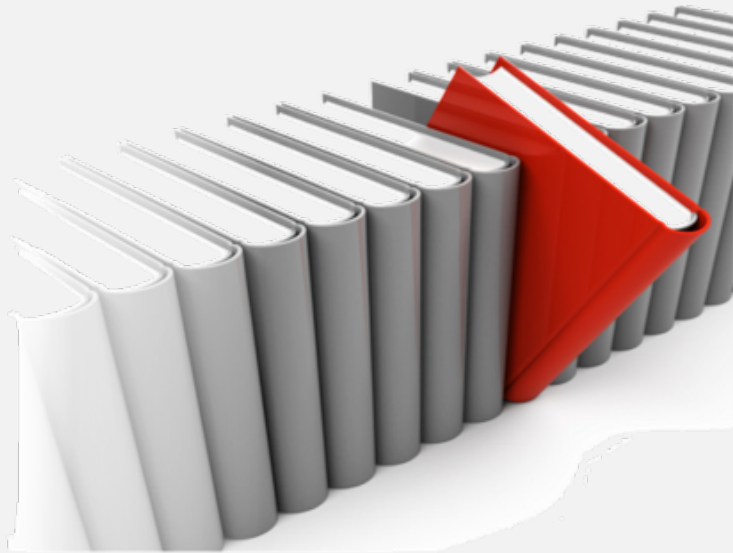


# IBM z15 Model T01 Hardware Overview



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# z15 Announcement Dates

## IBM z15 availability Dates – Driver Level 41 (1 of 3)

General Availability – September 23, 2019

- New features and functions for the IBM z15 (Type number: 8561)

### – New build systems:

- IBM z15 Model T01
- Features and functions for the IBM z15

### – Upgrades from z13 and z14:

- z13 air-cooled upgrades to IBM z15 air-cooled
- z13 air-cooled upgrades to IBM z15 water-cooled
- z13 water-cooled upgrades to IBM z15 water-cooled
- z13 water-cooled upgrades to IBM z15 air-cooled
- z14 air-cooled upgrades to IBM z15 air-cooled
- z14 air-cooled upgrades to IBM z15 water-cooled
- z14 water-cooled upgrades to IBM z15 water-cooled
- z14 water-cooled upgrades to IBM z15 air-cooled

**z15**



## IBM z15 availability Dates – Driver Level 41 (2 of 3)

General Availability – September 23, 2019

- **MES orders for IBM z15 that include the following features:**

- Field-installed features and conversions on IBM z15 that are delivered solely through a modification to the machine's Licensed Internal Code (LIC)
- HMC Table Top KMM (#0148) on IBM z15
- HMC Rack Mount KMM (#0154) on IBM z15
- Customer Supplied HMC KMM (#0188) on IBM z15
- HMC Tower (#0062) on IBM z15
- HMC Rack Mount (#0063) on IBM z15
- TKE Rack Mount (#0087) on IBM z15
- HMC Rack Mount KMM (#0154) on IBM z15
- Customer Supplied HMC KMM (#0188) on IBM z15

**z15**



## IBM z15 availability Dates – Driver Level 41 (3 of 3)

- **November 14, 2019 - orders cannot be placed until November 14, 2019**
  - IBM Z Hardware Management Appliance (#0100): HMC/SE housed in one physical server inside CPC frame
  - Dynamic Partition Manager (DPM) on IBM z15 (#0016)
  - zTPF exploitation of System Recovery Boost
- **December 31, 2019 - orders cannot be placed until December 31, 2019**
  - OOCoD for the People's Republic of China for IBM z15, IBM z14, and IBM z14 ZR1
- **January 29, 2020**
  - All remaining MES orders for IBM z15 Model T01

**z15**



# z15 Design Principles

## Elevate your hybrid cloud with IBM z15



### Service Level Excellence

*Industry's highest level of business uptime to meet SLA and regulatory compliance*



### Data Protection & Privacy

*Industry-first solution to protect sensitive data across your multicloud*



### Mission Critical Cloud

*Integrate seamlessly into hybrid multicloud, blockchain and AI*

## Standardized & Flexible for the Cloud Data Center

*Modular, scalable and proven cloud-ready infrastructure*

# z15 Overview

# IBM z15 at a glance

## System, Processor, Memory

- One model: T01;
- Five features: Max34, Max71, Max108, Max145, Max190
- 12 core 5.2GHz 14nm PU SCM
- 1 - 190 PUs configurable as CPs, zIIPs, IFLs, ICFs (up to 215 PUs)
- Increased Uniprocessor capacity
- Up to 34 sub capacity CPs at capacity settings 4, 5, or 6
- Enhanced Out-of-Order and new on-chip HW compression
- Enhanced processor/cache design with **2x L3 on-chip** and **1.4x L4 (SCM)** cache sizes
- Up to 40 TB DRAM, protected by Redundant Array of Independent Memory (RAIM)
- Virtual Flash Memory (VFM) granularity – 0.5 TB / Feature , up to 12
- 256 GB HSA
- Improved pipeline design and cache management



**Announce: Sept. 12, 2019**

## RAS, simplification and others

- |   |   |
|---|---|
| L3, <b>L4</b> Cache Symbol ECC                | Enhanced Dynamic Memory Relocation for EDA and CDR          |
| <b>N+2</b> pumps design for Air Cooled System | <b>Coupling Facility Resiliency enhancements</b>            |
| ASHRAE Class A3 design                        | <b>Enhanced SE and HMC Hardware (security)</b>              |
| Support for ASHRAE Class A3 datacenter        | <b>TKE 9.2 LICC and new Smart cards</b>                     |
| <b>System Recovery Boost*</b>                 | Simplified and enhanced functionality for STP configuration |
| Universal Spare SCMs (CP and SC)              | Virtual Flash Memory  |

## I/O Subsystem, Parallel Sysplex, STP, Security

- PCIe+ Gen3 I/O fanouts with 2 x 16 GBps Buses
- 6 CSS, 4 Subchannel sets per CSS
- 0 – 12 PCIe+ I/O Drawers (Gen3) – PDU Models
- 0 – 11 PCIe+ I/O Drawers (Gen3) – BPA Models
- Next generation FICON Express16AS
- 25 and** 10 GbE RoCE Express2
- Integrated Coupling Adapter (ICA SR) and Coupling express LR for coupling links
- Support for up to **384 coupling** CHPIDs per CPC
- CFCC Level 24 (HMC 2.15.0)**
- Crypto Express7S and On-chip compression (DEFLATE)
- STP configuration and usability enhancements (GUI)
- IBM zHyperLink Express
- OSA-Express7S**
- IBM Secure Service Container

## PR/SM

- Up to 190 CPUs per partition
- IBM Dynamic Partition Manager updates
- Up to 85 LPARs**
- 16 TB Memory per partition

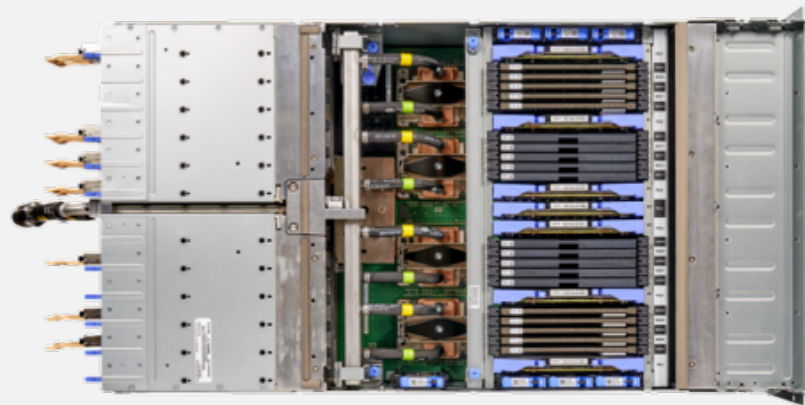
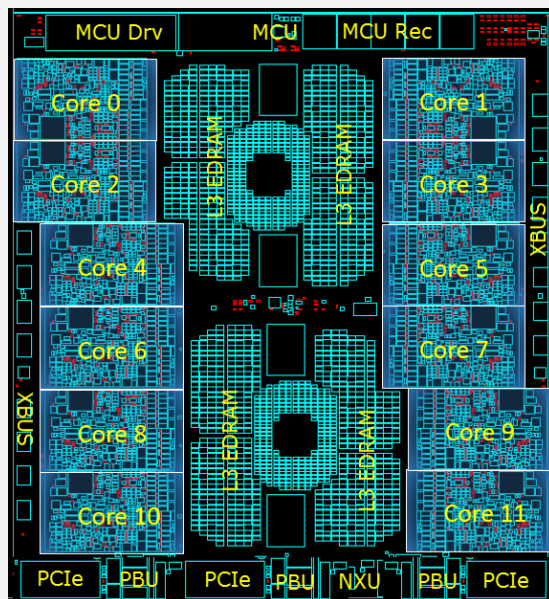


# z15 System Design Changes

- 14 nm Processor with optimized Out-of-Order, new DEFLATE and SORT
- 12 Cores per PU SCM design
- 4 CP SCMs per Drawer, up to five CPC drawers
- Integrated I/O with PCIe+ Gen3
- Single System Controller Chip, 960MB L4
- Simplified CPC Drawer SMP Fabric



- Integrated (on-chip) compression
- Crypto Express7S (single/dual port)
- OSA-Express7S 25GbE
- OSA-Express6S
- New FICON Express16SA
- 25GbE and 10GbE RoCE Express2
- IBM zHyperLink Express
- Coupling Express Long Reach



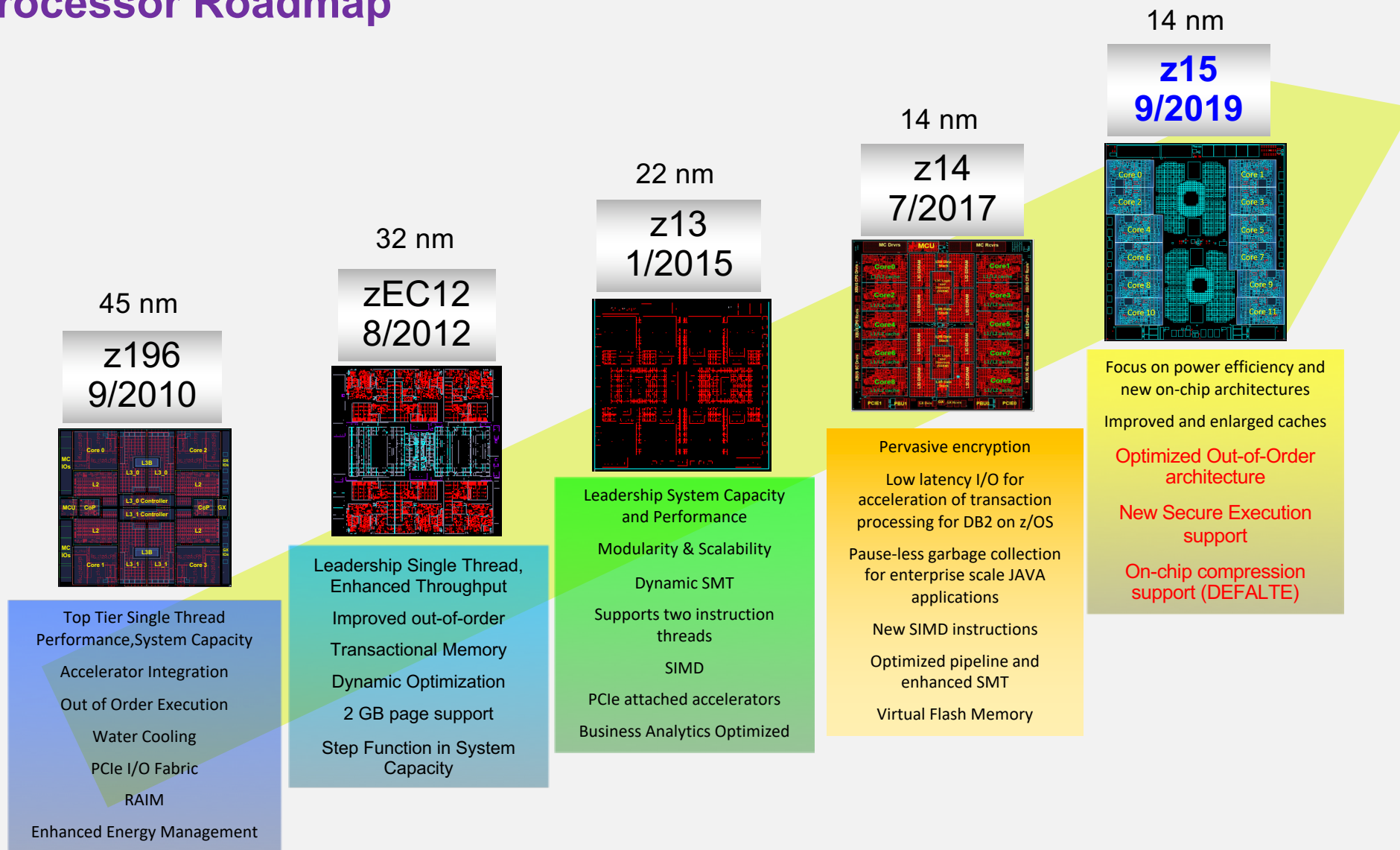
Back

Front



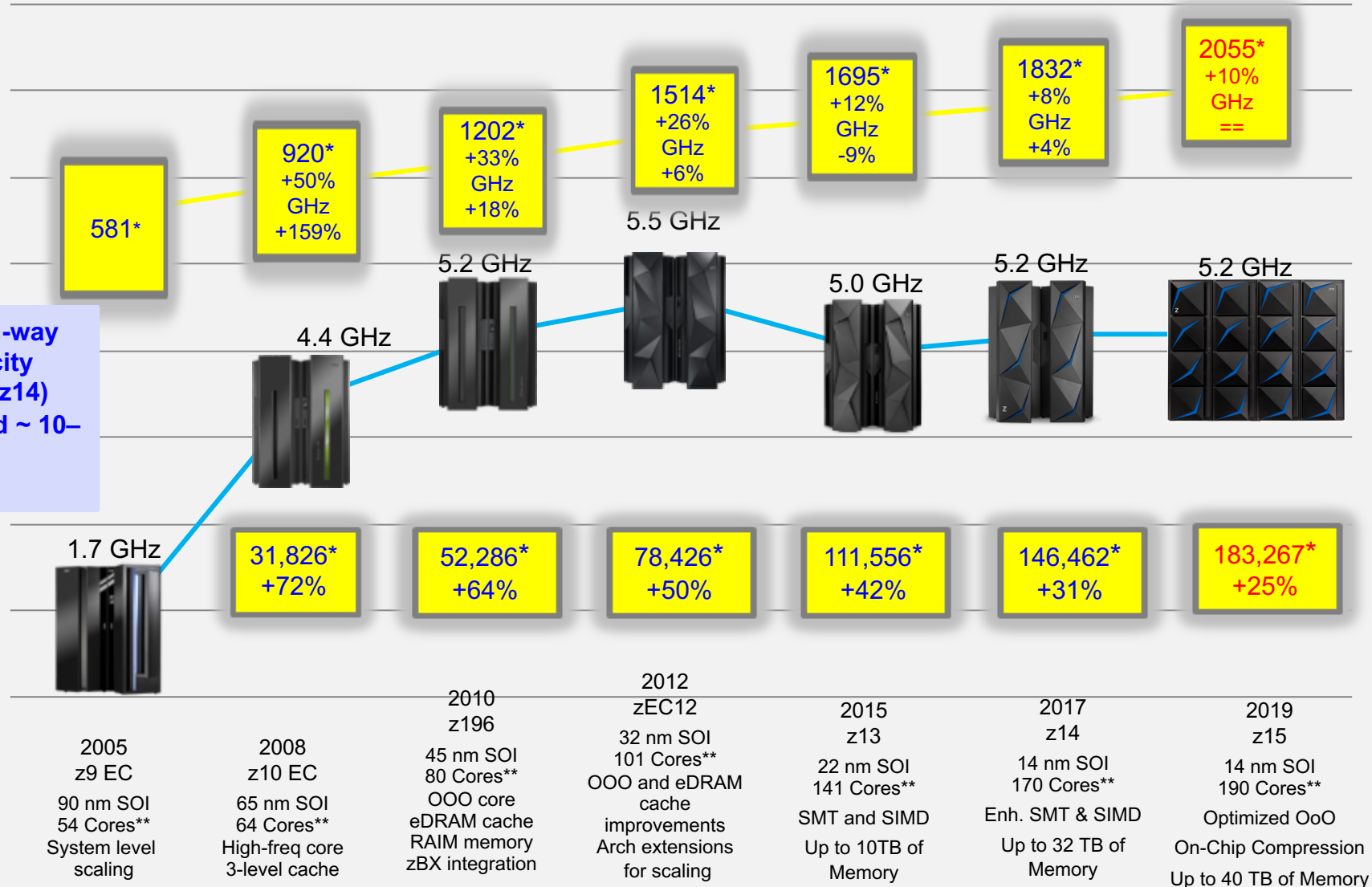


# IBM Z – Processor Roadmap



# z15 Continues the CMOS Mainframe Heritage

~ 14% for equal z14 n-way  
Up to 25% max capacity  
190-way vs 170-way (z14)  
SMT vs Single Thread ~ 10-40% (average 25%)  
- both zIIP & IFL



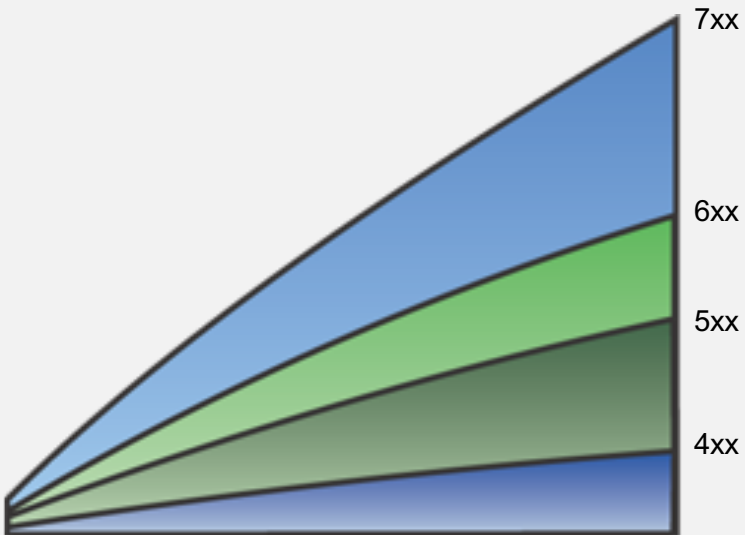
GHz / PCI\*

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

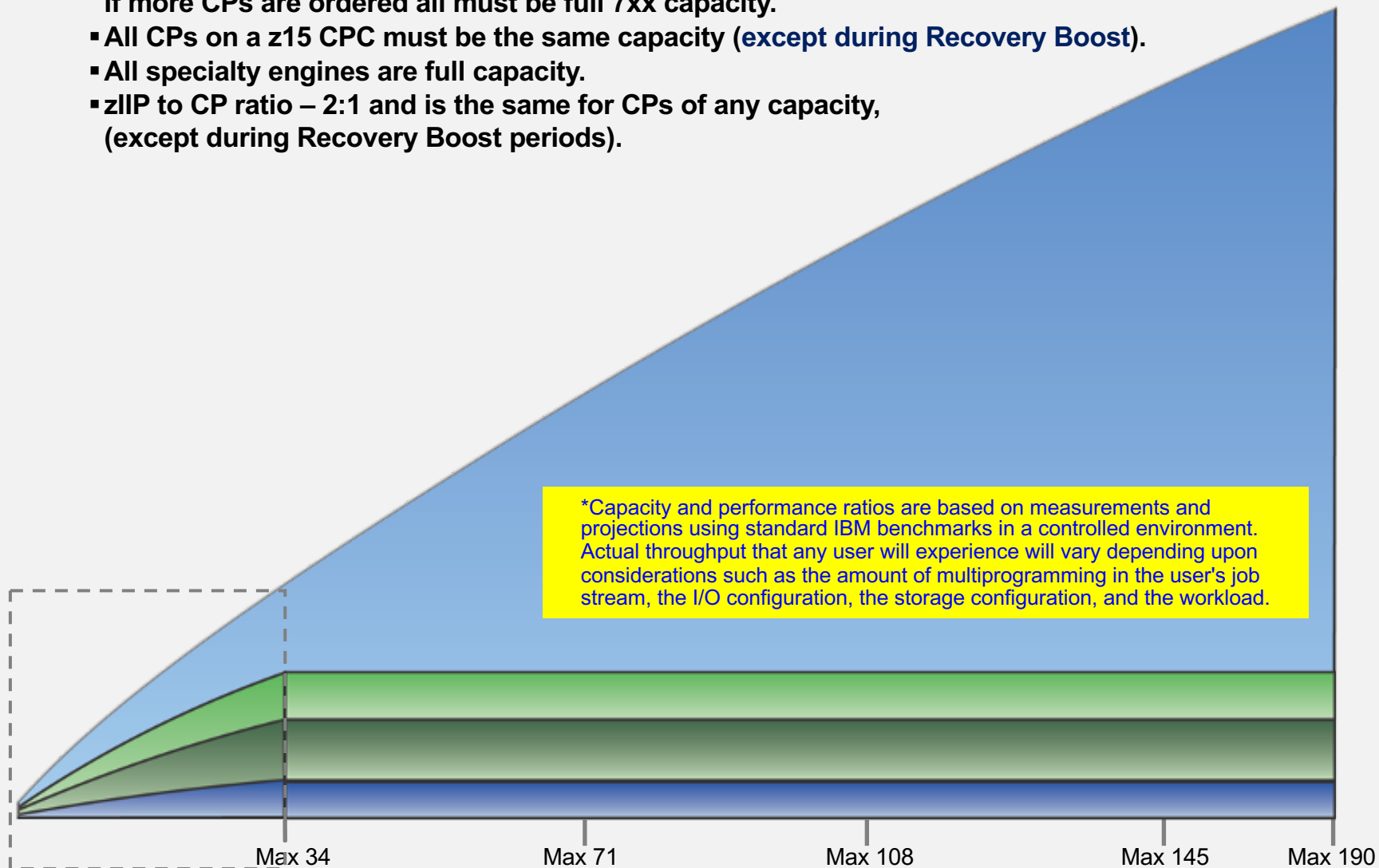
# z15 Full and Sub-Capacity CP Offerings

CP Capacity – Relative to Full Capacity Uni  
 701 = 100% ≈ 2,055.3 PCI  
 601 ≈ 0.56% ≈ 1,151 PCI  
 501 ≈ 0.38% ≈ 781 PCI  
 401 ≈ 0.13% ≈ 267.2 PCI

- Subcapacity CPs, up to 34 may be ordered (286 capacity levels).  
 If more CPs are ordered all must be full 7xx capacity.
- All CPs on a z15 CPC must be the same capacity (except during Recovery Boost).
- All specialty engines are full capacity.
- zIIP to CP ratio – 2:1 and is the same for CPs of any capacity, (except during Recovery Boost periods).

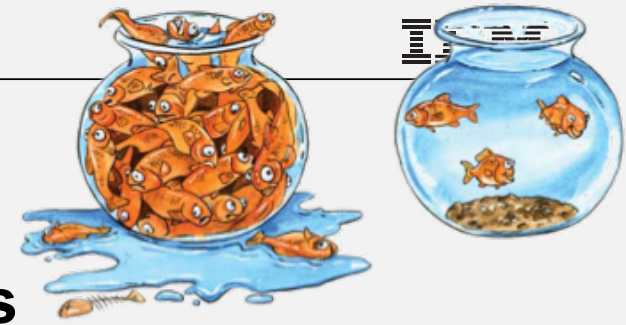


MSU Sub Capacity



## Call to Action – Sizing done right – Best Practices CPU Measurement Facility

- Ensure the CPU MF data is captured and kept for analysis
- Performance, Capacity Planning and Problem Determination
- Critical Migration Action for every IBM Z (z/OS and z/VM)
  - CPU MF Counters must be enabled on their current processor
  - CPU MF Counters must be enabled on their z15



**In z/OS there is a HIS started task.  
This is run on each System/LPAR and writes SMF 113 records.  
This should be set up and run on all partitions.**

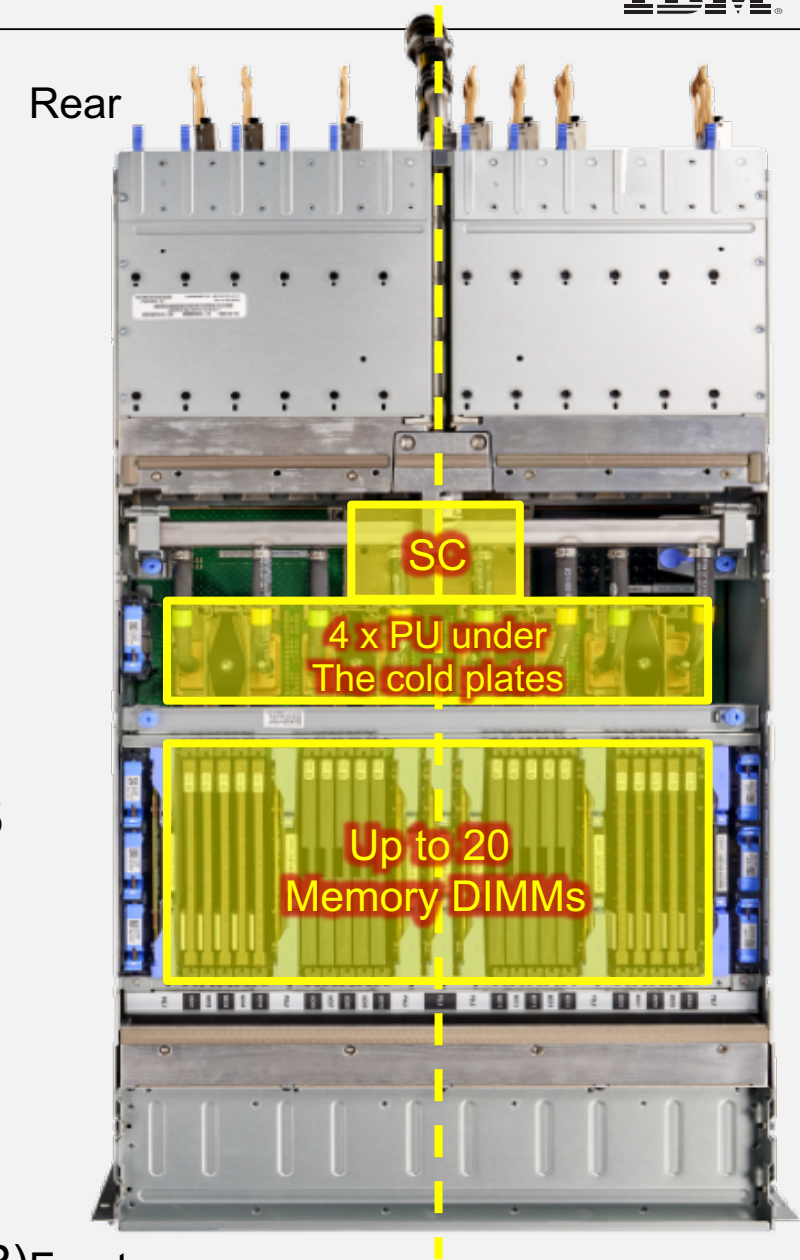
**z/VM also gathers CPU MF Counters through new z/VM Monitor Records.**

# z15 Processor Design and Structure



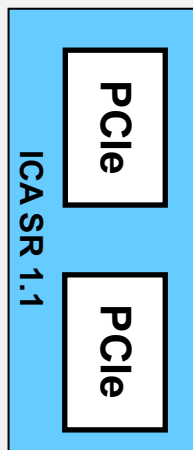
## z15 Processor Drawer (Top View)

- Each PU SCM:
  - 14nm
  - Four PU SCMs
  - One Memory Controller per PU Chip
  - Five DDR4 DIMM slots per Memory Controller
    - 20 DIMMs total per drawer
- Each drawer:
  - Two logical PU clusters (0 and 1)
  - Four PU Chips per CPC Drawer:
    - 41 active PUs per drawer - Max34, Max71, Max108 and Max145
    - 43 active PUs per drawer – Max190
  - One SC Chip (960 MB L4 cache)
  - DIMM slots: 20 DIMMs to support up to 8 TB of addressable memory (10 TB RAIM)
  - Water cooling for PU SCMs, air cooled SC SCM
  - Two Flexible Support Processors/ OSC Cards
  - 12 fanout slots for PCIe+ I/O drawer or PCIe coupling fanouts (ICA SR)Front

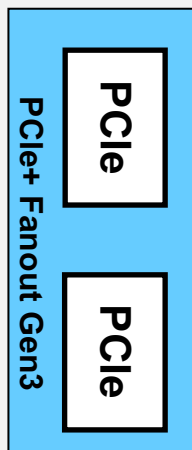


## z15 Processor (CPC) Drawer Connectivity

- 12 PCIe fanout slots per z15 CPC drawer
  - Increase from 10 PCIe fanouts in z14
- Integrated Coupling Adapter (ICA) SR1.1
  - Two ports @ 8 GBps\* (PCIe Gen3) for short distance coupling
  - 150m fiber optic coupling link
- PCIe+ Fanout Gen3
  - Two ports @ 16GBps (PCIe Gen3)
  - Connects to the PCIe Interconnect Gen3 in the PCIe+ I/O drawers

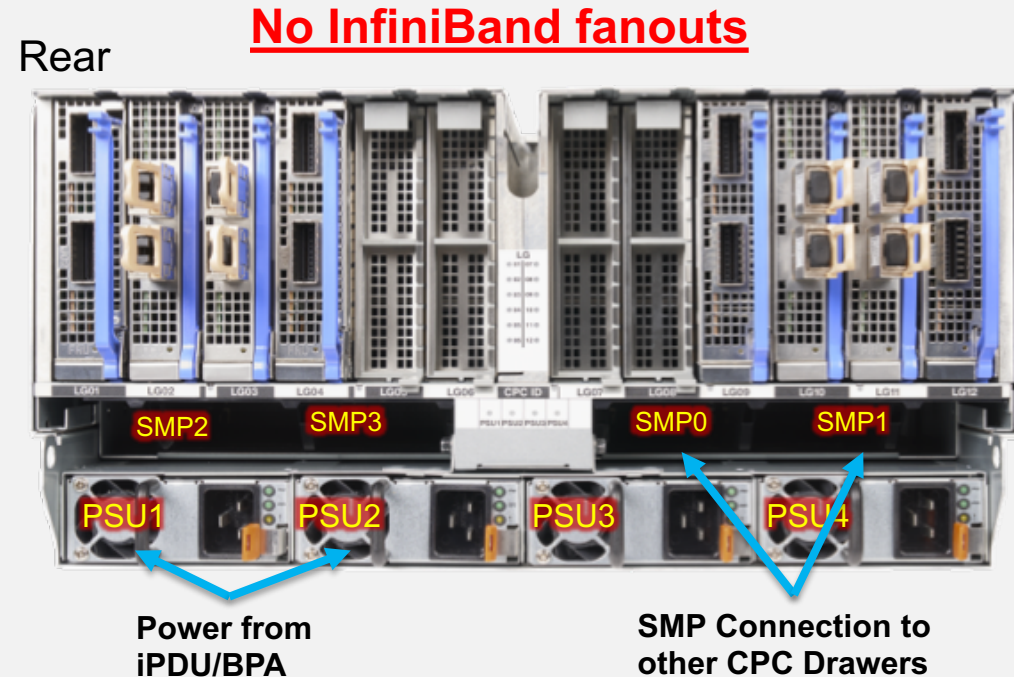


ICA SR1.1 Coupling Links



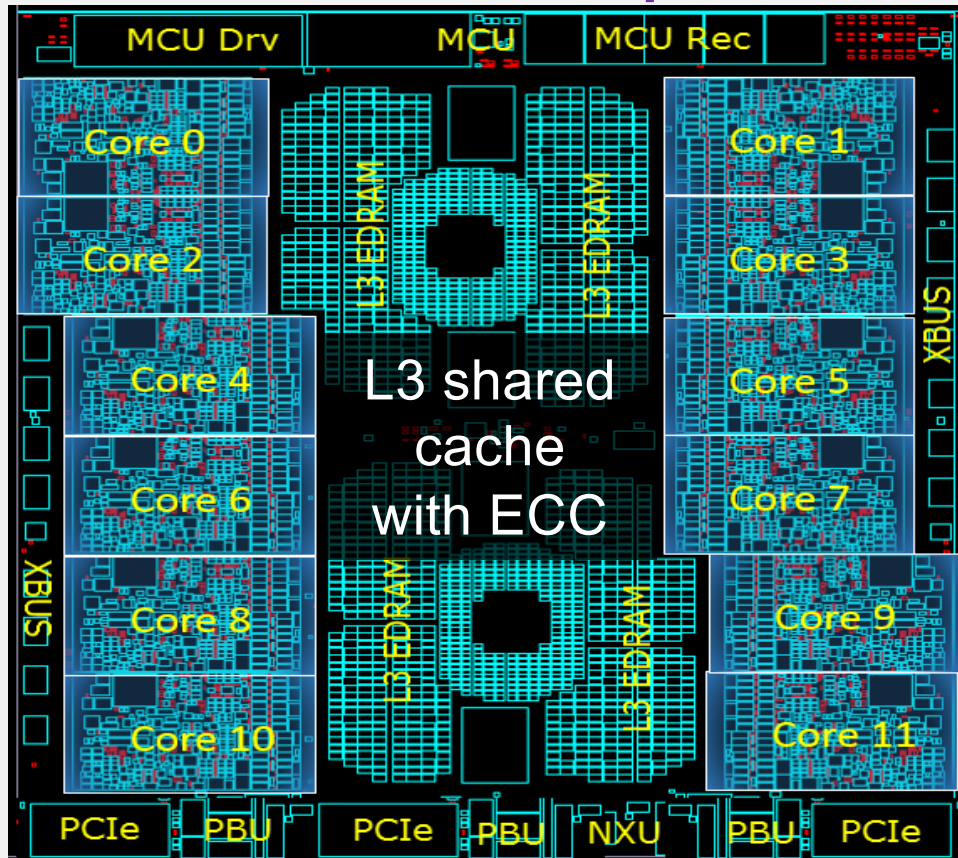
To PCIe+ I/O Drawers

\* The link data rates do not represent the performance of the links. The actual performance is dependent upon many factors including latency through the adapters, cable lengths, and the type of workload. © 2019 IBM Corporation



Front

## 12-Core Processor Chip Detail

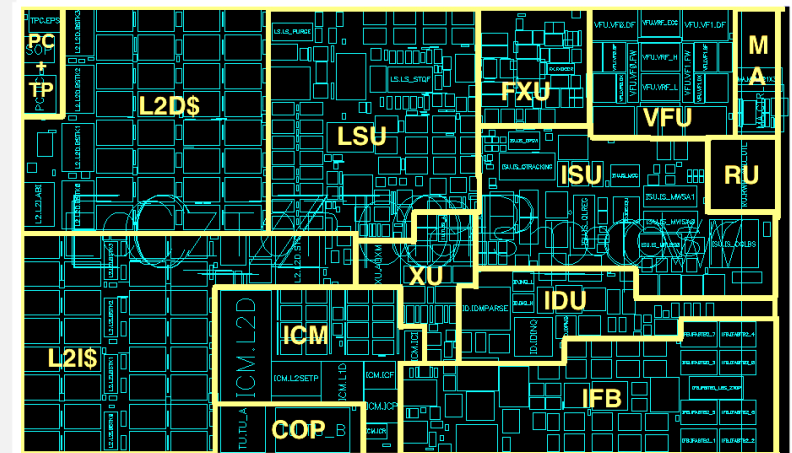


- **14nm SOI Technology**
  - 12 Cores
  - 17 layers of metal
  - 696 mm<sup>2</sup> chip area
  - 9.2B transistors versus 6.2B on z14
- **20% reduction area**
- **20% reduction in power**
- **5.2 GHz core frequency**
- **8, 9, 10, 11 or 12 active cores per chip**
- **IBM Integrated Accelerator for z Enterprise Data Compression (zEDC)**
  - **On-chip compression accelerator (NXU)**
- **On Core L1/L2 Cache**
  - L2-I from 2MB to 4MB per core
- **On chip L3 Cache**
  - Shared by all on-chip cores
  - Communicates with cores, memory, I/O and system controller single chip module.
  - L3 from 128MB to 256MB per chip
- **I/O buses**
  - Each CP chip will support up to 3 PCIe buses
    - PCIe+ I/O Drawer Fanout
    - ICA SR 1.1 Coupling Links



## z15 Core Details (1 of 2)

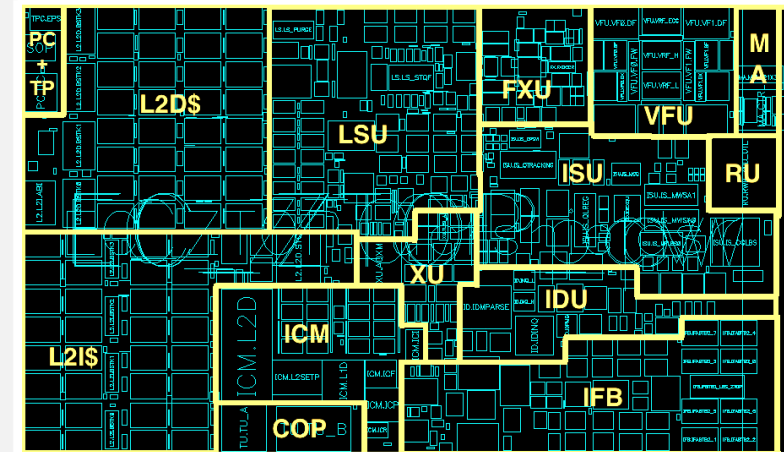
- Each processor unit, or core, is a superscalar and out-of-order processor that supports 10 concurrent issues to execution units in a single CPU cycle\*:
  - Fixed-point unit (FXU): The FXU handles fixed-point arithmetic
  - Load-store unit (LSU): The LSU contains the data cache. It is responsible for handling all types of operand accesses of all lengths, modes, and formats as defined in the z/Architecture
  - Instruction fetch and branch (IFB) (prediction) and Instruction cache & merge (ICM). These two sub units (IFB and ICM) contain the instruction cache, branch prediction logic, instruction fetching controls, and buffers. Its relative size is the result of the elaborate branch prediction
  - Instruction decode unit (IDU): The IDU is fed from the IFU buffers, and is responsible for parsing and decoding of all z/Architecture operation codes
  - Translation unit (XU): The XU has a large translation lookaside buffer (TLB) and the Dynamic Address Translation (DAT) function that handles the dynamic translation of logical to physical addresses
  - Instruction sequence unit (ISU): This unit enables the out-of-order (OoO) pipeline. It tracks register names, Out-of-Order instruction dependency, and handling of instruction resource dispatch



