

# Elevate your hybrid cloud with IBM z15

Jonathan Bradbury  
STSM Lead ISA Architect IBM Z



# Design Thinking Co-Created with Clients

**342**  
**Clients**

Sponsor User Program  
IBM Z Design Council  
GM Advisory Council  
Cross section of user groups  
(geos, industries, size)

**102**  
**Enterprises**

CISO  
IT Director  
Application Architects  
Infrastructure Architects  
IM/Data Architects  
Security Architects  
Z Administrator  
Z SME  
Z Junior System  
Programmer  
Security Administrators  
Application developers  
Line of Business Executive  
Cloud Architect  
Facilities Managers  
IT Operators

3x more engagement with user  
personas over z14, started at concept  
across z/OS and Linux on z,  
Cross-team alignment from OM,  
design, marketing, development, sales  
enablement

**15**  
**User  
Personas**

**467**  
**Interaction  
Hours**

# 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*

# Ready for cloud data center

*Designed to align with data center trends, to optimize cost, density and flexibility*

- **Modular and Scalable** 1-4 19" frames depending on capacity requirements
- A z15 single system performance enables **reduced overall system power consumption by 40% versus the equivalent x86** configuration
- Both **raised and non-raised floors** as well as top and bottom exit I/O and power



# Purpose built for mission-critical applications

## Processor

- Up to 190 client configurable cores
- **14%** Single Thread Performance Improvement
- **25%** maximum system capacity growth over z14
- New on-chip acceleration of compression for faster processing and more efficient storage of data
- More investments in pause-less garbage collection, 30+ new instructions codesigned and exploited by Java, and vector enhancements for analytics applications

## Memory

- 40 TB Max Per System - RAIM Memory design

## To the Data

- Significant scalability improvements – up to 20% more I/O channels and 50% more logical Coupling Facility connections over z14
- **Faster** SSL/TLS handshake performance on z15 with Crypto Express7S compared to z14 with Crypto Express6S

## IBM z15

Machine Type: 8561  
Model T01

### Feature Based Sizing

CPC Drawer	Customer PUs	Max Memory
5	190	40 TB
4	145	32 TB
3	108	24 TB
2	71	16 TB
1	34	8 TB

**15.6 miles of wires, 9.2B transistors and 26.2B wiring connections**

# z15 I/O Features

**FICON Express16SA**

**zHyperLink Express1.1**

**OSA Express7S**

**25GbE & 10GbE RoCE Express2.1**

**Crypto Express7S**

**Coupling Express LR**

**Integrated Coupling Adapter (ICA) SR1.1**

**LinuxOne only: NVMe carrier & FCP Express32S**

No InfiniBand Coupling Links

No zEDC card



**Carry Forward:**

**FICON Express16S & 8S; OSA-Express6S & 5S; 25GbE & 10GbE RoCE Express2; zHyperLink Express; Crypto Express6S & 5S; Coupling Express LR; Integrated Coupling Adapter (ICA) SR**

# Manage huge growth of data with Pervasive Compression

*Reduce data sizes by and improve workload execution time*

## Get started with compression now

- **6x Compression ratio** for storage savings, reduced bandwidth, faster transfer times
- BSAM/QSAM compression saves space, elapsed time, and CPU.
- Compression for file transfer: Compress data with zlib **42x faster** with Integrated Accelerator for zEDC compared to using software compression.

## Do more without limits

- Integrated Accelerator provides better reliability and eliminates complex planning and setup
- Standard on IBM z15 - replacement for zEDC Express adapter
- Full Linux virtualization – **100%** access for all LPARS and virtual machines
- No change to applications is required

## Optimized Security and Compliance

- Combine Pervasive Encryption with Integrated Acceleration for zEDC and get **optimized and secure** infrastructure
- **Save CPU and cost by combining compression with Pervasive Encryption**

## **Pervasive Encryption**

*Up to **17x** more compression throughput than a max configured z14*

# Service Level Excellence

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





# IBM Z – Service Level Excellence

In today's Digital Age of "always on" interconnected networks, businesses demand near-flawless and uninterrupted connectivity to conduct business operations. *This Digital Age is marked by dramatic increases in ....*

## EXTERNAL RISKS

*Natural disasters and cyber threats are on the rise*

**> 1,500**

*Natural disasters in the last 5 years (EMDAT)*

**\$3.86 Million**

*Avg cost of a single data breach to companies worldwide.  
(Ponemon Institute)*

## COSTS

*The average hourly costs of downtime are immense*

**81% of large enterprises lose \$300,000+ per hour ...**

**... and 33% lose \$1,000,000+ per hour. (ITIC)**

## CUSTOMER DEMANDS

*"Customers are **very unforgiving** if firms come up short on delivering a great experience, **regardless of the nature of disruption or outage.**" (Forrester)*

## COMPLIANCE REQUIREMENTS

***81% of corporations require a minimum of 99.99% uptime**  
(ITIC)*

# IBM Z – Transformational resilience

IBM Z is at the forefront to surpass industry availability requirements, maximizing uptime, and empowering your IT system to rapidly and autonomically recover from any disruption.

