxONE Emperor (Emperor), IBM LinuxONE Rockhopper, and IBM LinuxONE Rockhopper II.
- A system can be configured ***either*** in **DPM** mode or in **PR/SM** mode (POR is required to switch modes).
- DPM functions (high level):
  - Create, provision and manage partitions (processor, memory, adapters)
  - Manage network and storage configuration and allocation
  - Monitor and troubleshoot the environment
- Three things to remember about IBM Dynamic Partition Manager (DPM):
  - **Fast & much faster** than managing with HCD and/or HCM. From hours to minutes. Does not require prior IBM Z knowledge.
  - **Easy–Intuitive user interface**. No need for multiple administrators with different skills or tools. Do NOT expect First In Enterprise Linux clients to adopt the legacy way.
  - **Powerful**. The same low overhead PR/SM hardware virtualization without the complexity. It supports dynamic configuration changes with just a few clicks of the mouse. It provides a foundation for bare metal Cloud.

DPM functions available via Graphical and API interfaces



DPM Technical Specifications

- IBM z14 M0x, z14 ZR1, z13 or z13s, IBM LinuxONE Emperor, Emperor II, Rockhopper or Rockhopper II
  - Feature Code #0016: Hardware Requirements for IBM DPM
  - Two dedicated OSA-Express5S/6S/7S 1000BASE-T Ethernet
- Supported Features
  - FICON Express (Type FC and FCP)
    - ECKD DASD support on z14 hardware only
    - SCSI disk support
  - OSA Express5S, 6S, 7S
  - Crypto Express5S, 6S
  - zEDC Express
  - RoCE Express RoCE Express2 (as NIC)
  - Hipersockets
- Hypervisors and Operating Systems
  - KVM and/or Linux on Z & LinuxONE
  - z/VM support for FCP and FICON (type FC) configurations with z/VM 6.4 and z/VM 7.1 (no SSI cluster support)
  - IBM Secure Service Container Appliances
- Functions supported:
  - Import an existing IOCP file
    - Limited ECKD paths
    - FCP / FICON adapter configuration
  - Dynamic reconfiguration support for FICON
- No support for:
  - GDPS Virtual Appliance
  - FICON CTC (channel to channel links)
  - FICON tape

Hardware Management Console

HMC 2.14.1 System Support

- The new HMC Version 2.14.1 will support the systems/SE (Support Element) versions shown in the table
  - z9 EC/BC (Driver 67, SE version 2.9.2) systems are no longer supported.

Machine Family	Machine Type	Firmware Driver	SE Version	Ensemble Node Potential
z14	3906	36	2.14.1	Yes
z14 ZR1	3907	36	2.14.1	Yes
z13	2964	27	2.13.1	Yes
z13s	2965	27	2.13.1	Yes
zBX Node	2458 Mod 004	22	2.13.0	Required
zBC12	2828	15	2.12.1	Yes
zEC12	2827	15	2.12.1	Yes
z114	2818	93	2.11.1	Yes
z196	2817	93	2.11.1	Yes
z10 BC	2098	79	2.10.2	No
z10 EC	2097	79	2.10.2	No

Available HMC configurations

FC 0083 (1U HMC)
- Z14 M0x/z14 ZR1 only - Includes chassis/server/keyboard/display, maximum of 10
- Customers responsibility to order rack for mounting

FC 0082 (MiniTower)
- Can be ordered as new for z14 M0x or z14 ZR1, maximum of 10

FC 0092/ FC 0095 (MiniTower)
- Carry forward only* from z13 or z13s, maximum of 10
- Will be checked for proper driver and memory

FC 0094 / FC 0096 (1U HMC)
- Carry Forward only* - Includes chassis/server/keyboard/display
- Will be checked for proper driver and memory maximum of 10 allowed

- **HMC improvements:**
  - Multi-factor Authentication (MFA) – SE, HMC, TKE – Two Factors
  - Trusted Boot of software on CPC (SE), HMC and TKE Workstation

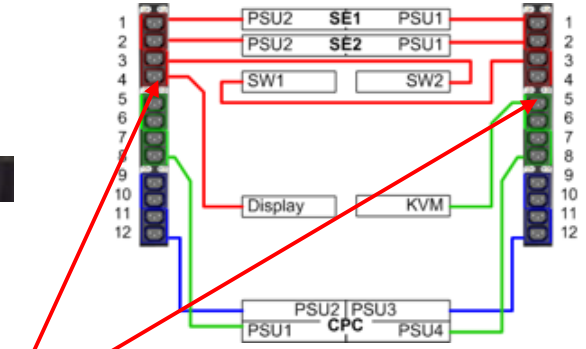
**** Carry Forward (not applicable for LinuxONE)***

New Console for the Support Elements

- The Support Elements console is now implemented in a 1U rack tray containing:
  - One Keyboard and pointing device
  - One flat panel display (with its power supply)
  - One Keyboard, Monitor, Mouse (KMM) switch that is connected to both Support Elements
- The KMM tray (installed at rack location A22B) slides out and provides access to the keyboard, pointing device and monitor.

KMM (front view)

Retracted KMM
(front view)



Rear view

Note: During PDU maintenance, the display or KMM switch power cables may need to be relocated to the PDU on the other side of the rack to ensure power availability.

z14 HMC Enhancements

- Workspace Direction/Enhancements – No more Classic UI
- Enhanced security for z14 HMC and SEs
- Java Applet Removal for z14
- Firmware management enhancements
- IBM Enhanced Support Facility – Changes to Call-Home infrastructure
- Crypto PCI-HSM Compliance Level
- Global OSA/SF
- LPAR Resource Assignment
- New characters allowed for load parameters
- FTP Through HMC
- Secure Console-to-Console Communications
- SNMP/BCPii API Enhancements
- Remote Browser IP Address Limiting
- Manage System Time (STP interface enhancements)
- Multi-factor Authentication (MFA for HMC authentication)