\*See speaker notes

## z15 Core Details (2 of 2)

- Instruction fetching unit (IFU) (prediction): These units contain the instruction cache, branch prediction logic, instruction fetching controls, and buffers. Its relative size is the result of the elaborate branch prediction design.
- Recovery unit (RU): The RU keeps a copy of the complete state of the system that includes all registers, collects hardware fault signals, and manages the hardware recovery actions.
- Dedicated Co-Processor (CoP): The dedicated coprocessor is responsible for data compression, encryption functions and Merge/SORT for each core
- Core pervasive unit (PC) for instrumentation, error collection
- Modulo arithmetic (MA) unit – support for Elliptic Curve Cryptography
- Vector and Floating point Units (VFU):
  - BFU - binary floating point unit,
  - DFU - decimal floating point unit,
  - DFx - decimal fixed point unit,
  - FPd - floating point divide unit,
  - VXx - vector fixed point unit unit,
  - VXs – vector string unit,
  - VXp - vector permute unit,
  - VXm - vector multiply unit
- L2I/L2D – Level 2 instruction/data cache



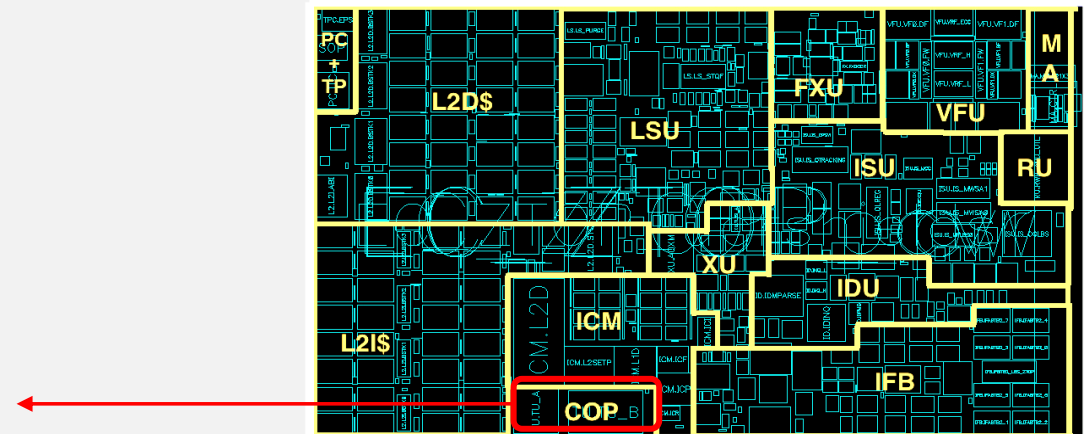
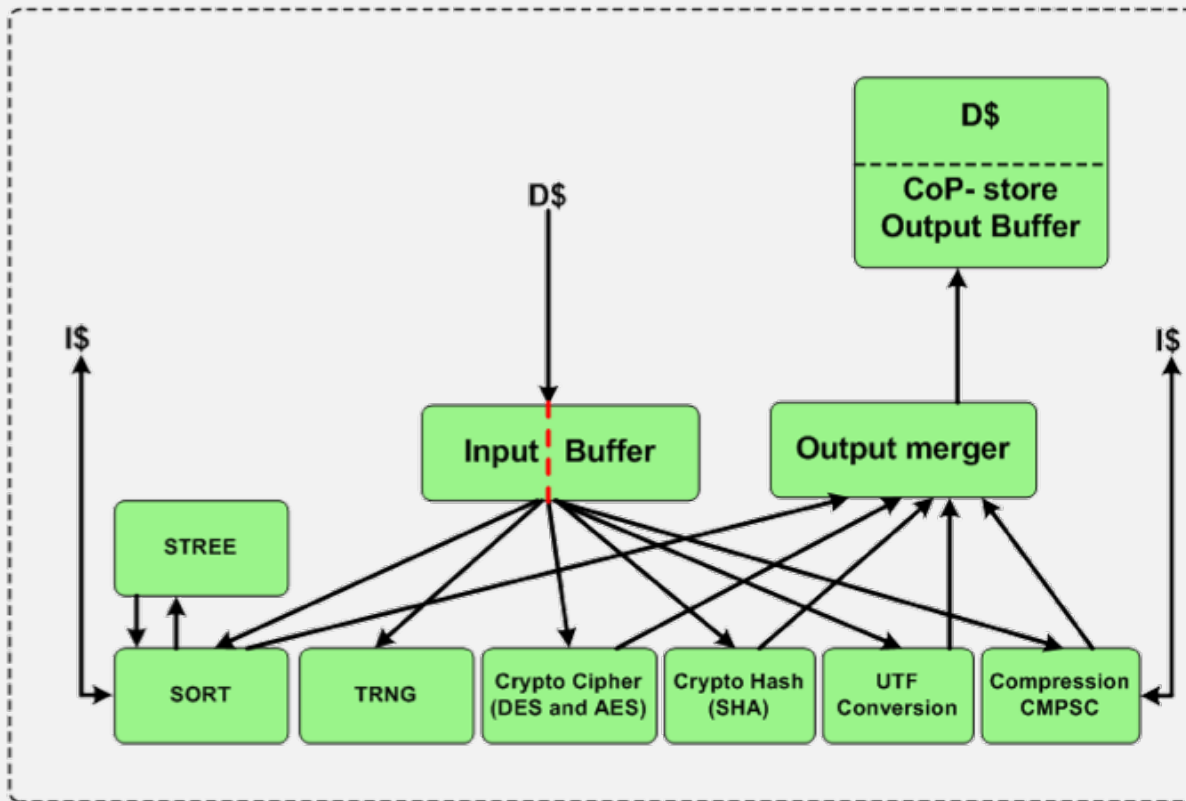


## z15 Processor Enhancements Overview\*

- Divide engine scheduler
- BFU „tandem“ operation:
  - 2x single precision bandwidth
- BFU latency reduction
- Double-bandwidth vector loads
- Multiply/Divide speed ups
- Conversion speed ups
- New and enhanced vector instructions
  - Load/store reversed (to help with little endian conversion)
  - More vector shift operations
  - VECTOR STRING SEARCH, for fast string search, supporting different encodings
  - New vector FP converts
- New and enhanced Vector Packed Decimal instructions
- Enhanced Out-of-Order:
  - GCT size increase
  - Issue queue size increase
  - New Mapper design
- New TAgged Geometric Page History Table (PHT)
- Branch prediction – simplified and larger BTB
- Add special hardware to significantly accelerate frequently used functions:
  - Compression/Decompression (DEFLATE)
  - Sort
- Load/Store unit enhancements
- Operand Store Compare improvements

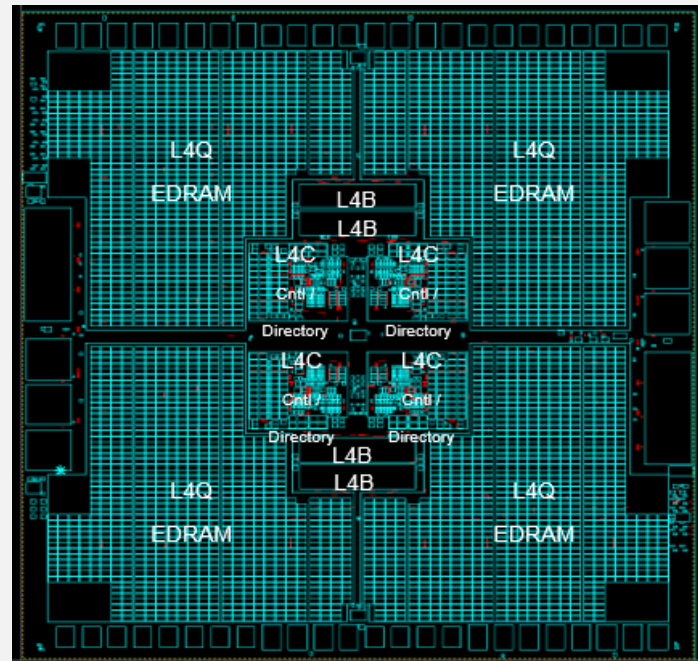
## z15 Co-Processor (COP) Overview

- Co-Processor results (data) now stored direct via L1D cache
- Re-designed crypto/hashing/UTF-conversion/compression engines for increased throughput
- True Random Number Generator

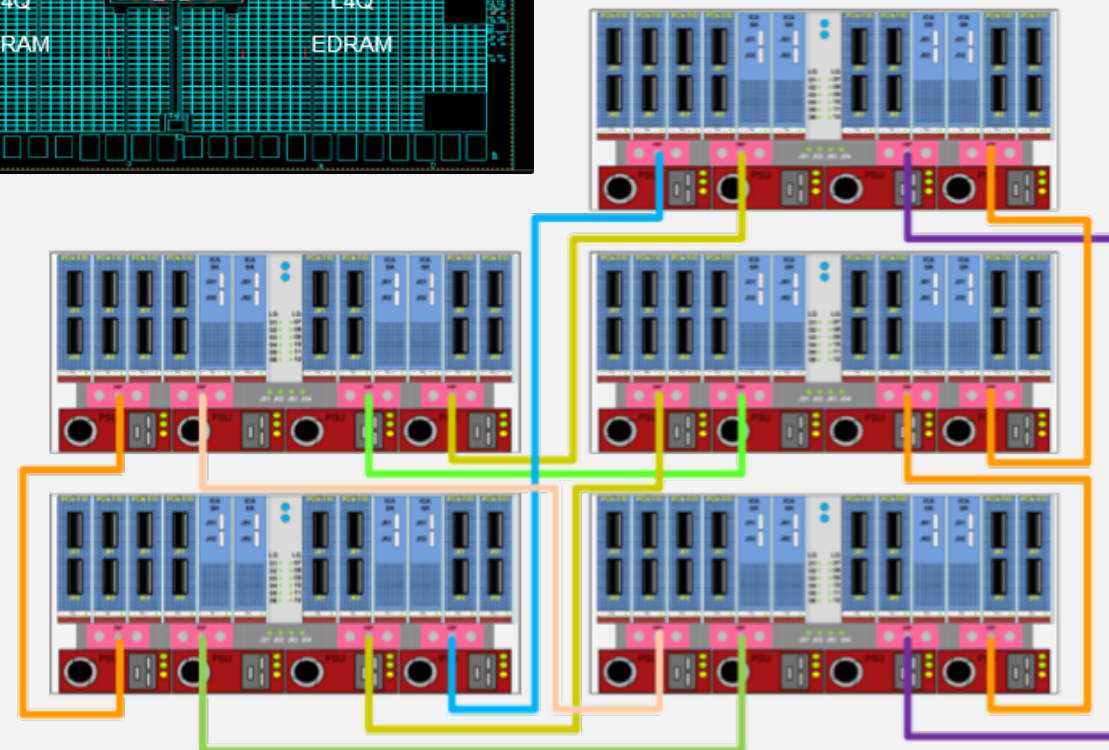
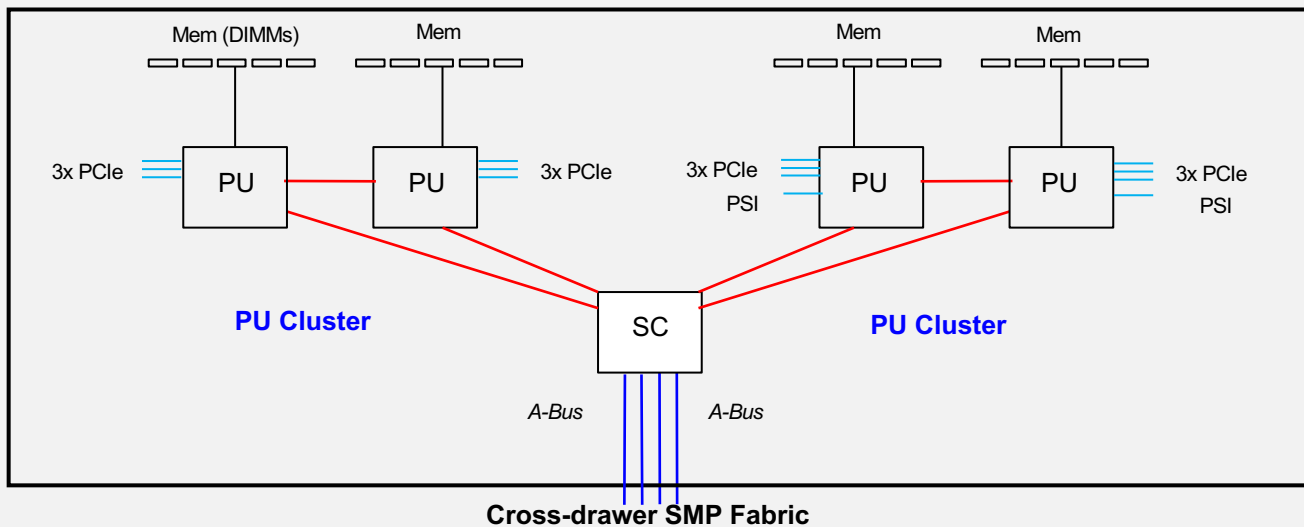


# z15 SC Chip

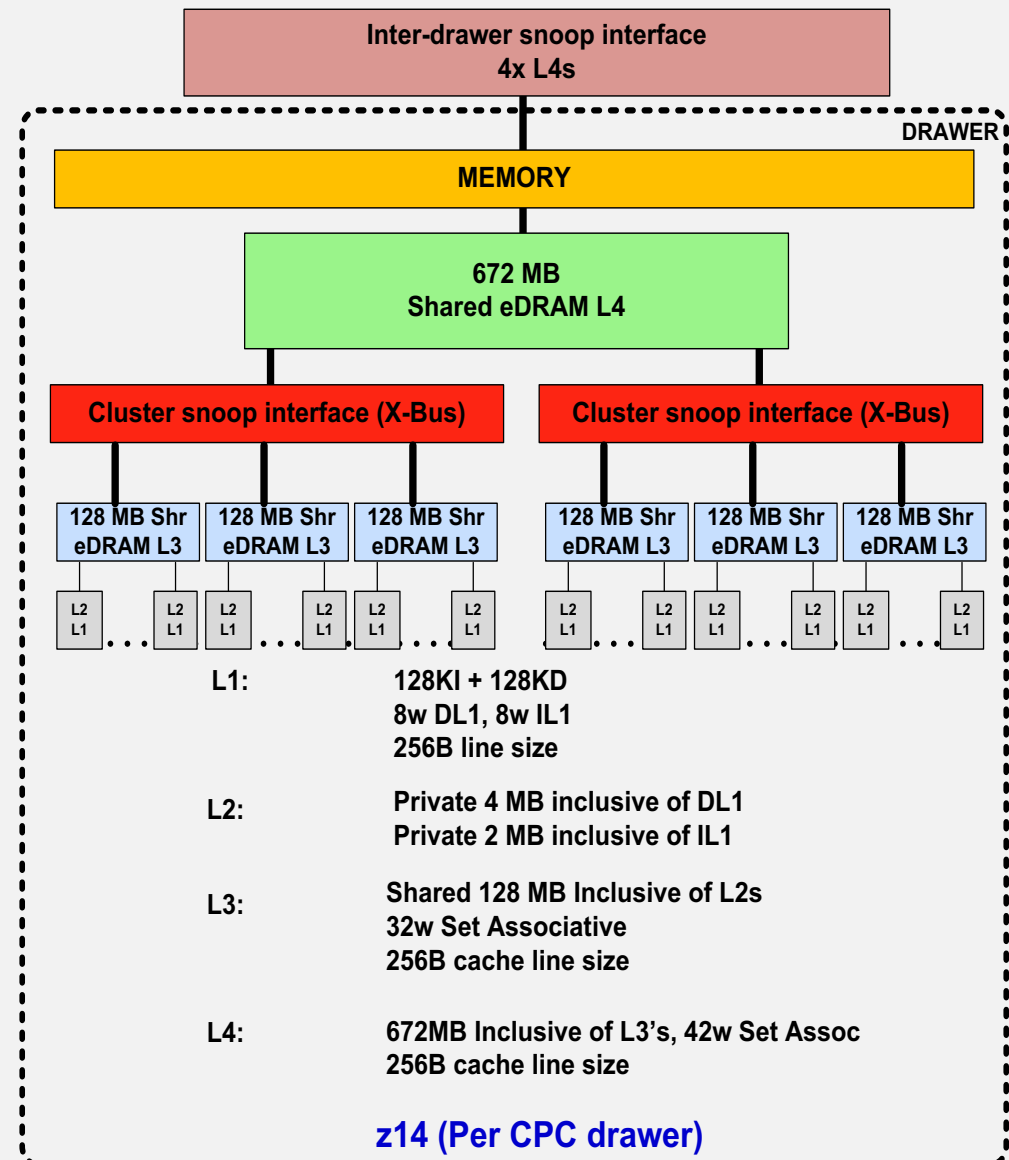
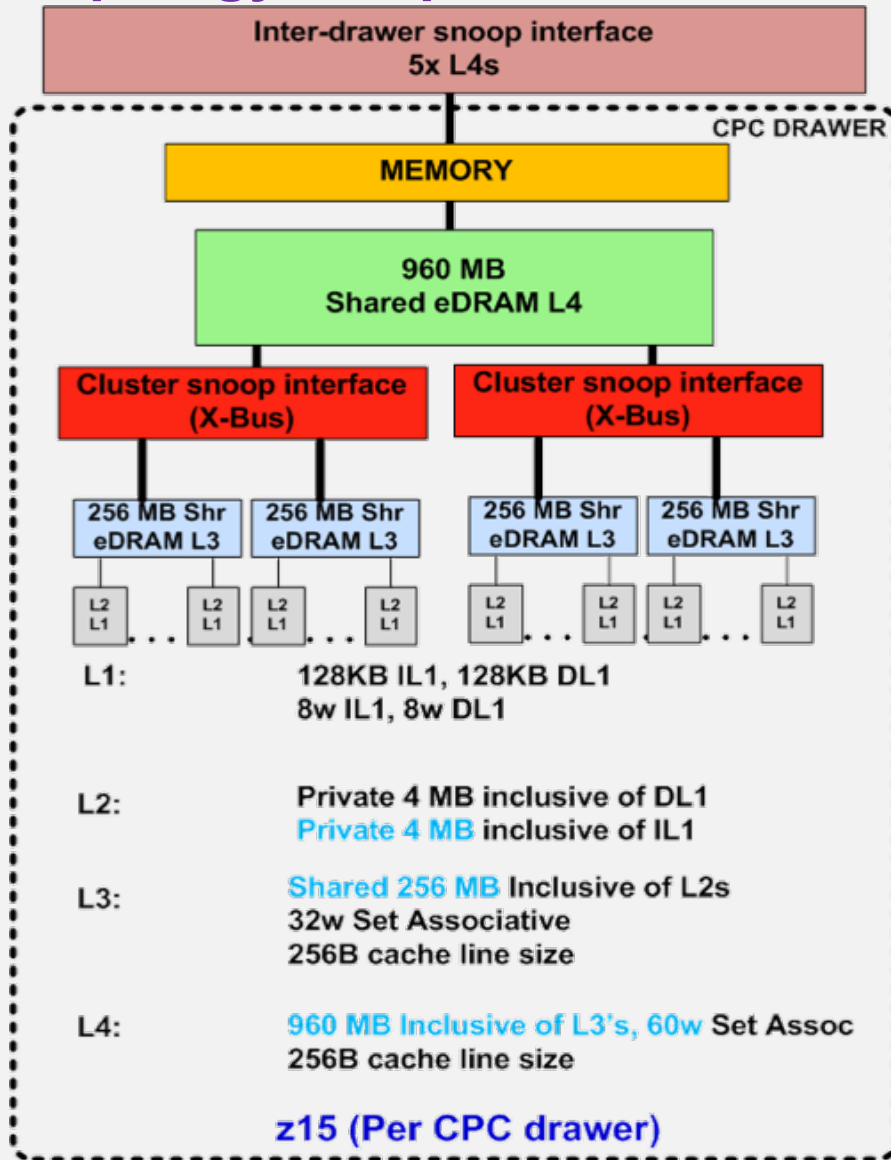
- 14nm SOI technology
- 960 MB shared eDRAM L4 Cache
- System Interconnect
- System Coherency Manager
- X and A Bus - Support for:
  - 4 CPs using 4 x-buses
  - 5 drawers using 4 A-buses (point-to-point).



Fully Populated Drawer



# Cache topology comparison: z15 vs. z14

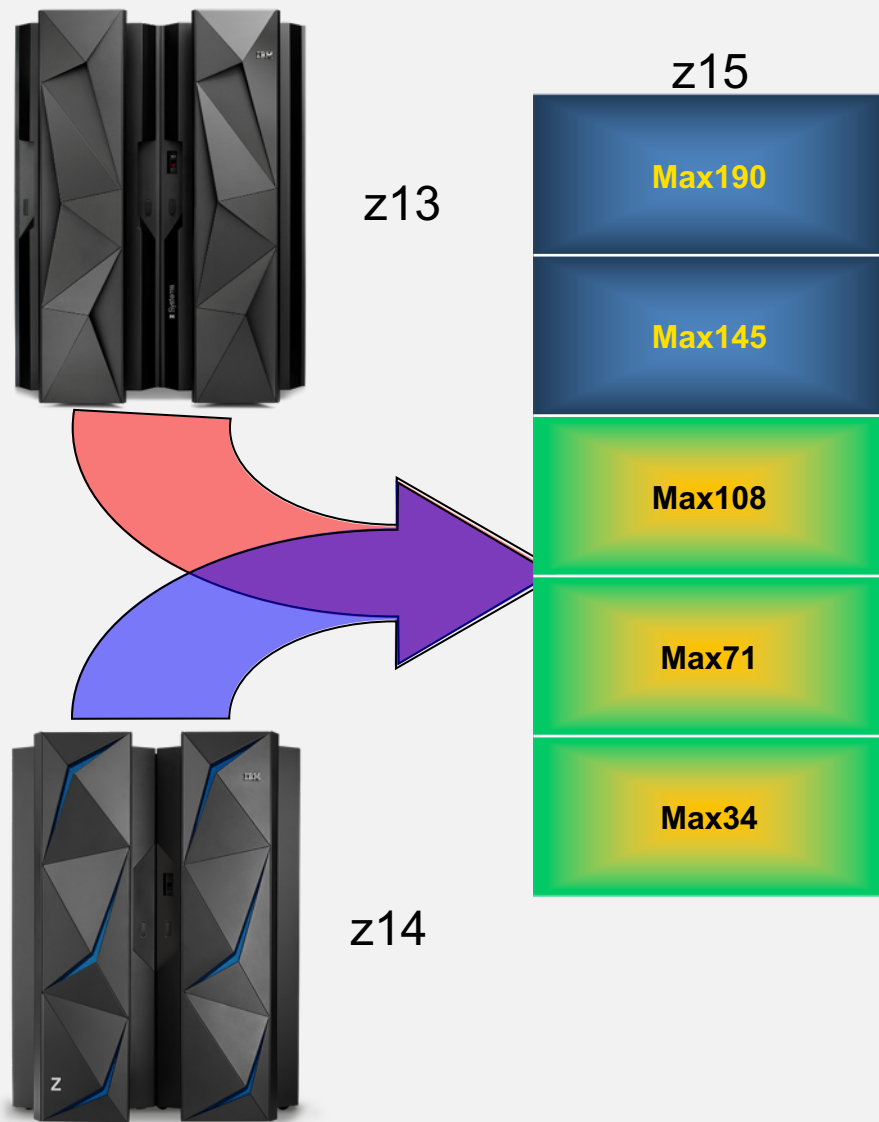


## z15 Capacity Considerations

| Feature | Feature Code | Drawers/<br>Cores | CPs   | IFLs<br>uIFLs  | zIIPs | ICFs  | Std<br>SAPs | Optional<br>SAPs | Std.<br>Spares | IFP | Memory |
|---------|--------------|-------------------|-------|----------------|-------|-------|-------------|------------------|----------------|-----|--------|
| Max34   | 0655         | 1/41              | 0-34  | 0-34<br>0-33   | 0-22  | 0-34  | 4           | 0-8              | 2              | 1   | 8 TB   |
| Max71   | 0656         | 2/82              | 0-71  | 0-71<br>0-70   | 0-46  | 0-71  | 8           | 0-8              | 2              | 1   | 16 TB  |
| Max108  | 0657         | 3/123             | 0-108 | 0-108<br>0-107 | 0-70  | 0-108 | 12          | 0-8              | 2              | 1   | 24 TB  |
| Max145  | 0658         | 4/164             | 0-145 | 0-145<br>0-144 | 0-96  | 0-145 | 16          | 0-8              | 2              | 1   | 32 TB  |
| Max190  | 0659         | 5/215             | 0-190 | 0-190<br>0-189 | 0-126 | 0-190 | 22          | 0-8              | 2              | 1   | 40 TB  |

1. At least one CP, IFL, or ICF must be purchased in every machine.
2. Two zIIPs may be purchased for each CP purchased if cores are available. (2:1). This remains true for sub-capacity CPs and for “banked” CPs.
3. “uIFL” = Unassigned IFL
4. The IFP is conceptually an additional, special purpose SAP – used by PCIe I/O features, and Dynamic I/O for Standalone Coupling Facility.
5. The Max142 and Max 190 is factory build only

## MES/Model Considerations



### ▪ z15 to z15 upgrades

- z15 Concurrent upgrade from Max 34 to Max71 to Max108

- Each max level adds a CEC drawer

- No MES upgrade to Max145 or Max190

- Additional I/O Drawers

- Based on available space in current frames and/or I/O expansion frames

- No conversion available between power types*

### ▪ Any z13 to any z15

### ▪ Any z14 M01- M05 to any z15

### ▪ No LinuxONE model conversions to LinuxONE III

### ▪ LinuxONE III to z15 MES available



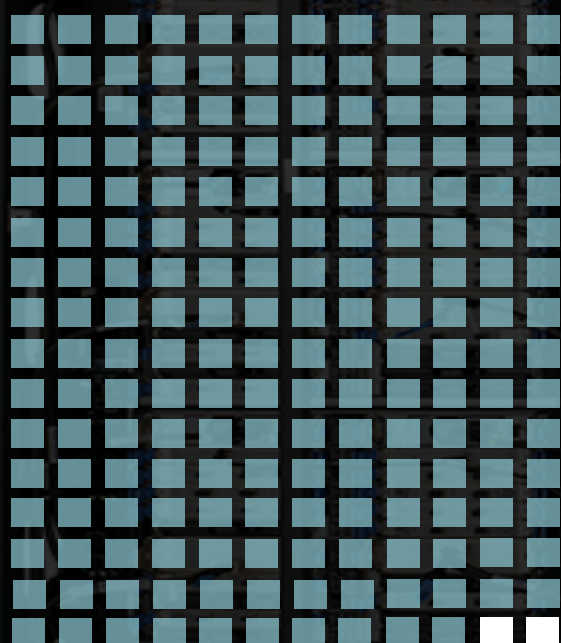
# Integrated system design for z15

Up to 190 cores  
on a CPC

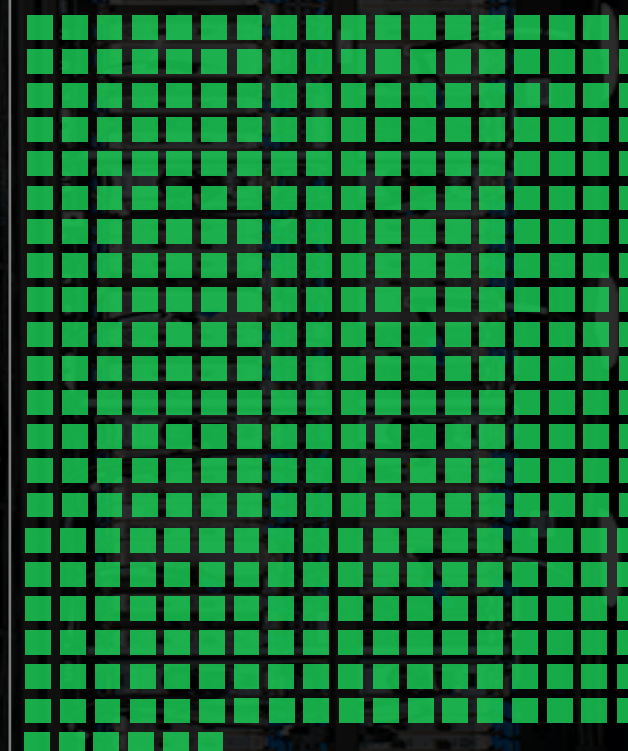
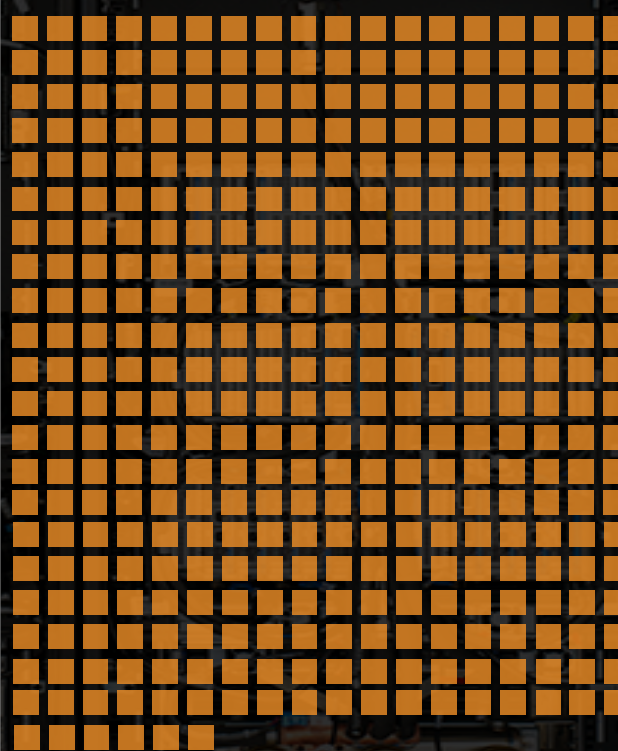
Up to 22 cores for  
offload system  
processing

Plus up to 384  
POWER® cores:  
I/O and Coprocessors

Plus up to 384  
RAS cores



22 SAPs  
1 IFP



- Share up to 190 processors with up to 85 LPARS
- **2 Spares**
- Configure the processors as CPs, IFLs, zIIPs, or ICFs

# z15 Memory

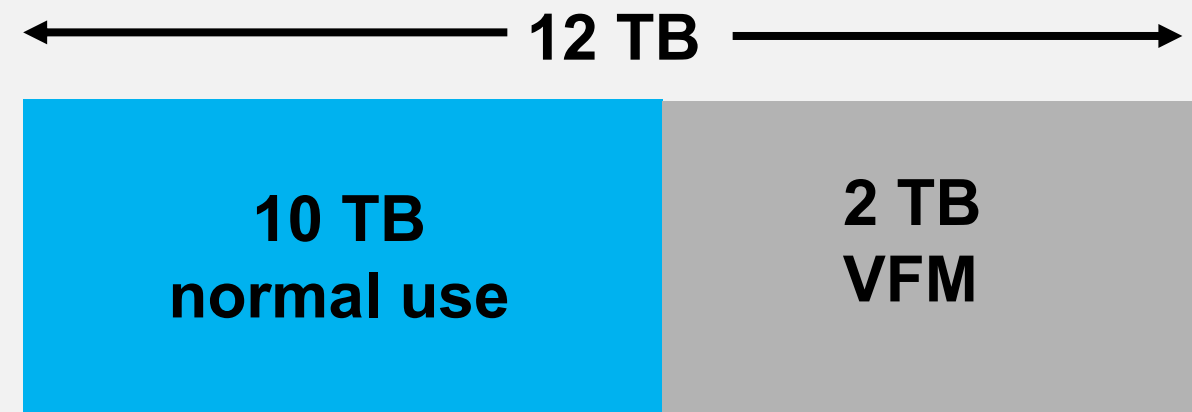
## z15 Purchased Memory Offering Ranges

| Feature | Standard Memory GB (Min* – Max) | Flexible Memory GB |
|---------|---------------------------------|--------------------|
| Max34   | 512 - 7936                      | NA                 |
| Max71   | 512 - 16128                     | 512 - 7936         |
| Max108  | 512 - 24320                     | 512 - 16128        |
| Max145  | 512 - 32512                     | 512 - 24320        |
| Max190  | 512 - 40704                     | 512 - 32512        |

- Purchased Memory – Memory available for assignment to LPARs
- Hardware System Area – Standard 256 GB of addressable memory for system use outside customer memory
- Standard Memory – Provides minimum physical memory required to hold customer purchase memory plus 256 GB HSA
- Flexible Memory – Provides additional physical memory needed to support activation base customer memory and HSA on a multiple CPC drawer z15 with one drawer out of service.
- **No Plan Ahead Memory for new orders.**
  - Existing Plan Ahead memory can be carried forward during an upgrade.

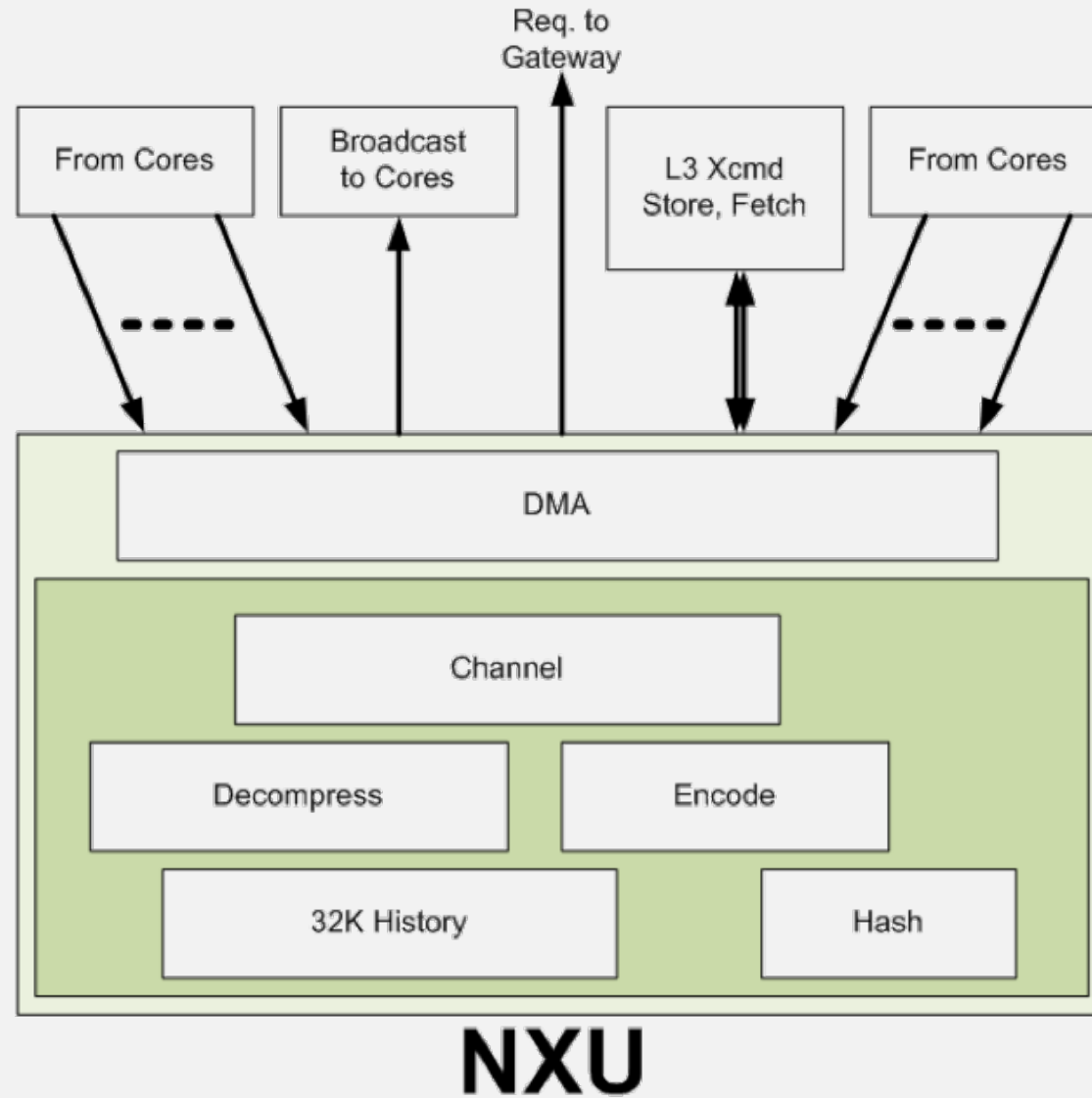
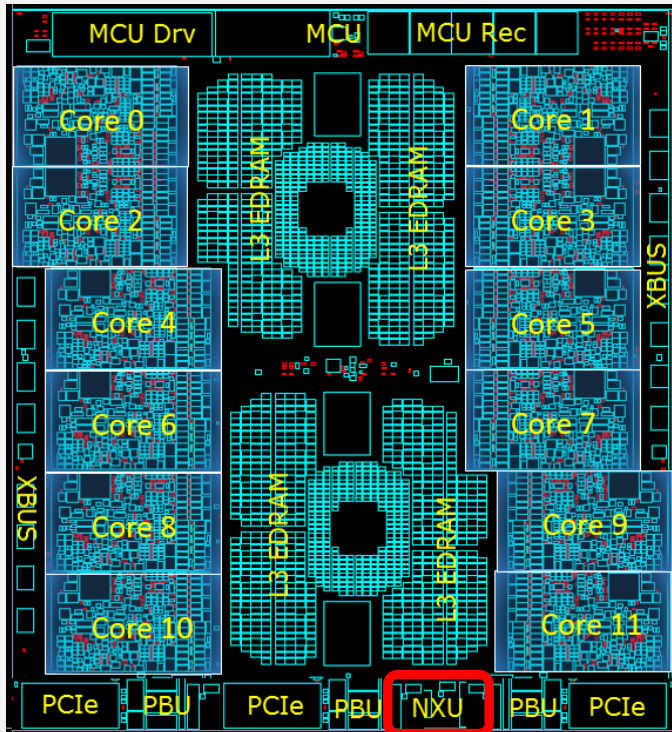
## IBM Virtual Flash Memory

- Replacement for IBM Flash Express I/O features – same use cases.
- Saves at least two PCIe I/O Drawer Slots from z13 upgrade
- Less power consumption
- During z13 upgrade, Feature Conversion for IBM Flash Express
- z14 offered 4 VFM features at 1.5 TB per feature for a total of 6TB
- **Increment Size**
  - Up to twelve features/increments
    - 0.5 TB | 1.0 TB | 1.5 TB | 2.0 TB
    - 2.5 TB | 3.0 TB | 3.5 TB | 4.0 TB
    - 4.5 TB | 5.0 TB | 5.5 TB | 6.0 TB



# z15 New Features and Functionality

# z15 Integrated Accelerator – Design Overview





## z15 Integrated Accelerator for zEDC

- Compression/Decompression implemented in Nest Accelerator Function
  - Replacement for existing zEDC Express adapter in I/O drawer
  - Nest accelerator unit per processor chip, shared by cores on this chip
  - Supports **DEFLATE compliant compression/decompression + GZIP CRC/ZLIB Adler**
- Brand new concept of sharing and operating an accelerator function in the nest
  - Low Latency
  - High Bandwidth
  - Problem State Execution
  - HW/FW Interlocks to ensure System Responsiveness
- Architected Instruction
  - Executed in Millicode
  - Operating shared HW accelerator on behalf of issuing core
- zEDC Express devices will NOT CARRY FORWARD

## Integrated Accelerator for zEDC – z15

|                                       | IBM z14™ with zEDC Express   | z15 with Integrated Accelerator for zEDC   |
|---------------------------------------|--|--|
| Application elapsed time              | Application elapsed time is affected by the time required for the data to be offloaded to and retrieved from the zEDC adapter (PCIe infrastructure in the PCIe I/O Drawer) | Up to 8x faster application elapsed time with no additional CPU time using IBM z15 Integrated Accelerator for zEDC compared to z14 zEDC Express for both compression and decompression.* |
| Total CEC Throughput                  | Fully Configured z14 – 16 GB/s   | Compress up to 260 GB/sec with the Integrated Accelerator for zEDC on the largest IBM z15.**   |
| Virtualization                        | 15 LPARs or VMs per adapter  | All LPARs and VMs have 100% access   |
| Capacity Planning                     | Clients run zEDC cards at 30-50% to handle LPAR consolidation for DR   | Enable everything – More than enough throughput  |
| Compatibility                         | Full compatible with z15   | Fully compatible with zEDC   |
| Sequential Data Sets                  | Selectively enabled by application   | Enable everything – More than enough throughput  |
| Migration to Tape or VTS              | Balanced against data set compression  | Enable everything – More than enough throughput  |
| Network Traffic (e.g. Connect:Direct) | Enabled only if enough capacity available  | Enable everything  |
| Linux on Z Support                    | Limited client adoption, virtualization layer adding complexity and affecting throughput   | Fully available for Open Source software – NO virtualization employed (on-chip engine)<br>NEW DIFFERENTIATION AGAINST Linux on other platforms   |

# Unparalleled Business Continuity and Resiliency for the Digital Age

## System Recovery Boost

For the *ultimate* boost



**UNLEASH** the power of IBM Z

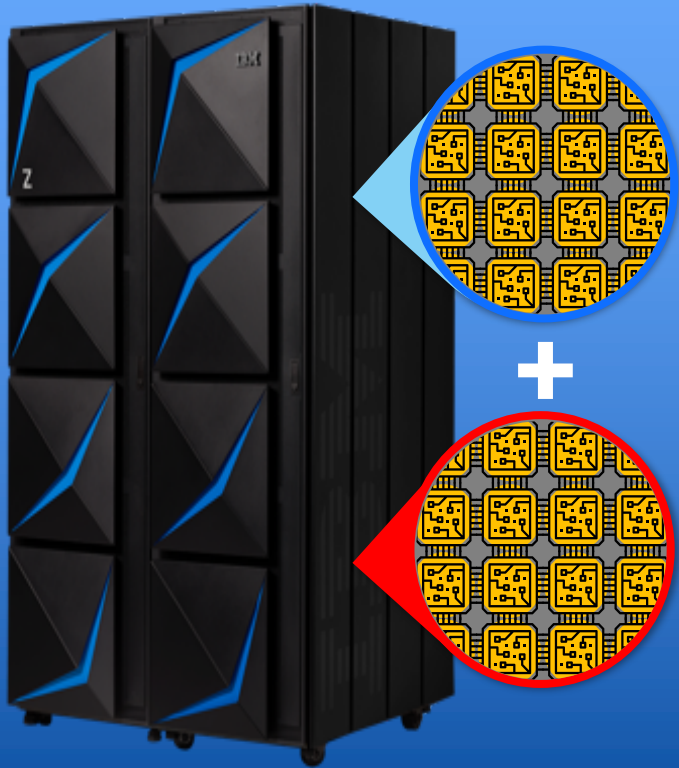
Restore normal service and catch up after both planned and unplanned events faster than on any previous Z machine...