- Better throughput, less stutter
- Higher overall server hardware reliability
- Faster recovery when failures occur
- Reduce I/O latency to storage
- Concurrent maintenance improvements
- React faster to workload fluctuations
- Improved workload scaling
- Parallel Sysplex coupling technology for data sharing and workload balancing

“ *IBM Z is in a class of its own: 83% of respondents said their firms achieved five and six nines –99.999% and 99.9999% – or greater uptime.*

*(ITIC)*

# IBM System Recovery Boost

## Unleash your capacity to maximize your availability

Diminish the impact of any event, planned or unplanned, so you can achieve service level excellence with **zero increase in IBM software licensing costs**.

Recover workloads substantially faster than on prior Z machines by unleashing additional processing capacity during a fixed-period performance increase on an LPAR-by-LPAR basis.

With System Recovery Boost, you can achieve up to:

**2.0x Faster**

*Return to  
pre-shutdown  
service levels*

**2.0x Faster**

*Processing of  
transactional backlog*

**2.5x Faster**

*Processing  
of batch  
backlog*

**2.5x Faster**

*GDPS automated  
startup, shutdown,  
site switches, etc.*

# Performance for the System Recovery Boost period

1

## Processor Capacity Boost using zIIPs

Provides parallelism and a boost in processor capacity for processing any kind of work during the Boost.

2

## Speed Boost

Sub-capacity machines gain a boost in processor speed by running the central processors at full-capacity speed during the Boost.

3

## GDPS Reconfiguration

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

***System Recovery Boost Turbo - Unlock additional “dark cores” for extra zIIP processor capacity***

# Cryptographic acceleration with z15 hardware



## Cryptographic acceleration with Crypto Express7S:

- Improved SSL/TLS handshake performance on z15 with Crypto Express7S compared to z14 with Crypto Express6S
- Updates to Common Cryptographic Architecture (CCA) for security modules that enhance remote ATM key loading, offer new protections for banking payments, and extended compliance support to stay up to date on industry standards

## Cryptographic coprocessor on every core with CP Assist for Cryptographic Function (CPACF):

- Enhanced with elliptic curve cryptographic (ECC) algorithms that can help reduce CPU consumption for applications like Blockchain
- Enable an EP11 secure key to be converted to a protected key that can be used by CPACF

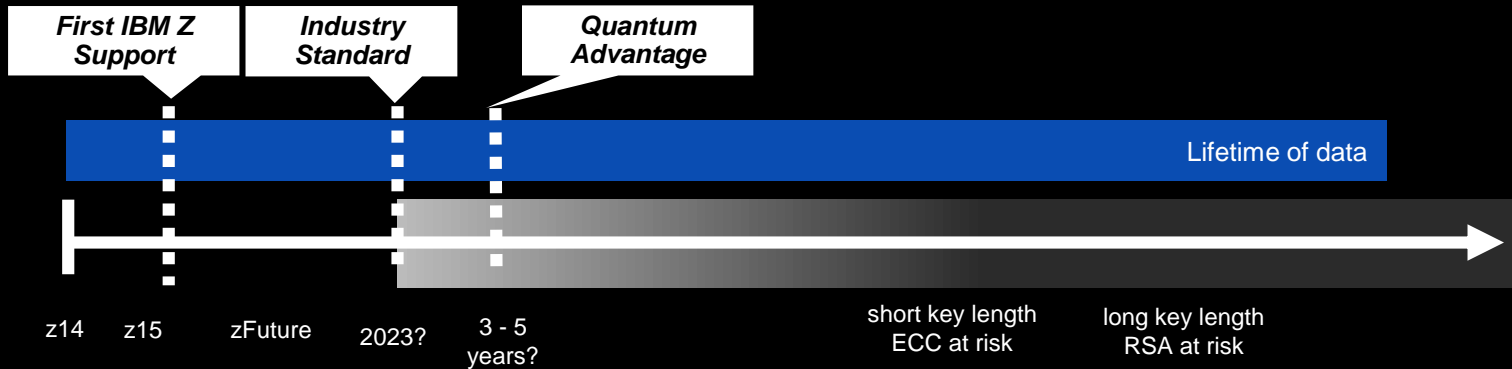
## Designed for EAL5+

# IBM Z investments in Quantum Safe Cryptography


## Initial z15 Capability

- Initially delivered via Quantum safe digital signatures for z/OS SMF records
- Agility in algorithms to update as standards evolve
- Acceleration coming in HSM for essential primitives for Quantum Safe cryptography

## Timeline of Quantum Advantage vs. Data Lifecycle



# Accelerate application development and solve business problems with the most advanced and fit-for-purpose compilers



Compilers enable modernization and increases performance of critical business applications

- Using COBOL 6.3 on average **58% reduction in CPU usage** over applications compiled with COBOL v4.2 on z15
- Automatic Binary Optimizer v3.2 **reduces CPU usage by up to 57%** for compute intense apps built originally on COBOL 4.2
- **Up to 22% reduction in CPU usage** on z15 over the same set of key numerically intensive double-precision floating-point applications built with z/OS v2.3 XL C/C++ on z14

Java enables delivery of rich, scalable and robust applications with speed and agility

- Up to **20% throughput improvements** in general Java workloads
- Takes advantage of new Integrated Accelerator for zEDC for **up to 15x** improvement over software and **up to 2x** faster elapsed times over zEDC Express
- Pause-less garbage collection: **reducing pause times by up to 3x** better throughput for constrained Service Level Agreements

# End to end solution for data in flight protection

Future **IBM Fibre Channel Endpoint Security** to allow FICON® or FCP Links from the z15 to the next generation of the IBM DS8900F storage family to be encrypted and protected

Statement of  
Direction in  
Announce – To be  
delivered post GA

## Challenges

- Corporate directive to encrypt all data in-flight.
- Ensure the integrity and confidentiality of data that is in-flight is protected.