z14 GA2 HMC Enhancements

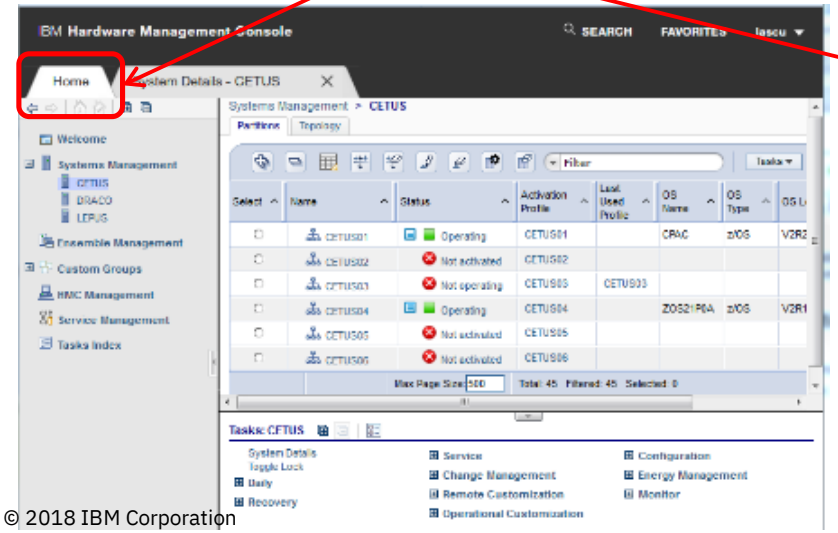
1. Enable/Disable InfiniBand Coupling Port (Previously only available via the Support Element)
2. z14 ZR1 Manage Power Service State – Power off ½ of the PDU's without call home.
3. eBoD on HMC (Previously only available via Single Object Operations) TERs
4. IBM Z Net Promoter Score (NPS) survey via HMC (Remote Sysprog, e-mail it to another user, remind me later).
5. OSA-ICC Enhancements
6. SCSI Load Normal Enhancement
7. Dynamic I/O for Standalone Coupling Facility
8. Enhancement of SE logins from the HMC (Chat, SOO - force off other user).
9. z14 ZR1 Enhanced Driver Maintenance
10. Manage STP Split/Merge

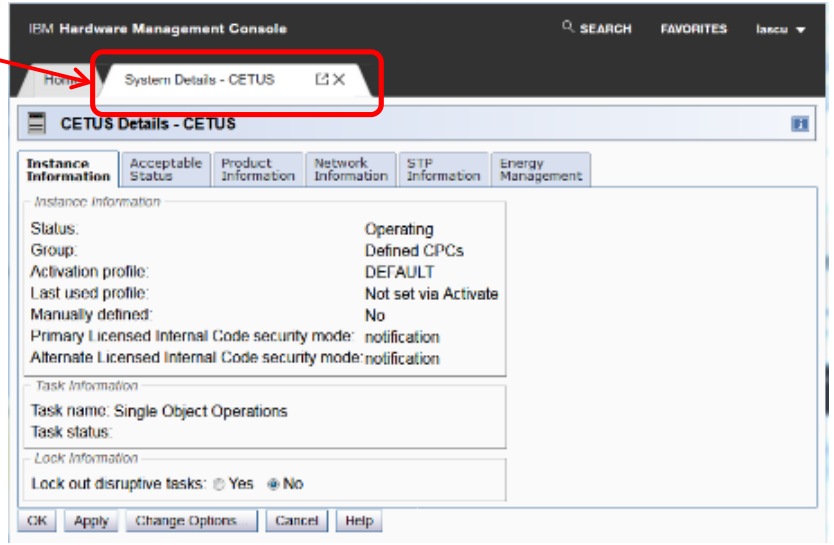
YouTube Videos for HMC Content

- Current documentation on HMC
  - Online Help information
  - Also, can be found on IBM Resource Link
- New additional information on HMC via YouTube videos:
  - YouTube videos for HMC Content - https://ibm.biz/IBM-Z-HMC
  - HMC Mobile Enhancements, Biometrics, load, delete HW messages, respond to OS messages, delete OS messages: https://ibm.biz/hmc-mobile
- Initial topics to be covered:
  - Manage System Time
  - User Management
  - Tree Style User Interface
  - Dynamic Partition Manager

Workspace Enhancements

- **Classic UI Style NO longer available on HMC/SE 2.14.0 and later**
  - z13/z13s Statement of Direction - **Fullfilled**
- Workspace Enhancements to aid in transition to Tree Style UI
  - Changes to address user concerns
    - A **new masthead** for the HMC and SE will help users quickly find and launch tasks
    - Tasks will now open in **tabs** within the user interface (instead of separate browser windows) to make finding and managing running tasks easier.





z14 Java Applet Removal

- 2.13.1: HMC Tasks no longer Java Applet based implementations
  - Operating System Messages
  - Integrated 3270 Console
  - Integrated ASCII Console
  - Text Console
- 2.14.0: NEW: Open IOCDS Source option on Input/Output Configuration task
  - With HMC/SE 2.14.0 can now edit IOCDS source directly on HMC console
  - Alternative with remote browsing still available:
    - Use Export Source File option on Input/Output Configuration task
    - Use editor on your own workstation
    - Use Import Source file option to put back onto Support Element

Firmware Integrity Monitoring - Overview

GA2

- Firmware Integrity Monitoring in support of NIST Computer Security Standard 800-147B
- Current IBM Z Firmware protected on delivery => Digital Signatures
- Firmware Integrity Monitoring => protection against subsequent tampering
  - BIOS Secure boot of SE/HMC/TKE Embedded Operating System
  - Signature/hash verification of SE/HMC IBM Z Firmware
    - Continuously monitors integrity of files
    - Code measurements stored in TPM (Trusted Platform Module) on SE/HMC
    - Provides security logs for internal analysis
  - Trusted 3rd Party Validation (IBM Resource Link via zRSF data)
    - Analyzes periodic call home measurement data
    - Initiates challenge/response to verify authenticity of the data
    - Display of local console data analysis, Resource Link analysis, and notification of lack of receiving console data (console locked or blocked network reporting of data).