- ✓ *Faster IPL and subsystem/middleware restart and recovery*
- ✓ *Faster recovery of production workload*
- ✓ *Boosted capacity to deliver on SLAs catch up on workload faster*
- ✓ *Faster GDPS reconfiguration for automated start-up, shut-down, site switches, etc.*
- ✓ *Easy set-up and management*
- ✓ *Available for every IBM z15*
  - ✓ *Turn subcapacity processors to full capacity per LPAR*
  - ✓ *Allow GP work to be run on currently available zIIPs*

**...all without introducing additional IBM software MSU consumption and cost!**

# Unparalleled Business Continuity and Resiliency for the Digital Age

## System Recovery Boost *For the ultimate boost*



**UNLEASH** the power of IBM Z

Unlock additional dark capacity when you need it the most through the '**System Recovery Boost**' offering

- ✓ Up to 20 engines additional capacity / 6 hour duration
- ✓ Takes advantages of unused, but available dark cores (elastic capacity).
- ✓ Annual subscription for unlimited entitlement.
- ✓ No capacity planning needed.
- ✓ Simple activation via temporary capacity record.





## Overview

- System Recovery Boost expedites planned system shutdown processing, system IPL, middleware/workload restart and recovery, and the client workload execution that follows, by

### 1. Processor Capacity Boost using zIIPs

- a) Using the client's already-entitled GPs and zIIPs
- b) System Recovery Boost Record
  - CoD like record activating unused/available processor resources on the machine to provide additional zIIP processors and capacity.  
(Priced Feature)

### 2. Speed Boost

On sub-capacity machine models, providing a Boost in processor speed by running the GP processors at full-capacity speed, for the Boosting images, during the Boost period.

### 3. Expedited GDPS Reconfiguration

Expediting and parallelizing GDPS reconfiguration actions that may be part of the client's restart, reconfiguration, and recovery process

- Boost features can be used together and are enabled on a **per LPAR basis**
  - Supported operating systems **z/OS, z/VM, z/TPF\*, and zVSE\***
- **30 minutes for shutdown, 60 minutes for IPL, and 6 Hours for System Recovery Boost Record.**
- All this without increasing the 4HRA IBM software billing cost or MSU consumption costs

## System Recovery Boost

- **BOOST={SYSTEM | ZIIP | SPEED | NONE}**
- SYSTEM: activate whichever boosts the machine and environment accommodates.
- SPEED: Must be on a sub-capacity processor.
- zIIP: HIPERDISPATCH=YES on a non-dedicated partition.
- NONE: neither boost. NO can be used as a synonym of NONE.
- DISPLAY IPLINFO,BOOST can be used to display the value used.

## Fibre Channel Endpoint Security

*Clients who desire to ensure business and customer data is accessed only by trusted servers and storage devices within and across datacenters can leverage the IBM Z Fibre Channel Endpoint Security ...*

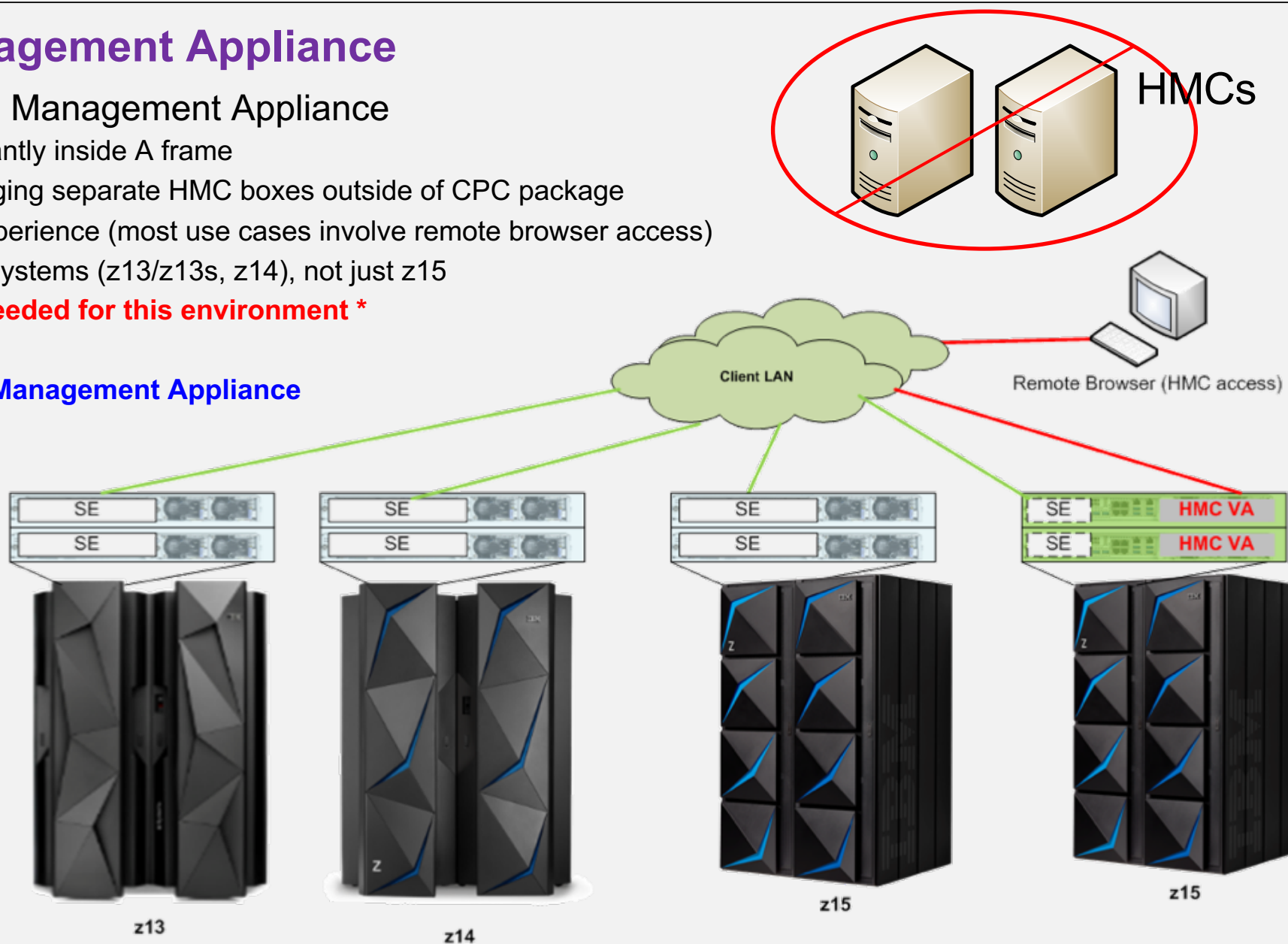
***without application, operating system, or file system changes and without consuming host CPU cycles.***

- Enabled automatically between host and storage endpoints that are 'security-capable'
- Each established link must 'prove' its identity as a trusted component
- Trusted connections are identified; visible to both OS and HMC
- Policy can be established to enforce that only trusted connections can be made
- Each time a link goes down/up re-authentication/negotiation of encryption keys occurs
- Zero host CPU cost
- Integrated key management

## IBM Z Hardware Management Appliance

- z15 introduces Hardware Management Appliance
  - HMC & SE packaged redundantly inside A frame
  - Eliminates the need for managing separate HMC boxes outside of CPC package
  - No change in general user experience (most use cases involve remote browser access)
  - Can be used to manage N-2 systems (z13/z13s, z14), not just z15
  - **NO Standalone HMCs are needed for this environment \***

**Note: z15 HMC and Hardware Management Appliance support ONLY N-2 Servers**



## Protect sensitive data in dumps

### Today:



In sending data in dumps to vendors, clients risk accidentally sharing sensitive data—putting themselves at risk in more ways than one.

Organizations are forced to make a choice between **regulatory compliance** and **serviceability**.

### With z15:



With peace of mind, knowing that data in dumps will be appropriately protected, clients can more easily collaborate with vendors to fix major issues.

This solution would ensure that open problems can be addressed without fear of sensitive data exposure.

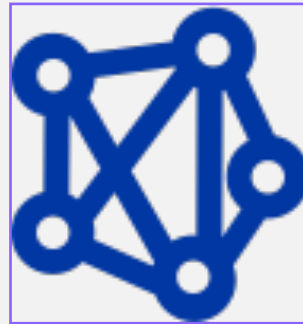


## Protect sensitive data in diagnostic dumps – how to?



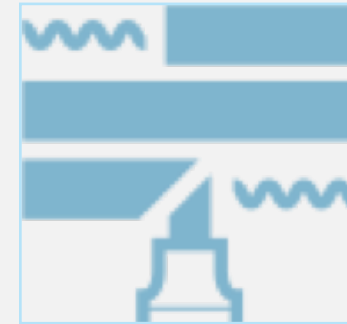
Must identify sensitive data in order to secure it

- Tag via z/OS APIs
  - Sensitive=yes, if user data
  - Sensitive=no, if meta data



Detect via Machine Learning (ML)

- Interrogate untagged data in a complete dump
- Tag if sensitive data is discovered



Ways of protecting sensitive data

- Redacting or sanitizing
  - Enforced data (irreversible)
- Encrypting (not MVP)
  - Protected data (reversible)

## What is PTP and why it is introduced to STP?

- The PTP Standard has been originally approved in 2002, with update in 2008:
  - Provides more accurate timestamps to connected devices
  - Initially used for Power Distribution Systems, Telecommunications, and Laboratories
  - **Requires Customer Network Infrastructure to be PTP-capable**
  - **Accuracy comparison\*** :
    - NTP – synchronize to within 100 milliseconds
    - NTP with Pulse Per Second – to within 10 microseconds
    - PTP – to sub-microsecond accuracy
- Regulatory requirements for time synchronization (to UTC):
  - Financial Industry Regulations
    - FINRA - 50 milliseconds
    - MiFID II - 100 microseconds
  - Payment Card Industry (PCI) Requirements and Security Assessment Procedures V3.2.1 (May 2018) requires an auditable, tightly synchronized system for credit card companies
- How will z15 use PTP?
  - New External Time Source (like NTP is used today)
  - Use of PTP is optional – customers can continue to use NTP
  - PTP will be provided via the Support Element

## LPAR placement improvements

| Drawer 1  |    |           |    | Drawer 2  |    |           |    | Drawer 3  |    |           |    | Drawer 4  |    |           |    | Drawer 5  |    |           |    |
|-----------|----|-----------|----|-----------|----|-----------|----|-----------|----|-----------|----|-----------|----|-----------|----|-----------|----|-----------|----|
| Cluster 1 |    | Cluster 2 |    | Cluster 1 |    | Cluster 2 |    | Cluster 1 |    | Cluster 2 |    | Cluster 1 |    | Cluster 2 |    | Cluster 1 |    | Cluster 2 |    |
| C1        | C2 | C1        | C2 | C1        | C2 | C1        | C2 | C1        | C2 | C1        | C2 | C1        | C2 | C1        | C2 | C1        | C2 | C1        | C2 |

- **Chip level optimization**
- **Movement of IFL processors and ICF processors**
  - Isolation of GP+ZIIP, IFL and ICF by chip, to the degree possible to avoid cross sharing of cache
- **In the rare situation where a logical partition's processors span more than one drawer, the memory for the partition will be consolidated into the drawer with the maximum entitlement, if possible (for Dedicated and Hiperdispatch=YES partitions only)**
- **Memory movement within clusters of a drawer**
- **Global Activation**

Check placement every 50 seconds

  - LPAR Act/Deact, Sparring Event
- **Value – Optimal placement of partitions translates to better performance of partitions**

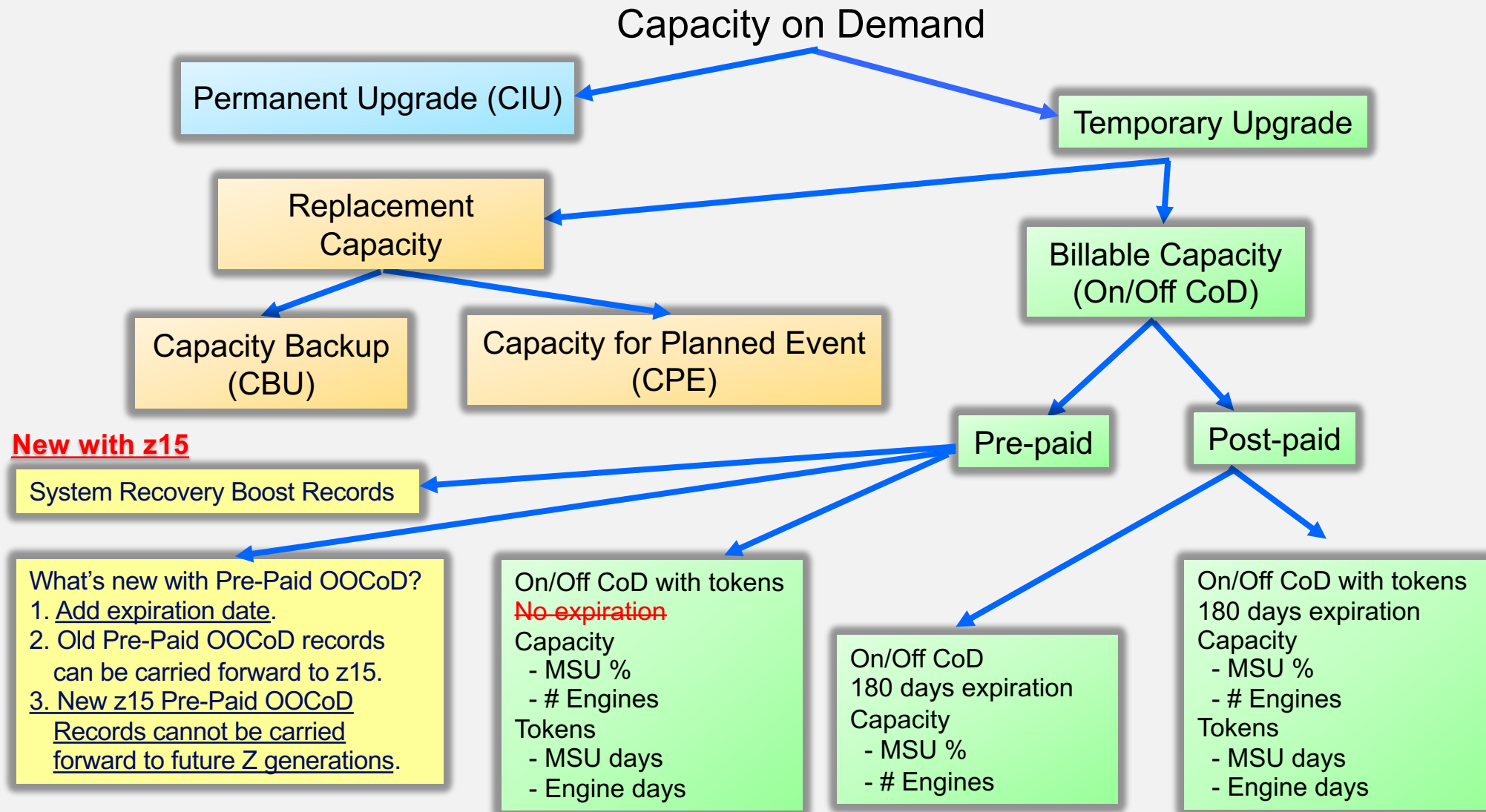
# Capacity on Demand

## Capacity on Demand (CoD) Offerings

- On-line Permanent Upgrade
  - Permanent upgrade performed by customer
- Capacity Backup (CBU)
  - For disaster recovery
  - Concurrently add CPs, IFLs, ICFs, zIIPs, SAPs
  - Pre-paid
- Capacity for Planned Event (CPE)
  - To replace capacity for short term lost within the enterprise due to a planned event such as a facility upgrade or system relocation
  - Predefined capacity for a fixed period of time (3 days)
  - Pre-paid
- On/Off Capacity on Demand (On/Off CoD) \*
  - Production Capacity
  - Supported through software offering – Capacity Provisioning Manager (CPM)
  - Payment:
    - Post-paid or Pre-paid by purchase of capacity tokens
    - Post-paid with unlimited capacity usage
    - On/Off CoD records and capacity tokens configured on Resource Link
- Customer Initiated Upgrade (CIU)
  - Process/tool for ordering temporary and permanent upgrades via Resource Link
  - Permanent upgrade support:
    - Un-assignment of currently active capacity
    - Reactivation of unassigned capacity
    - Purchase of all PU types physically available but not already characterized
    - Purchase of installed but not owned memory
- New with z15: System Recovery Boost record:
  - Pre-paid temporary zIIP capacity for boost events – shutdown (30 min/event) , restart (IPL) (60 minutes/event):
  - Contract enablement (boost authorization): 9930
  - 20 zIIPs \* 6 Hours for **one year**: FC 6802



# z15 Basics of Capacity on Demand



# z15 I/O Infrastructure

# Logical channel subsystems (LCSS), subchannel sets (SS), Function Definitions, and Logical Partitions

- **Up to 85 Customer Logical Partitions: 15 each in LCSS 0 – 4, 10 in LCSS 5**
- **Six Logical Channel Subsystems (LCSS) each with four subchannel sets (SS) and up to 256 channels**
  - Maximum channel count includes channels spanned to more than one LCSS
  - Total physical channels depend on I/O features configured
  - Up to 63.75k base IODEVICES in SS 0 and 64 k alias IODEVICES each in SS 1 to SS 3 per LCSS

| z15   |   |   |   |   |   |
|---|---|---|---|---|---|
| HSA fixed at 256 GB   |   |   |   |   |   |
| LCSS 0  | LCSS 1  | LCSS 2  | LCSS 3  | LCSS 4  | LCSS 5  |
| Up to 15 Logical Partitions   | Up to 15 Logical Partitions   | Up to 15 Logical Partitions   | Up to 15 Logical Partitions   | Up to 15 Logical Partitions   | Up to 10 Logical Partitions   |
| Subchannel Sets:<br>SS 0 – 63.75 k<br>SS 1 – 64 k<br>SS 2 – 64 k<br>SS 3 – 64 k | Subchannel Sets:<br>SS 0 – 63.75 k<br>SS 1 – 64 k<br>SS 2 – 64 k<br>SS 3 – 64 k | Subchannel Sets:<br>SS 0 – 63.75 k<br>SS 1 – 64 k<br>SS 2 – 64 k<br>SS 3 – 64 k | Subchannel Sets:<br>SS 0 – 63.75 k<br>SS 1 – 64 k<br>SS 2 – 64 k<br>SS 3 – 64 k | Subchannel Sets:<br>SS 0 – 63.75 k<br>SS 1 – 64 k<br>SS 2 – 64 k<br>SS 3 – 64 k | Subchannel Sets:<br>SS 0 – 63.75 k<br>SS 1 – 64 k<br>SS 2 – 64 k<br>SS 3 – 64 k |
| Up to 256 Channels  | Up to 256 Channels  | Up to 256 Channels  | Up to 256 Channels  | Up to 256 Channels  | Up to 256 Channels  |

## CPC & PCIe+ I/O Drawer Structure and Interconnect

### Max drawer count power dependent

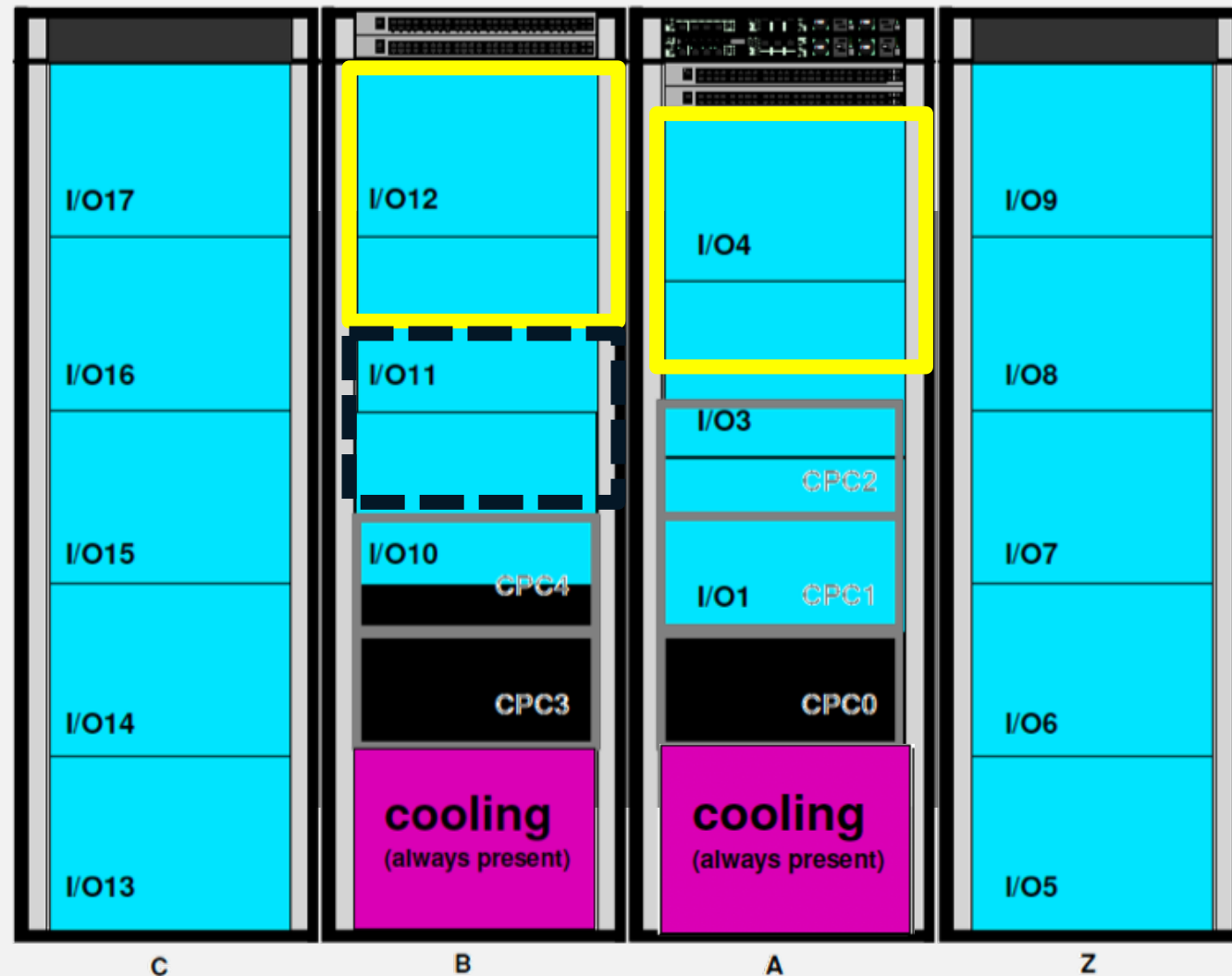
| Power Type                     | Max PCIe+ I/O Drawers | Max PCIe I/O Cards |
|--------------------------------|-----------------------|--------------------|
| iPDU (Power Distribution Unit) | 12                    | 192                |
| BPA (Bulk Power Assembly)      | 11                    | 176                |

### I/O drawer location configuration dependent

- Placement starts above the CPU Drawers in the A Frame and expands to the Z frame then the C Frame
- B Frame is "Factory build only", included if Max145 or Max190 are ordered

### Fanout Management

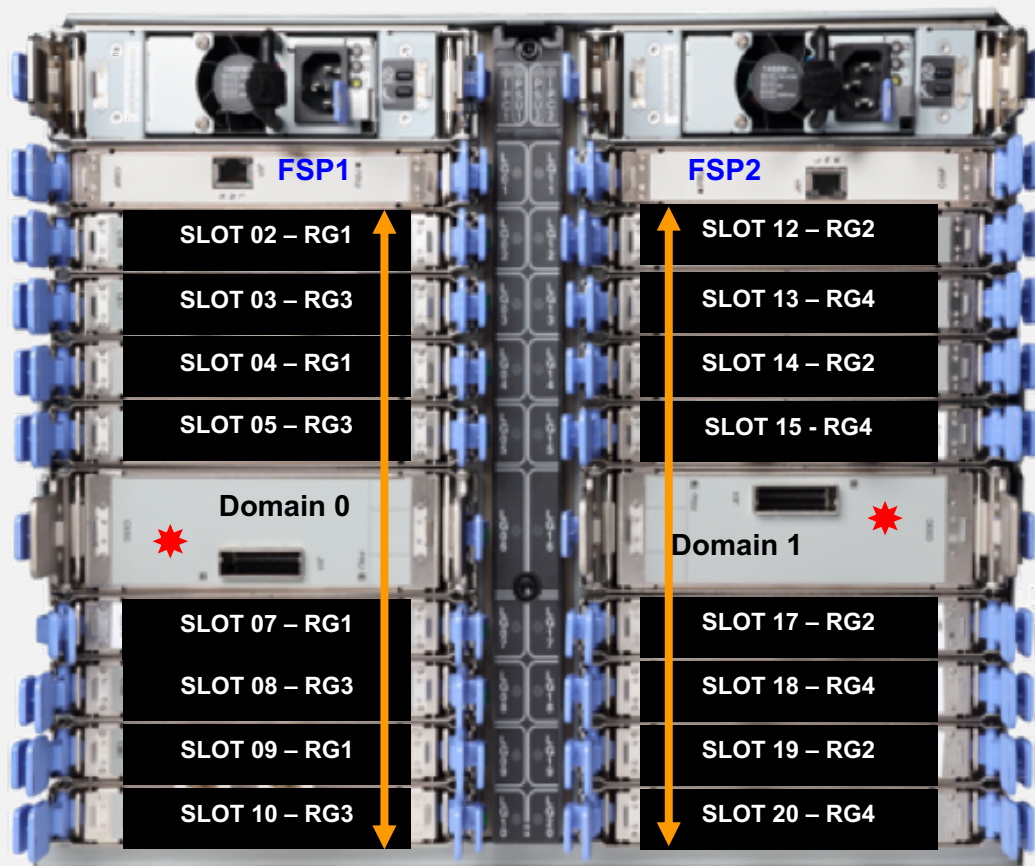
- Plugging will be balanced across all CPC Drawers
  - Fanout cable lengths will account for potential future rebalancing.
- New internal cabling routing system will ensure all fanout cables will be organized and out of way of any component needing service



■ BPA Components  
 I/O Drawer 11 shifted location

Possible I/O drawer Locations  
Rear View

## PCIe+ I/O Drawer – 16 slots



- **Supports PCIe I/O cards**

- First introduced on the z14 ZR1/Rockhopper II
- PCIe+ I/O drawers locations are dependent on power type (BPA or iPDU) and CPC drawer count.

- **Supports 16 PCIe I/O cards, horizontal orientation, in two 8-card domains.**

8U

- **Requires two 16 GBps PCIe Interconnect cards (★), each connected to a 16 GBps PCIe+ Fanout Gen3 to activate both domains.**

- **To support Redundant I/O Interconnect (RII) between domain pairs 0/1 the interconnects to each pair will be from 2 different PCIe+ Fanout Gen3.**

- **Concurrent repair of drawer & concurrent install of all I/O features (hot plug).**



## A new Chip Design

### What's Changed:

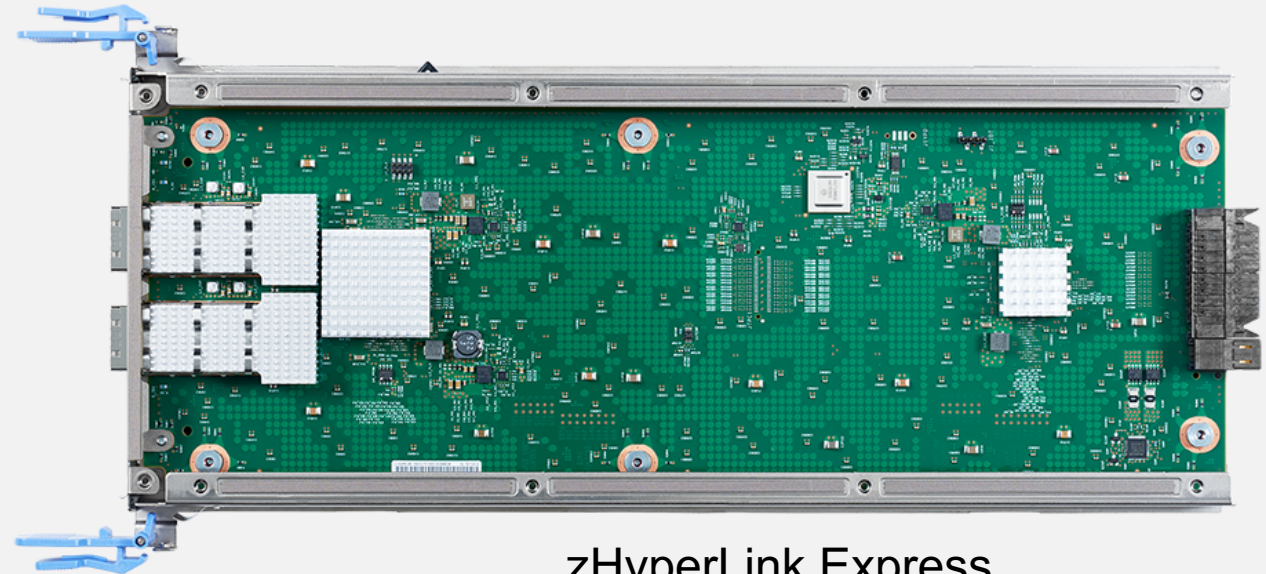
- IBM has introduced new componentry onto all new build I/O cards on for the z15 to address components at end of life

### Features Affected:

- All new build I/O Cards
  - Carry forward not affected







### Changes to these features

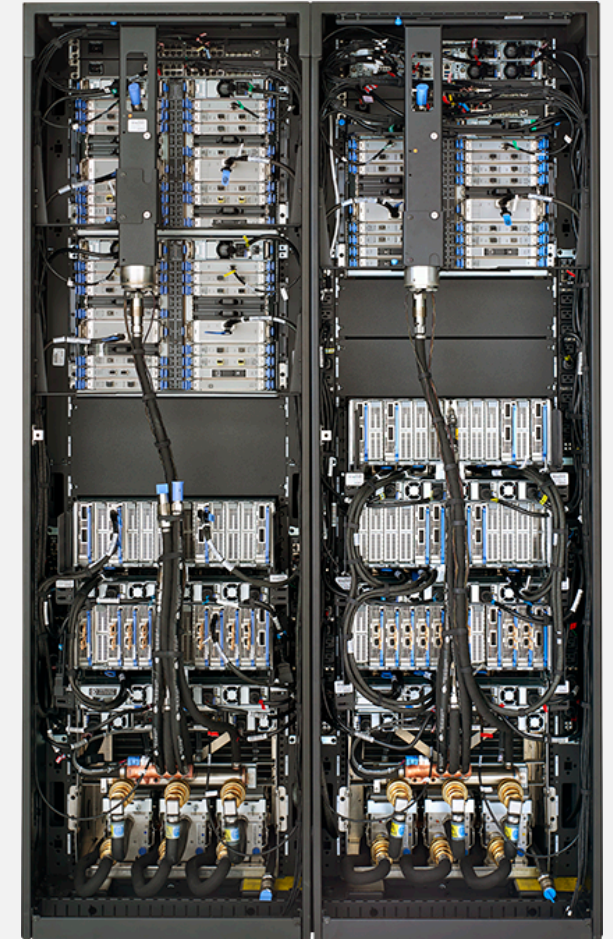
- **No functional change to the card.**
- z15 new build I/O cards will have a different Feature Code from the previous generation.
  - Example
    - OSA-Express7s 25 GbE      z14 FC 0429 / z15 FC 0449
    - zHyperlink Express      z14 FC 0431 / z15 FC 0451




zHyperLink Express

## z15 I/O Features (new build)

- **FICON Express16SA**
  - FC 0436, 0437
- **zHyperLink Express1.1** 
  - FC 0451
- **OSA Express7S:**
  - 25 GbE SR1.1, GbE (LX, SX) 10GbE (LR, SR) , 1000BASE-T; FC 0442, 0443, 0444, 0445, 0449, 0446
- **10GbE RoCE Express2.1;**
  - FC 0432
- **25GbE RoCE Express2.1;**
  - FC 0450
- **Crypto Express7S;**
  - FC 0899, 0898
- **Coupling Express LR;** 
  - FC 0433
- **Integrated Coupling Adapter (ICA) SR1.1;** 
  - FC 0176
- **IBM Adapter for NVMe1.1;** 
  - FC0448
- **FCP Express32S;**  
  - FC 0438, 0439



 z15 Only

 LinuxONE III Only

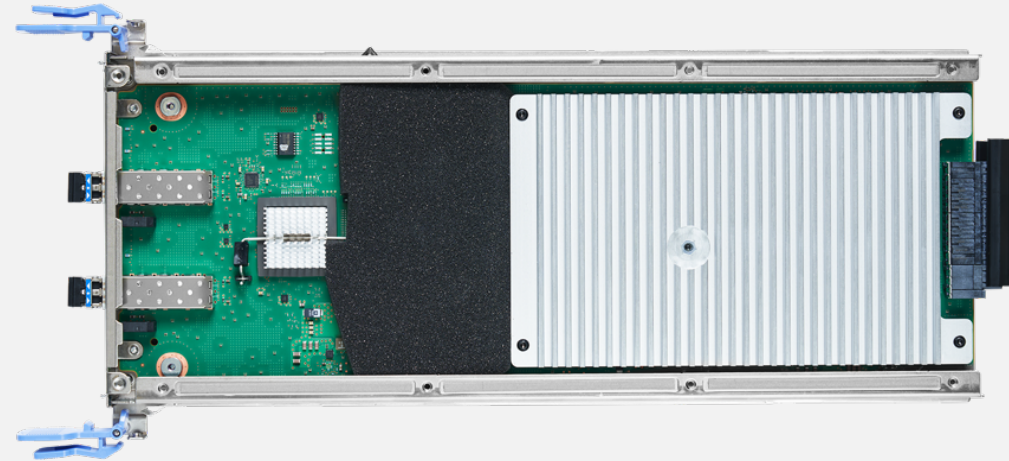
**No InfiniBand Coupling Links**

## z15 I/O Features – Carry Forward

- **FICON Express16S+**
  - FC 0427, 428
- **FICON Express16S**
  - FC 0417, 0418
- **FICON Express8S**
  - FC 0409, 0410
- **OSA-Express7S 25GbE SR**
  - FC 0429
- **OSA-Express6S**
  - FC 0422, 0423, 0424, 0425, 0426
- **OSA-Express5S;**
  - FC 0413, 0414, 0415, 0416, 0417
- **10GbE RoCE Express;**
  - FC 0411
- **10GbE RoCE Express2;**
  - FC 0412
- **25GbE RoCE Express2;**
  - FC 0430
- **zHyperLink Express;**
  - FC 0433
- **Crypto Express6S;**
  - FC 0893
- **Crypto Express5S;**
  - FC 0890
- **Coupling Express LR;**
  - FC 0433
- **Integrated Coupling Adapter (ICA) SR;**
  - FC 0172