## Client Value

- Knowledge that all data flowing within and across datacenters are traveling between trusted entities
- Be able to provide auditable data verifying that customer data is only being accessed by trusted IBM Z and storage devices
- Supports all IBM Z operating systems
- Reduces and eliminates insider threats of unauthorized access to data in flight





# Protection of data that must be shared

New **z/OS Data Privacy for Diagnostics** is a z/OS capability **exclusive to z15** with the ability to control access to data shared with business partners and eco-systems

## Challenges

- Protection from accidentally sharing sensitive data when sending diagnostic information to vendors
- Concern for organizations who must comply with GDPR laws and/or other data privacy laws or company mandates

## Client Value

- Sensitive data tagging APIs combined with machine learning (ML) to detect, tag and redact all tagged data from diagnostic dumps
- MVP is working with 1<sup>st</sup> set of exploiters (Db2, IMS and some DFSMS™ components) to provide the infrastructure to tag sensitive data in z/OS
- Tagging does not impact dump times
- Supported on IBM z15 running z/OS 2.3 or 2.4

# IBM 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/VSE

- z/VSE 6.2

## z/TPF

- z/TPF 1.1

## z/VM

- z/VM 7.1 compatibility and exploitation support
- z/VM 6.4 compatibility support
- Data compression and sort optimization, new adapter support



## Linux on Z

- Red Hat RHEL 8.0
- Red Hat RHEL 7.7
- Red Hat RHEL 6.10
- SUSE SLES 15.1
- SUSE SLES 12.4
- Ubuntu 18.04 LTS
- Ubuntu 16.04 LTS

## KVM running on Z

KVM hypervisor for IBM Z is offered with the following Linux distributions:

- Red Hat RHEL 8.0
- SUSE SLES 15.1
- SUSE SLES 12.4
- Ubuntu 18.04 LTS
- Ubuntu 16.04 LTS

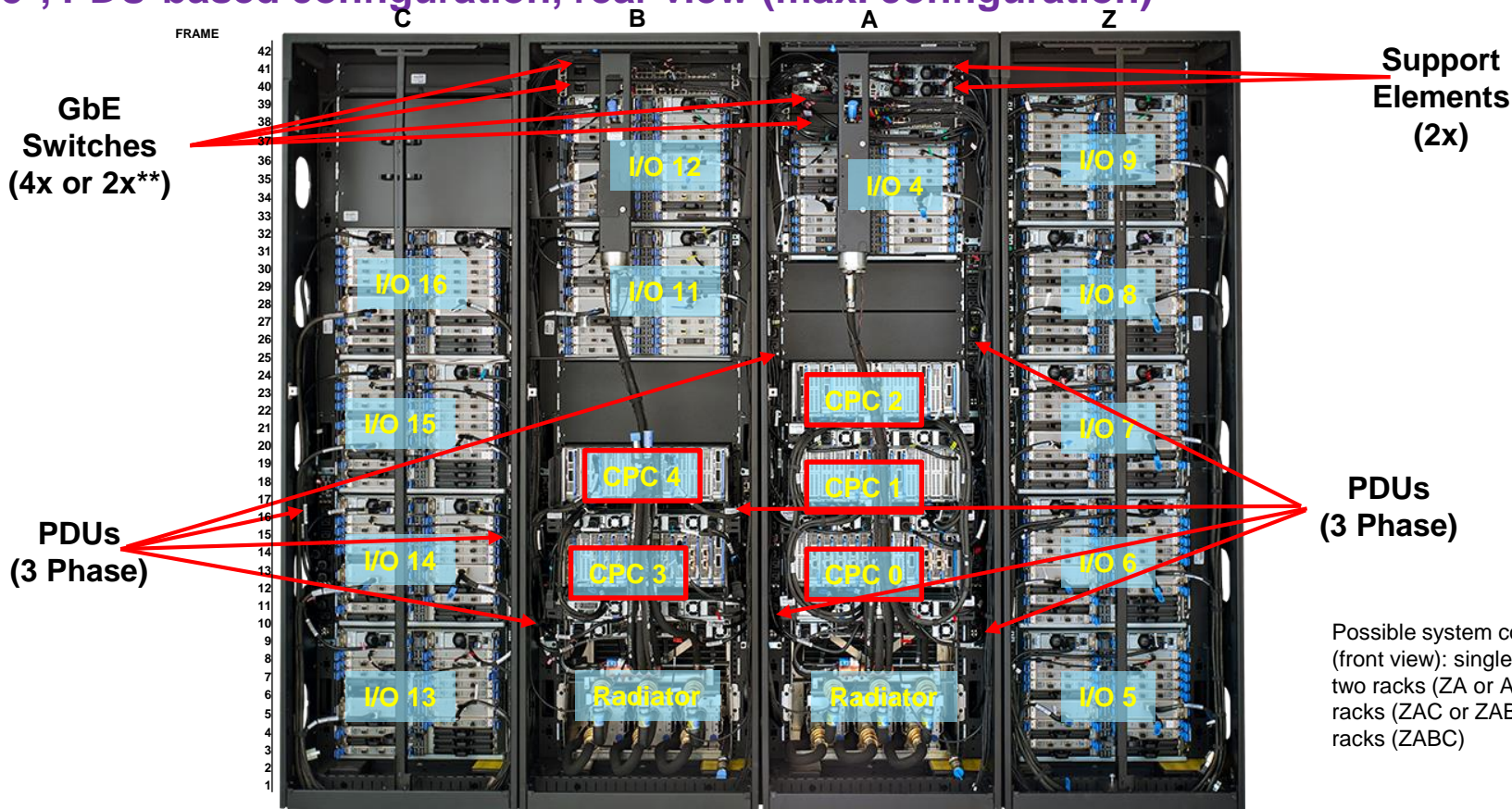
**NOTE:** IBM and the Linux distribution partners plan to support the listed Linux distributions on z15. For IBM tested and Partner certified Linux environments see: [ibm.com/it-infrastructure/z/os/linux-tested-platforms](https://ibm.com/it-infrastructure/z/os/linux-tested-platforms)