Firmware Integrity Monitoring - Customer Choices

- Modes of Operation => New HMC/SE task configuration
  - Monitoring: Logging/Hardware Message, mirror/backup block
  - Monitoring and Protecting: Logging/Hardware Message & ‘Blue Screen’ console lockup
- SE Firmware Integrity Monitoring is enabled on all z14 ZR1 systems
  - Sufficient to comply with the NIST Standard 800-147B for z14 ZR1 CPC firmware
- HMC Firmware Integrity Monitoring
  - Not required for z14 ZR1 CPC NIST 800-147B compliance but same technology used as SE
  - Will be enabled on new z14 ZR1 HMC Feature Codes (new build hardware only)
    - Provides tamper protection monitoring and reporting
    - MES HMC hardware to z14 ZR1 HMC level cannot utilize HMC Firmware Integrity Monitoring

OSA/SF on HMC – Add APIs to existing UI capabilities

- OSA/SF was moved from the operating systems to the HMC on zEC12 an onward.
- APIs are available to manipulate OSA/SF.
- Web APIs and SNMP APIs that can be exploited by client tooling and potentially internal IBM tooling such as through BCPii or z/OSMF.
- Programmatic access to monitoring and control data

OSA-ICC Enhancements – IPV6 Support

- The IPv6 communications protocol is supported by OSA-ICC 3270 so that clients can comply with existing regulations that require all computer purchases to support IPv6.
- Support of IPv4 continues
- IPv6 is supported by the Advanced Facilities (SE) task and OSA Advanced Facilities (HMC) task as follows:
  - Display Client Connections
  - Ping Utility
  - Trace Route Utility
  - Display Active Server Configuration
  - Edit Server Configuration
- IPv6 is also supported by the Validation of Source File panel
  - Note: The Source file is the configuration of the card represented in an ascii format.

OSA-ICC Enhancements – Limit negotiation of TLS levels

GA2

- The customer can specify the supported TLS protocol level(s) for the OSA-ICC 3270 client connection.
- Supported protocol levels are: TLS 1.0, TLS 1.1, and TLS 1.2
  - TLS 1.0 → OSA-ICC 3270 server will permit TLS 1.0, TLS 1.1 and TLS 1.2 client connections.
  - TLS 1.1 → OSA-ICC 3270 server will permit TLS 1.1 and TLS 1.2 client connections.
  - TLS 1.2 → OSA-ICC 3270 server will permit only TLS 1.2 client connections.
- TLS 1.2 introduced for z13 GA2 for OSA-Express4S and OSA-Express5S
  - Also supported on OSA-Express6S
- The Server Configuration panels in the Advanced Facilities (SE) task and the OSA Advanced Facilities (HMC) task is updated as follows:
  - Display Active Server Configuration
  - Edit Server Configuration

OSA-ICC Enhancements – Separate Security Certificates

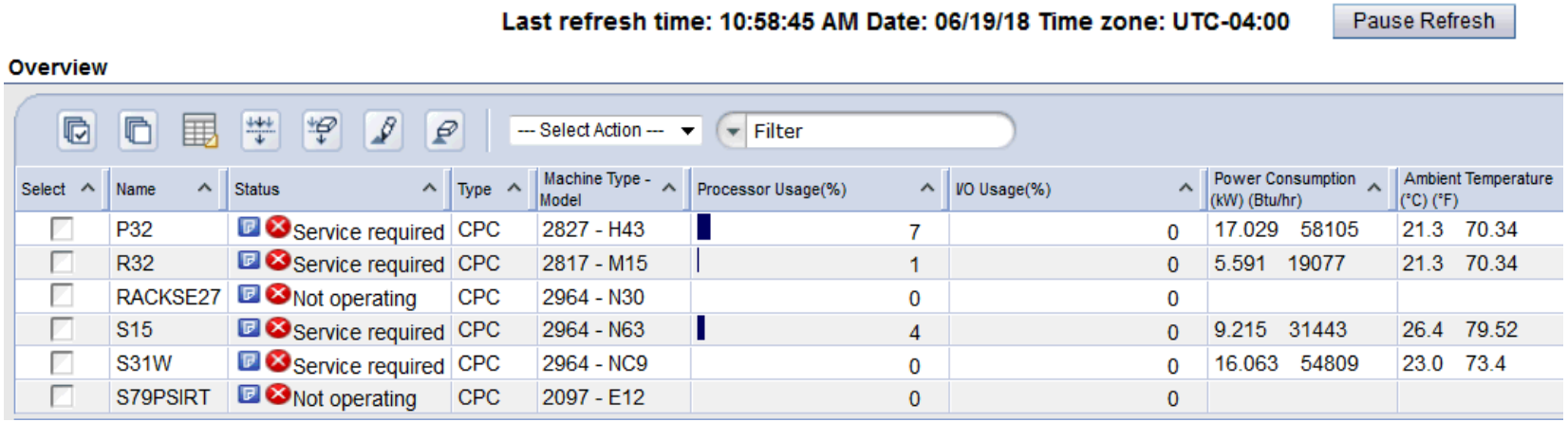
GA2

- Separate and unique OSA-ICC 3270 certificates are supported, for the benefit of customers who host workloads across multiple business units and/or datacenters, where cross-site coordination is required.
  - Customers can avoid interruption of all the TLS connections at the same time, when having to renew expired certificates.
- OSA-ICC continues to also support a single certificate for all OSA-ICC PCHIDs in the system.
- The certificate for the PCHID is independently managed with respect to expiry/renewal and other properties such as self-signed vs. CA signed.
- The Manage Security Certificates panel in the Advanced Facilities (SE) task and OSA Advanced Facilities (HMC) task supports the separate certificate.

Monitors Dashboard Enhancements

GA2

- Local time (last refresh time and time zone) displayed at top of Overview, updated with every data update
- Additional Status column
  - CPC Status
  - Indicators for Hardware Messages and Acceptable Status
  - Click on indicator to launch Hardware Messages task
- Systems view is no longer a fixed size but adjusts according to the number of systems in the view.



Select	Name	Status	Type	Machine Type - Model	Processor Usage(%)	I/O Usage(%)	Power Consumption (kW) (Btu/hr)	Ambient Temperature (°C) (°F)
☐	P32	Service required	CPC	2827 - H43	7	0	17.029 58105	21.3 70.34
☐	R32	Service required	CPC	2817 - M15	1	0	5.591 19077	21.3 70.34
☐	RACKSE27	Not operating	CPC	2964 - N30	0	0		
☐	S15	Service required	CPC	2964 - N63	4	0	9.215 31443	26.4 79.52
☐	S31W	Service required	CPC	2964 - NC9	0	0	16.063 54809	23.0 73.4
☐	S79PSIRT	Not operating	CPC	2097 - E12	0	0		

SCSI Load (IPL) Enhancements - Overview

GA2

- Before z14 GA2, when performing a standard (CCW-type) load, the user can choose to clear memory or not clear memory (aka “normal”)
- Memory is always cleared during a SCSI load.
- For z14 GA2, SCSI load can be performed without clearing memory first (a.k.a. “SCSI load normal”)
  - Available on the Load task and the Activate task with a load profile.
  - ***Note: Memory is always cleared as part of activating an image before any load is performed. Therefore, not clearing memory is not an option when activating with an image profile.***
- Faster load time when the loaded program does not require memory to be cleared for proper operation.