## FICON Express16SA

- **For FICON, zHPF, and FCP**
  - FC 0436 (LX) & 0437 (SX)
  - CHPID types: FC and FCP
    - Two PCHIDs/CHPIDs
    - **NO mixed CHPIDs for same card** – only FC or FCP
- **Same performance as FICON Express16S+**
- **Auto-negotiates to 8 or 16 Gbps**
  - **Negotiation to 4 Gbps NOT supported**
  - 2 and 4 Gbps supported through a switch with 8 or 16 Gbps optics
- Max. 192 features per system
- **Concurrent repair/replace of small form factor pluggable (SFP) optics**
  - Port components can be replaced instead of the entire adapter.
  - 10KM LX - 9 micron single mode fiber
    - Unrepeated distance - 10 kilometers (6.2 miles)
    - Receiving device must also be LX
  - SX - 50 or 62.5 micron multimode fiber
    - Distance variable with link data rate and fiber type
    - Receiving device must also be SX





## What is IBM zHyperLink™?

- zHyperLink Express is a direct connect short distance IBM Z I/O feature designed to work in conjunction with a FICON or High Performance FICON SAN infrastructure
- zHyperLink improves application response time, cutting I/O sensitive workload response time in half without significant application changes.
- Current Support
  - Db2 V11/V12 Read Support
  - Db2 V12 Active Log Support
  - VSAM Read Support
  - Db2 log writes with Metro Mirror support
    - The zHyperlink Write capability supports Metro Mirror and HyperSwap® within 150 meter distances.
    - Requires PTFs for z/OS and Db2®.
    - Not supported asynchronous replication (Global Mirror, zGlobal Mirror (XRC), Global Copy, Safeguarded Copy), and DS8882/F

IBM z15 CPC



Up to 5x  
reduction  
in latency

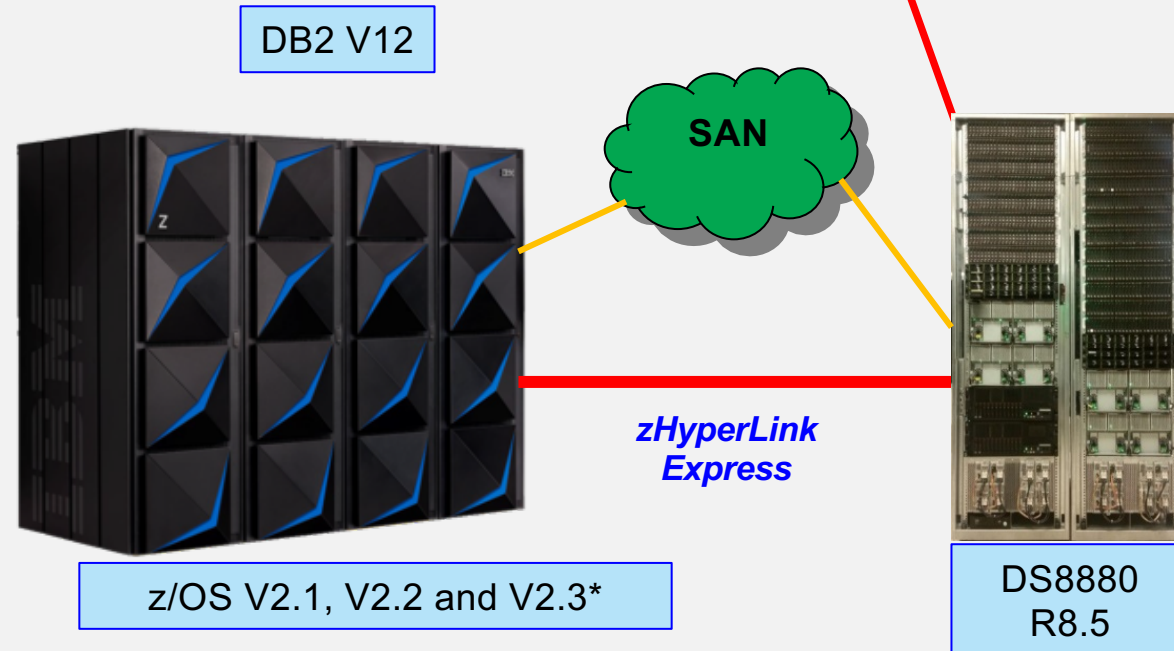
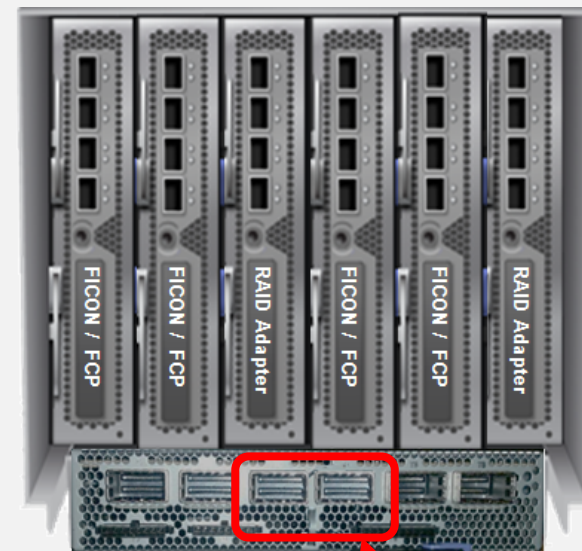
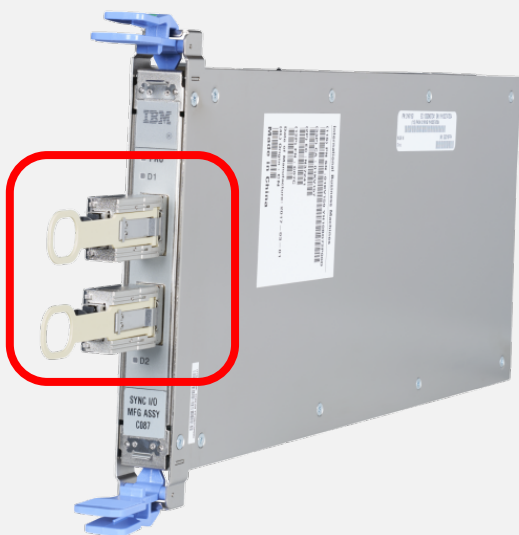


IBM DS8880



## zHyperLink Express® at a Glance\*

- Feature Code 0451 (FC 0431 carry forward)
  - Two ports per feature
  - Maximum of 16 features (32 ports)
  - Function ID Type = HYL
  - Up to 127 Virtual Functions (VFs) per port (254 per feature)
  - Point to point connection using PCIe Gen3
  - Maximum distance: 150 meters
- DS8880 models 984, 985, 986 and 988\*



## OSA Express7S 25 GbE SR1.1 – FC0449

- 25 Gigabit Ethernet (25 GbE)
  - CHPID types: OSD
  - Multimode (SR) fiber ONLY
  - One port SR
    - 1 PCHID/CHPID
  - Small form factor pluggable (SFP+) optics
  - LC Duplex
  - 25GbE does NOT auto-negotiate to a slower speed.
  - Up to 48 features per system

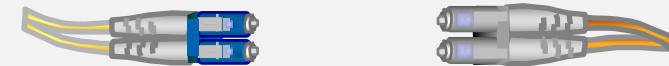


## OSA-Express7S Fiber Optic Features

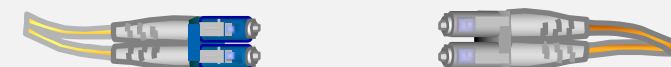
- 10 Gigabit Ethernet (10 GbE)
  - CHPID types: OSD
  - Single mode (LR) or multimode (SR) fiber
  - One port of LR or one port of SR
    - 1 PCHID/CHPID
  - Small form factor pluggable (SFP+) optics
  - LC Duplex
  - 10GbE does NOT auto-negotiate to a slower speed.
  - Up to 48 features per system (48 ports)
- Gigabit Ethernet (GbE)
  - CHPID types: OSD
  - Single mode (LX) or multimode (SX) fiber
  - Two ports of LX or two ports of SX
    - 1 PCHID/CHPID
  - Small form factor pluggable (SFP+) optics
  - LC Duplex
  - Up to 48 features per system (96 ports)



FC 0444 – 10 GbE LR | FC 0445 – 10 GbE SR

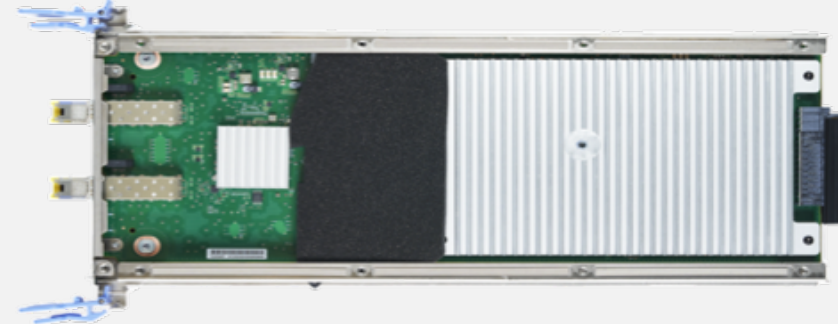


FC 0442 – GbE LX | FC 0443 – GbE SX



## OSA-Express7S 1000BASE-T

- 1000BASE-T Ethernet (1 GbE)
  - Copper Wiring
  - Two ports with RJ-45 connector
    - 1 PCHID/CHPID
  - Small form factor pluggable (SFP+) transceivers
  - Concurrent repair/replace for each SFP transceiver
  - 1000 Mbps (1 gbps full duplex) – NO negotiation to lower speeds
  - Up to 48 features per system (96 ports)



Connector = RJ-45

| Operation Mode            | CHPID TYPE | Description  |
|---------------------------|------------|--|
| OSA-ICC                   | OSC        | TN3270E, non-SNA DFT, OS system console operations             |
| QDIO                      | OSD        | TCP/IP traffic when Layer 3, Protocol-independent when Layer 2 |
| Non-QDIO                  | OSE        | TCP/IP and/or SNA/APPN/HPR traffic                             |
| Dynamic Partition Manager | OSM        | DPM Management   |

## 10 and 25 GbE RoCE Express2.1

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



### Capabilities

Card electronics update with 25GbE and 10GbE RoCE Express2.1 (compare to FC 0430 and FC 0412)

Virtualization - 63 Virtual Functions per port (126 VFs per feature)

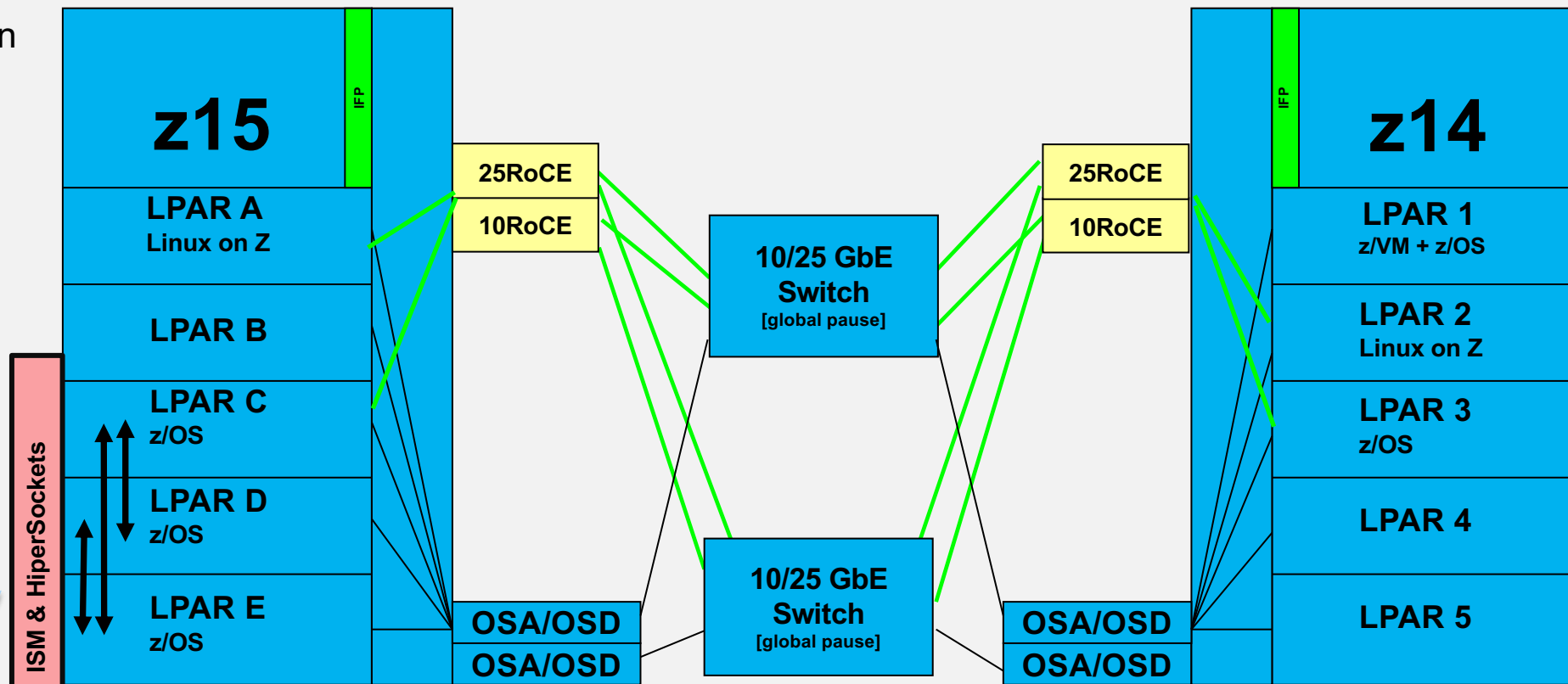
Improved RAS - ECC double bit correction

Old 10GbE RoCE Express → FC0411 (2-Ports on z15/z14/z13/z13s, 1-Port on zEC12)



# Shared Memory Communications-Remote (SMC-R) Shared Memory Communications-Direct (SMC-D)

No application changes required.



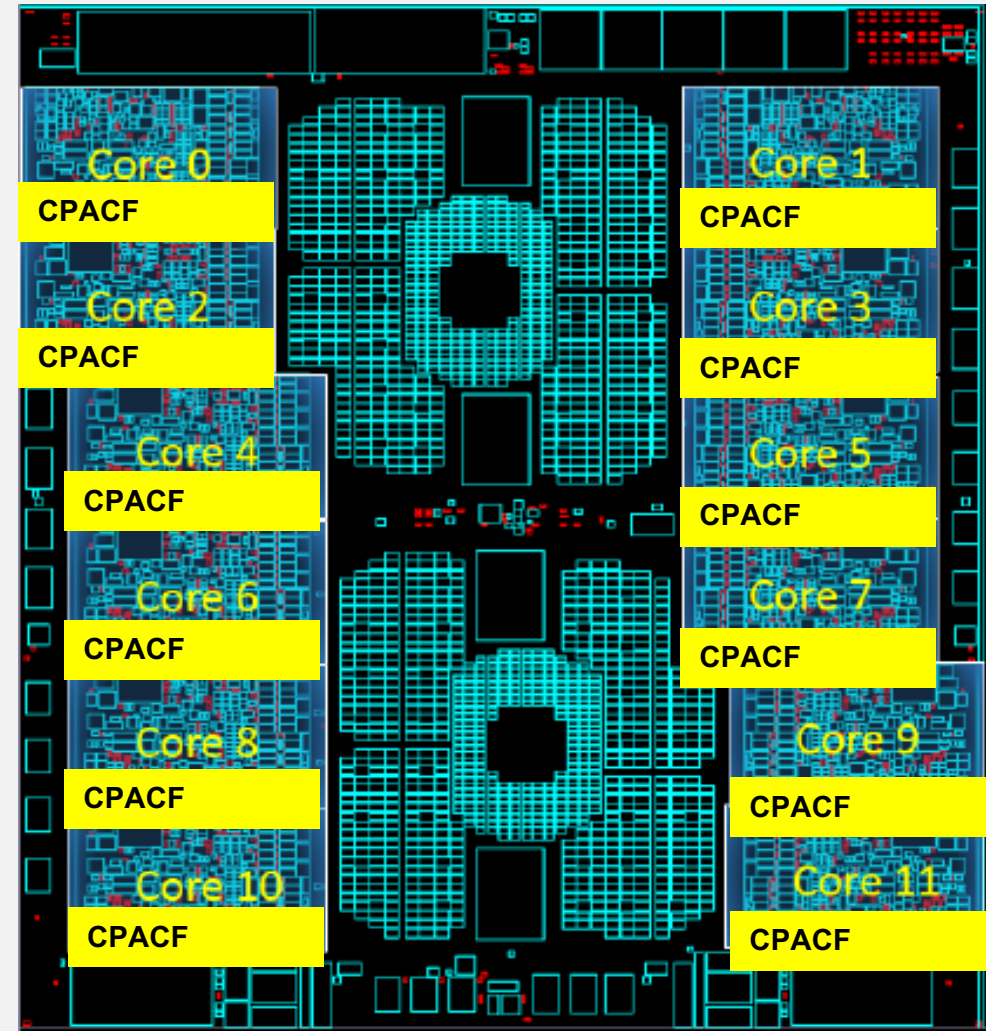
z13 supports 10GbE RoCE Express only.

**ISM = Internal Shared Memory via SMC-D**  
 LPAR to LPAR, HiperSockets or OSD connections are required to establish the SMC-D communications.  
 No additional hardware required. SMC-D bypasses the IP stack, sparing CPU cycles.



## Central Processor Assist for Cryptographic Function (CPACF)

- Feature Code 3863, CFACF enablement  
No Charge
- Value = Lower latency for encryption operations & better performance
- Hardware accelerated encryption on every core designed to provide faster encryption and decryption than previous servers.
- **New - Elliptic Curve Cryptography clear key support in CPACF. No application changes.**
  - Value = better ECC performance & throughput.
- Support for new Algorithms
  - *EdDSA (Ed448, Ed25519), ECDSA (P-256, P-384, P-521), ECDH(P-256, P-384, P521, X25519, X448)*
  - *Support for protected key signature creation*



## Crypto Express7S

### Two new cards designed for z15

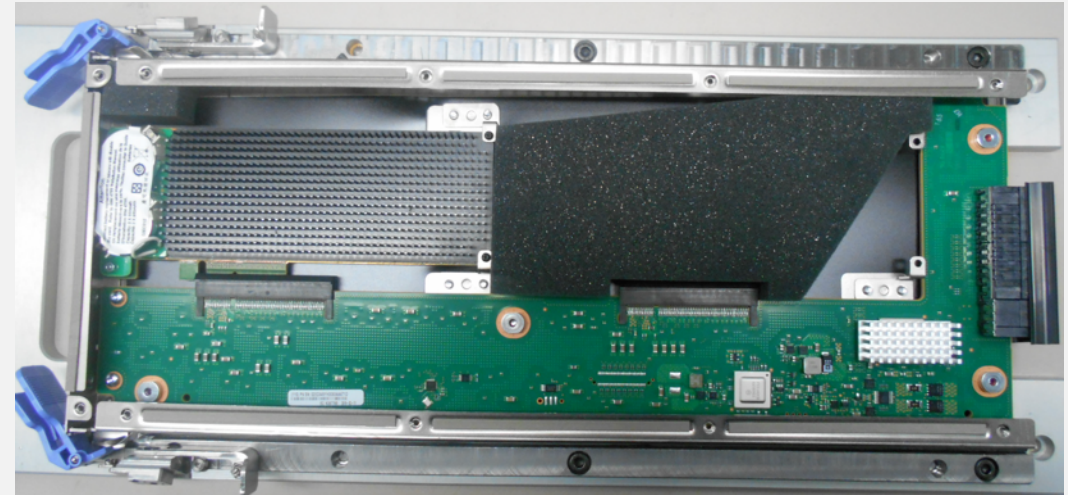
- FC 0899 One co-processor
  - Max 16 per server
- FC 0898 Two co-processors
  - Max 8 per server

A mix of Crypto cards can be ordered for both new build and carry forward

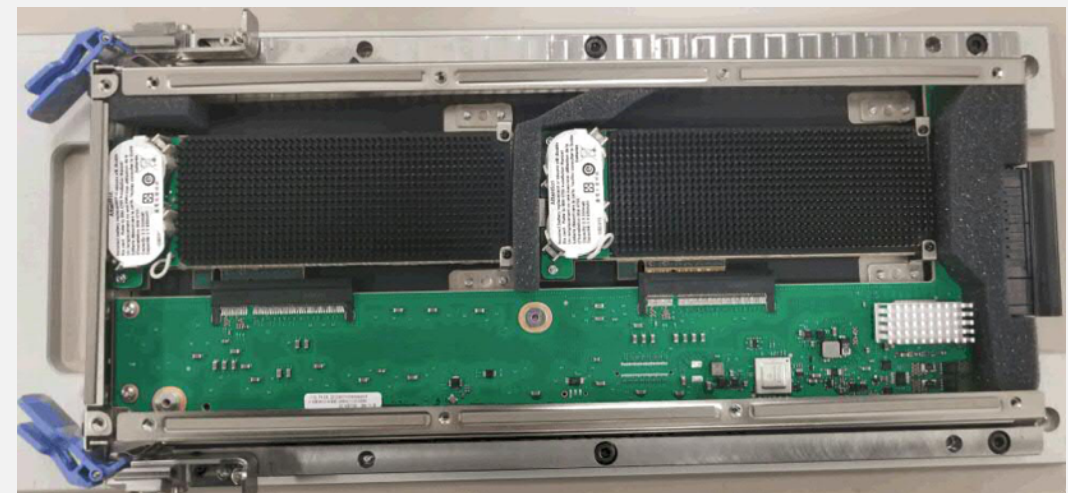
- Max combined total: 16 co-processors

New design and format driven by the adoption of blockchain and other highly secure applications

- Designed for 2X performance improvement
- Support for new Algorithms
  - *SHA3*, *SHA3 XOF* modes, *FFX*, *VAES3*, *BPS*
  - **Dilithium (Quantum Safe)**



FC 0899



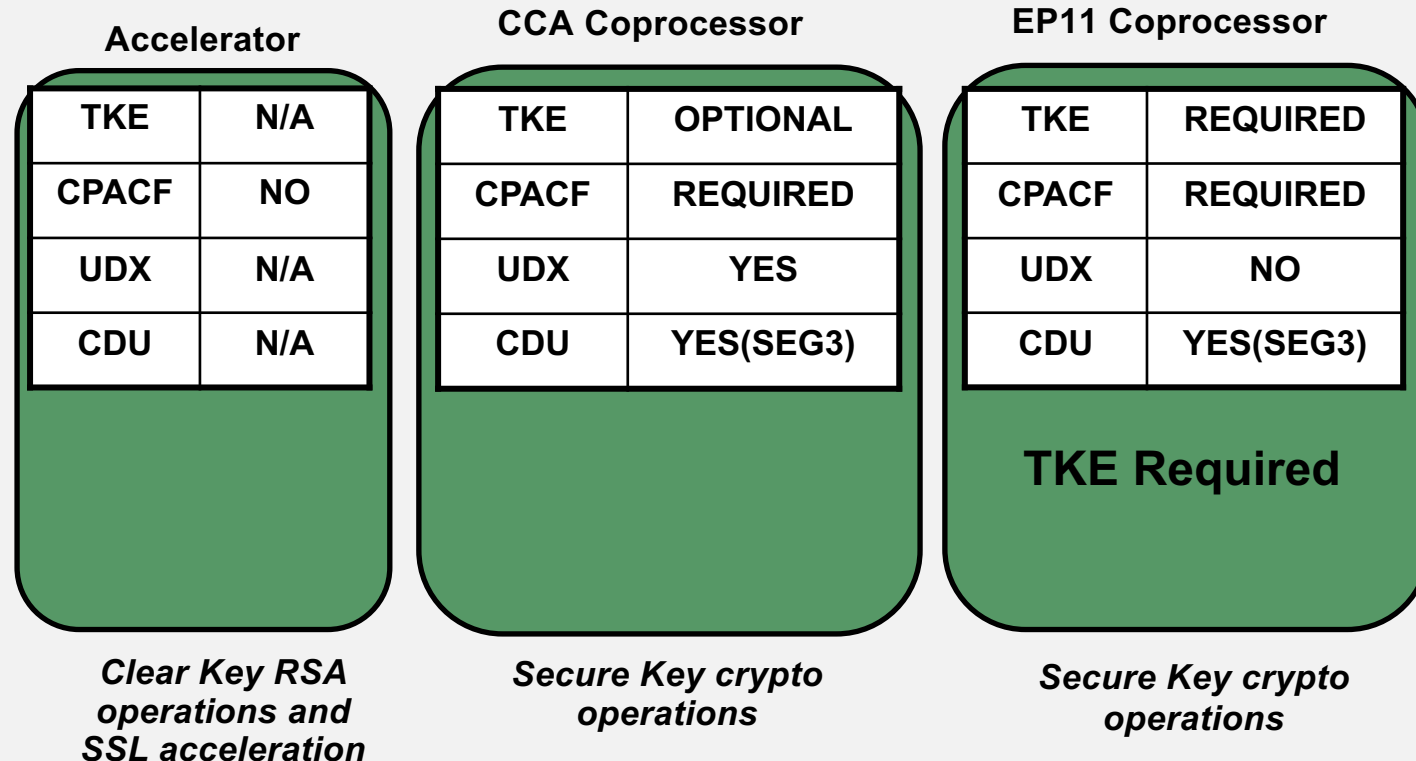
FC 0898

## Crypto Express7S co-Processor

- Half the length and height of the PCIe Standard (approx. 23mm x 23mm)
- Double number of public key cryptographic engines
- Double number of processors (PPC)
- Preprocessing and functionality offloading from main processor
- Embedded True Random Number Generator
- Designed to be FIPS 140-2 Level 4 compliant
- EP11 can now run with Protected Keys

### Three Crypto Express7S configuration options

- Only one configuration option can be chosen at any given time
- Switching between configuration modes will erase all card secrets
  - Exception: Switching from CCA to accelerator or vice versa

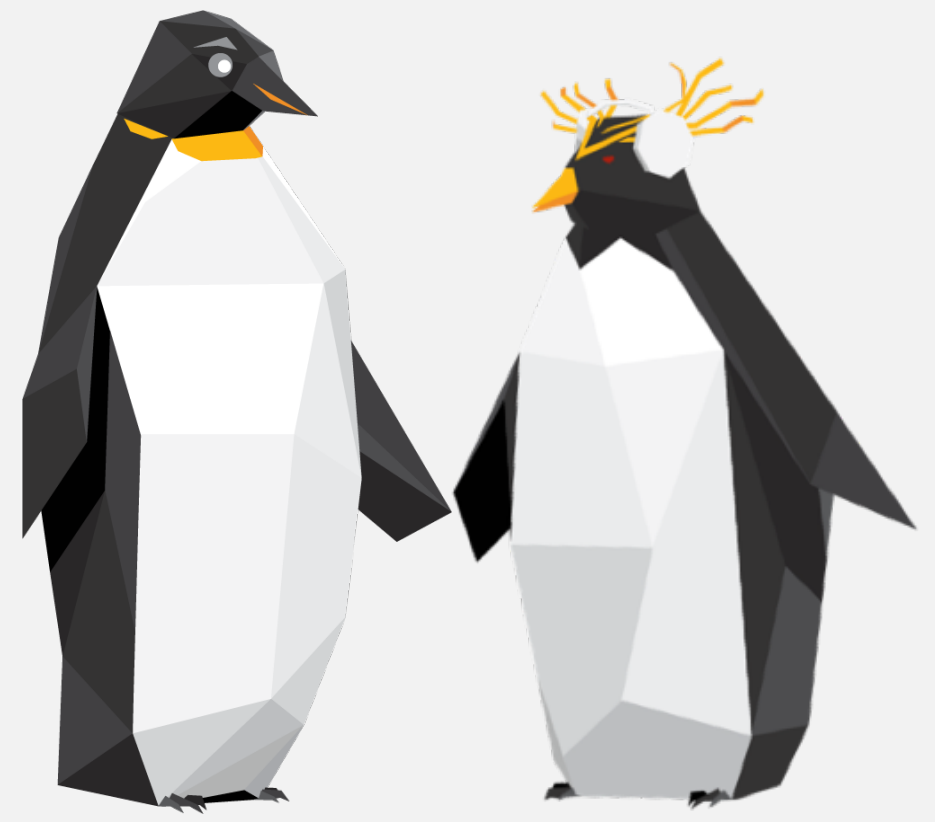


## Trusted Key Entry and TKE LIC

- Although customers can carry forward their TKEs on IBM z15, new capabilities will only be delivered on newly manufactured TKEs.
- The IBM z15 environment can contain both TKEs that have been carried forward and newly manufactured TKEs.
- TKE 9.2 LIC is required if you choose to use the TKE to manage a Crypto Express7S.
- CCA in PCI-HSM mode and EP11 also require a smartcard reader plus FIPS certified smart cards.
- Smart card readers: Feature 0891
  - (2 Identiv readers and 20 00RY790 smart cards)
- Smart cards: FC0900
  - Smart card readers from FC0885 or FC0891 can be carried forward to any TKE 9.2 workstation.

| Description | FC                       | z15 with LIC 9.2   |
|-------------|--------------------------|--|
| TKE 9.2 LIC | 0881                     | Crypto Express5S<br>Crypto Express6S<br>Crypto Express7S |
| Workstation | 0087 Rack<br>0085 Rack   | Yes  |
| Workstation | 0088 Tower<br>0086 Tower | Yes  |
| Workstation | 0841                     | No   |
| Workstation | 0842 Tower               | No   |
| Workstation | 0847 Tower               | No   |
| Workstation | 0849 Rack                | No   |
| Workstation | 0097 Rack                | Yes w/4768 (FC0844)                                      |
| Workstation | 0098 Tower               | Yes w/4768 (FC0844)                                      |
| Workstation | 0080 Rack                | Yes w/4768 (FC0844)                                      |
| Workstation | 0081 Tower               | Yes w/4768 (FC0844)                                      |

# LinuxOne Only





## FCP Express32S

- **For FCP Only**

- FC 0438 LX & 0439 SX
- CHPID types: FCP
  - 2 PCHIDs/CHPIDs

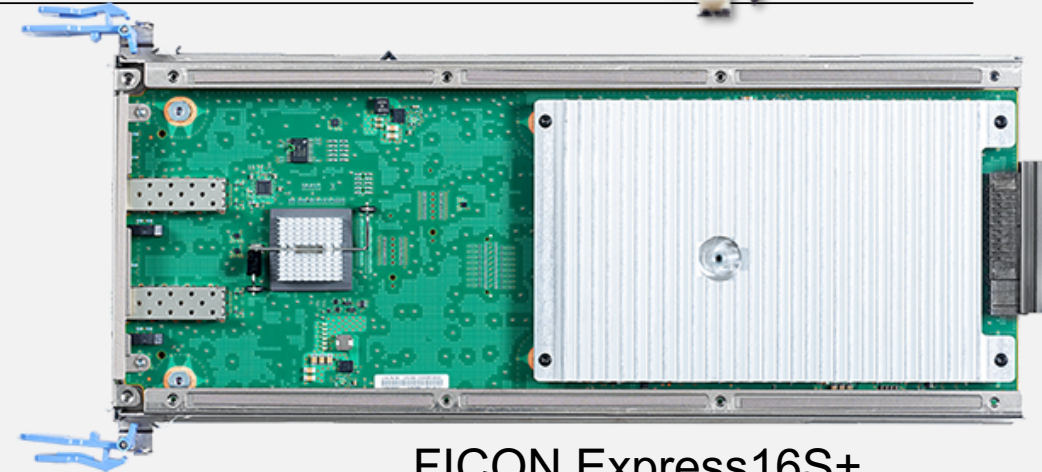
- **Auto-negotiates to 8, 16, or 32 Gbps**

- **Concurrent repair/replace of small form factor pluggable (SFP) optics**

- 10KM LX - 9 micron single mode fiber
  - Unrepeated distance - 10 kilometers (6.2 miles)
  - Receiving device must also be LX
- SX - 50 or 62.5 micron multimode fiber
  - Distance variable with link data rate and fiber type
  - Receiving device must also be SX

- **Maximum of 32 two port features**

- **These features will only be available on the **LinuxONE** machines.**

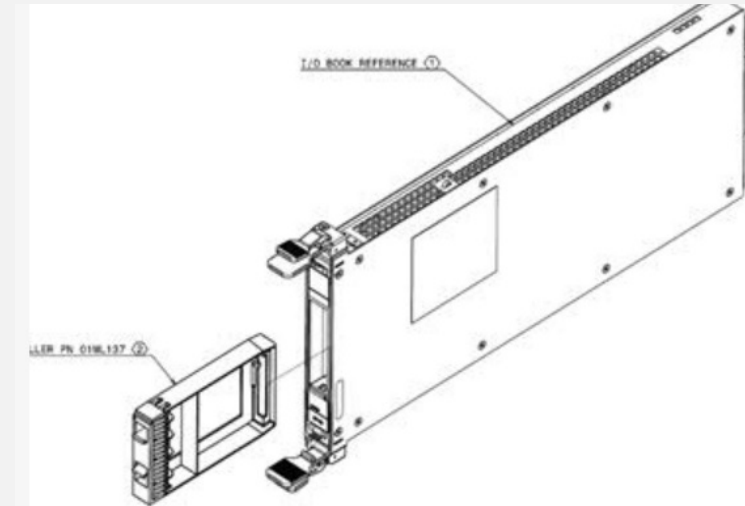


FICON Express16S+



## IBM Adapter for NVMe1.1 – FC0448

- **LinuxONE only**
- **“Built in” storage. No boot support initially.**
- **Uses the normal INext PCIe EC Stream.**
- **Carrier Card**
  - Zero ports
  - IBM provides a carrier card into which NVMe SSDs can be plugged.
  - IBM service will install the vendor SSD concurrently into the carrier card on-site. Hot/cold plug.
- **Up to 16 features in increments of one.**
- **The vendor SSD card will be purchased by the client from a reseller or directly from the vendor.**
- **Tested in IBM Z – we will not make support statements just testing statements**
  - Intel PN SSDPE2KX010T701 (1TB) – Up to 16 TB
  - Intel PN SSDPE2KX040T701 (4TB) - Up to 64 TB
    - Both can coexist on the same system and same I/O Drawer.
- **Details can be found in the IMPP GC28-7002. Performance testing found [here](#)**



| Features                      | New Build (NB)<br>Carry Forward (CF) | Maximum<br>Features | Ports      | Increment       |
|-------------------------------|--------------------------------------|---------------------|------------|-----------------|
| FICON Express16SA -LX and -SX | NB                                   | 192                 | 2          | 1               |
| FICON Express16S+             | CF                                   | 192                 | 2          | 1               |
| FICON Express16S              | CF                                   | 192                 | 2          | 1               |
| FICON Express8S               | CF                                   | 192                 | 2          | 1               |
| FCP Express32S                | NB                                   | 192                 | 2          | 1               |
| OSA Express7S                 | NB                                   | 48                  | 2/1        | 1               |
| OSA Express7S 25GbE SR1.1     | NB/CF                                | 48                  | 1          | 1               |
| OSA Express6S                 | CF                                   | 48                  | 2/1        | 1               |
| OSA Express5S                 | CF                                   | 48                  | 2/1        | 1               |
| Crypto Express7S (2 adapters) | NB                                   | 8                   | 2 Adapters | 2, 1 thereafter |
| Crypto Express7S (1 adapter)  | NB                                   | 16                  | 1 adapter  | 2, 1 thereafter |
| Crypto Express6S              | CF                                   | 16                  | 1 adapter  | 2, 1 thereafter |
| Crypto Express5S              | CF                                   | 16                  | 1 adapter  | 2, 1 thereafter |
| 25GbE RoCE Express2.1         | NB/CF                                | 16                  | 2          | 1               |
| 10GbE RoCE Express2.1         | NB/CF                                | 16                  | 2          | 1               |
| 10GbE RoCE Express            | CF                                   | 16                  | 2          | 1               |
| NVMe Express                  | NB                                   | 16                  | 1          | 1               |
| zHyperlink Express1.1         | NB/CF                                | 16                  | 1          | 1               |
| Virtual Flash Memory          | NB                                   | 12 Units            | 0.5 TB     | 1               |
| Integrated Coupling SR1.1     | NB/CF                                | 48                  | 2          | 1               |
| Coupling Express2 LR          | NB/CF                                | 32                  | 2          | 1               |

# z15 Coupling

## Parallel Sysplex and Server Time Protocol

- z15 CFCC Level 24
- The z15 can be connected with coupling links to the following servers with these MCL requirements.
- z14 (3906/3907) at Driver 36
  - CFCC Product Release 23 – Service Level 0.13
  - Bundle S13 / MCL P41419.003 (February 2019)
- z13/z13s (2964/2965) at Driver 27
  - CFCC Product Release 21 – Service Level 2.20
  - Bundle S82 / MCL P08416.008 (February 2019)
- Enhancements to coupling communication up to 4 virtual paths (CHPIDs) per link.
  - Max ICA SR increased from 80 to 96
  - Max coupling CHPIDs per system increased to 384
    - Currently 256 on the z14, 50% more
    - Max 128 per LPAR same as z14
  - Max ICP CHPIDs increased to 64
    - Currently 32 on the z14, 2X more



## Integrated HCD for S/A Coupling Facility

### Eliminate S/A CF planned outages for I/O Reconfigurations

The client needs a controlling HCD Instance, which is the User Interface

- z14 GA2 or higher
- z/OS 2.1, 2.2, 2.3 with APARS:
  - OA53952 (IOS)
  - OA54912 (HCD)
  - AA55404 (IOCP)
  - IO25603 (HCM)

**Value = Keep the business running!  
Easier migrations with no CF outage.**

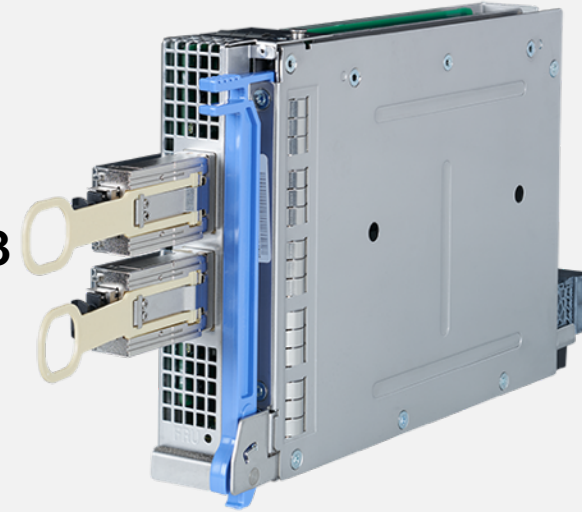
On z14 (GA2), enable functionality by adding the **MCS\_1 LPAR** to the target system's configuration.