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

IBM is working with the open source community and the Linux distribution partners to get new z15 functionality supported with Linux for Z and KVM.

# CEC Details

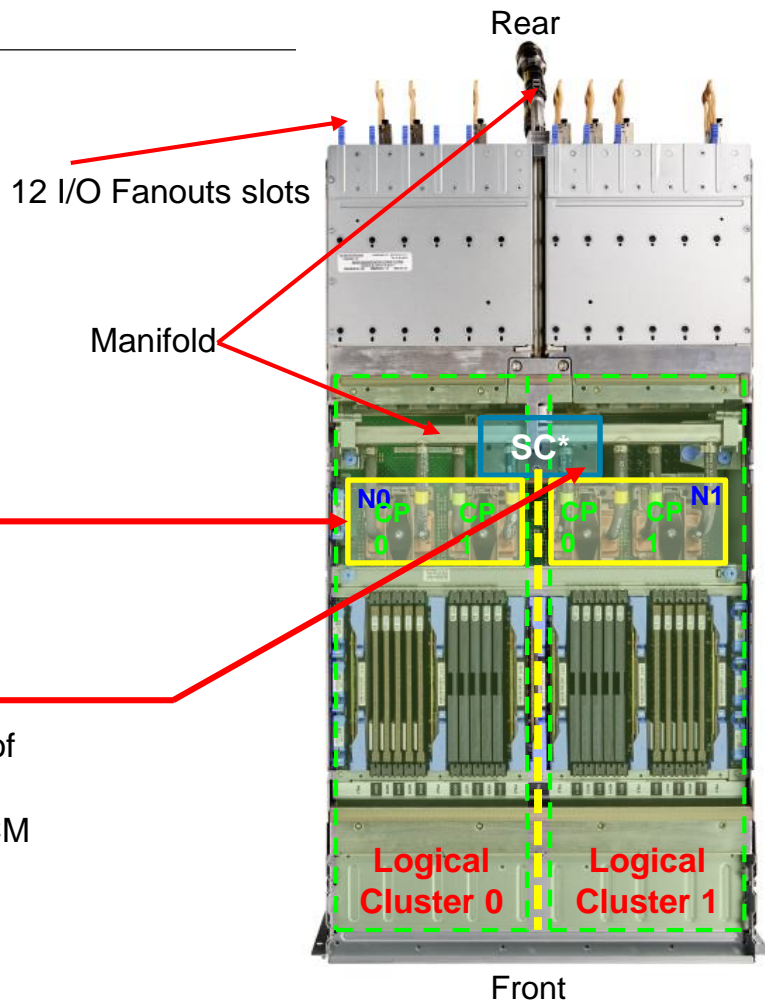
# z15\*, PDU-based configuration, rear view (max. configuration)



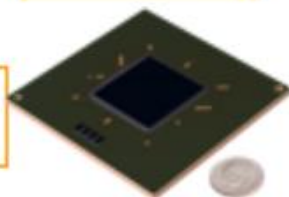
Possible system configurations (front view): single rack (A), two racks (ZA or AB), three racks (ZAC or ZAB) or four racks (ZABC)

## 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).



PU SCM  
(uncapped)