- **Note: When managed by a z14 GA2 HMC, a z14 GA1 or older system cannot take advantage of the SCSI load normal option**

SE Logins from HMC – Enhancements

- The HMC Single Object Operations (SOO) task supports logging into an SE from a managing HMC
- An enhancement has been added to help deal with this common access denial scenario:
  - A different HMC already has an SOO session established to an SE.
  - Currently:
    - The HMC attempting to establish the new session displays a panel denying access.
    - The denial panel includes only a “Chat” option to attempt to contact the person using the SOO session at the other HMC.
- When attempting to access an SE using SOO from an HMC, and there already is an existing SOO session:
  - Access is still initially denied, but the denial panel now offers an option to disconnect the remote userid.
  - When selecting this option, a confirmation panel is displayed, requiring the HMC user to confirm before proceeding with the disconnect.
  - If confirmed, the existing SOO session to the SE from the other HMC is terminated and that associated user is disconnected. Establishment of the new SOO session proceeds immediately.
  - Security log entry is written on the SE to record information about both the disconnected HMC/session and the disconnecting HMC/session.
    - This is in addition to the previously available SOO log entries.

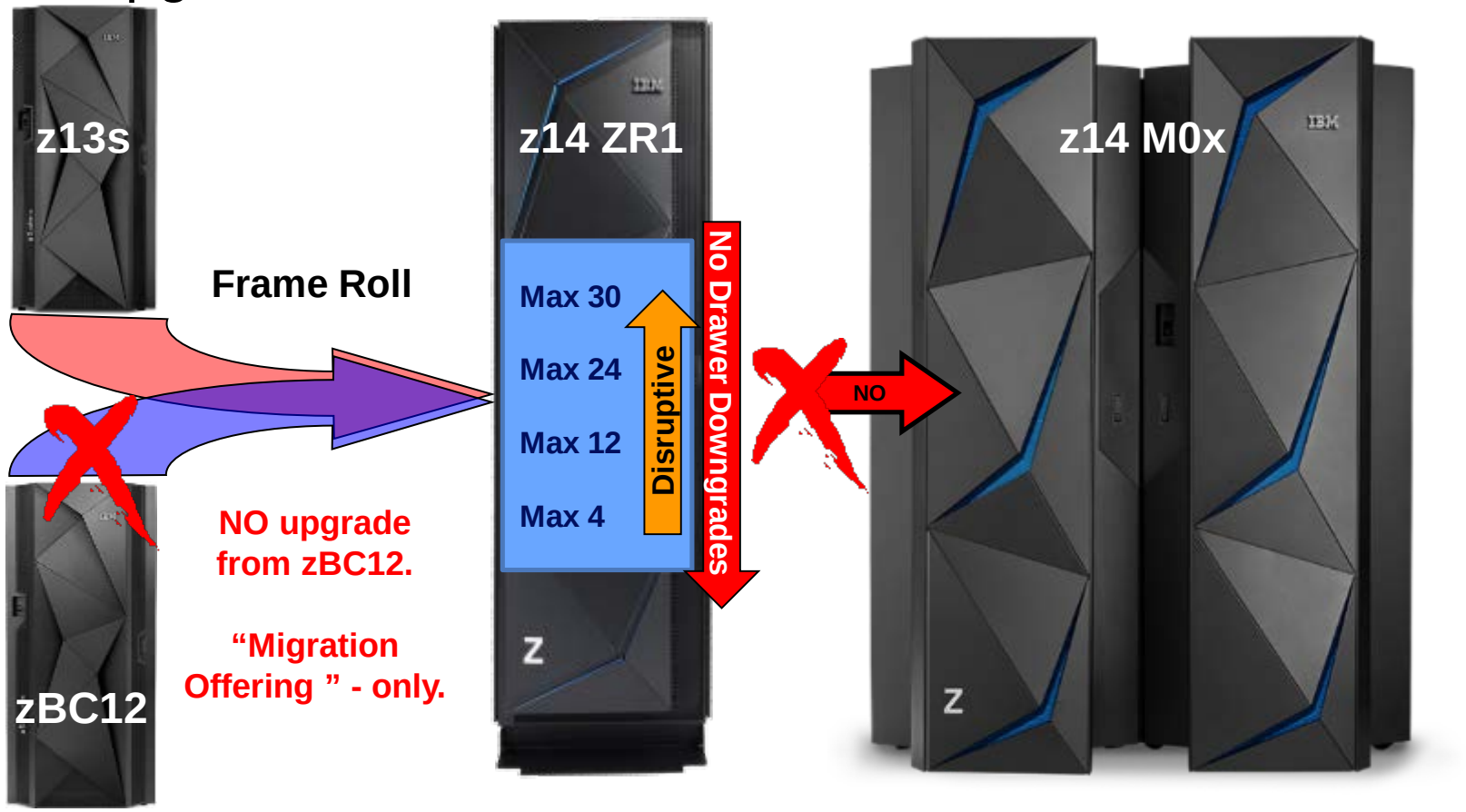
Enhanced Driver Maintenance (EDM): Overview

- Concurrent upgrade of entire system new firmware release
- Concurrent Definition
  - The action is performed non-disruptively (transparently) to the operating systems that are running on the system.
  - The action has no impact to the operating systems or any applications running on those operating systems.
  - Note that this is true from an application and general user's perspective, but technically as part of the concurrent activation process, the system might be halted for an extremely brief period that could be recognizable by a benchmark performance program.
- HMC Panel term: Concurrent Engineering Changes Upgrade
  - Can only be used for post GA1 firmware releases (ie., GA2)
  - z14 ZR1 is first single frame class of systems that can do a EDM to GA2
    - Note EDM can be used to upgrade a z14 M0x to GA2.

z14 ZR1

Installation and Planning

z14 ZR1 Upgrades



Upgrade Detail

Frame Roll MES	z14 ZR1	Rockhopper II
zBC12	Migration Offering Only	No
z13s N10	Yes	No
z13s N20	Yes	No
z13s L10 Rockhopper	No	No
z13s L20 Rockhopper	No	No