Functionality & MCS\_1 LPAR is already present in the z15.

# z15 Coupling Links

## IBM Integrated Coupling Adapter SR1.1 (ICA SR1.1)

- *Coupling Connectivity into the Future (Short Distance)*
- Coupling CHPID CS5, Performance similar to Coupling over InfiniBand 12X IFB3 protocol
- PCIe+ Gen3, Fanout in the CPC drawer, 2-ports per fanout, 150m;
- z13 GA1 availability



## Coupling Express2 LR (CE LR)

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

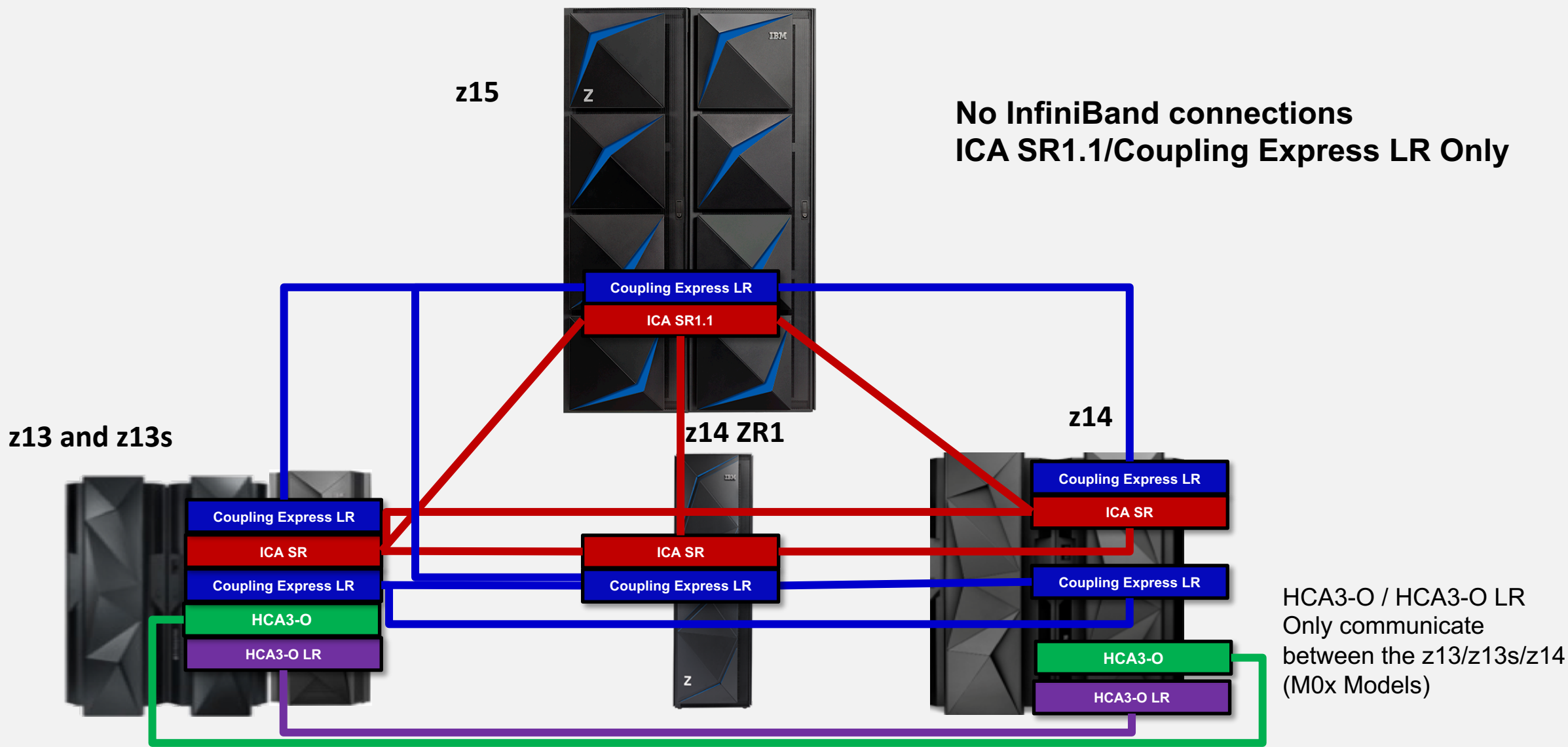


The link data rates do not represent the performance of the links. The actual performance is dependent upon many factors including latency through the adapters, cable lengths, and the type of workload.

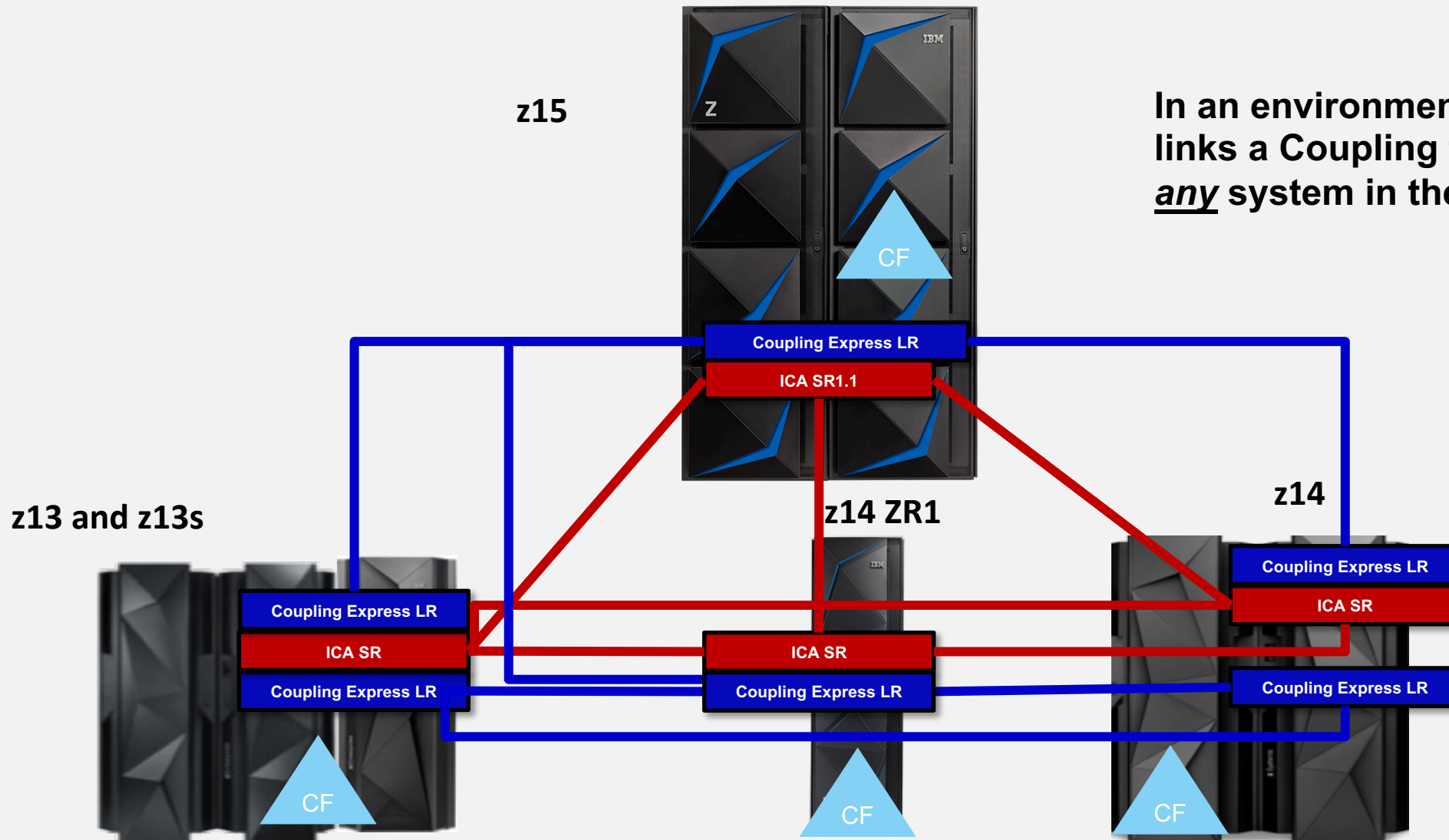




# z15 Coupling Considerations



## z15 Coupling Migration without HCA3-O connections



In an environment with no HCA3-O links a Coupling facility can reside on any system in the sysplex

# z15 Coupling Migration with HCA3-O environment

z15

In an environment with a z13 or z13s that only has HCA3-O coupling optics the Coupling Facility **MUST** reside on a z14 with coupling connections to all other systems

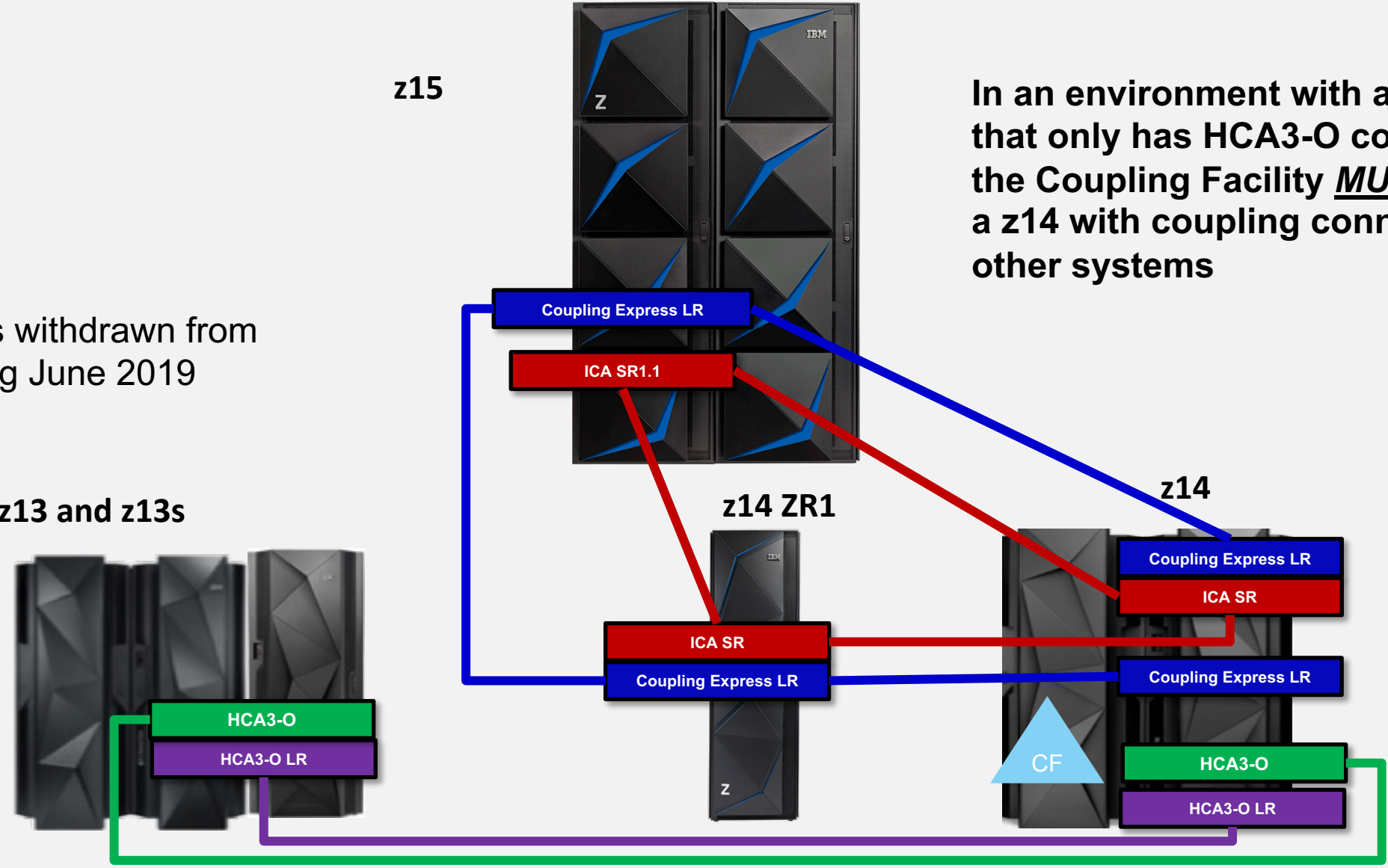
z13/z13s withdrawn from marketing June 2019

z13 and z13s

z14 ZR1

z14

HCA3-O / HCA3-O LR  
Only communicate between the z13/z13s/z14 (M0x Models)



# z15 STP

## Why Precision Time Protocol (PTP)?

### Synchronization Regulations

**Prepare for prerequisite regulations and audits.**

- **SEC - within 50ms of UTC**
- **FINRA (investor fairness) - within 50ms of UTC**
- **MiFID (European – like FINRA) - within 100µs of UTC**
- **Other regulating agencies are developing standards ie. PCI**

### Single Point of Failure reporting

- **Another European regulation**
- **If the STP Preferred Time Server & Current Time Server (PTS/CT) is taken down or fails, the Backup Time Server (BTS) becomes the Current Time Server. In this mode, it could be seen as a single point of failure.**

### PTP History

- **Standard designed for labs, cell phone networks, radar, robots**
- **Finding its way into computer networking**
- **Capable of synchronization to less than a microsecond**

## Precision Time Protocol (PTP) - IEEE 1588

The Precision Time Protocol (PTP) is a protocol used to synchronize clocks throughout a computer network. Other vendor platforms may also exploit PTP.

- PTP is designed for local systems requiring accuracies beyond those attainable using NTP. [Wikipedia]
- The first IBM Z implementation will provide the use of an external time source (ETS) capable of supporting PTP.
  - Accuracy today with
    - NTP – within about 100ms
    - NTP with PPS – within about 10 $\mu$ s
    - PTP with PPS – within about 10 $\mu$ s
    - PTP future without PPS – 100ns or less.

z15 provides a stepping stone to further PTP support.

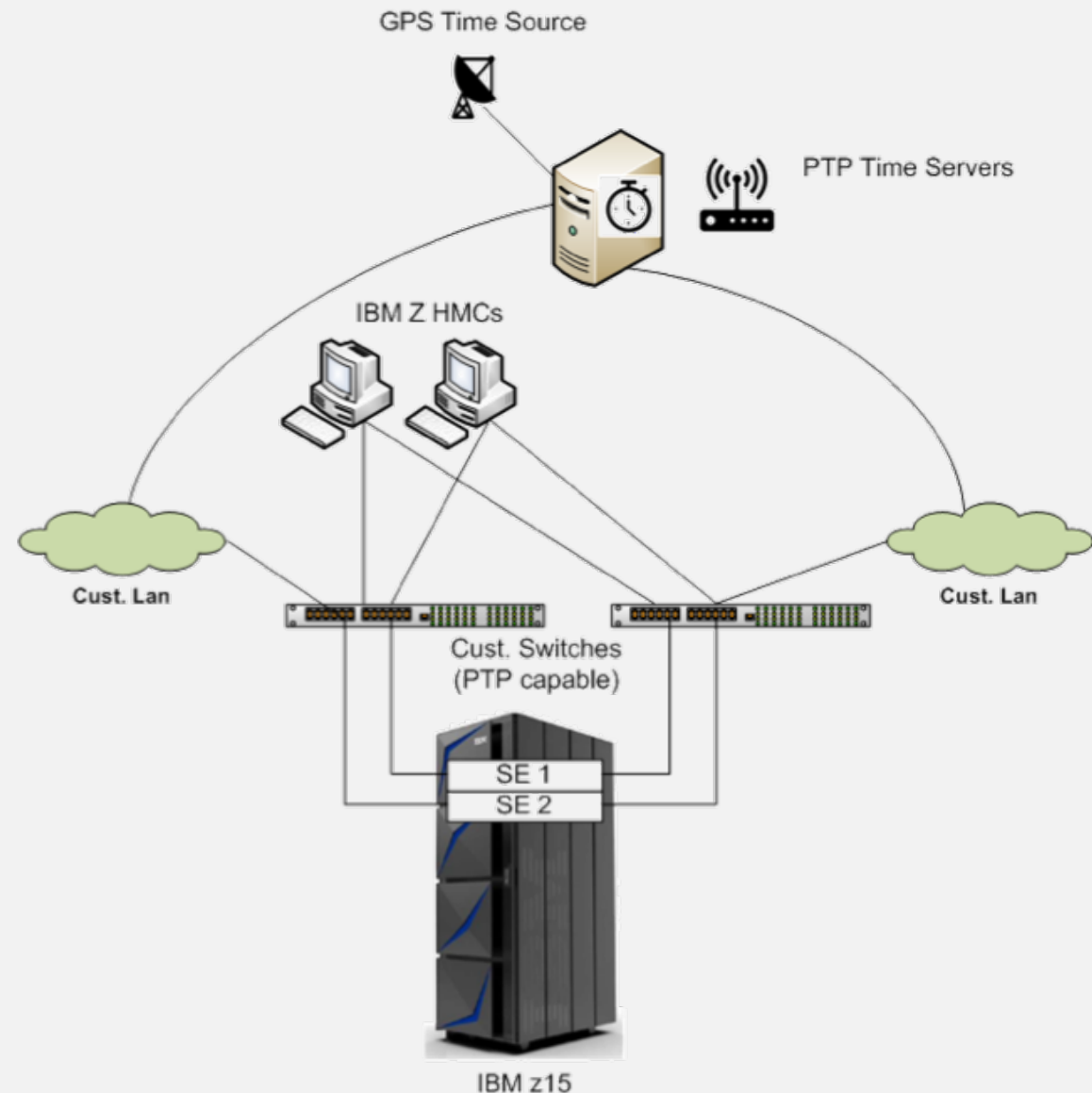
- Sets the stage for exciting future enhancements.

PTP ETS exploitation is optional on z15. No feature code required.

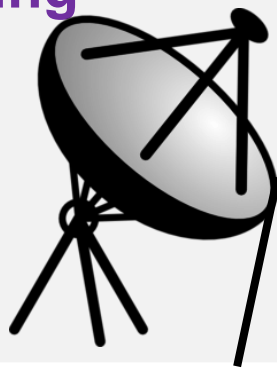


## Implementation details

- PTP requires network infrastructure support
  - For z15, the PTP Ethernet cable must plug directly into the SE and HMC/SE virtual appliance\*
  - Due to SE to CPC interface, for current implementation, Pulse Per Second still required for PTP to meet Financial Regulations

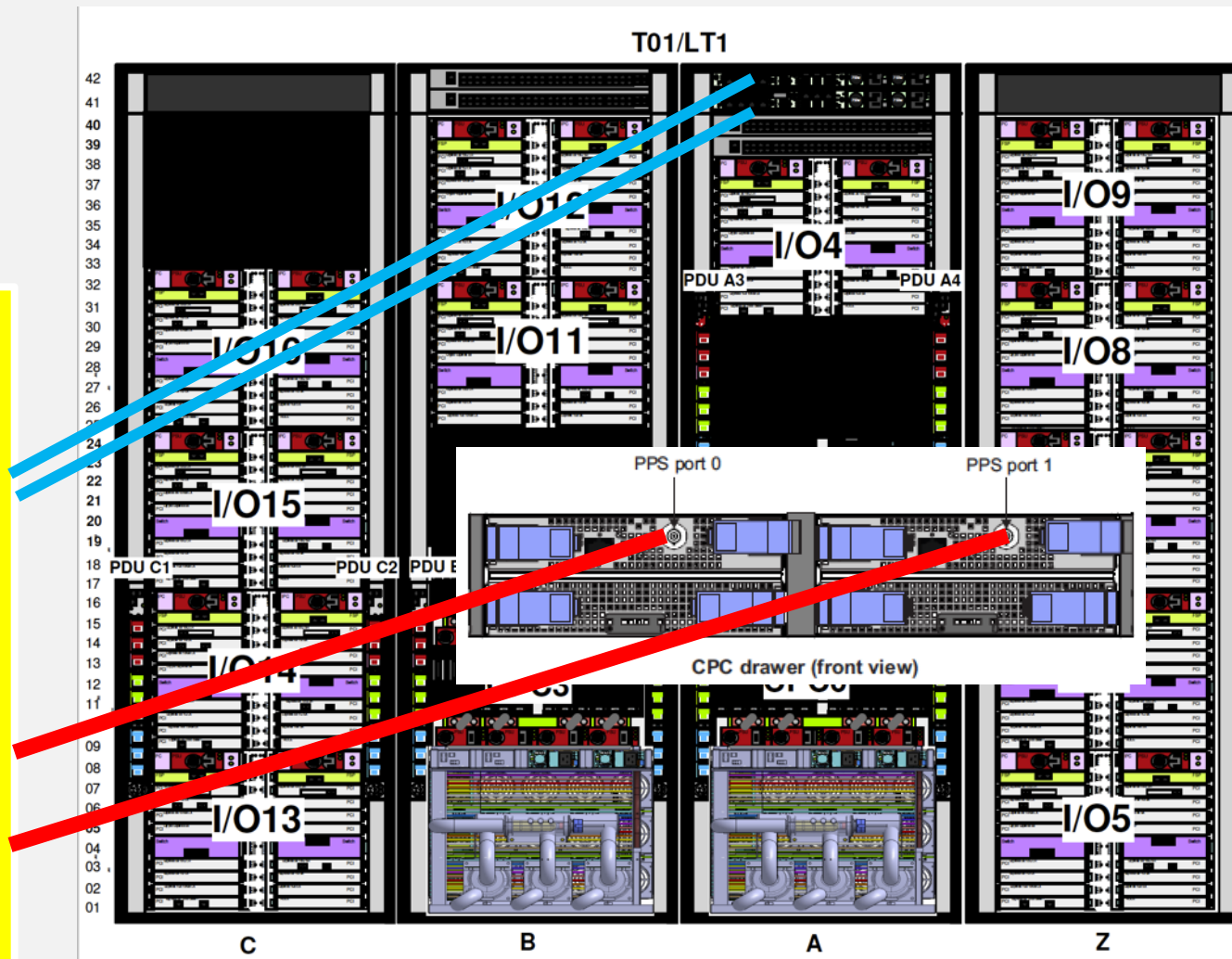


# PPS Cabling



**PTP Receiver/Server  
“rear” LAN cabling  
directly into the  
Support Elements.**

**PPS Cabling always  
attach to the “front”  
bottom CPC Drawer or  
the bottom two CPC  
Drawers in Frame A.**



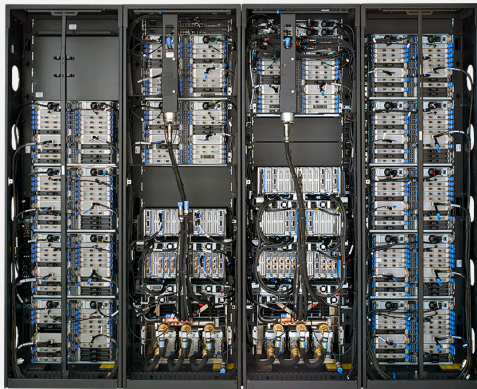
PPS cables connected to CPC 0 (Frame A)  
PPS cables connected to CPC 0 and CPC 1 (if multi-drawer cnfg).

# z15 Power and cooling

## System Level Power and Choice

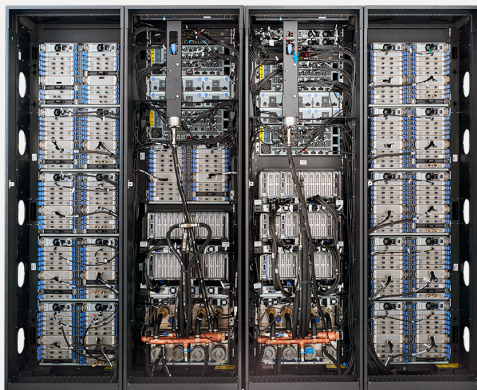
**NEW** -> Must choose one option: iPDU or Bulk system power (both are fully integrated into system)

**NEW** -> Higher AC voltage groups Must have neutral (5 wire). (no change for 200-240 VAC)



### Intelligent PDU (iPDU) based system power:

- **Highest density:** Has potential of one less frame configurations
- **Higher electrical efficiency:**
  - On average saves ~1 kW for typical system, 2kW for large system
- **Larger maximum Config I/O slot count**
- Total number of line cords per system is **two minimum to eight maximum**



### Bulk Power (BPA) based system power:

- **IBF (internal UPS) option**
- **Balanced 3 phase option**
- Client water cooling feature requires bulk power (and raised floor)
- Total number of line cords per system is **two minimum to four maximum line cords**

Note: No DC power on z15

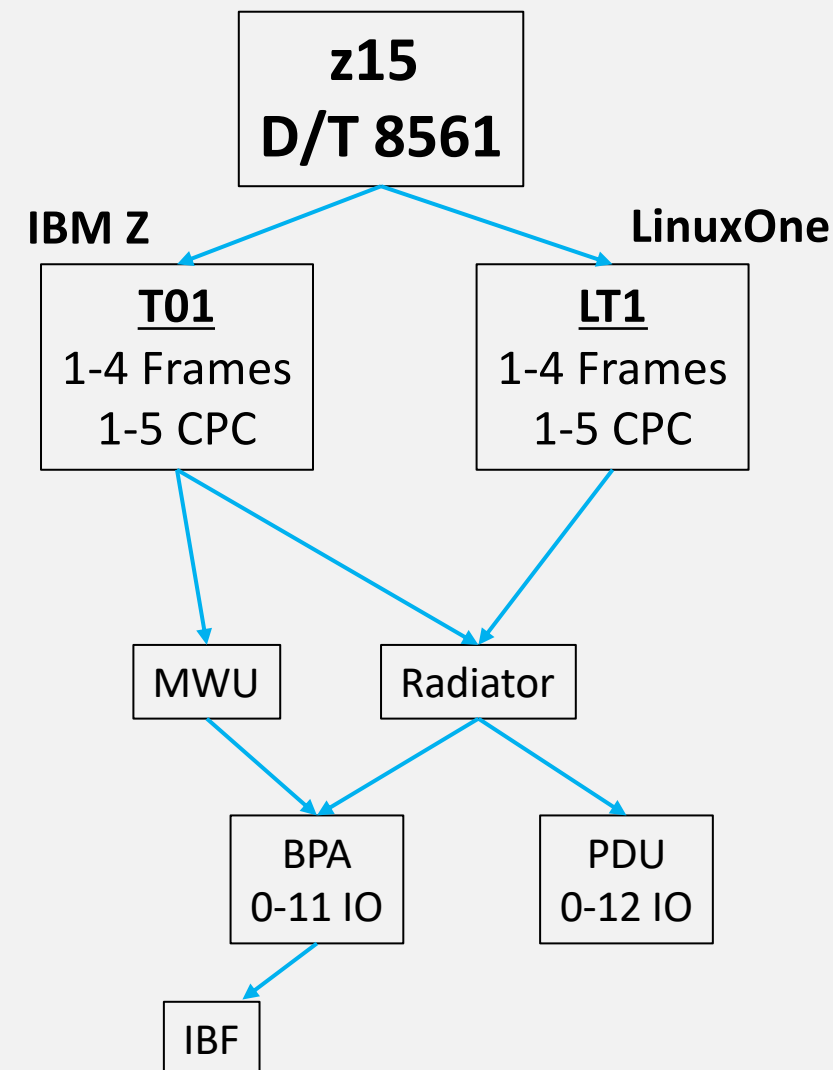
## Power considerations for z15

- z15 max vs. z14:
  - Core frequency: 5.2 GHz (same as 3906)
  - 215 physical cores on max system vs. 196
  - max memory +25% = 40TB vs 32TB
- Power choice: Power Distribution Units (PDU) or Bulk Power Adapter (BPA)
  - Estimated maximum power for z15:
    - PDU Based system – 28.9 kW
    - BPA Based systems – 30.3 kW (Radiator) or 29.4 kW (Water Cooling Unit – WCU)
- One Model, five features Max34, Max71, Max108, Max145\*, and Max190\*
  - PU SCMs are water cooled
  - System is build in 1-4 frames (A, ZA, ZAC, AB, ZAB, ZABC) - 19" standard industry format
  - System can be air cooled (radiator) or using customer chilled water (water cooling unit - WCU)
  - PDU-based system is AIR cooled (radiator) only, while BPA-based system can be AIR cooled or using customer chilled water (WCU)

## Power options

| Feature Description                       | BPA | iPDU    |
|---|-----|---------|
| <b>Number of line cords</b>               | 2,4 | 2,4,6,8 |
| 3-Phase Line cords                        | Yes | Yes     |
| 200-240VAC (4wire, 60A Delta)             | Yes | Yes     |
| 380-415VAC<br>(5 wire Wye*, 30/32A Delta) | Yes | Yes     |
| <b>480VAC (5 wire Wye*)</b>               | Yes | No      |
| <b>PCIe+ I/O drawer max</b>               | 11  | 12      |
| <b>Customer Water Cooling **</b>          | Yes | No      |
| Radiator Cooling                          | Yes | Yes     |
| <b>Internal Battery Feature</b>           | Yes | No      |
| <b>Phase loss immunity</b>                | Yes | No      |
| <b>Balanced Power</b>                     | Yes | No      |

**No DC Power available**



\* Wye cords require 5 wires, 3 for power, 1 for neutral, 1 for ground

\*\* Raised floor required. Not available on LinuxONE.



## Power Options

- Depending on if you order iPDU or BPA power you will receive the necessary amount of corresponding line cords for your country.
- Power usage estimates are available from the power and weight estimation tool available on resource link as well as the z15 IMPP.

| Feature Code | Powered Type | Description                        | Location             | Plug Type   | Change |
|--------------|--------------|------------------------------------|----------------------|-------------|--------|
| 7946         | iPDU         | 30A/400V 3Ph Wye w/Hubbell*        | US, Canada and Japan | HBL530P6V02 | YES    |
| 7947         | iPDU         | 32A/380-415V Wye 3Ph Cut End*      | World Trade          | Cut End     | YES    |
| 7948         | iPDU         | 32A/380-415V Wye 3Ph Cut End LSZH* | World Trade          | Cut End     | YES    |
| 7950         | iPDU         | 60A/250V 3Ph w/Hubbell             | US, Canada and Japan | HBL460P9V05 | NO     |
| 7951         | iPDU         | 60A/250V 3Ph w/Hubbell             | World Trade          | Cut End     | NO     |
| 7962         | iPDU         | 60A/250V Low smoke zero halogen    | World Wide           | Cut End     | NO     |
| 7954         | BPA          | 60A/250V w/Hubbell                 | US, Canada and Japan | HBL460P9V05 | NO     |
| 7955         | BPA          | 60A/250V w/Hubbell                 | World Trade          | Cut End     | NO     |
| 7956         | BPA          | 30A/400V Wye w/Hubbell*            | US, Canada and Japan | HBL530P6V02 | YES    |
| 7957         | BPA          | 32A/380-415V Wye Cut End *         | World Trade          | Cut End     | YES    |
| 7958         | BPA          | 32A/380-415V Wye Cut End LSZH*     | World Trade          | Cut End     | YES    |
| 7959         | BPA          | 30A/480V Wye w/Hubbell*            | US, Canada and Japan | HBL530P7W   | YES    |
| 7965         | BPA          | 60A/20V Low smoke zero halogen     | World Wide           | Cut End     | No     |

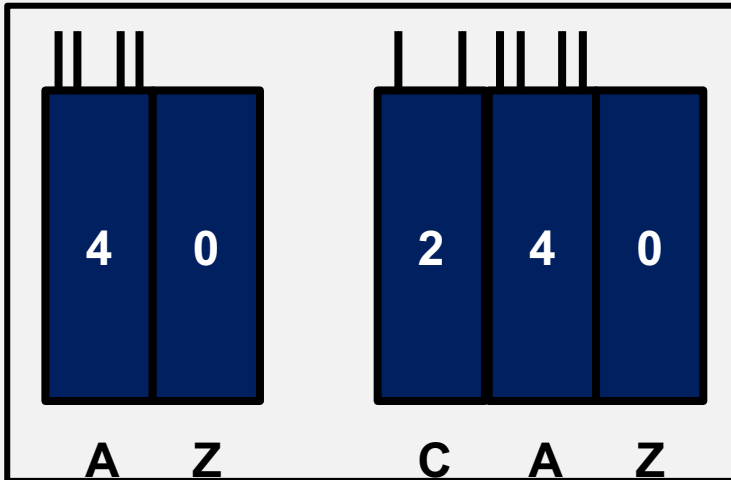
## Summary of line cords Rear View

iPDU Based Power

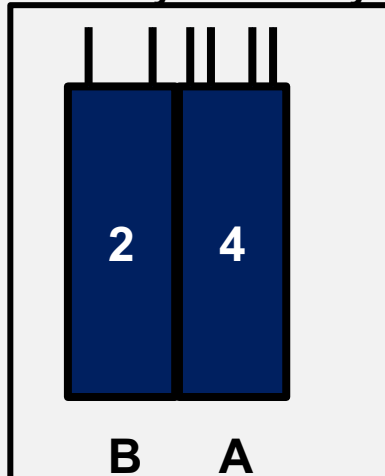


Frame **A**

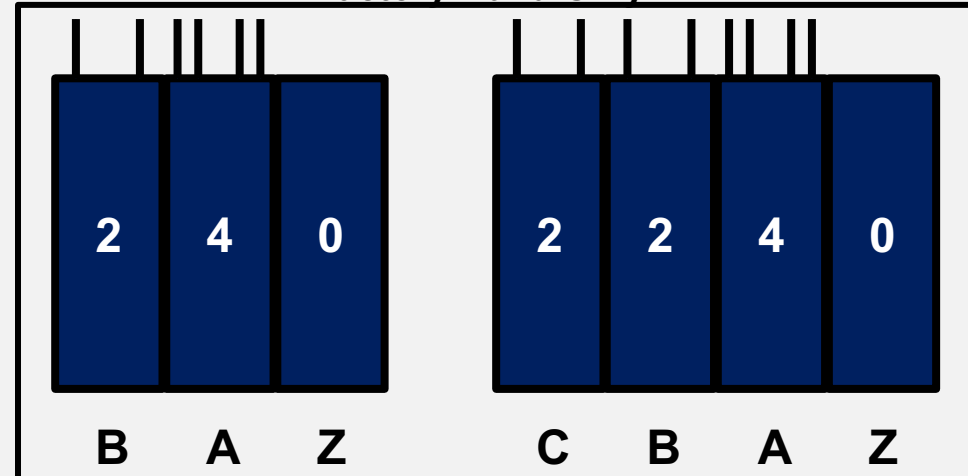
I/O Expansion



CP Expansion  
Factory Build Only



CP and I/O Expansion  
Factory Build Only



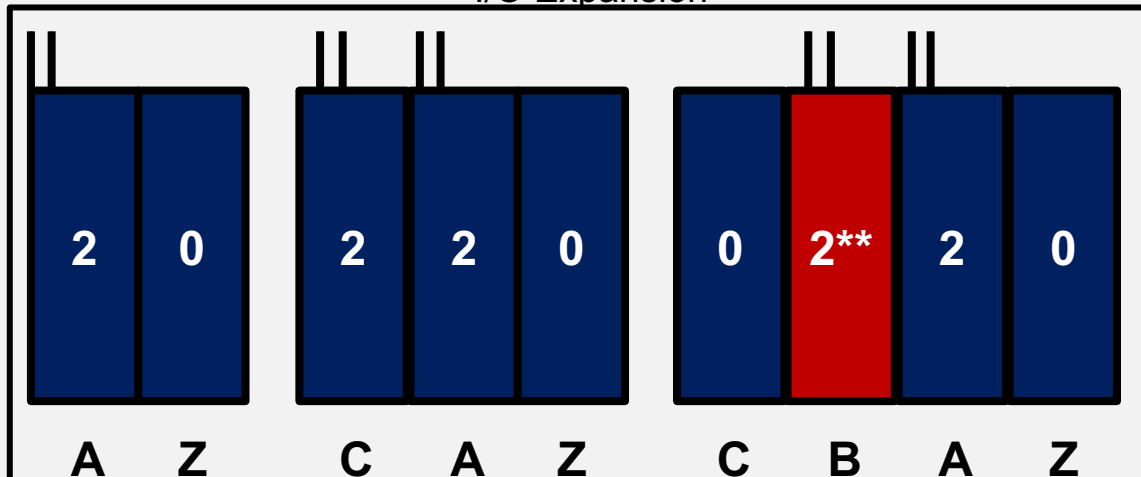
\*4 line cords required in the A frame if more than 1 CPC drawer or 3 I/O drawers are present

BPA Based Power

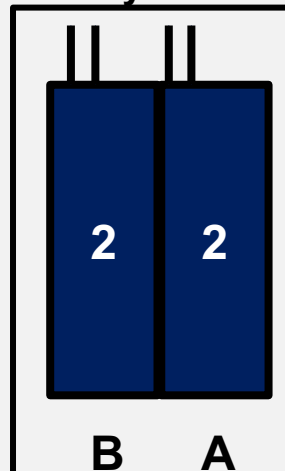


Frame **A**

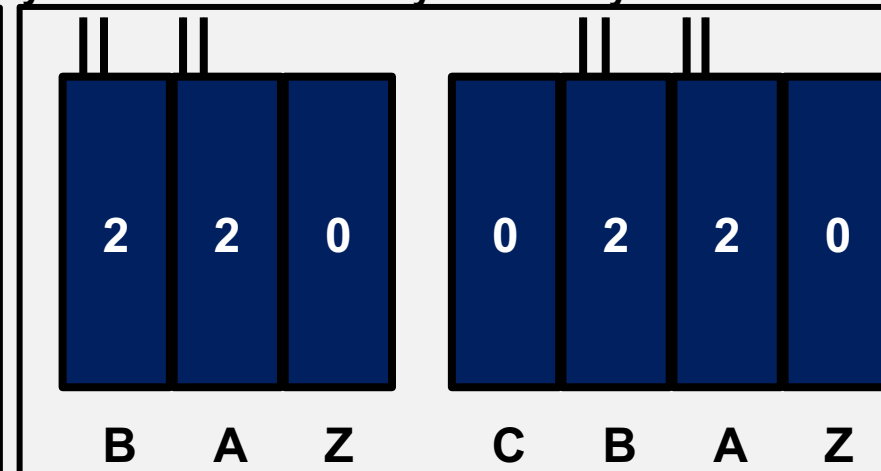
I/O Expansion



CP Expansion  
Factory Build Only



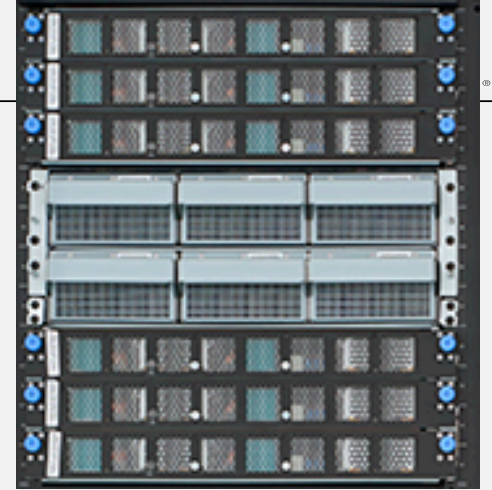
CP and I/O Expansion  
Factory Build Only



\*\*Special BPA B-Frame plan ahead. B-Frame contains no CPC drawers or cooling

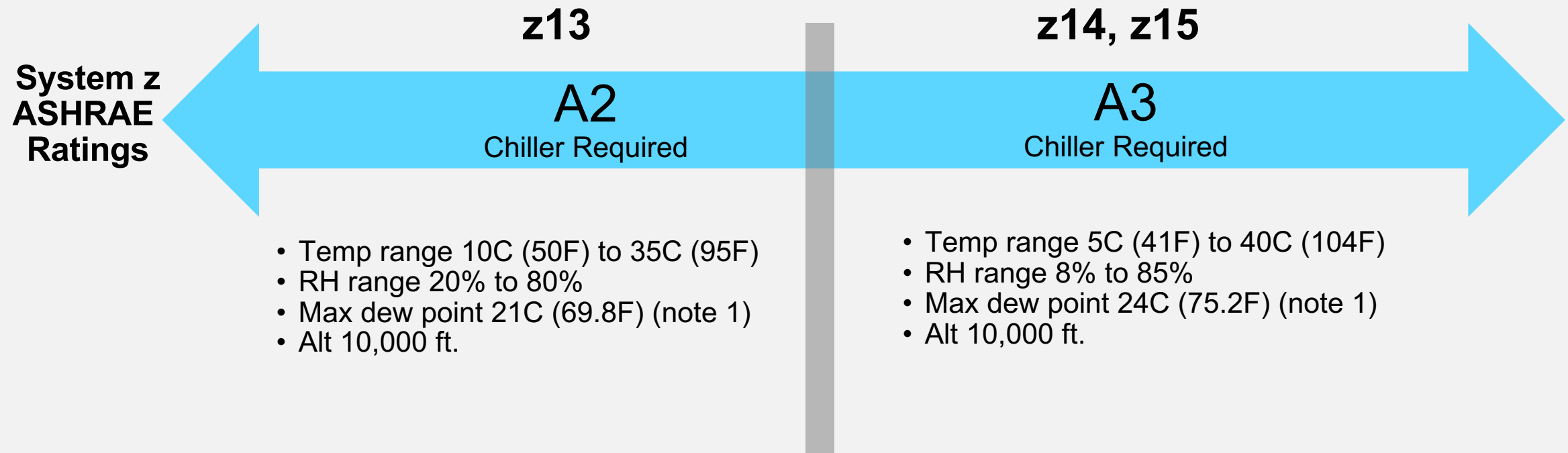
## Internal Battery Feature

- Only available with BPA Power selected
- Newly designed Lithium Ion cells to improve the IBF
  - Previously offered lead acid batteries will not carry forward
- IBF considerations
  - The IBF (FC #3217) contains Lithium ion batteries > 100 Wh and are fully regulated Dangerous Goods, **Clients will incur premium costs associated with owning**
  - The need for the IBF would be redundant if your location provides uninterruptable power
  - IBF is shipped separate from system, arrival times could be delayed
  - The IBFs **must** be removed if the machine is moved **at all**
    - Client will have to use a person certified in Dangerous Goods transportation, to ship the IBFs
    - **The Client is responsible to handle properly in accordance with all legal requirements of any removed IBFs from repair actions, relocations, or machine returns**
    - If IBM/Business Partner is the Importer and has responsibility to Take Back the IBFs, 1) the client can ship the IBF to IBM/BP or an authorized disposal site, or 2) if required by local law, IBM/BP would have to arrange to pick up the IBF
  - GDPR: There is a business need to provide the Clients data to AcBel



## Environmental classes – Same ASHRAE Rating as z14

ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) is an organization devoted to the advancement of indoor-environment-control technology in the heating, ventilation, and air conditioning (HVAC) industry.