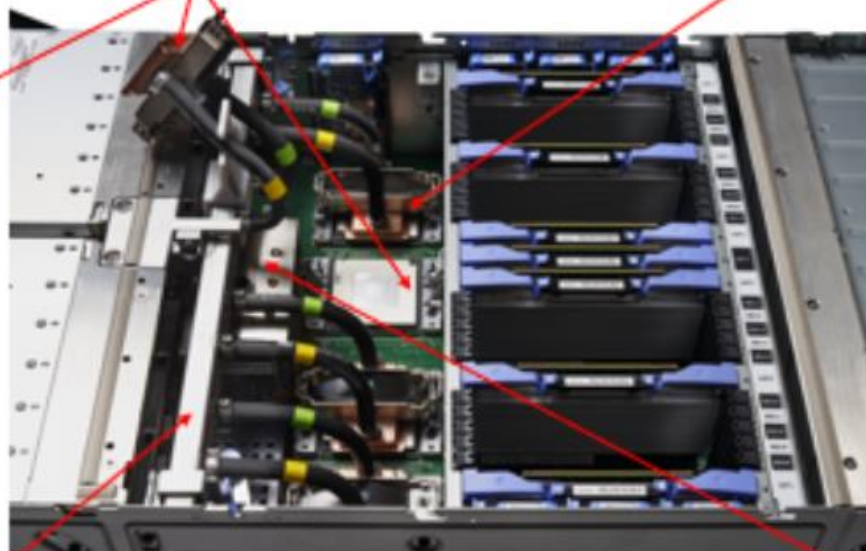


Capped  
PU Chips



PU SCM  
Cold plate lifted

PU SCMs  
under the cold-plates



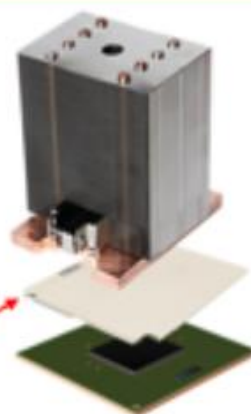
Chilled water supply  
manifold

1x SC SCM (Air Cooled)  
heatsink under the manifold

SC Chip



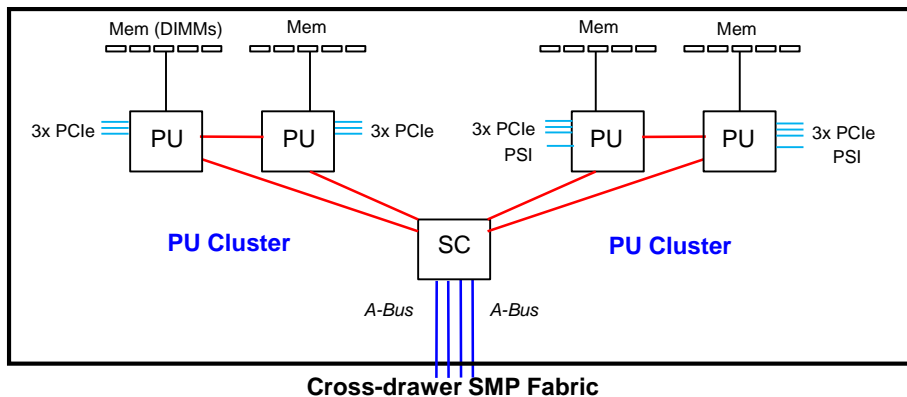
SC SCM with  
Thermal Module



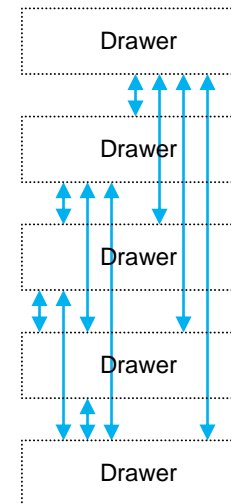
Front of CPC Drawer  
OSCFSPs

## z15 On-Drawer and System Topology

### Fully Populated Drawer

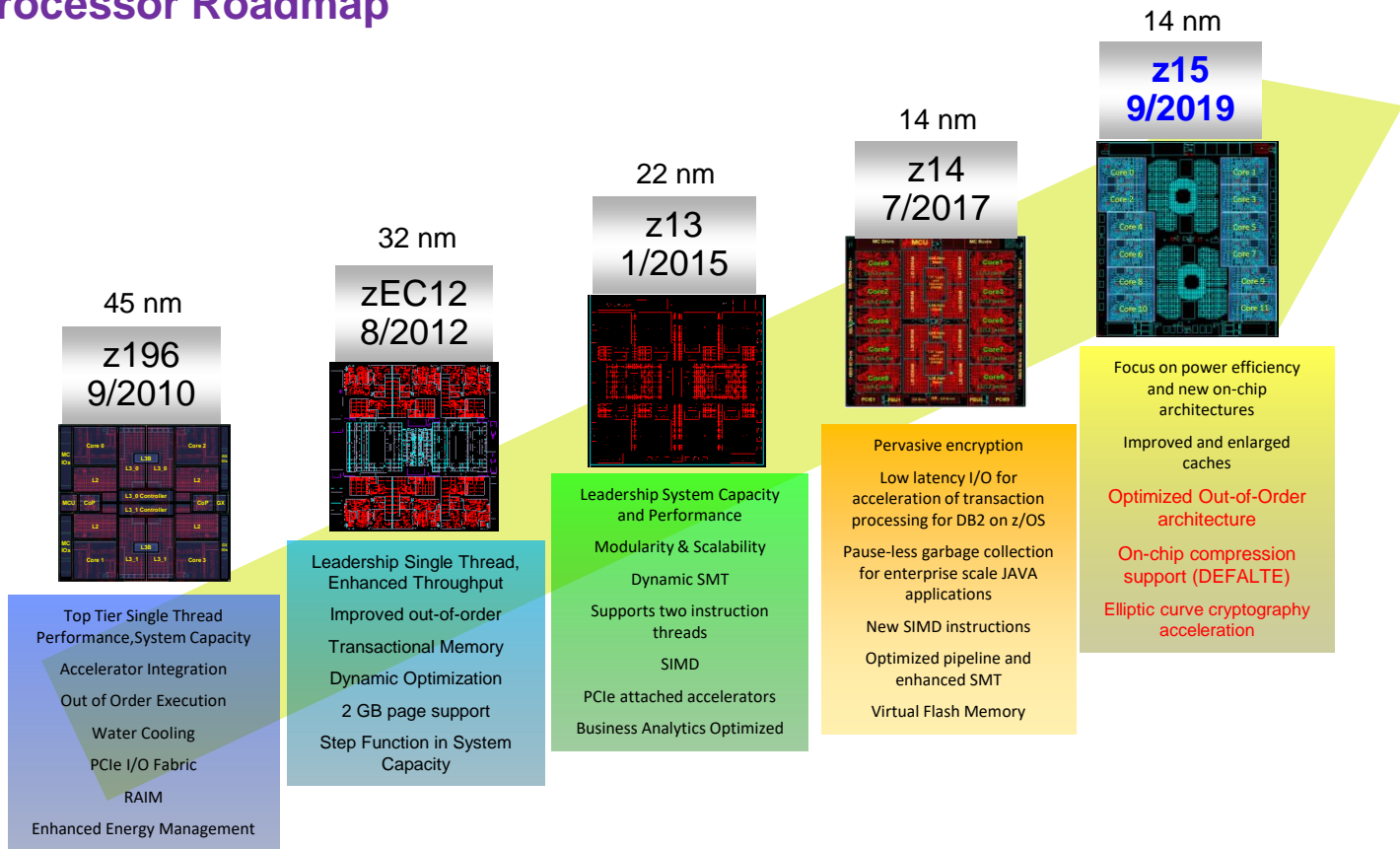