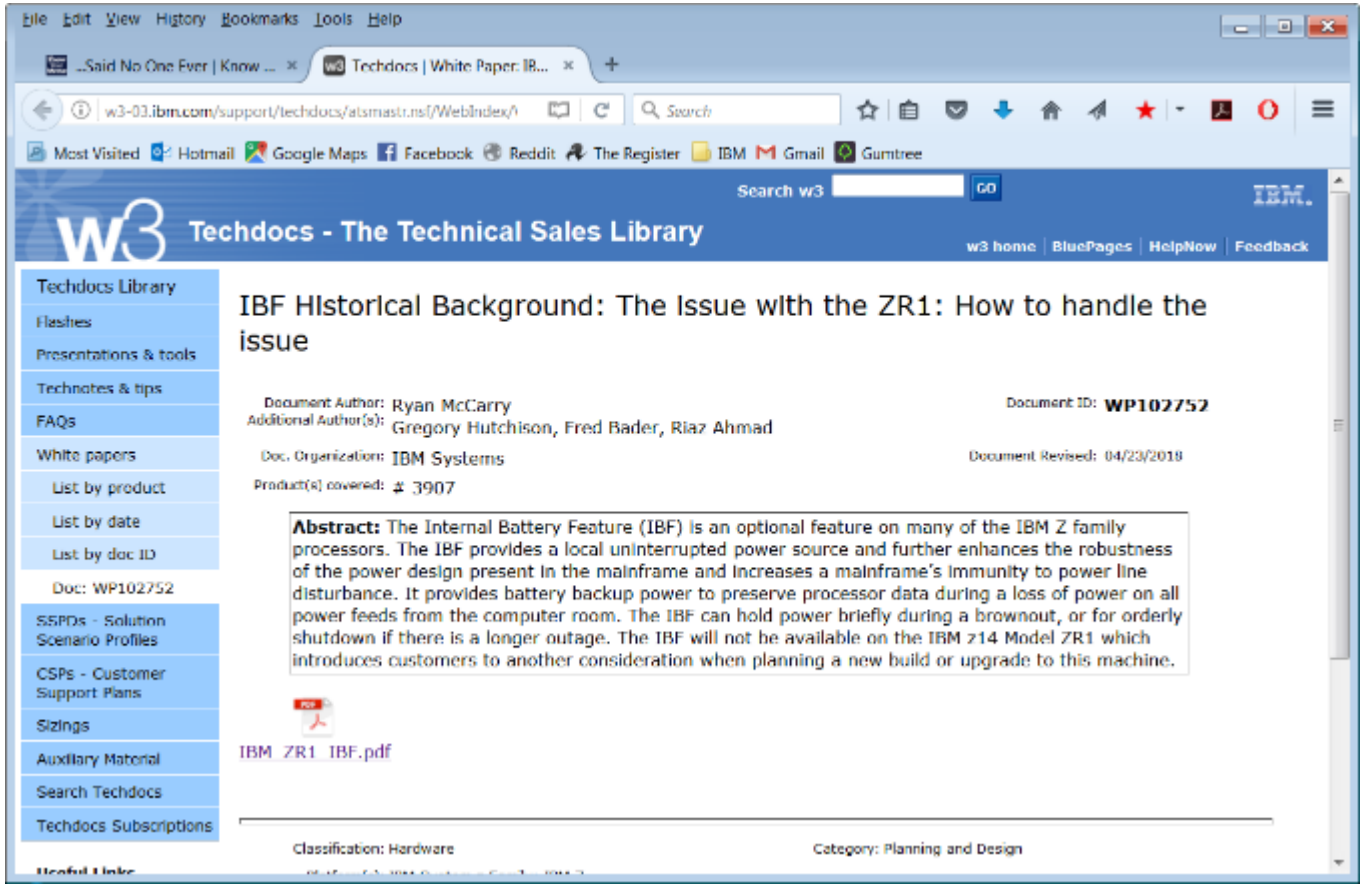
Within the z14 and LinuxONE Families	
Rockhopper II LR1 to z14 ZR1	Yes
z14 ZR1 to Rockhopper II	No
z14 ZR1 to z14 M01-M05	No
Rockhopper II to Emperor II	No

z14 ZR1 Installation Planning

- Air Cooled – Single Frame
- An IBM-designed 19” frame
  - A first for IBM Z
  - 42 EIA (40 EIA + 2 EIA [removable top])
  - Ships with removable side covers.
  - Height 2020mm (79.5 in) [5mm higher than z13s]
- The System Control Hubs (SCHs) have been eliminated.
  Ethernet switches provide power system control network (PSCN) connectivity.
  - N+1
  - Individually power
- The Power Subsystem is based on commercially available Power Distribution Units (rather than being based on an IBM-designed Bulk Power Distribution system)
  - Single Phase power only. No 3-phase
  - 2 or 4 line cords depending on I/O configuration
  - AC only - No DC power
- No Internal Battery Feature (IBF)
- System requirements have improved to support ASHREA Class 3 (40°C ambient/104°F) temperature

Feature Code 7917 = Top Exit cabling
Feature Code 7919 = Bottom Exit cabling

z14 ZR1 – No Internal Battery Feature - Planning



Cabling Exit options

- Top and Bottom Exit options
  - Client now has additional flexibility
  - Feature Code 7917 = Top Exit cabling
  - Feature Code 7919 = Bottom Exit cabling
- Order in any combination desired.
  - Order one, or both will effect both power and I/O
- Additional cabling features
  - Feature Code 7934 = Fiber Quick Connect
  - Feature Code 7935 = LC Duplex harness, 6.6’

REAR

FRONT

z14 ZR1/LR1 Power Supplies / Cords

Based on the configuration, the z14 ZR1/LR1 will require 2 or 4 30 amp line cords.

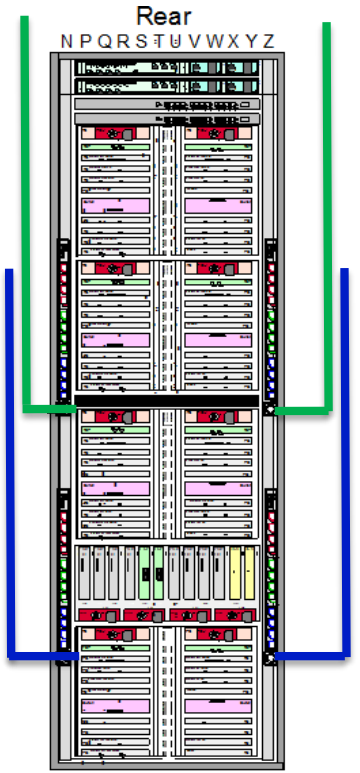
PCIe+ I/O Drawers	1	2	3	4
PDU Pairs (line cord pairs)	1	2	2	2

The second pair of PDUs is also added when ordering the ‘16U Reserved’ feature (FC 0617)

Switched 200-240v PDUs will be used to power the 19” rack.