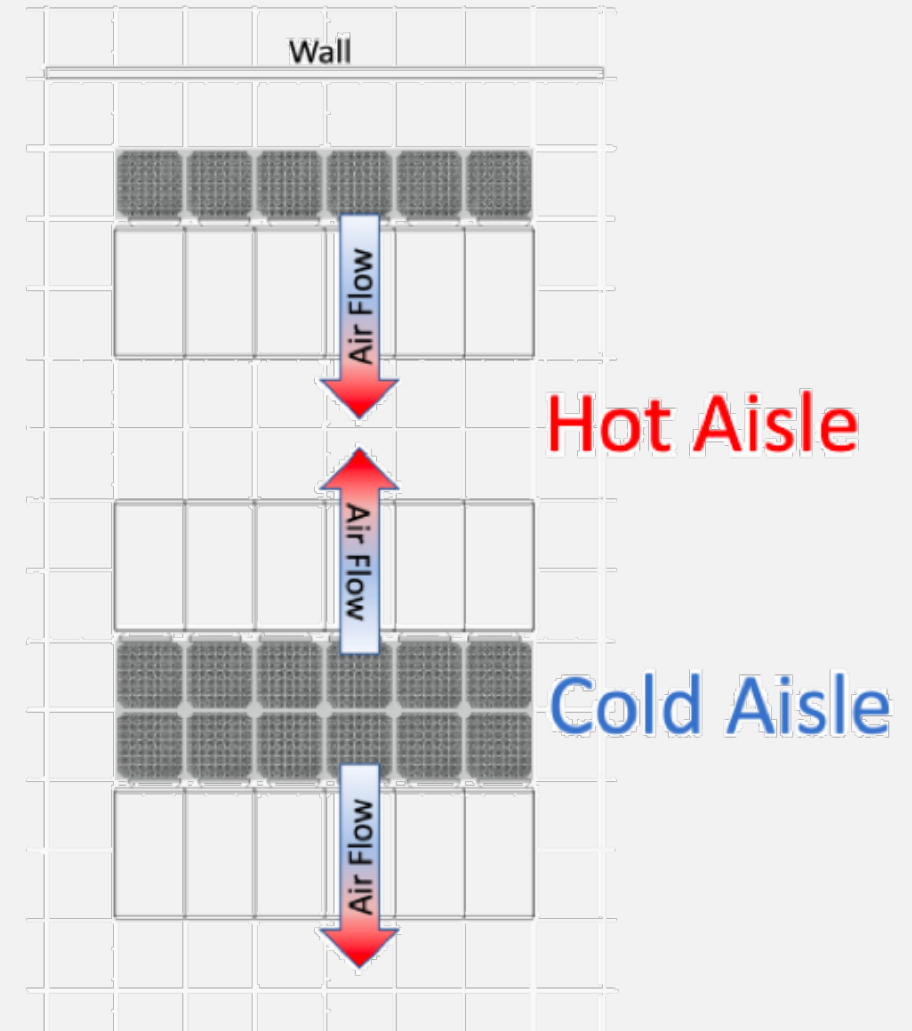


**IBM recommended Temp range 18C (64.4F) to 27C (80.6F)  
RH range 5.5C (41.9F) min dew point; up to 60%, Max dew point 15C (59F) (note 1)**

Note 1: Actual inlet air moisture content range (grams moisture/Kg dry air) A1: 2 – 12 A2: 1.5 – 16 A3: 1.5 – 19, Recommended: 6.2 - <10

## Hot and cold aisle cooling containment

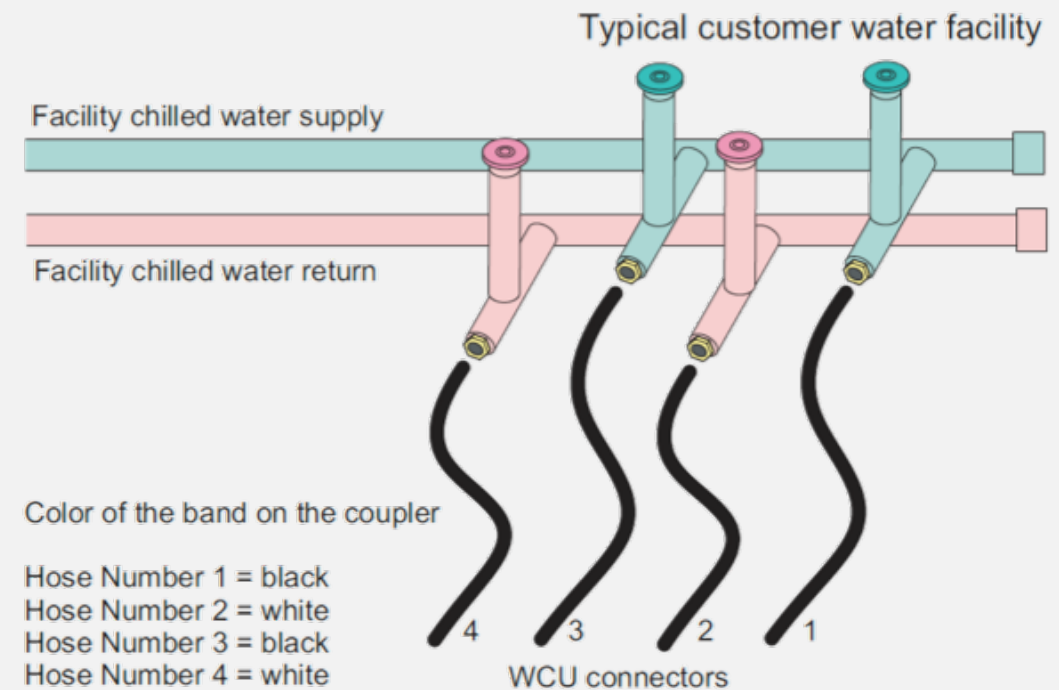
- Partitions used in the aisle cooling containment solution should be self-supporting and not attach to the frame for structural integrity.
- Service clearances must be maintained when the system is installed in the cooling containment solution.
- Airflow requirements of the z15 must meet the intended and abnormal operating conditions to assure sufficient airflow can be provided, particularly in cold aisle cooling containment systems.
- Ensure racks across the aisle will not negatively impact the z15 operation or the z15 impacts other racks.



## Water Cooling

### Water-cooled machines

- Up to four fully redundant water control units (WCUs)
  - One to three CPC drawers require two feeds and two returns
  - Over three CPC drawers require an additional two feeds and two returns
- Water Supply must meet general conditions



\*See IMPP for more information



# z15 Physical Configuration

## Frame Considerations

- System sits in a IBM 19" wide frame
  - Utilizing the design changes made in the z14 ZR1
  - *Up to four* frames depending on configuration
- This change allows us to become a more strategic part of a clients' datacenter infrastructure
  - Designed to fit most datacenters hot/cold aisle containment systems
  - Can be integrated into existing aisles
  - All rear exit cabling
  - Can be on Raised/Non-raised Floors
  - Enables clients to achieve floor space reduction



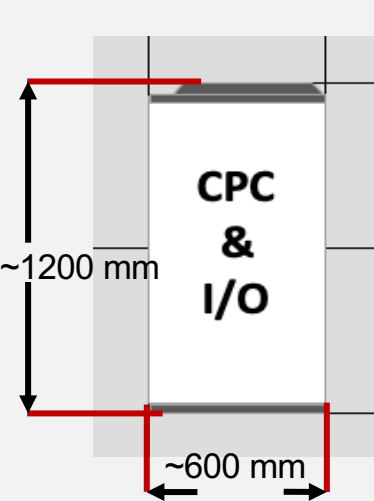
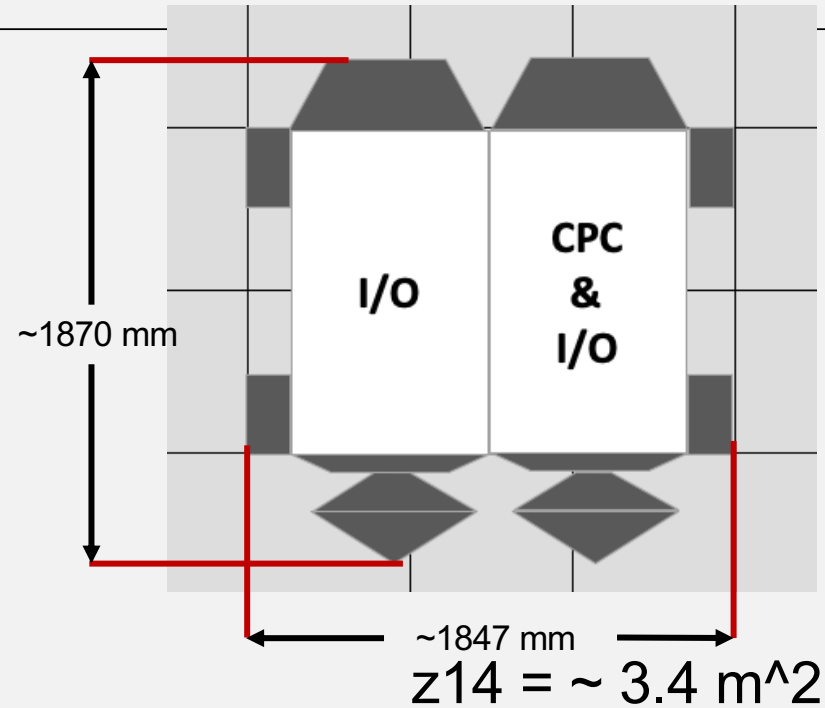
## Space savings/New Layout

### ■ The Positives

- Most clients will see reduced floor space
- Frames fits on standard floor tile
- Height reduction available

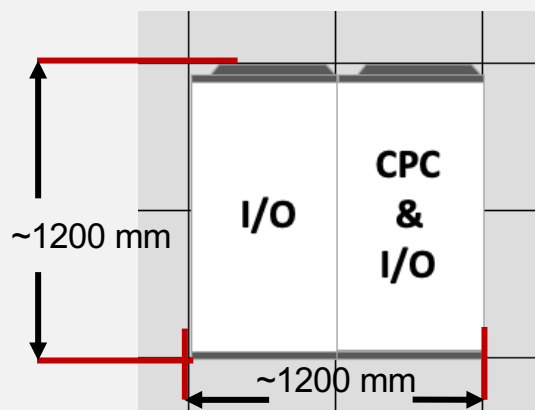
### ■ The Considerations

- May not fit into existing IBM Z space
- Clients may need to move floor stanchions
- New tile cut-outs may be needed



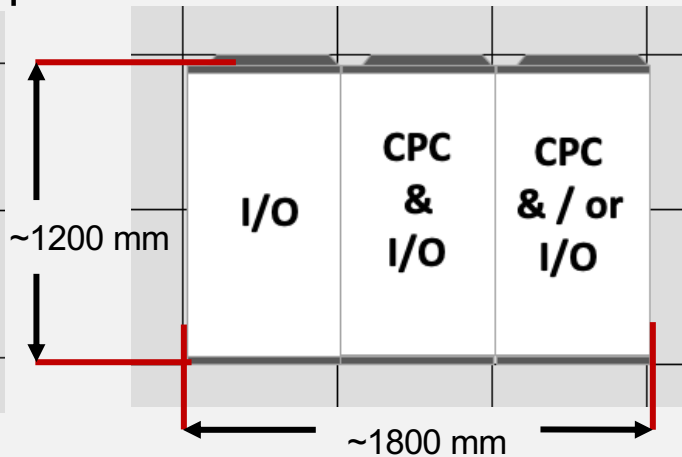
~ 1.44 m<sup>2</sup>

~50% Reduction in floor space



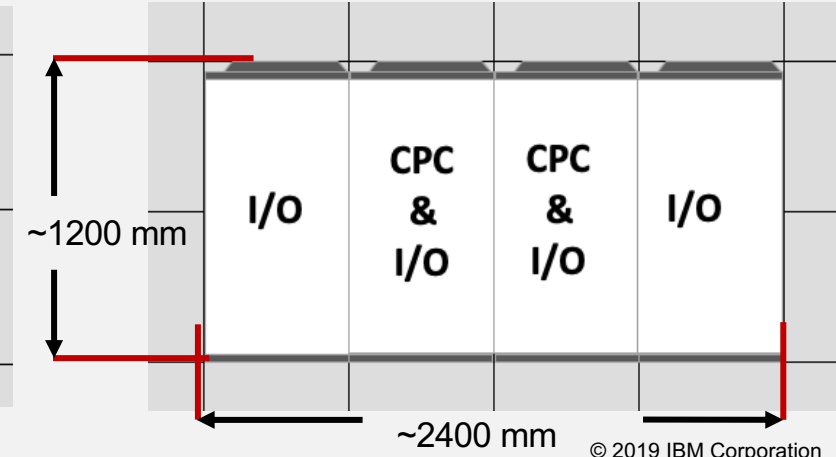
~ 2.2 m<sup>2</sup>

~25% Reduction in floor space



~ 2.9 m<sup>2</sup>

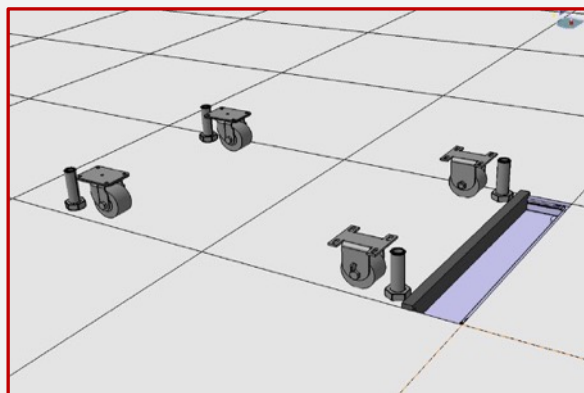
About equivalent to the z14



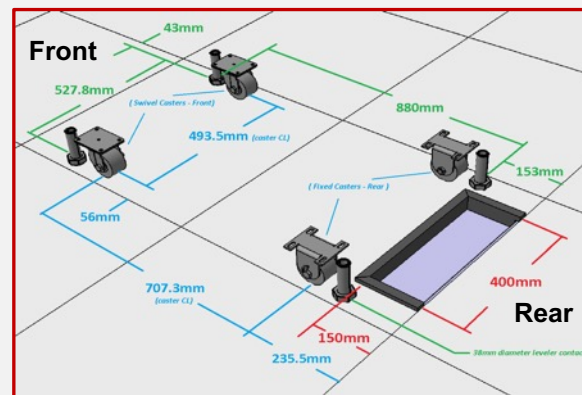
# Guide For Raised Floor Preparation

## Things to consider:

- Number of frames are configuration dependent and can change based of future MESs
  - Plan your z15 floor placement for future growth
- Rear exit I/O and power only, both for bottom and top exit cabling
- New floor cutouts may be necessary depending on placement
- Raised floor stanchions locations may need to be reevaluated
- As with previous system the z15 should be placed with adequate service clearance areas on both the front and back of the system.

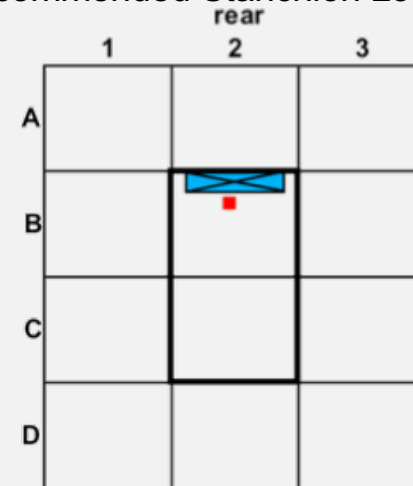


Max Floor Tile Cut-out

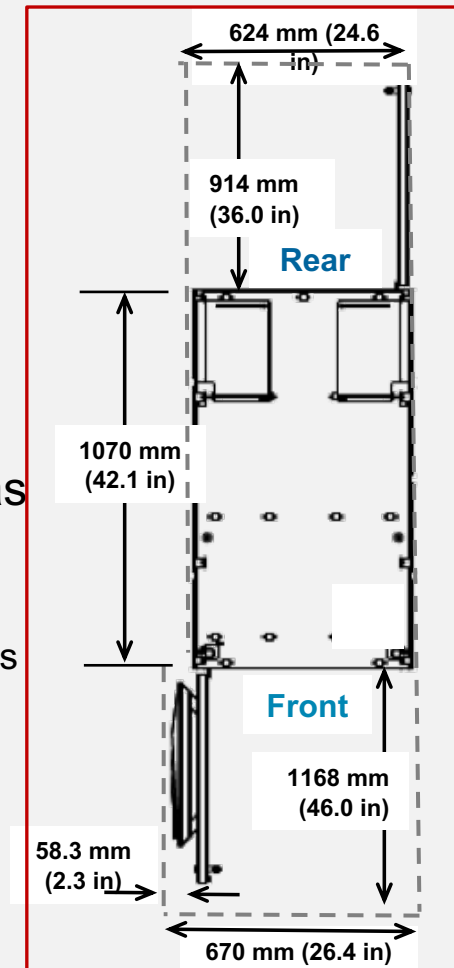


Typical Floor Tile Cut-out

## Recommended Stanchion Locations



■ = added pedestal



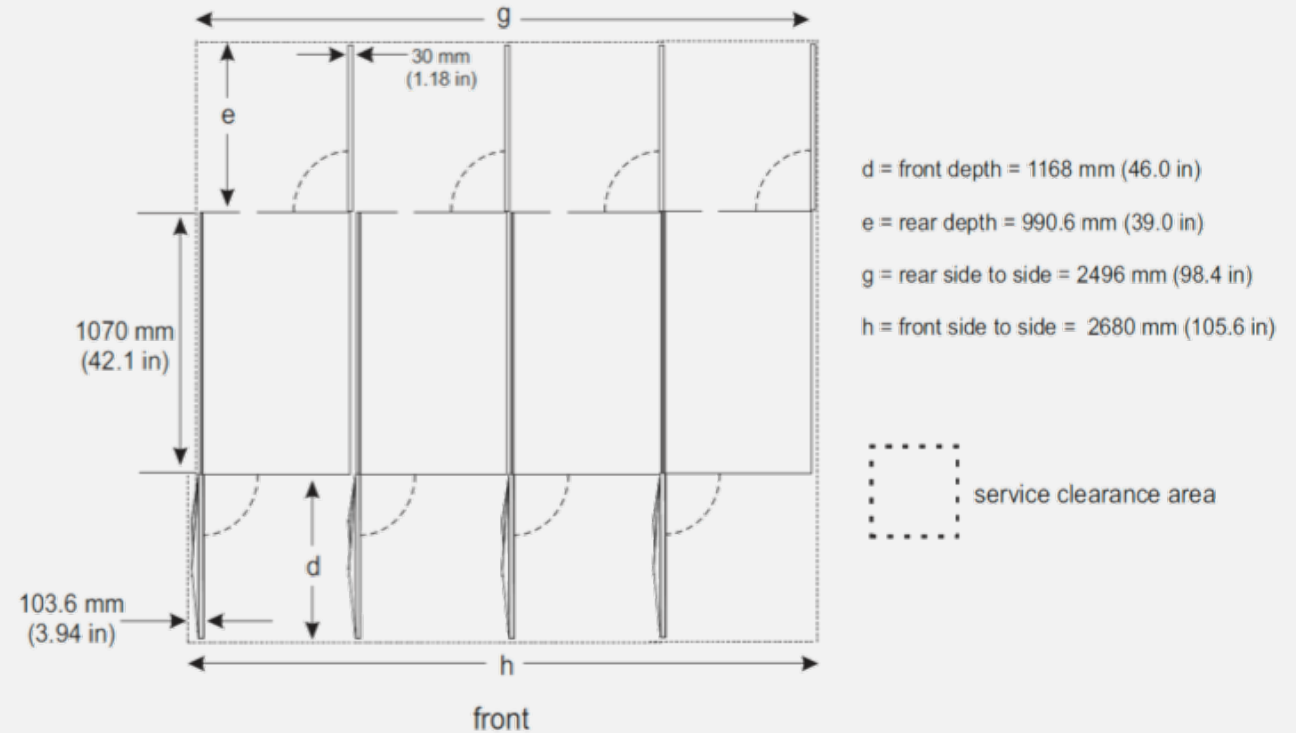
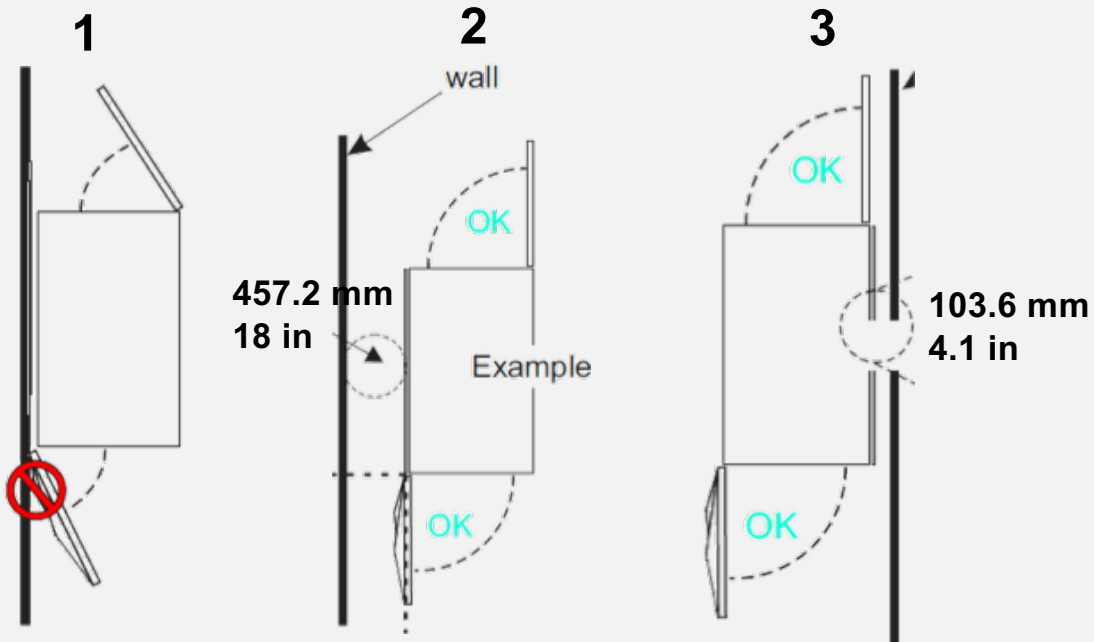
Service Clearance Area

Consult the z15 IMPP for additional information IMPP GC28-7002

## Machine and service clearance areas

### Service clearance

1. Cannot be placed adjacent to a wall
2. Left side must be at least 457.2mm (18in) from wall
3. Right side must be at least 103.6mm (4.1in) from wall

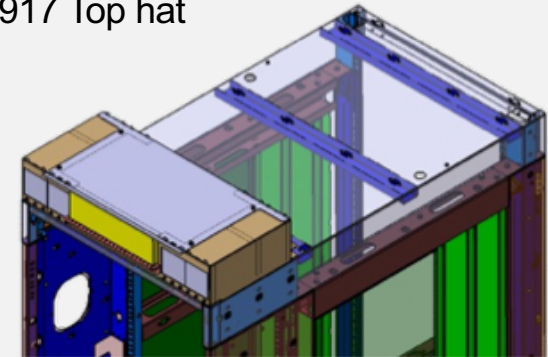




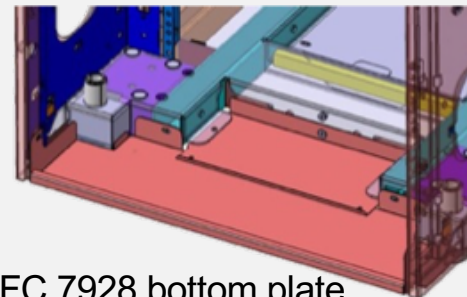
## Cabling Design and Management

- **Top exit and bottom exit options (applicable to both power and I/O cabling)**
  - Three feature codes available for both power and I/O cable management
  - **FC 7919 Bottom Exit Cabling**
    - Necessary hardware to allow cable egress out the bottom *or* top of the frame
    - If only routing out the top hardware is included to cover bottom tailgate
  - **FC 7917 Top Exit Cabling**
    - Should only be ordered if using fiber trunking services and you want to exit out the top
    - Includes an additional top hat hardware to use the trunking cables
  - **FC 7928 Top Exit Cabling without Top Hat**
    - Should be order for non-raised floor or if client only wants top exit cabling
    - Comes with a cover to seal the bottom of the frame that limits access as well as a top plate on the top that will slide open for cables to egress.

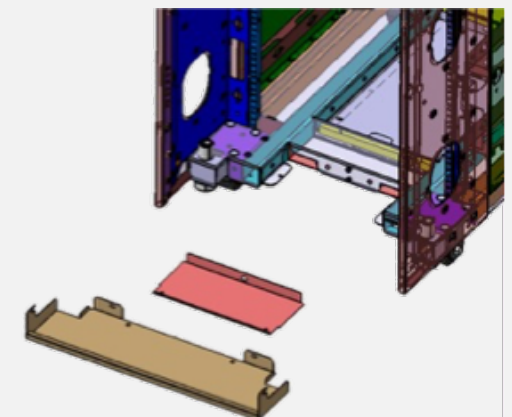
FC 7917 Top hat



FC 7928 top plate



FC 7928 bottom plate

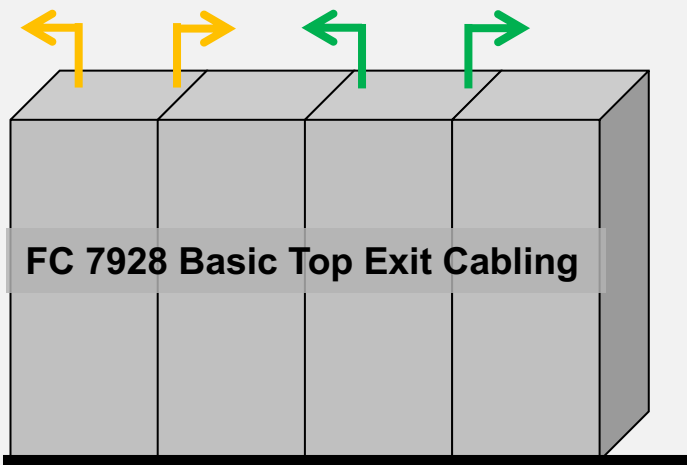
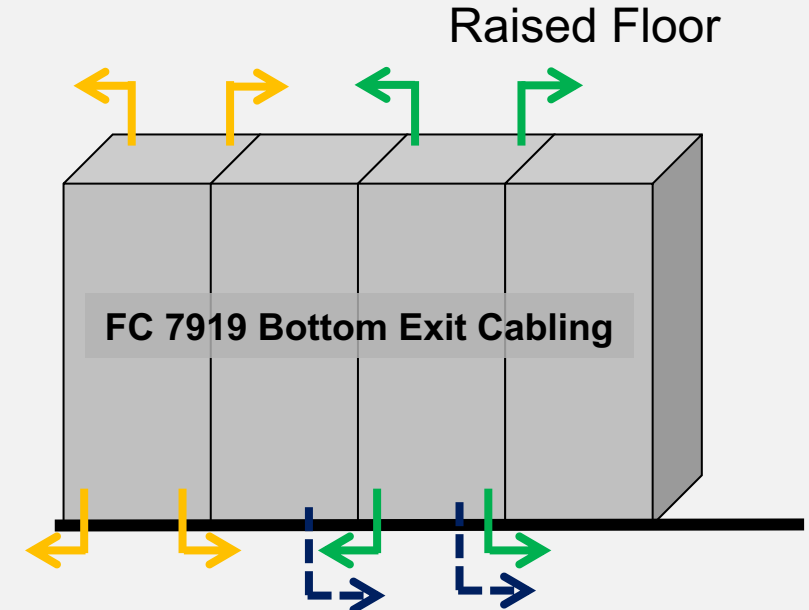
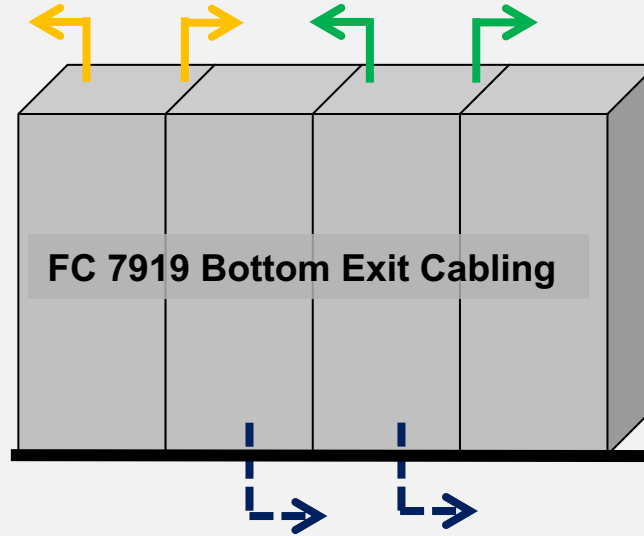
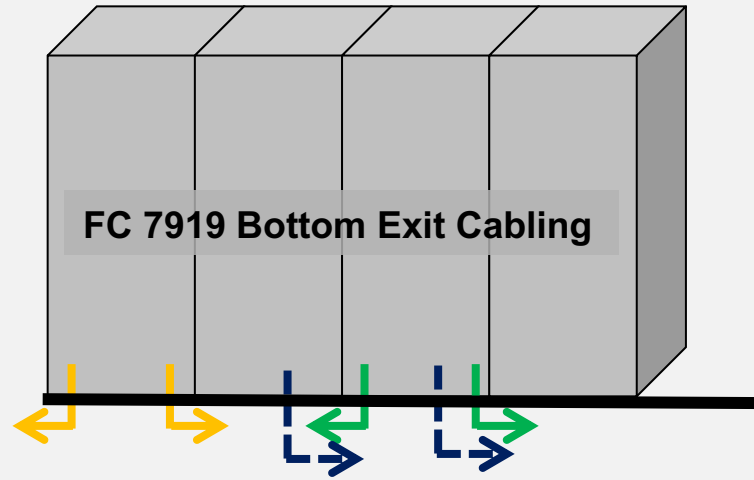


FC 7928 bottom plate



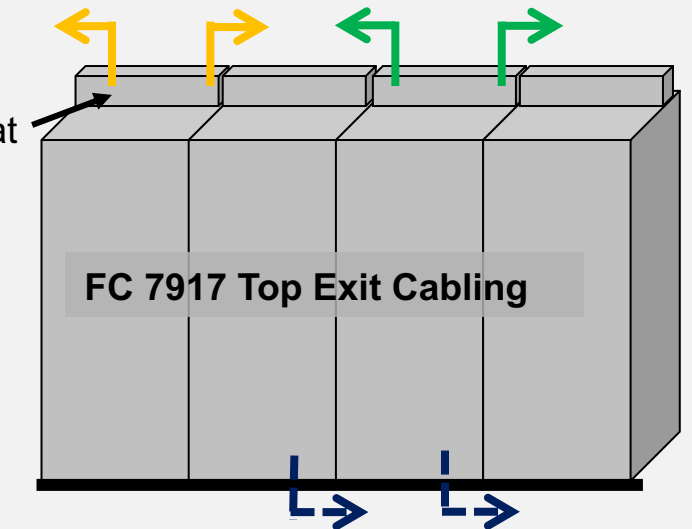
# Cabling Exit Summary for Raised Floor

All cabling exits from the rear of the system



Number of frames and cable locations configuration dependent

Adds top hat  
Only required for Fiber Transport Services/ Fiber Quick Connect

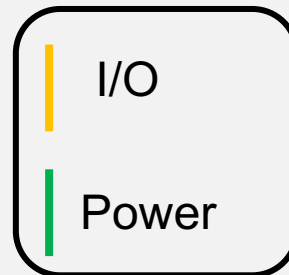
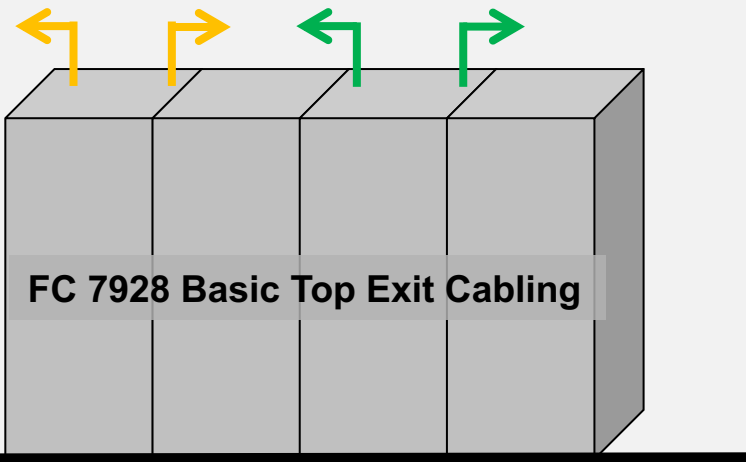
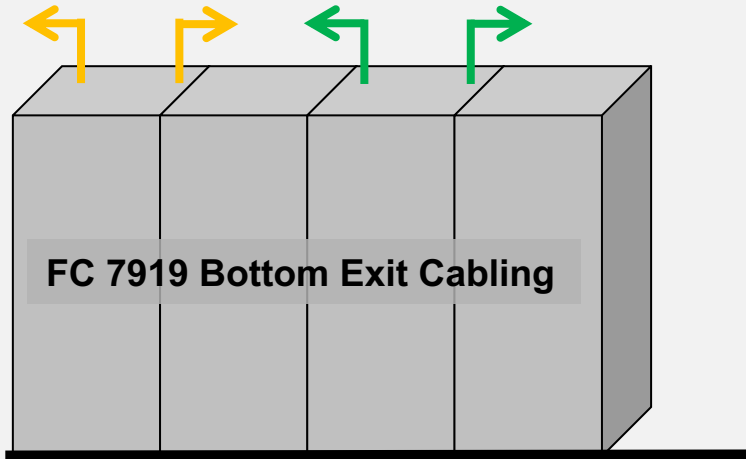