- PU Chip: 12 SMT2 cores per PU chip, core frequency @ 5.2 GHz, SC with 960MB L4 per Drawer
- Cores count: 24 cores per cluster, 48 cores in a drawer, 240 way 5-drawer system (with all core chips active\*, actual design has max. 215 active cores)
- Fabric: Multi-layer (X and A) peer-peer fabric protocol
- Memory: DDR4 DIMMs, 5 DIMM's (RAIM) per CP, Support up to 40TB (512GB DIMMs) in a 5-drawer system
- PCIe: 3x PCIe x16 Gen4\* per CP, 12 PCIe ports are pinned out from drawer



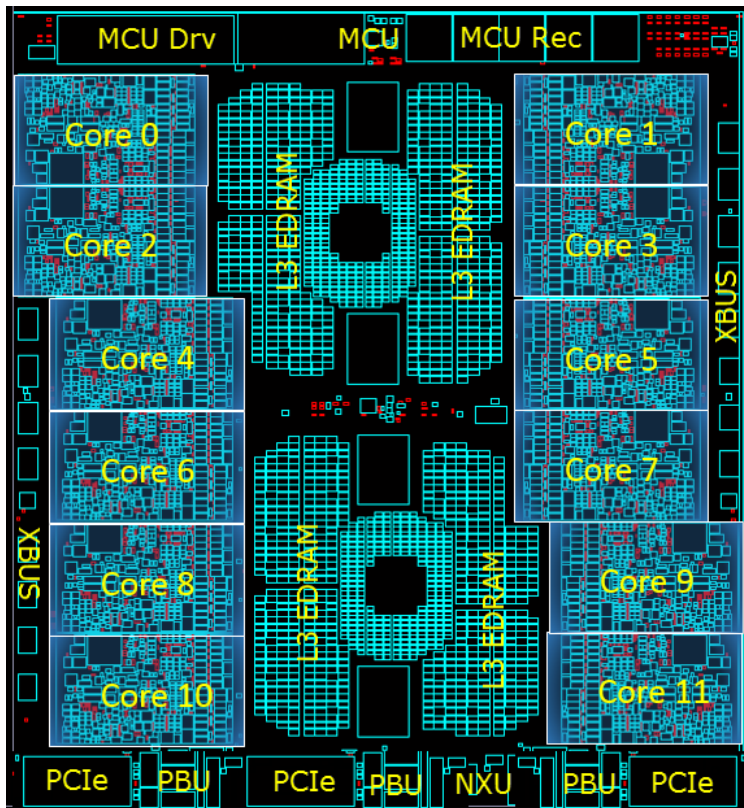
### 5 Drawer System Fully Interconnected