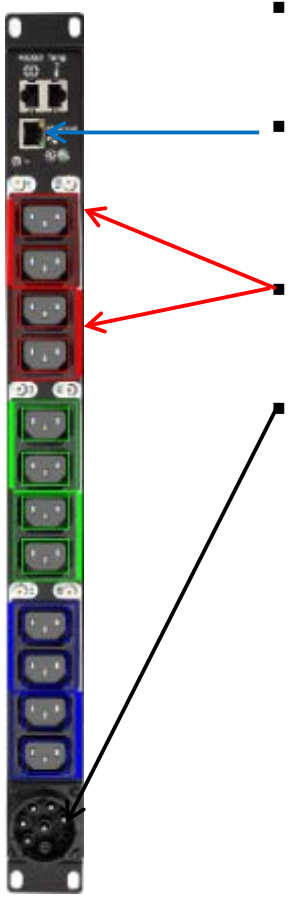
All elements in the rack are AC powered from the PDUs.
All elements are dual powered from each PDU.

Based on the configuration ordered, eConfig will determine the quantity of power cord features required i.e. 2 or 4.



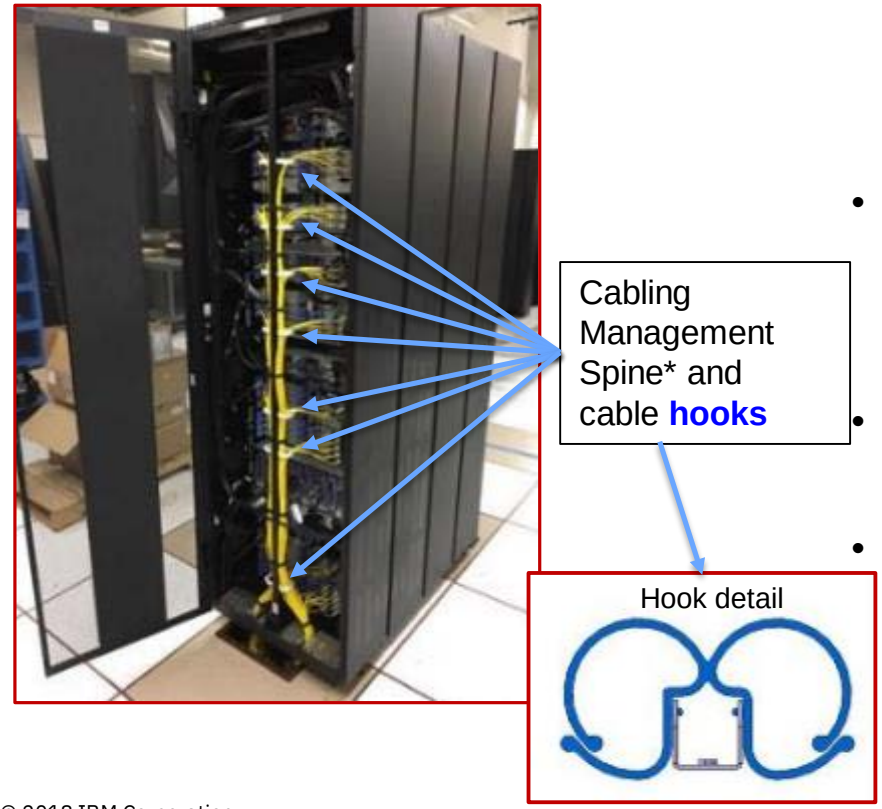
First pair of PDUs installed on the top – **GREEN**
Second pair of PDUs installed as required - **BLUE**

Intelligent PDU



- Intelligent PDU (iPDU) provides three groups of four IEC C13 receptacles each.
- The receptacles can be switched (ON/OFF) independently and are controlled via the **Ethernet** port (connected to the ToR Ethernet Switches)
- Each group of four receptacles has two circuits, protected by circuit breakers
- Line cord is rated 200-240VAC, 30A single phase

Cooling considerations



- Airflow direction is front-to-back* (i.e. other airflow orientation (for non-Z equipment) could lead to hot exhaust air being recirculated back to the front of the drawers).
- Cabling must be dressed appropriately such it does not block the front or back (i.e., would result in reduced airflow and increased component temperatures).
- All unused rack locations must be blocked with front and rear filler plates.
- No cabling in the front of the rack (i.e. if power cables for non-Z equipment are present, these should be routed to the sides and towards the rear side of the rack)

*See Speaker Notes

Software Support

NOTE: You should always refer to the device PSP buckets and or FIXCATs (Fix Categories) for the latest fixes required by OSes. Certain functions/features have specific pre-requisites (PTFs/APARs) that must be applied. Its up to the reader to research these to make sure they have supported software. z/OS FIXCAT URL: http://www.ibm.com/systems/z/os/zos/features/smpe/fix-category.html

IBM z14 M0x and ZR1 operating system support

The IBM z13 was the last IBM Z server to support running an operating system in ESA/390 architecture mode
Applies to operating systems running native on PR/SM or operating systems running as second level guests

z/OS

- z/OS 2.3 Sept. 29, 2017 GA
- z/OS 2.2 with PTFs
- z/OS 2.1 with PTFs (Sept 2018, EoS)
- z/OS 1.13 (compatibility only)
  - IBM Software Support Services purchase
  - September 2016, EoS

z/VSE

- z/VSE 6.2 Preview 4/11/17
- z/VSE 6.1 with PTFs
- z/VSE 5.2 with PTFs
  - October 31, 2018 = EoS
- z/VSE 5.1
  - June 30, 2016 = EoS, limited toleration
- Earlier releases cannot IPL

z/TPF

- z/TPF 1.1 with PTFs (Compatibility, including Crypto Express5S or 6S Card support)
- HiperDispatch Support

Linux on Z

Minimum Distributions *

- RHEL 7.3 with service update
- RHEL 6.9 with service update
- SLES 12 SP2 with service update
- SLES 11 SP4 with service update
- Ubuntu 16.04 LTS
- Ubuntu 17.10 (supported until Jul 2018)