Raised Floor

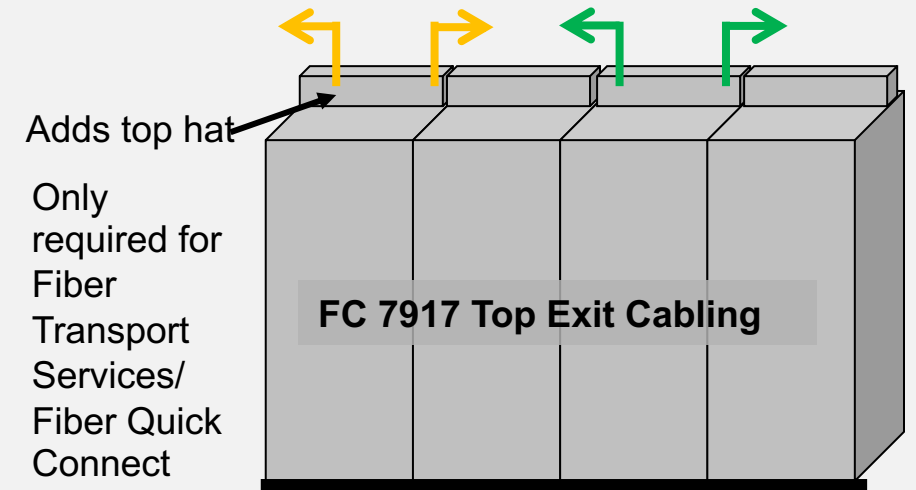
# Cabling Exit Summary for Non Raised Floor

All cabling exits from the rear of the system

Non-Raised Floor



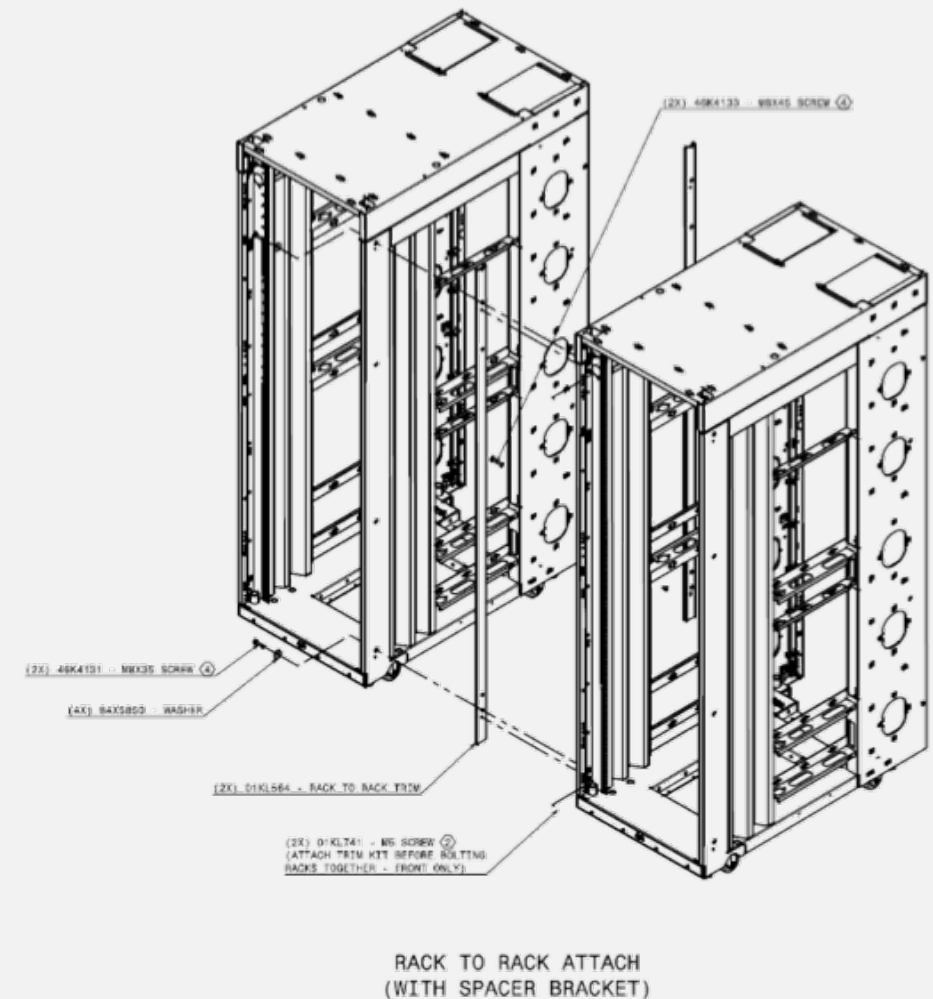
Number of frames and cable locations configuration dependent



Water cooling only available for raise floor

## System Frame Marriage Hardware

- All frames of a z15 system are bolted together
- z15 does not bolt to any adjacent I/T frames/racks
- Side to Side Attach Kit is shown (also known as “marriage hardware kit”)
- Hardware supplied to remain on pitch (that is “on grid”) for 600mm and 24”
  - For 24” pitch use sheet metal spacer bracket (comes connected to frame and is easily removed if not needed)
  - There is no foam, only sheet metal spacer front and back



## z15 Frame Overview

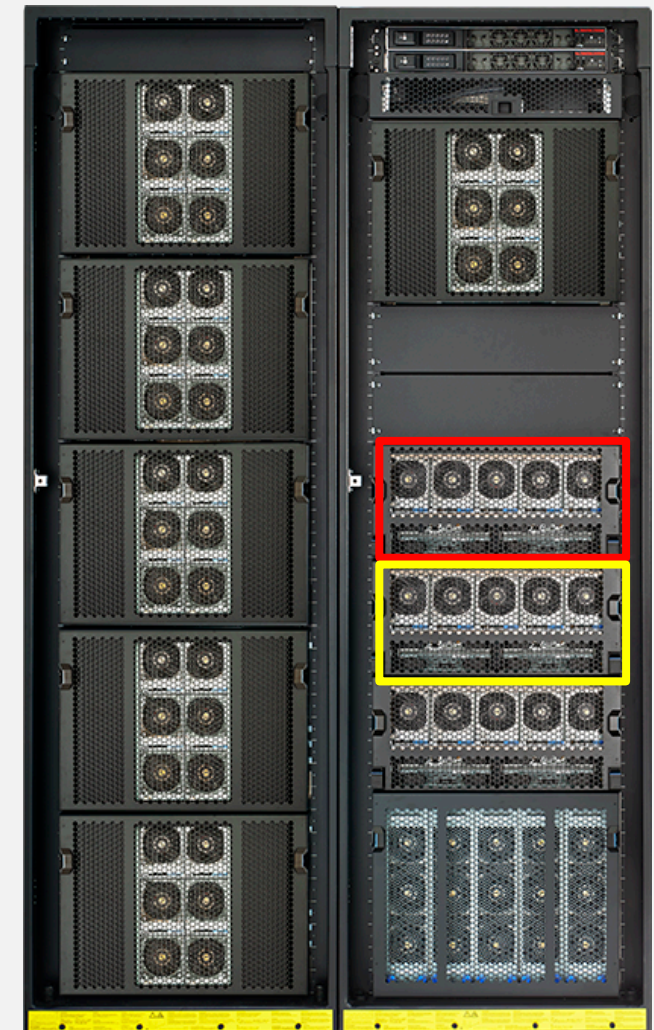
By **default** systems reserve space for up to two additional CPC drawers in the A Frame using two Reserve CPC feature codes

- 2271 – Yellow box
- 2272- Red box

Removing these F/C can allow additional I/O drawers to be plugged in place of the CPC drawers

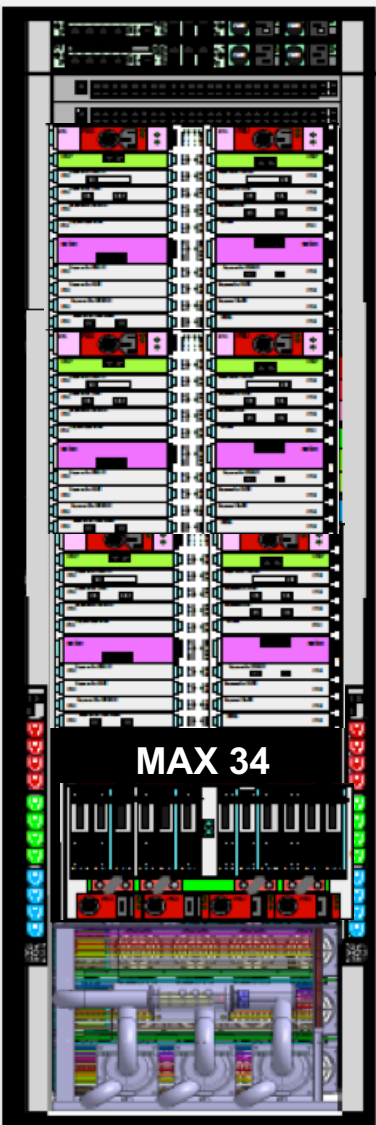
- iPDU Power
  - Up to 2 additional I/O Drawers
    - One I/O drawer per feature code
- BPA Power
  - Up to 1 additional I/O Drawer
    - Requires removal of both feature codes

**Clients will not be able to add additional CPC drawers if they override reserve features and plug I/O drawers.**



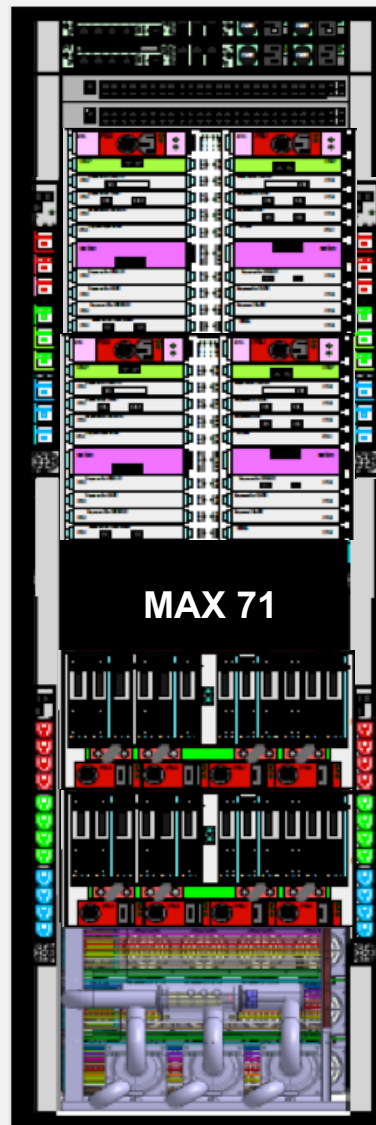
Z iPDU Power A  
Front View

## z15 Configuration: iPDU based single frame Rear View



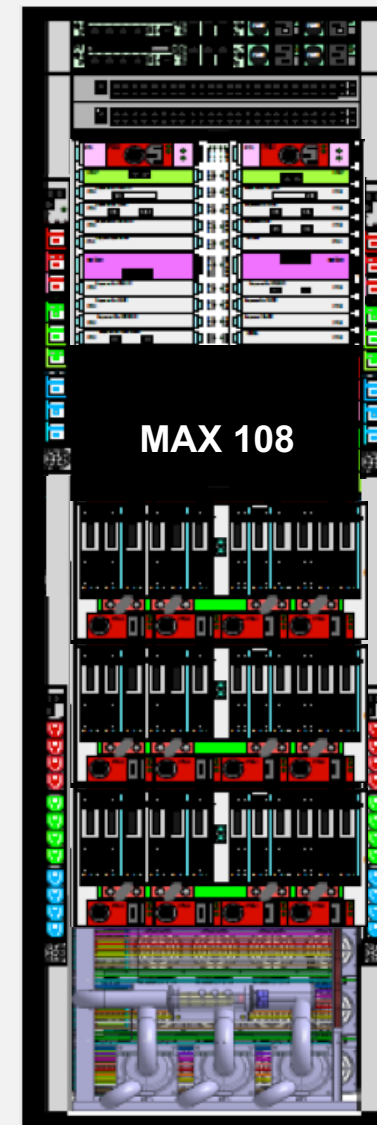
- 2 line cords required
- Up to 34 CPs
- Up to 3 I/O Drawers (48 I/O Cards) without CPC Reserve FCs 2271 and 2272

A Frame



A Frame

- 4 line cords required
- Up to 71 CPs
- Up to 2 I/O Drawers (32 I/O Cards) without CPC Reserve FC 2272

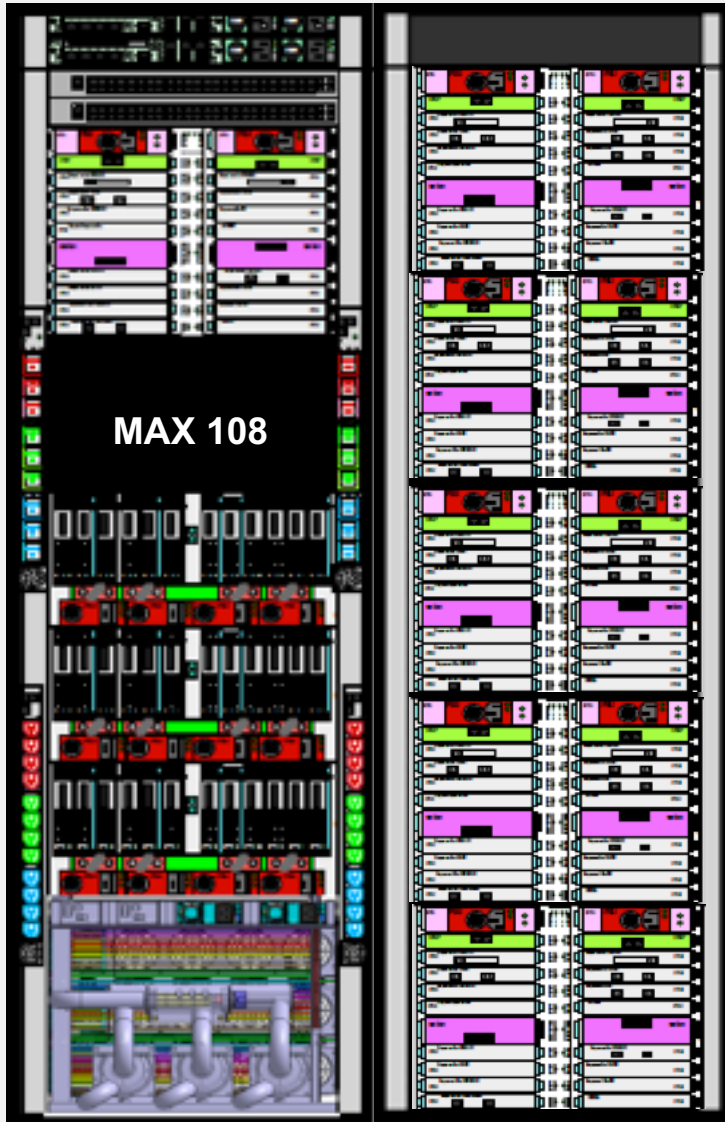


A Frame

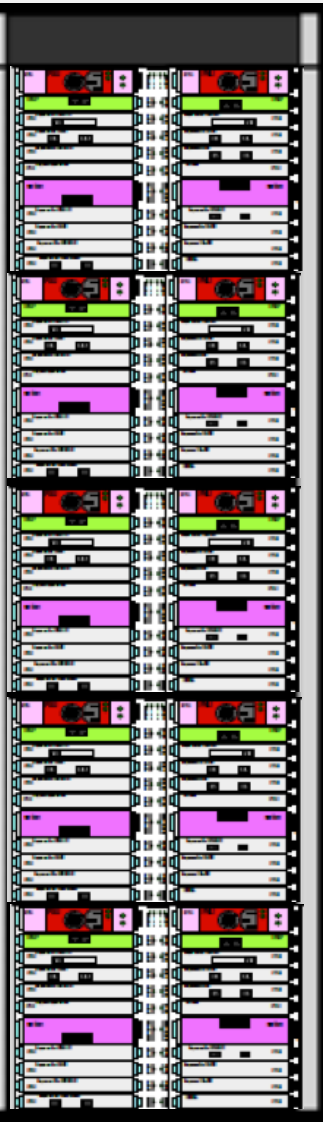
- 4 line cords required
- Up to 108 CPs
- 1 I/O Drawers (16 I/O Cards)
- **Default A-Frame configuration** with CPC Reserve FCs 2271 and/or 2272



# z15 Configuration: iPDU based I/O Expansion Rear View



A Frame

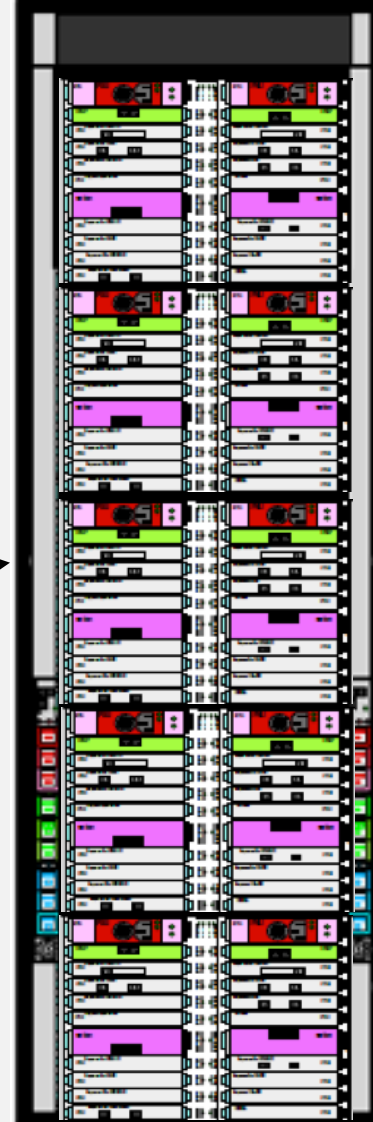


Z Frame

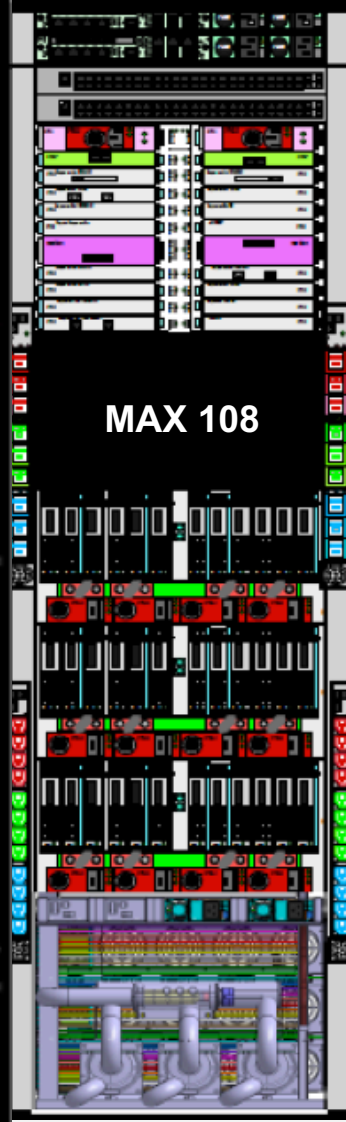
- 4 line cords required
- From 34 to 108 CPs
- 2-8 I/O Drawers (128 I/O Cards Max)
- 6 I/O Drawers Max with Default A-Frame



- 6 line cords required
- From 34 to 108 CPs
- 7-12 I/O Drawers (192 I/O Cards Max)
- 11 I/O Drawers Max with Default A-Frame



C Frame



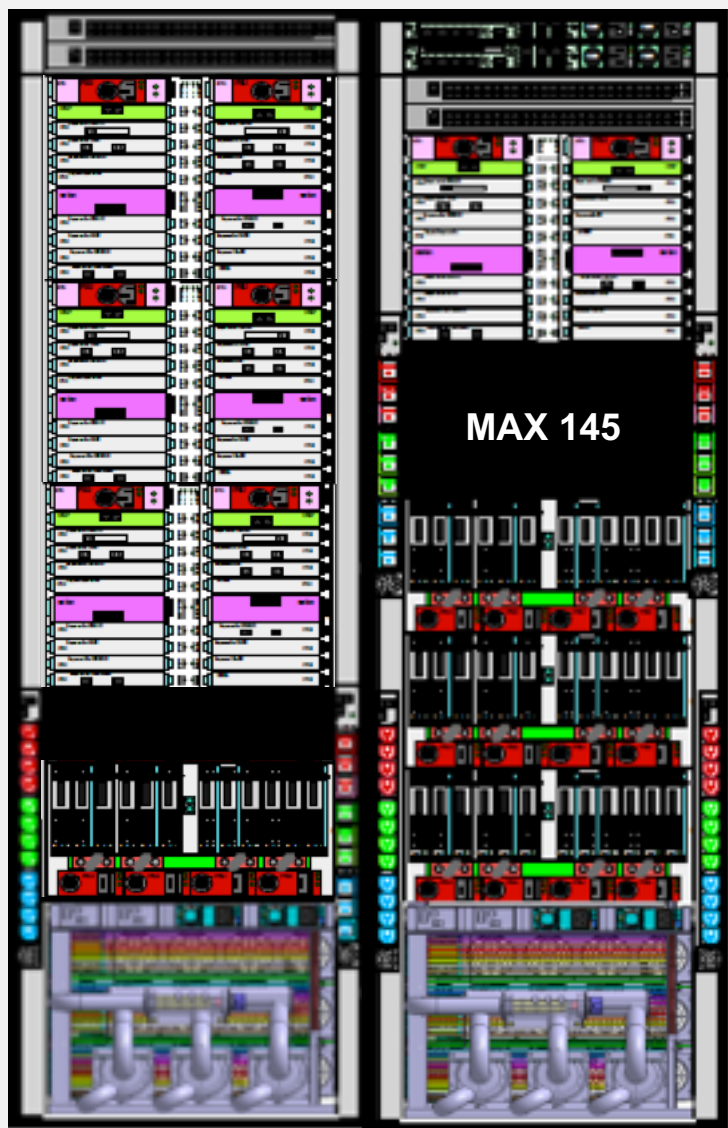
A Frame



Z Frame



## z15 Configuration: iPDU based CP Expansion Rear View

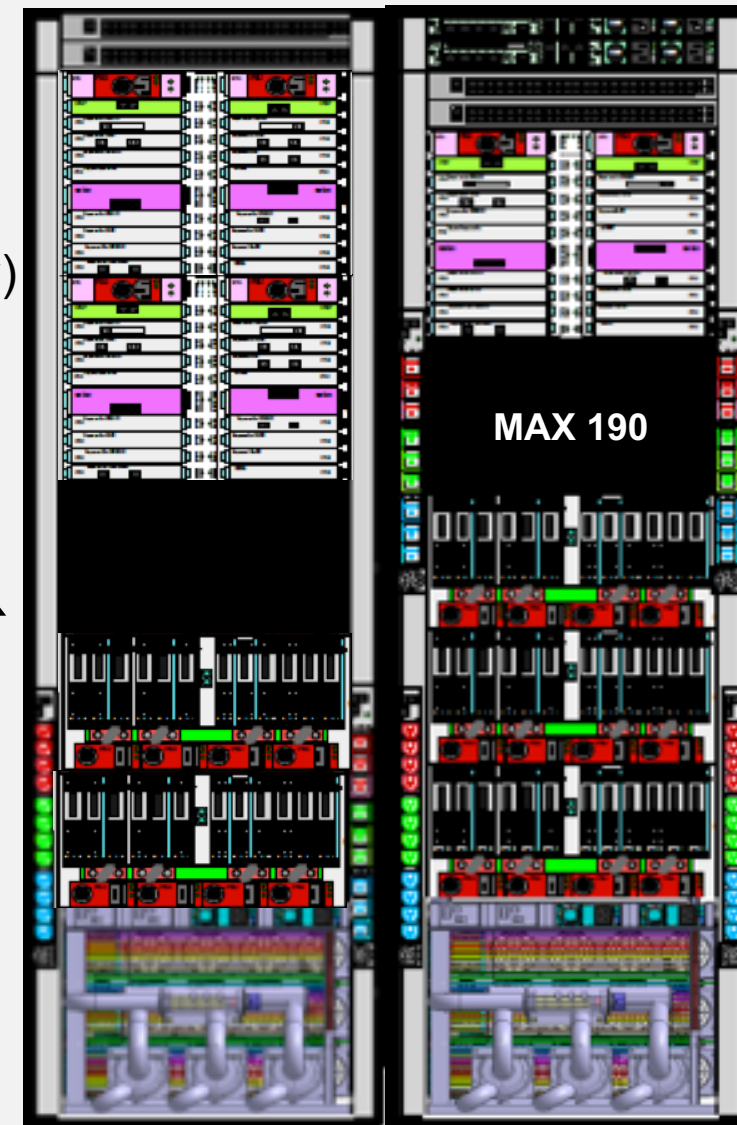


B Frame

A Frame

- 6 line cords required
- 190 CPs (**Factory Build Only**)
- 0-3 I/O Drawers (48 I/O Cards Max)

- 6 line cords required
- 145 CPs (**Factory Build Only**)
- 0-4 I/O Drawers (64 I/O Cards Max)

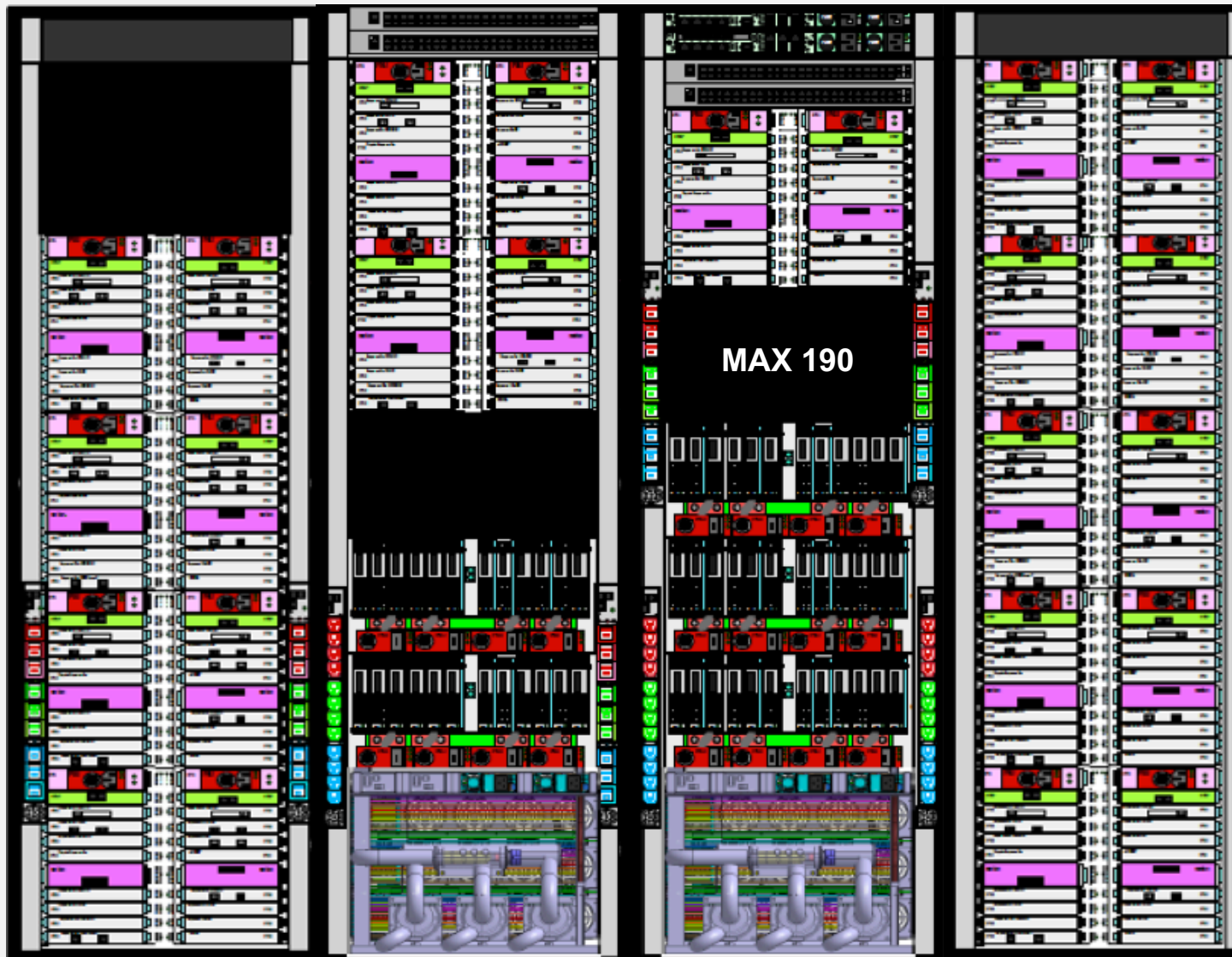


B Frame

A Frame

## z15 Configuration: iPDU base I/O and CP Expansion

- 4 frame expansion
- 8 line cords required
- 145-190 CPs  
**(Factory Build Only)**
- 9-12 I/O Drawers  
(196 I/O Cards Max)



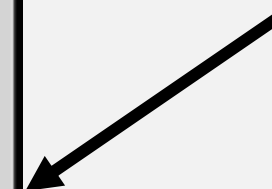
C Frame

B Frame

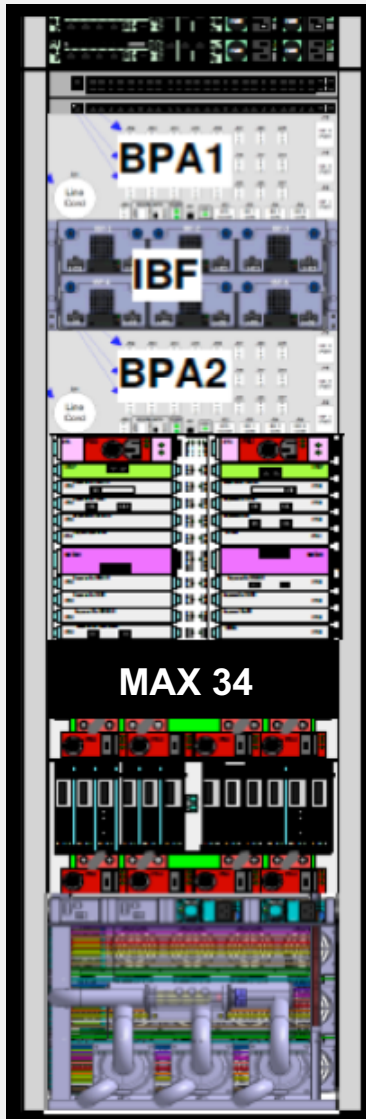
A Frame

Z Frame

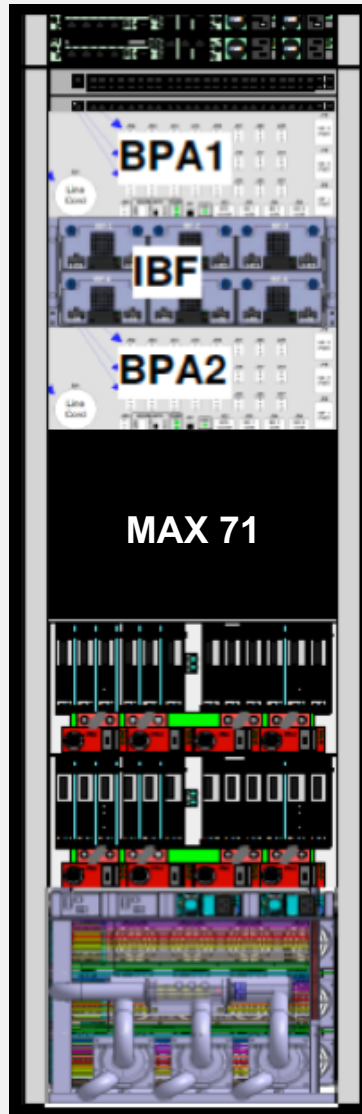
- 3 Frame Expansion
- 6 line cords required
- 145-190 CPs  
**(Factory Build Only)**
- 4-9 I/O Drawers  
(144 I/O Cards Max)
- 8 I/O Drawers Max  
with Max 190



## z15 Configuration: BPA based single frame Rear View

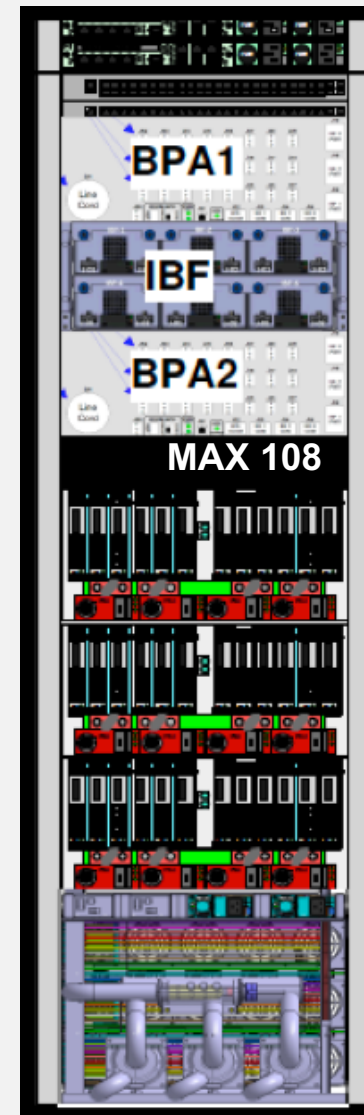


- 2 line cords required
- Up to 34 CPUs
- Up to 1 I/O Drawers (16 I/O Cards Max) without CPC Reserve FCs 2271 and 2272



A Frame

- 2 line cords required
- Up to 71 CPUs
- 0 I/O Drawers (0 I/O Cards Max)

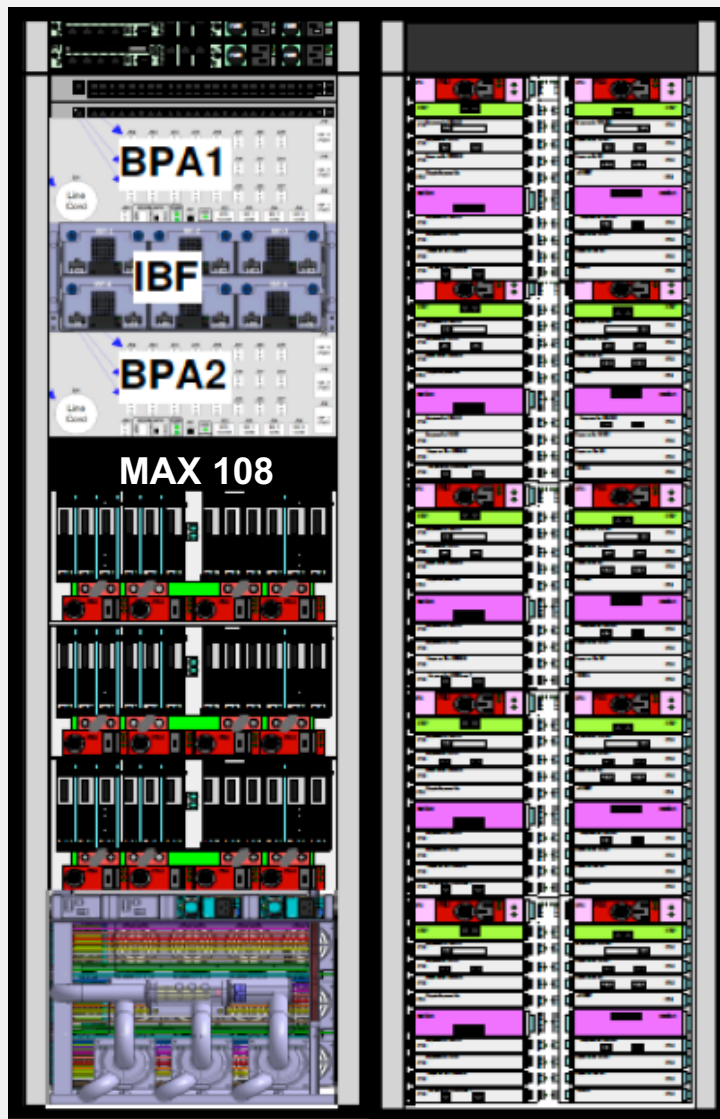


A Frame

- 2 line cords required
- Up to 108 CPUs
- 0 I/O Drawers (0 I/O Cards Max)
- **Default A-Frame configuration** with CPC Reserve FCs 2271 and/or 2272



# z15 Configuration: BPA based I/O Expansion Rear View

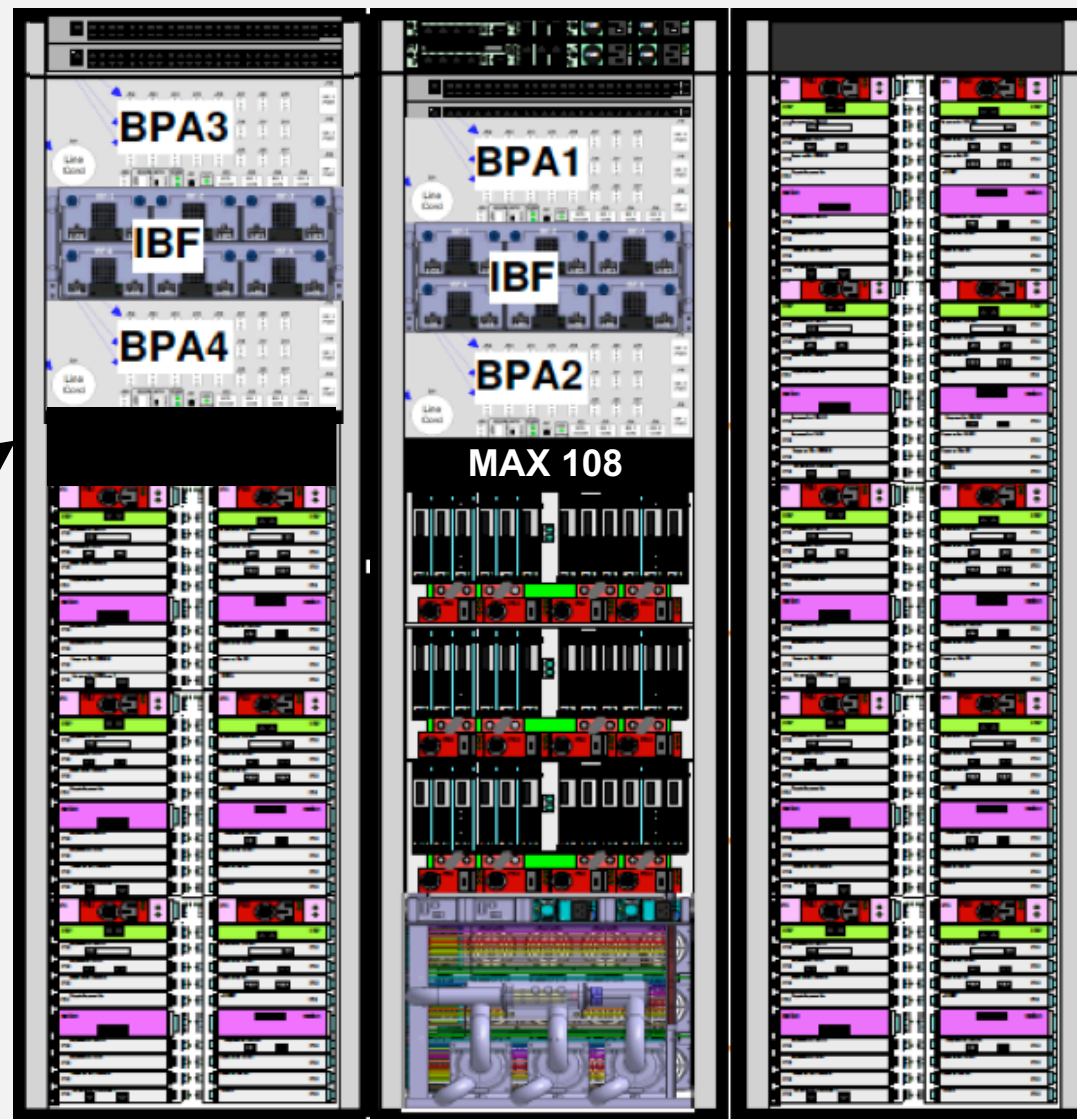


A Frame

Z Frame

- 2 line cords required
- Up to 34 to 108 CPs
- 1 to 6 I/O Drawers (96 I/O Cards Max)
- 5 I/O Drawers Max with Default A-Frame