# IBM Z – Processor Roadmap

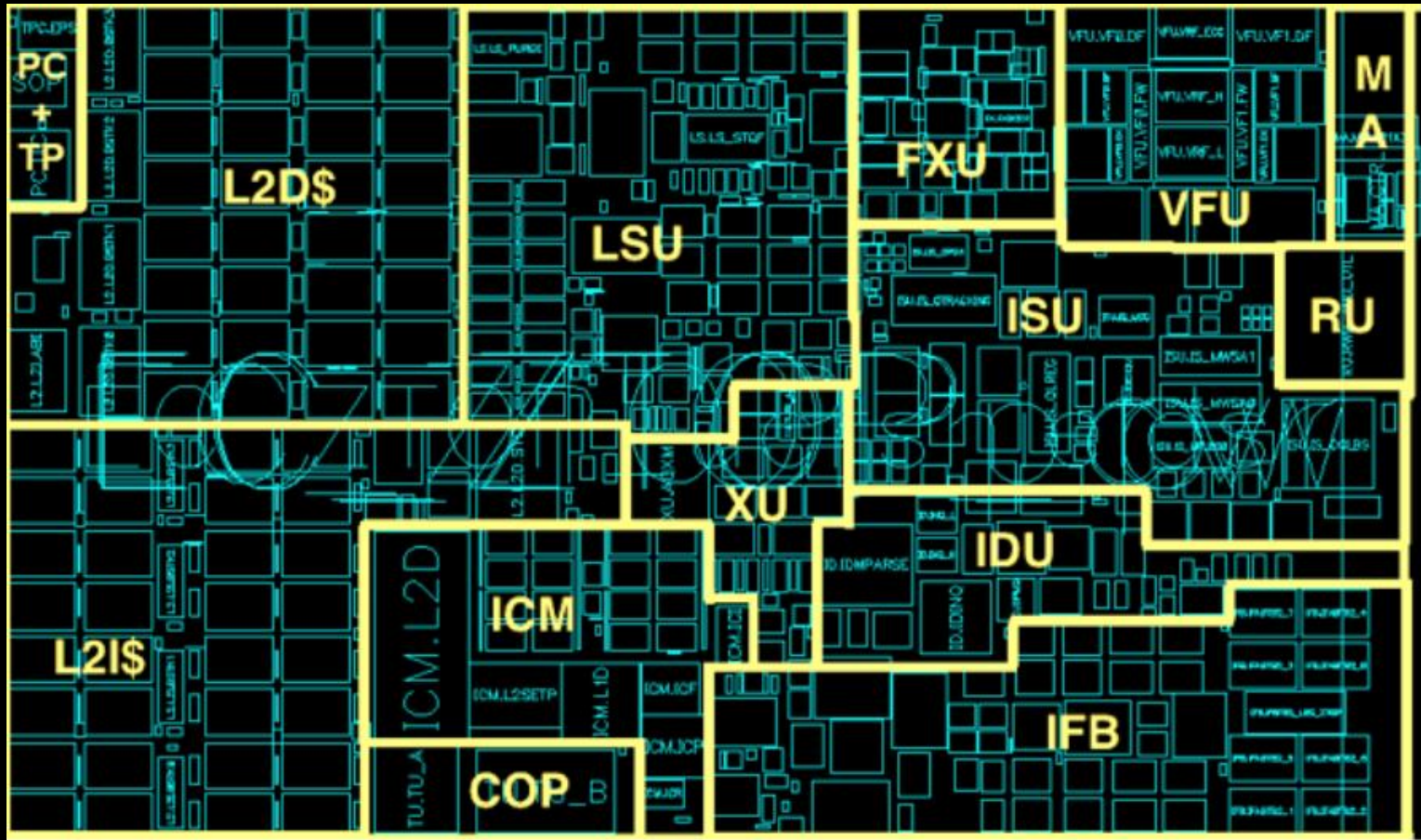




## z15 Processor Design Summary

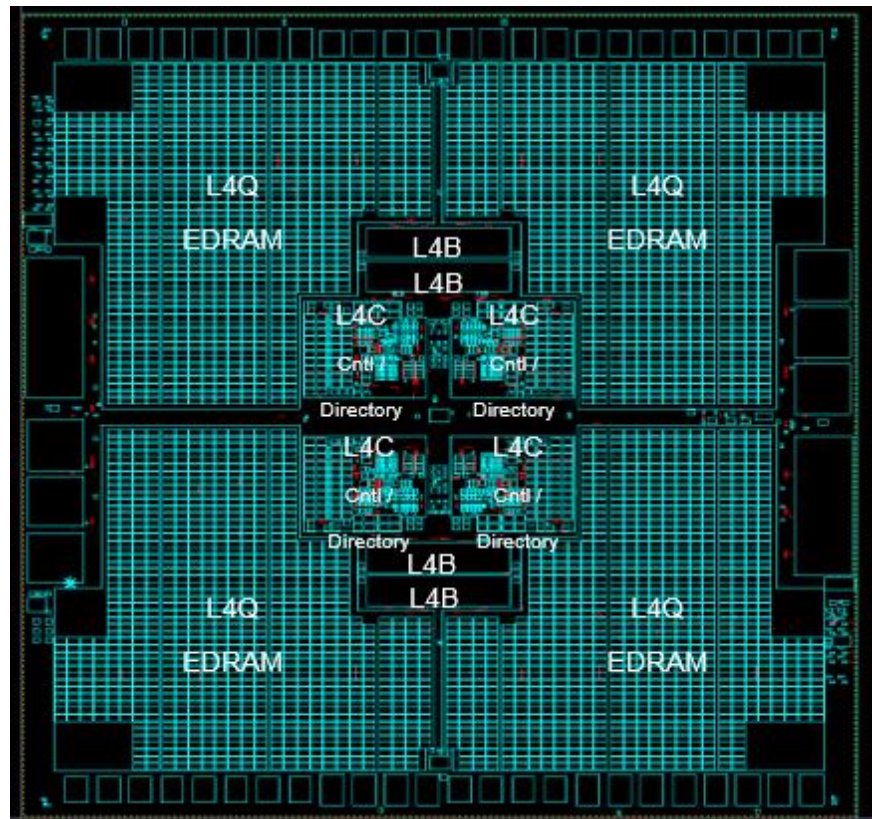


- More than 9.1 Billion transistors
  - 15.6 miles of wire
  - 696 mm<sup>2</sup> chip area
  - 14nm SOI technology,
  - 17 layers of metal
  - 12 cores per CP-chip design
  - 5.2 GHz core frequency
- Optimized to enable performance and capacity growth
    - 20% reduction in core area
    - 20% reduction in core power
    - Cache Growth
  - Pipeline enhancements for performance