KVM running on Z

- KVM hypervisor offered with the Linux distributions: SLES12 SP2 or higher, and Ubuntu 16.04 LTS or higher

z/VM

- z/VM 6.4 with PTFs and z/VM 7.1

NOTE: For minimum required distribution levels see the IBM tested and supported Linux environments:
ibm.com/it-infrastructure/z/os/linux-tested-platforms
IBM cannot legally discuss z14 exploitation prior to GA from distributors.
IBM is working with the open source community and the Linux distribution partners to get new z14 ZR1 functionality supported with Linux for Z

z/OS Support Summary

Release	z900/z 800 WdfM	z990/ z890 WdfM	z9 EC z9 BC WdfM	z10 EC z10 BC WdfM	z196 Z114 WdfM	zEC12 zBC12 WdfM	z13 z13s	z14 M0x-ZR1	End of Service	Extended Defect Support
z/OS v1.12	X	X	X	X	X	X	X		9/2014	9/2017 [2]
z/OS v1.13	X	X	X	X	X	X	X	X	9/2016	9/2019 [2]
z/OS v2.1			X	X	X	X	X	X	9/2018	9/2021 [2]
z/OS v2.2				X	X	X	X	X	9/2020 [1]	9/2023 [2]
z/OS v2.3						X	X	X	9/2022 [1]	9/2025 [2]

Notes:

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

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

WdfM - Server has been withdrawn from Marketing

*** z/OS v2.3 on z14 requires a minimum of 8 GB memory**

Legend

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

New delivery strategy for KVM on IBM Z and IBM LinuxONE

- Delivery model is changing; see:
- https://www-01.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=ZSQ03110USEN&
- Delivery of KVM hypervisor and Linux operating system can be done more efficiently through our Linux distribution partners
  - Helps to simplify delivery of open source infrastructure
  - Linux and KVM now provided from a single source
  - Easier obtaining and installing of KVM
  - Distributions include open source cloud infrastructure components
  - Simplifies enabling of other technologies, such as container management and cloud management.

Statements of Direction

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

Statements of Direction

- **IBM intends to deliver IMS exploitation of IBM z14 and DS8880 zHyperLink™ WRITE operations:**

zHyperLink Express is a direct connect short distance IBM Z I/O adapter designed to work in conjunction with a FICON or High Performance FICON SAN infrastructure.

- **IBM z14 will be the last z Systems and IBM Z high-end server to support FICON Express8S:**

z14 will be last z Systems and IBM Z high-end server to support FICON Express8S (#0409 and #0410) channels. Enterprises should begin migrating from FICON Express8S channels to FICON Express16S+ channels (#0427 and #0428). FICON Express8S will not be supported on future high-end IBM Z servers as carry forward on an upgrade.

- **OSA-Express6S 1000BASE-T adapters:**

OSA-Express6S 1000BASE-T adapters (#0426) will be the last generation of OSA 1000BASE-T adapters to support connections operating at 100 Mb/second link speed. Future OSA-Express 1000BASE-T adapter generations will support operation only at 1000 Mb/second (1Gb/s) link speed.

Statements of Direction (Cont.)

- **IBM intends to deliver VSAM exploitation of z14 and DS8880 zHyperLink Express**.

zHyperLink Express is a short distance mainframe attach link designed for up to 10x lower latency than High Performance FICON.

- **Future z/VM release guest support:**

z/VM V6.4 will be the last z/VM release supported as a guest of z/VM V6.2 or older releases.

- **Disk-only support for z/VM dumps:**

z/VM V6.4 will be the last z/VM release to support tape as a media option for stand-alone, hard abend, and snap dumps. Subsequent releases will support dumps to ECKD DASD or FCP SCSI disks only.

Statements of Direction (Cont.)

GA2

HMC Support Efficiency Updates

IBM z14 is planned to be the last release that will allow HMC support across the prior four generations of server (N through N-4). Future HMC releases are intended to be tested for support of the prior two generations (N through N-2). For example, the next HMC release would support the zNext generation, plus z14 generation and z13®/z13s® generation.

This change will improve the number and extent of new features and functions that are able to be pre-tested and maintained in a given release with IBM's continued high-reliability qualification procedures.

Removal of System (Sysplex) Time on the Support Element

IBM z14 is planned to be the last machine generation to support the System (Sysplex) Time task on the Support Element. The System (Sysplex) Time task was replaced by the "Manage System Time" task on the Hardware Management Console 2.14.0 release, associated with the IBM z14 models. Clients should begin shifting to the new HMC 2.14.0 or later releases for tasks and procedures, including time management.

Statements of Direction (Cont.)

GA2

The z14 will be the last IBM Z machine family where the associated Hardware Management Console release will support greater than n-2 machine family CPCs.

Machine Family	Machine Type	Firmware Driver	SE Version	Ensemble Node Potential
z14	3906	32	2.14.0	Yes
z13	2964	27	2.13.1	Yes
z13s	2965	27	2.13.1	Yes
zBX Node	2458 Mod 004	22	2.13.0	Required
zBC12	2828	15	2.12.1	Yes
zEC12	2827	15	2.12.1	Yes
z114	2818	93	2.11.1	Yes
z196	2817	93	2.11.1	Yes
z10 BC	2098	79	2.10.2	No
z10 EC	2097	79	2.10.2	No

Machine Family	Machine Type	Firmware Driver	SE Version
zNext*	xxxx	xx	x.xx.x
z14 M0x	3906	36	2.14.1
z14 ZR1/LR1	3907	36	2.14.1
z13	2964	27	2.13.1
z13s	2965	27	2.13.1

*Note: No support for Unified Resource Manager (Ensemble)

Red text indicates end of support after December 31, 2018.

STP: The old user interface to go away from SE on the zNext.

Statements of Direction (Cont.)

Ensemble and zEnterprise® Unified Resource Manager

IBM z14 is planned to be the last IBM Z server to support Ensembles and zEnterprise Unified Resource Manager (zManager).

The z14 HMC level is planned to be the last HMC level to support Ensembles. Statements by IBM regarding its plans, directions, and intent are subject to change or withdrawal without notice at the sole discretion of IBM.