- 4 line cords required
- Up to 34 to 108 CPs
- 6 to 9 I/O Drawers (144 I/O Cards Max)
- 8 I/O Drawers Max with Default A-Frame
- Additional BPA Required
- Limits I/O Expansion



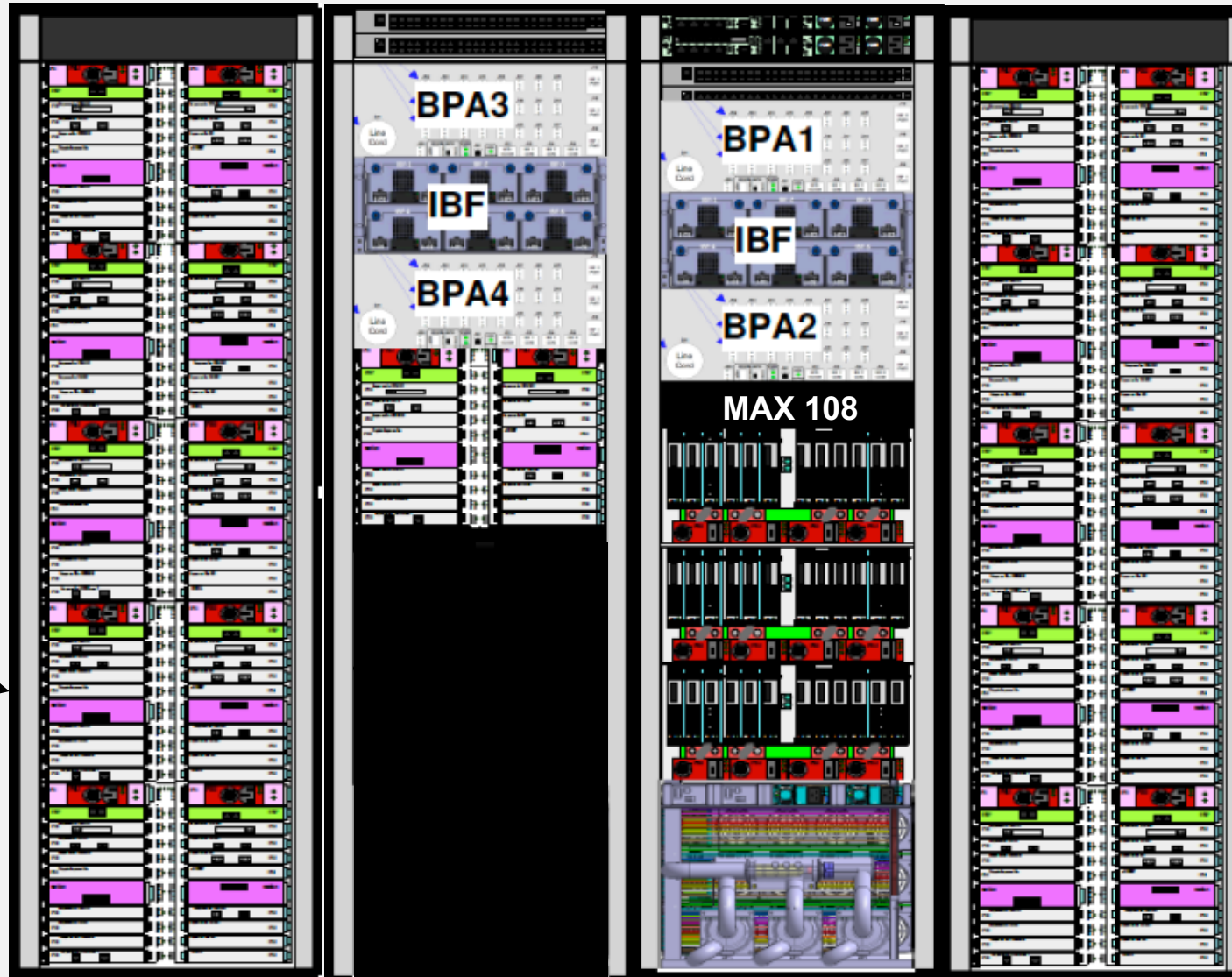
C Frame

A Frame

Z Frame

## z15 Configuration: BPA based I/O Expansion Special Case B-Frame Plan Ahead Rear View

- **Factory Build Only**
- Special case to allow customers with Max34, Max71, or Max108 configurations to be able to use more than 8 I/O Drawers in a typical configuration.
- IBM will ship a B- Frame with **no CPC Drawers or Cooling**
- First I/O drawer will be plugged in B-Frame under the BPA
- 4 line cords required
- Up to 34 to 108 CPs
- 9 to 11 I/O Drawers (176 I/O Cards Max)



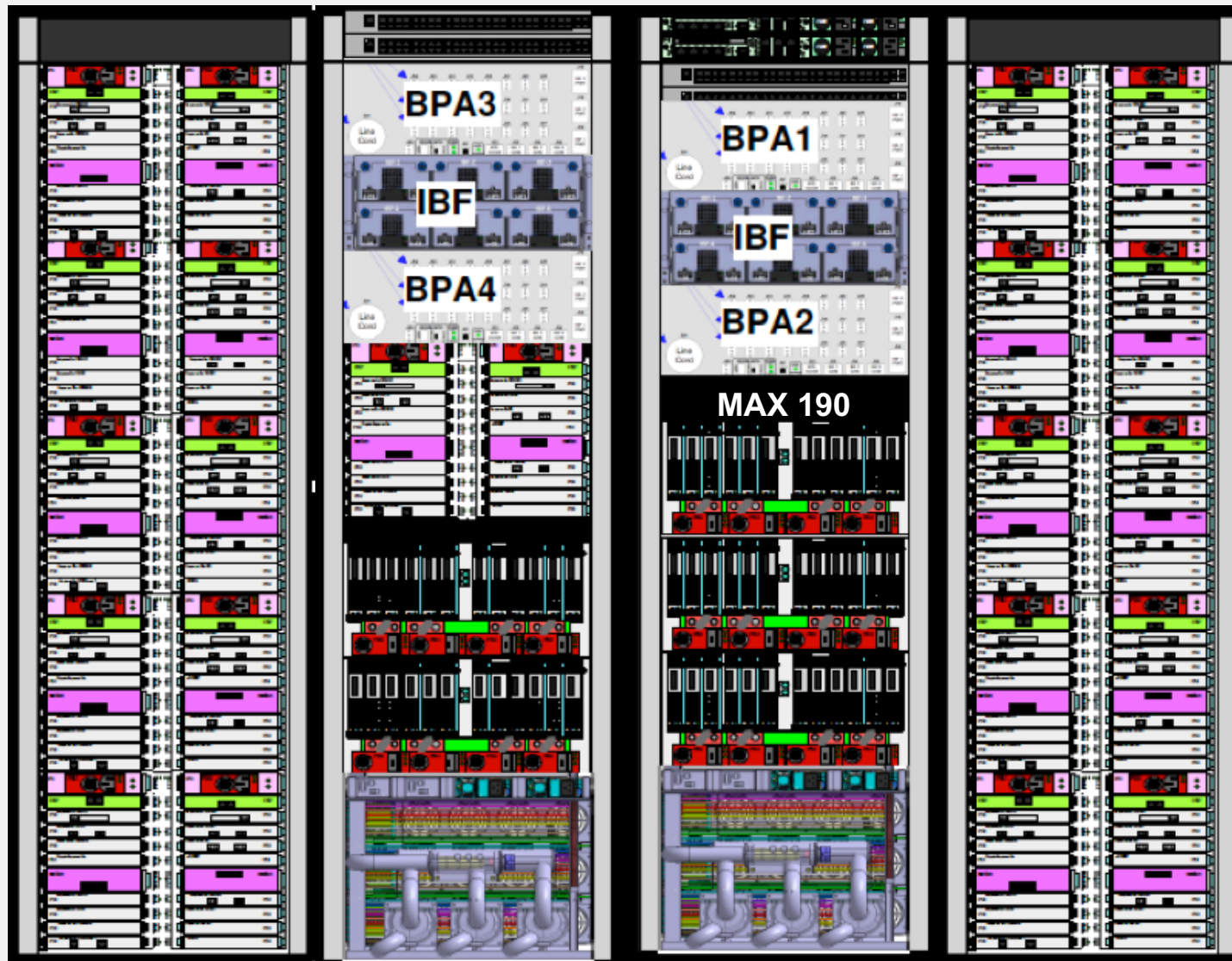
C Frame

B Frame

A Frame

Z Frame

# z15 Configuration: BPA base I/O and CP Expansion



- 4 line cords required
- 145 CPs **Factory Build only** w/ 4 drawers
- 190 CP **Factory Build only** w/ 5 drawers
- Up to 1 I/O Drawers (16 I/O Cards Max) with out I/O expansion

- 7 to 11 I/O Drawers (176 I/O Cards Max) With 2nd I/O expansion

- 2 to 6 I/O Drawers (96 I/O Cards Max) With 1st I/O expansion

C Frame

B Frame

A Frame

Z Frame



## Package Shipping Specifications

### ▪ z15 shipment:

- Systems are shipped protected with an anti-static poly bag with desiccant inside. This is placed in a wooden container and mounted on pallets requiring commercial lift transportation. This packaging is used for all world-wide shipments.

### ▪ Packaged Shipping Specifications:

|                          | Width mm (in)    | Depth mm (in)     | Height mm (in)    | Max. Weight kg (lb) |
|--------------------------|------------------|-------------------|-------------------|---------------------|
| Crated Frame w/o covers  | 940 mm (37.0 in) | 1334 mm (52.5 in) | 2286 mm (90.0 in) | 958 kg (2110 lb)    |
| Cover Set with Packaging | 457 mm (18.0 in) | 2134 mm (84.0 in) | 1016 mm (40.0 in) | 49.9 kg (110 lb)    |

### ▪ Height Reduction (FC 9975):

- If during transit to or entry to the final installation location contains openings less than 2032 mm (80.0 in) high, FC 9975 should be ordered.
- This feature reduces the frame height to 1898 mm (74.7 in), with the frame's top hat and side covers shipped in a separate carton.
- Note: FC 9976 shall be ordered for "ship to return" packaging

*\*Excludes front and rear doors (called covers here), but does include side covers*

# z15 HMC

# IBM z15 Hardware Management Console

You can order up to 10 HMCs total for a system

## Available HMCs for z15

| Feature Code | Description    | CF/NB     |
|--------------|----------------|-----------|
| 0062         | HMC Tower      | NB        |
| 0063         | HMC Rack Mount | NB        |
| 0082         | HMC Tower      | CF        |
| 0083         | HMC Rack Mount | CF        |
| 0095         | HMC Tower      | CF        |
| 0096         | HMC Rack Mount | CF        |
| <b>0100</b>  | <b>HMA</b>     | <b>NB</b> |



## Available peripherals

- HMC Table top KMM FC 0148
- HMC Rack Mount KMM FC 0154

## HMC Support

- Seamless hard drive encryption
- Will only support n-2 Systems
- DVD drives removed
- zBX & Ensemble Support Removed

| Machine Family | Machine Type | Firmware Driver | SE Version |
|----------------|--------------|-----------------|------------|
| z15            | 8561         | 41              | 2.15.0     |
| z14 M0x        | 3906         | 36              | 2.14.1     |
| z14 ZR1        | 3907         | 36              | 2.14.1     |
| z13            | 2964         | 27              | 2.13.1     |
| z13s           | 2965         | 27              | 2.13.1     |

## HMC/SE -- NO DVD drive

- No DVD/CD drives in HMC FC 0062, FC 0063 (new build) or SE HW
- No DVD/CD drives in TKE FC 0087, FC 0088 (new build)
- USB slots still present
- Two options for service and functional operations:
  - USB
  - Electronic
- Both options provide:
  - HMC/TKE/SE firmware loading
  - eBoD (eBusiness on Demand) records (eg, On Off Capacity on Demand, Capacity Backup Unit (Disaster Recovery))
  - Operating System code (used for Load from Removable Media or Server task)

## HMC/SE – NO DVD – Firmware load

- USB

- Same as with DVDs today
- New system orders will normally ship HMC, TKE, or SE firmware on USB
  - UNLESS new FC (Feature Code) 0846 ordered

- Electronic (NEW for 2.15.0)

- Use when USB not acceptable or when FC 0846 ordered
- Firmware (ISO image) put on HMC
- HMC is server of ISO image
- ISO image loaded to target HMC/TKE/SE over network
- New build HMCs pre-loaded with HMC/SE ISO images

### Notes:

- HMC 2.15.0 (MES or new build) with Legacy Systems (z14/z13):
- Can support z14/z13 Service functions/Read Only Feature directly on SE
- No ISO Images required for z13/z14

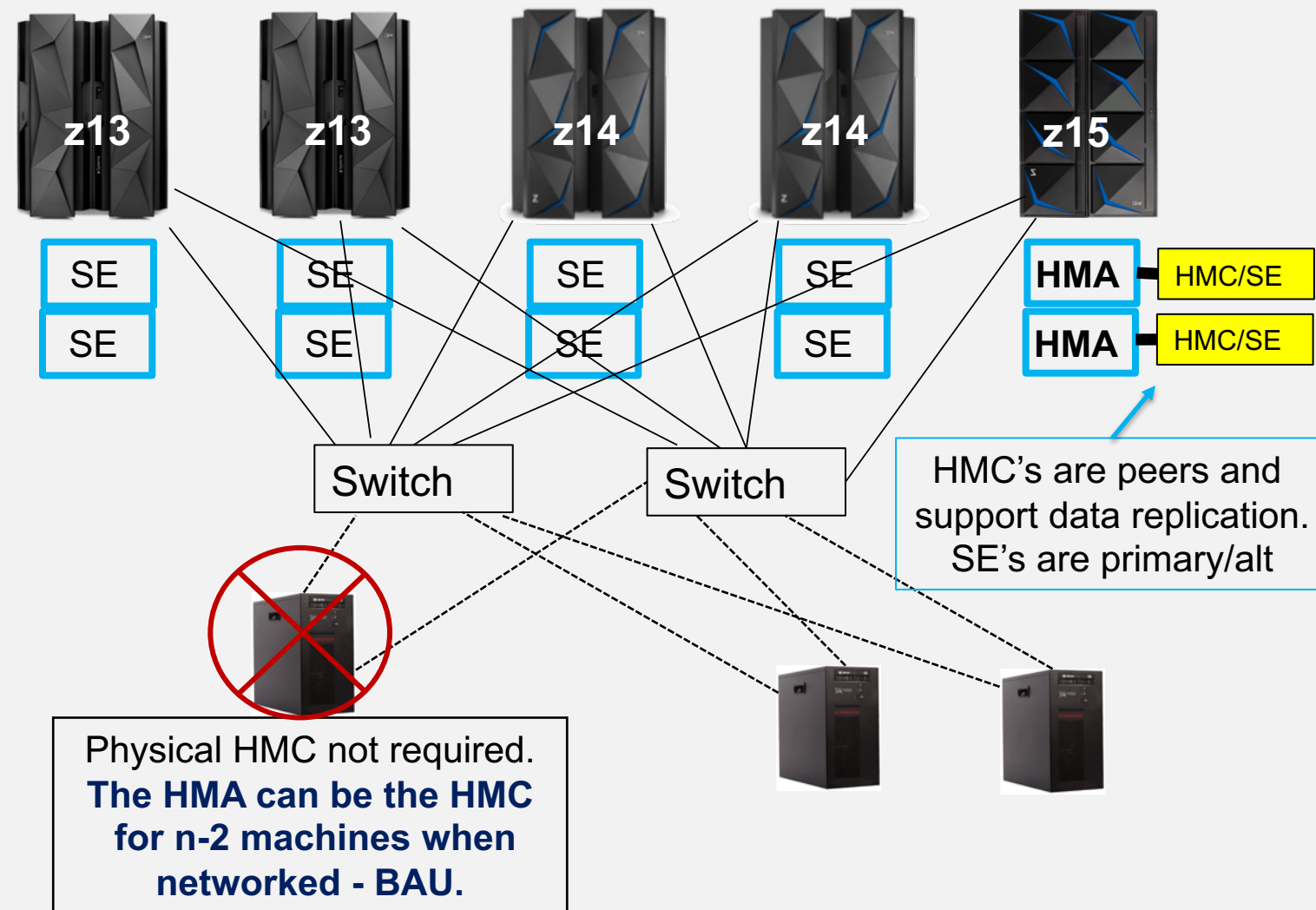
## HMC/SE – No DVD - FC 0846 (No physical media shipped)

- **Drives requirement for two 2.15.0 HMCs on every unique network subnet where HMC, SE, or TKE is connected.**
  - The requirement is driven by “dead” HMC recovery scenario
- ISO image download options (if needed)
  - Remote Support Facility (zRSF) to HMC
  - Resource Link to FTP server.
    - HMC downloads from FTP server
- MES / eBoD data will be available for download from a website
  - FTP option can used to load to HMC



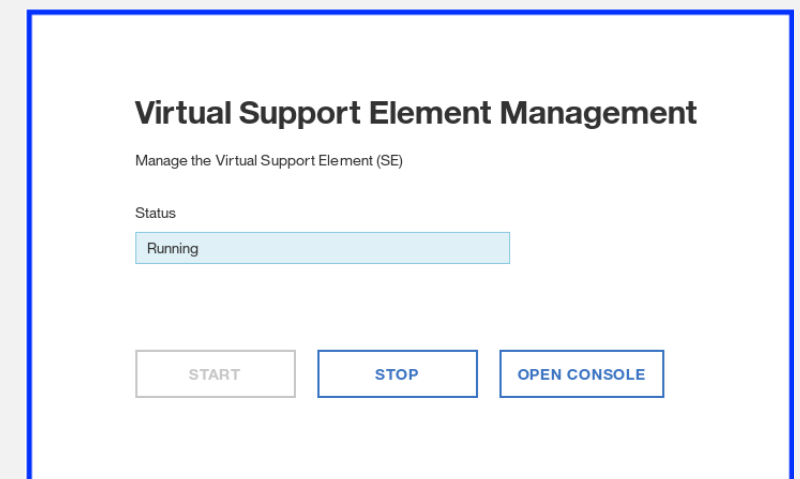
## Hardware Management Appliance (HMA)

- The HMC code runs as an appliance on a higher performance model of the Support Element.
- Logon to HMC remotely from your browser.
- Same Driver 41 LIC as a physical HMC.
- Up to 10 physical HMCs plus the HMA can be ordered and used.
- Optional – FC0100
- PR/SM or DPM mode
- New Build Only – No MES



## Hardware Management Appliance details (1 of 2)

- The Support Element runs as a guest of the HMC.
  - Hardware: Two 1U Rack Mounted servers running HMCs first level.
  - SEs maintain primary/alternate relationship
  - HMCs do not have a primary/alternate relationship, though data replication can be set up
- Manage the SE using the new “Virtual Support Element Management” task
  - Allows start/stop of the SE
    - These operations should be seldom used since:
      - The SE is automatically started when the HMC boots
      - The SE “Shutdown” task should be used to gracefully shutdown the SE. The stop function should only be needed in the event of an SE hang
    - Allows user to open the graphical console of the SE



## Hardware Management Appliance details (2 of 2)

- Accessing the HMC and SE.

- You can access the HMC through a remote web browser as usual
- If you walk up to the physical KMM display, you will see the HMC UI
- The SE can be accessed via “Single Object Operations” from the HMC as usual
- You can also use “Virtual Support Element Management” -> “Open Console” to view the full SE desktop

- Things to be aware of

- Since the SE is running as a guest under the HMC, any reboot or shutdown will be disruptive to the SE running on that HMC
  - This means that operations like HMC code updates must be performed on the HMC hosting the Alternate SE first, followed by a Primary/Alternate switch before proceeding to update the other HMC.
- “Restart application” on the HMC will \*not\* disrupt operation of the SE.
- Vast majority of SE and HMC tasks work the same way they do on standalone consoles

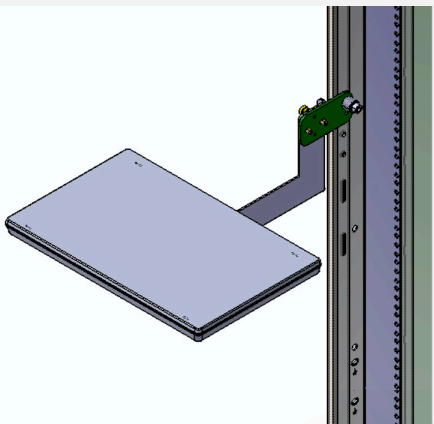
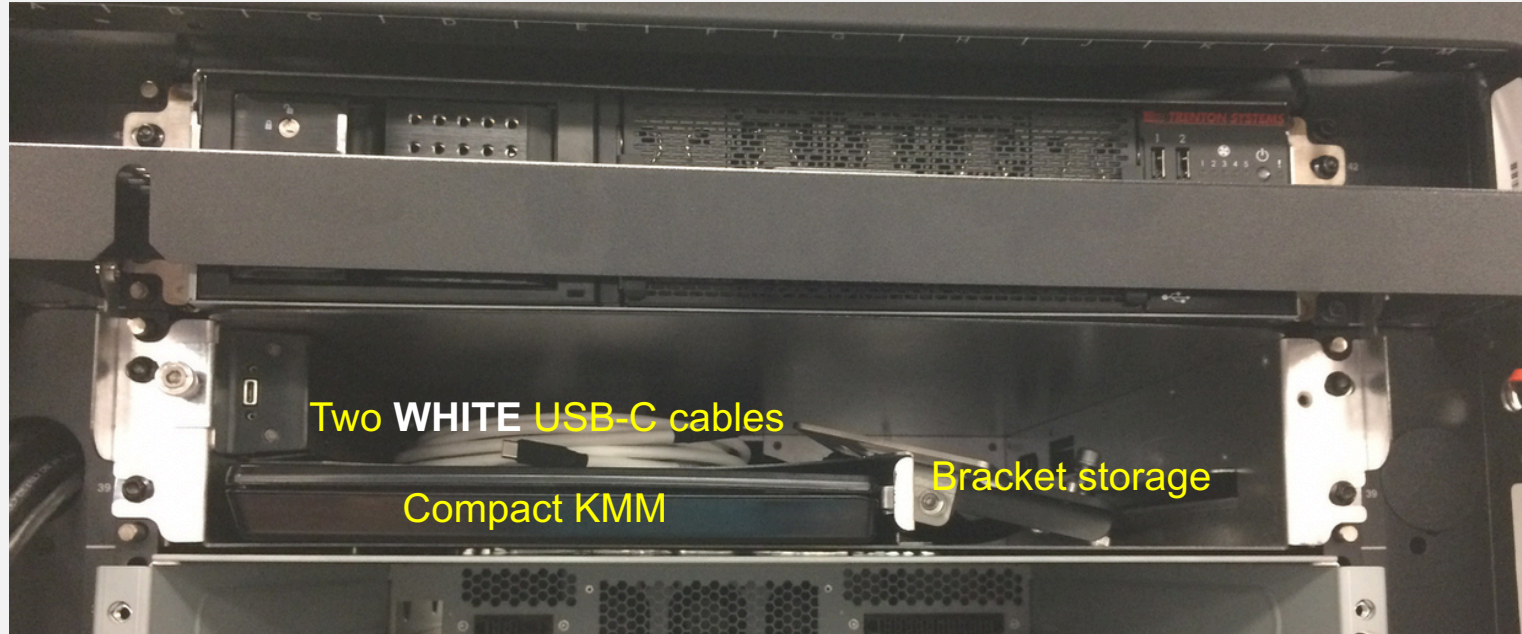
## Mini KMM for SE

- SE Keyboard/Display intended for Service use
  - Non critical hardware for functional & monitoring of CPC, Images, & OSes
  - Customer physical access intended use => HMC only (no SE physical access)
    - Understand that some clients may physically access SE
    - New Human Interface for SE => clients must utilize service solution
    - For Virtual Appliance Feature
      - Intended HMC/SE Physical access via remote browser workstation
      - If clients access VA directly => must accept service solution
    - Recommendation to clients: Don't physically access Mini KMM in IBM Z frame
- Mini (or Compact) KMM (Keyboard Monitor Mouse) solution
  - Single KMM
  - Attaches via USB-C cable connection
    - Connections via front/back of frame
    - Interface Adapter to switch between Primary/Alternate SEs



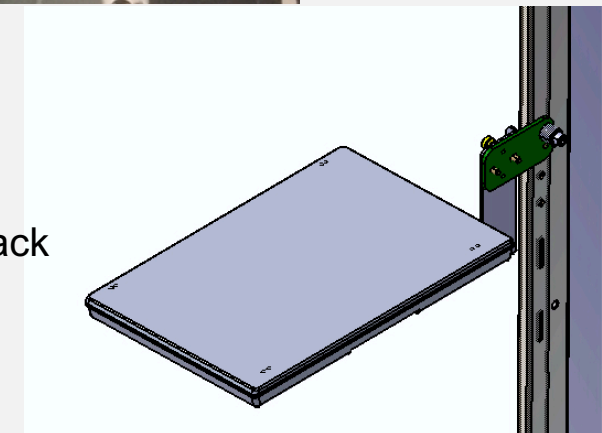
## Mini KMM for SE

Open Cubby =&gt; KMM Stored



Mini KMM  
Frame Mounting  
Opens OUT of the  
drawer space

Mounts to either side,  
left or right,  
front or back  
Can mount on an adjacent rack

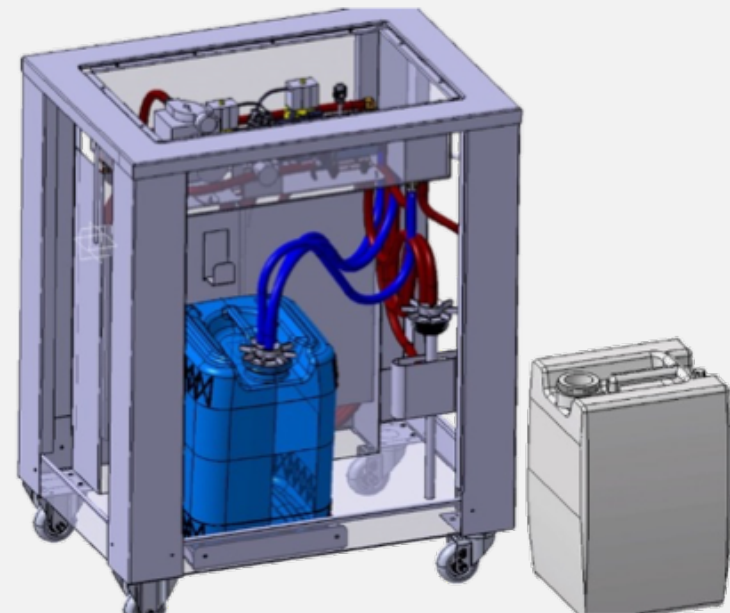


# z15 Site Tools



## Fill and Drain Kit

- **New Fill and drain tool will be shipped with z15 and LinuxONE III FC 3393**
  - Previous tools will *not* be compatible
  - New tool designed to reduce the complexity of operation and improve its efficiency
    - Reduced the number of parts and streamlined its operation
    - Old tool could take up to 3 hours
- **Tool will include a 5 gal blue fill jug and a 6 gal drain jug that are interchangeable for operation**
  - Goal is to use one jug for fill or drain
- **Tool always connects to the system the same way**
- **Controlled by the SE once connected**



## Lift Tool and Extension Ladder

- Lift Tool FC 3100
  - Same as the z14 ZR1
  - 5 separate components that attach to the front of the system
  - Each site requires at least one for all z15 systems
- 
- Extension Ladder FC 3101
  - Same as the z14 ZR1
  - Each datacenter requires at least one for all z15 Systems



# z15 Operating Systems

## z15 operating system support

### z/OS

- z/OS 2.4 with PTFs
- z/OS 2.3 with PTFs
- z/OS 2.2 with PTFs
- z/OS 2.1 (compatibility only)
  - IBM Software Support Services purchase
  - September 2018, EoS

### z/VM

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

### z/VSE

- z/VSE 6.2



### KVM Hypervisor

- RHEL 7.6
- RHEL 8.0
- SLES 12.4
- SLES 15.1
- Ubuntu 16.04 LTS
- Ubuntu 18.04 LTS

### • Minimum Distributions

- SLES 15.1
- SLES 12.4
- SLES 11.4
- RHEL 8.0
- RHEL 7.6
- RHEL 6.10
- Ubuntu 16.04 LTS
- Ubuntu 18.04 LTS

IBM cannot legally discuss z15 exploitation prior to GA from distributors.

### Officially Tested:

[www.ibm.com/systems/z/os/linux/re-sources/testedplatforms.html](http://www.ibm.com/systems/z/os/linux/re-sources/testedplatforms.html)

### z/TPF

- z/TPF 1.1 with PTFs

# z/OS Support Summary

| Release               | z10 EC<br>z10 BC<br>WdfM | z196<br>z114<br>WdfM | zEC12<br>zBC12<br>WdfM | z13<br>z13s | z14 | z15            | End of Service | Extended Defect Support <sup>1</sup> |
|-----------------------|--------------------------|----------------------|------------------------|-------------|-----|----------------|----------------|--------------------------------------|
| z/OS 2.1              | X                        | X                    | X                      | X           | X   | X <sup>1</sup> | 9/18           | 9/21*                                |
| z/OS 2.2              | X                        | X                    | X                      | X           | X   | X              | 9/20*          | 9/23*                                |
| z/OS 2.3              |                          |                      | X                      | X           | X   | X              | 9/22*          | 9/25                                 |
| z/OS 2.4 <sup>2</sup> |                          |                      | X                      | X           | X   | X              | 9/24*          | 9/27*                                |

**Notes:**

- 1 The IBM Software Support Services for z/OS V2.1 offered, provides the ability for customers to purchase extended defect support service for z/OS V2.1
- 2 Planned to be Generally Available in September 2019

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

WdfM – Server has been withdrawn from Marketing

**Legend**

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

# Summary: z/OS Support for IBM z15

| Release                | IBM.Device.Server.z15-8561.RequiredService |                                |                    |                       |               |                    | IBM.Device.Server.z15-8561.Exploitation |                                    |                  |               |                    |             |                   | Max Memory/ LPAR |
|------------------------|--|--------------------------------|--------------------|-----------------------|---------------|--------------------|---|------------------------------------|------------------|---------------|--------------------|-------------|-------------------|------------------|
|                        | Base Support                               | CPU Measurement Facility (HIS) | FICON Express 16S+ | z15 Assembler Support | OSA-Express7S | Fair Latch Manager | System Recovery Boost                   | Nest Acceleration Unit Compression | Crypto Express7S | RoCE Express2 | Z/OS V2R4 XL C/C++ | CF Level 24 | Quantum Safe      | TB               |
| z/OS V2.1 <sup>S</sup> | P  |                                | P                  | P                     | P             | P                  |   | P                                  |                  | P             |                    | P           |                   | 4                |
| z/OS 2.2               | P  | P                              | P                  | P                     | P             | P                  |   | P                                  | W <sup>D1</sup>  | P             |                    | P           | P,W <sup>D1</sup> | 4                |
| z/OS 2.3               | P  | P                              | P                  | P                     | P             | P                  | P                                       | P                                  | W <sup>D1</sup>  | P             |                    | P           | P,W <sup>D1</sup> | 4                |
| z/OS 2.4               | Y  | P                              | Y                  | P                     | Y             | Y                  | P                                       | P                                  | W <sup>D1</sup>  | Y             | Y                  | P           | P,W <sup>D1</sup> | 4                |

**Notes:**

- S IBM Software Support Services required for extended support.
- P PTF is required, use SMP/E FIXCAT for identification
- Y Support is in the base

D1 Requires the ICSF web deliverable for FMID HCR77D1 minimally.

W A web deliverable is required, available at <http://www-03.ibm.com/systems/z/os/zos/downloads/>



## z/VM Release Status Summary

| z/VM Level | GA      | End of Service Target* | End of Marketing Target* | Minimum Processor Level  | Maximum Processor Level | Security Level  |
|------------|---------|------------------------|--------------------------|--------------------------|-------------------------|---|
| 7.1        | 9/2018  | 3/2022                 | 3/2023                   | zEC12 & zBC12            |                         |   |
| 6.4        | 11/2016 | 3/2020                 | 3/2021                   | z196 & z114 <sup>®</sup> | -                       | Common Criteria Complete!<br><br>FIPS 140-2 In Progress |

\* End of Marketing and End of Service dates have not yet been announced

# ICSF Supported Releases

|                    |                      | 9/18<br>EOS | 9/20<br>EOS    | 9/22<br>EOS    | 9/24<br>EOS    |
|--------------------|----------------------|-------------|----------------|----------------|----------------|
|                    | Ship Date GA         | V2R1        | V2R2           | V2R3           | V2R4           |
| HCR77D1<br>(WD#19) | 10/2019              |             | X              | X              | X              |
| HCR77D0<br>(WD#18) | 12/2018              |             | X              | X              | X <sup>b</sup> |
| HCR77C1<br>(WD#17) | 9/2017               | X           | X              | X              |                |
| HCR77C0<br>(WD#16) | 10/17/2016<br>(3Q17) | X           | X              | X <sup>b</sup> |                |
| HCR77B1<br>(WD#15) | 11/2/2015            | X           | X              |                |                |
| HCR77B0<br>(WD#14) | 2/2015<br>(2H2015)   | X           | X <sup>b</sup> |                |                |

x<sup>b</sup> Support in base z/OS release

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

## IBM Z server support – z/VSE

| VSE Release  | z800 / z900<br>z890 / z990 | z9  | z10 | z196 / z114 / zEC12<br>zBC12 / z13 / z13s | z14 / z14 ZR1<br>z15 | VSE EoM    | VSE EoS    |
|--------------|----------------------------|-----|-----|---|----------------------|------------|------------|
| z/VSE V6.2   | No                         | No  | No  | Yes                                       | Yes                  | tbd        | tbd        |
| z/VSE V6.1   | No                         | No  | Yes | Yes                                       | Yes                  | 12/01/2017 | 06/30/2019 |
| z/VSE V5.2   | No                         | Yes | Yes | Yes                                       | Yes                  | 03/13/2017 | 10/31/2018 |
| z/VSE V5.1   | No                         | Yes | Yes | Yes                                       | Yes (PTF)            | 05/23/2014 | 06/30/2016 |
| z/VSE V4.3   | Yes                        | Yes | Yes | Yes                                       | z/VM guest           | 06/25/2012 | 10/31/2014 |
| z/VSE V4.2   | Yes                        | Yes | Yes | Yes                                       | z/VM guest           | 10/26/2010 | 10/31/2012 |
| z/VSE V4.1   | Yes                        | Yes | Yes | Yes                                       | z/VM guest           | 10/17/2008 | 04/30/2011 |
| z/VSE V3.1   | Yes                        | Yes | Yes | Yes                                       | no                   | 05/31/2008 | 07/31/2009 |
| VSE/ESA V2.7 | Yes                        | Yes | Yes | Yes                                       | no                   | 09/30/2005 | 02/28/2007 |
| VSE/ESA V2.6 | Yes                        | Yes | Yes | Yes                                       | no                   | 03/14/2003 | 03/31/2006 |

z/VSE hardware and release status: <https://www.ibm.com/it-infrastructure/z/zvse-resources>

## z15 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 General Direction

- **Removal of the z/VM PAGING63 IPL parameter:** z/VM 7.1 will be the last z/VM release to support use of the PAGING63 IPL parameter. This parameter directed the paging subsystem to behave as it had in releases prior to z/VM 6.4. It also prevented use of z/VM 6.4 and 7.1 paging subsystem improvements, which include support for High Performance FICON, HyperPAV, encryption, and EAV.
- **Prepaid OoCoD tokens:** Beginning with IBM z15, new prepaid OoCoD tokens purchased will not carry forward to future systems.
- **IEEE 1588 Precision Time Protocol (PTP):** In the future IBM plans to introduce PTP as an external time source for IBM Z Server Time Protocol (STP) for an IBM Z Coordinated Timing Network (CTN). The initial implementation will be for PTP connectivity via the IBM Z HMC/SE. At that time there will be no change to the use of STP CTNs for time coordination, other than the potential to use a PTP-based external time source. Future implementation is planned to include full connectivity of an external PTP time source directly to the IBM Z CPC, and re-introduction of the concept of a mixed CTN, with support for traditional STP and native PTP implementations. Beyond that, the goal is to enhance the role of IBM Z machines in a PTP environment that addresses the many governmental regulations and security concerns that our clients are facing.

## Statements of General Direction

- **Operational Data Generation and Analytics:** In the future IBM intends to deliver z/OS and Middleware interdependency data generation, and automated z/OS cross stack analytics to reduce skill requirements level and amount of time required to perform problem definition.
- **z/VSE exploitation of System Recovery Boost:** In the future, IBM intends to deliver native z/VSE exploitation of System Recovery Boost, which is expected to enable restoration of service from, and catch up after, both planned and unplanned outages faster than on any prior Z machine.
- **Fibre Channel Endpoint Security:** In the future IBM intends to provide Fibre Channel Endpoint Security to extend Pervasive Encryption on IBM Z, providing additional data protection and helping to achieve compliance mandates.



Thanks