    - Improved out-of-order, improved branch prediction, Enhanced Store-Forwarding, 2x bandwidth vector load, double single-precision FP capacity, ...
  - New instructions
    - Elliptic Curve Crypto, Vector, String & BCD Ops
  - New accelerators
    - Modular Arithmetic, Compression, Sort

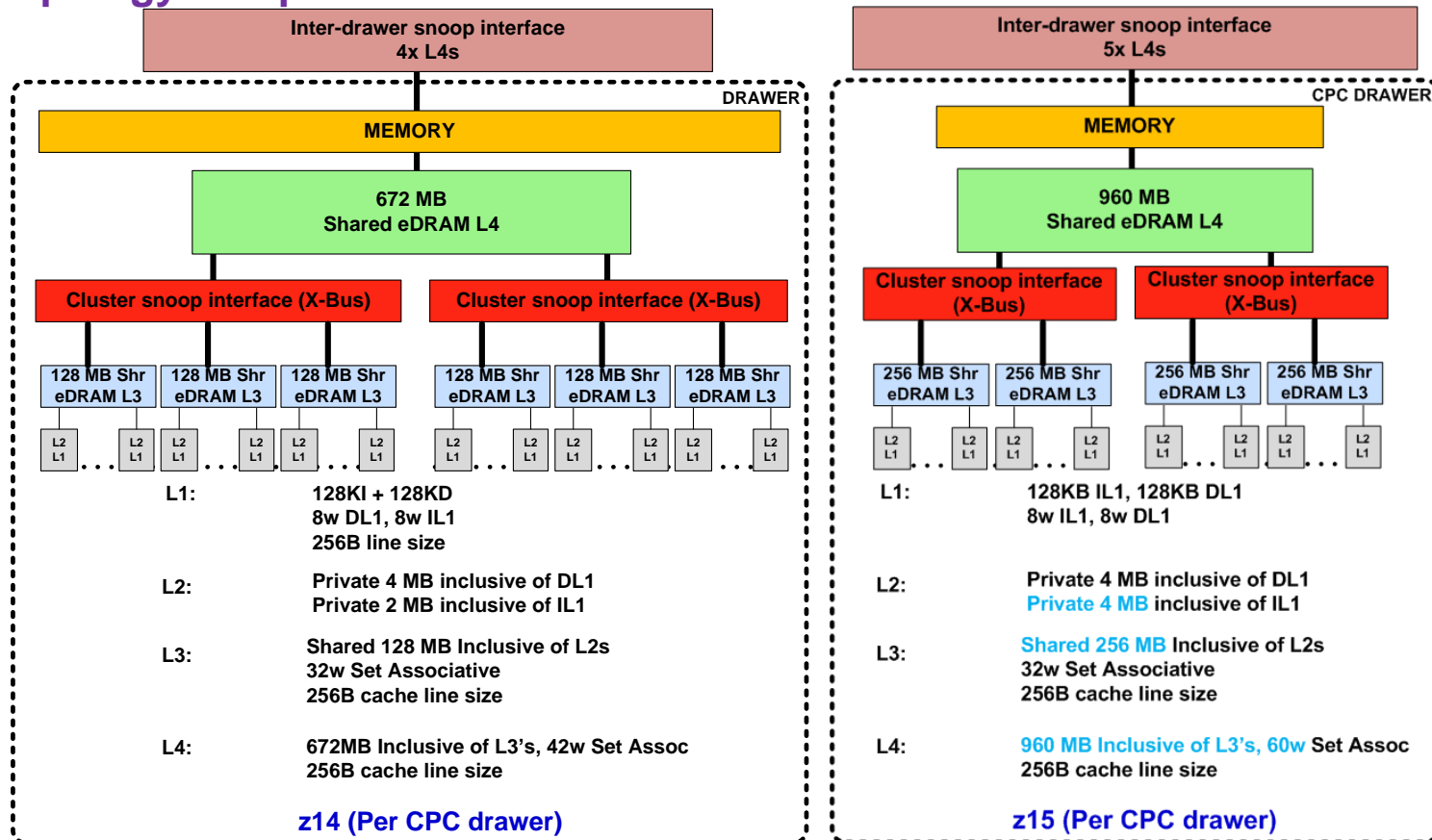


## z15 SC Chip

- SC Chip area: 696 mm<sup>2</sup>
- 9.7 Billion transistors
- 14nm SOI technology, 17 layers of metal
- 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).



# Cache topology comparison: z15 vs. z14



## Fully Populated Drawer