Other Information

Brocade Gen 4 Compatibility

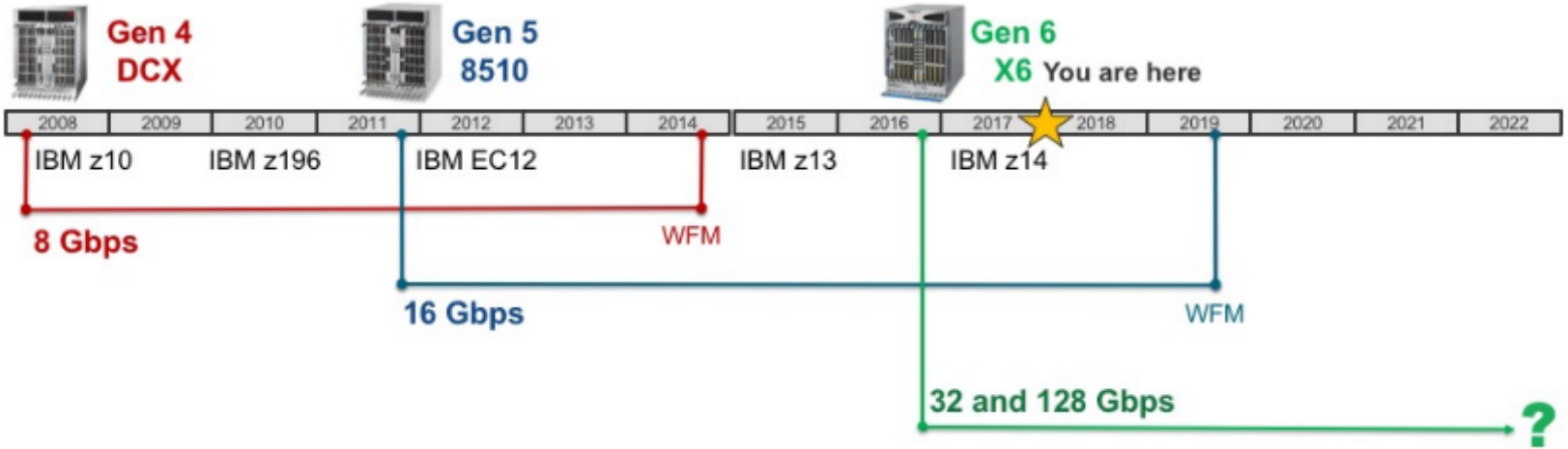
- Starting with the z14 Gen 4 Switches/Directors will **not** be supported.
  - If your Clients environment has Gen 4 equipment
    - Start the process to upgrade to Gen 5/6
    - Brocade will provide GEN4 extended support for certain Directors on a one-off basis.
- Gen 4 RPQ process
  - Send an email to brocadez14RPQ@brocade.com
    - Customer name
    - Number of Gen 4 switches/directors with serial numbers
    - Collect current Supportsave logs of each Gen4 switch
    - Run SANHealth and send data to email above
  - Collect and upload SupportSaves to Secure FTP
    - FTP site: sftp://sftp.brocade.com
    - Login information:
      - Username : “IBMRPQ”
      - Password: “BrocadeZ14RPQ”
    - Please create a folder using customer name
  - Once you send the email and upload the data Brocade can process it

- Questions?
  - Contact Jeff Seidell - jseide@us.ibm.com

IBM Name	IBM Model	Brocade Name	EMC Brocade	HDS Brocade
SAN768B-Backbone	2499-384	DCX Backbone	ED-DCX-B	HD-DCX
SAN384B Backbone	2499-192	DCX-4S Backbone	ED-DCX-4S-B	HD-DCX-4S
SAN80B-4	2498-B80	5300	DS-5300B-DE	HD-5300
SAN40B-4	2498-B40	5100	DS-5100B	HD-5100
SAN24B-4	2498-B24	300	DS-300B	HD-300
SAN06B-R	2498-R06	7800	MP-7800B	HD-7800-0001-M

Modernizing your Infrastructure.

Why connect the z14 to a network that is already 5 to 10 years old?



- z14 not supported on Gen 4 DCX (SAN768B and SAN384B)
  - Requires ***Billable*** RPQ approval.
  - DCX – WFM was 2014. EOS is 2019. Clients must migrate to new SAN before EOS.
- z14 is the last IBM Z platform tested, qualified & supported on Brocade 8510 directors (SAN384B-2 and SAN768B-2 Gen 5)
- Gen 6 (SAN512B-6 and SAN256B-6) provides best performance, features, and investment protection for IBM Z clients.

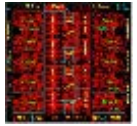
1

Summary

Leveraging the breadth of IBM Technology

z14 ZR1 CPC Drawer

z14 M0x CPC Drawer



PU Chip

Single Chip Module

IBM Investment in IBM Z spans the platform stack

IBM z14 model ZR1 / Rockhopper II model LR1 at a glance

Performance & Scale

- Improved ST and IFL SMT ★
- Capacity Growth >10% Single thread
- 1.5x more on-chip cache per core then previous generation ★
- Min 64GB, Max 8TB of Memory ★
- z/OS MIPS Range 88 → 7800

I/O

- 16Gb Channel with 3x start rate than previous generation ★
- zHyperLink for low latency IO
- 10/25 GbE RoCE ★
- SMT extended to dedicated I/O System Assist Processors (SAPs)★
- **IBM FCP Express32S**
- **IBM Adapter for NVMe**

Designed for Linux

- New, smaller footprint ★
- Up to 30 Linux cores★
- > 50% Total Linux Capacity ★
- Simplification with Dynamic Partition Manager – FiCON Support **– SOD**
- iSCSI ★

Standardization

- Removes barriers for client adoption
- Industry-standard form factor ★
- PDU-based power ★
- Redundant power, cooling, line cords ★

Pervasive Encryption

- Crypto Acceleration ★
- Secure Sysplex: CF encryption
- Secure Service Container ★

Ecosystem Enablement

- z/OS, z/TPF
- z Middleware
- Linux Distro Support ★
- z/VM, KVM ★ -
- Container Pricing for IBM Z
- Vast portfolio of IBM, ISV and open source software ★

★ Designed for Linux

IBM z14

Extending the IBM z14 Family

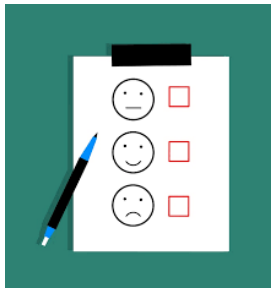
Breakthrough technologies

Designed for the Secure Cloud


Q&A

We want your feedback!

- Please submit your feedback online at ….
  - http://conferences.gse.org.uk/2018/feedback/BF
- Paper feedback forms are also available from the Chair person
- This session is BF




THANK YOU