

Let's take a dive into the IBM z15



Introducing IBM z15

Franco Pinto

Client Technical Specialist

franco.pinto@ch.ibm-com

Phone: +41 79 625 57 69

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Physical planning



Frame overview

What are the frame options available

Power Supply config

Pro's and con's between iPDU and BPA

Hardware cornerstones

New features and capabilities



Standardized & Flexible for the Cloud Data Center

Modular, scalable and proven cloud-ready infrastructure

Ready for cloud data center

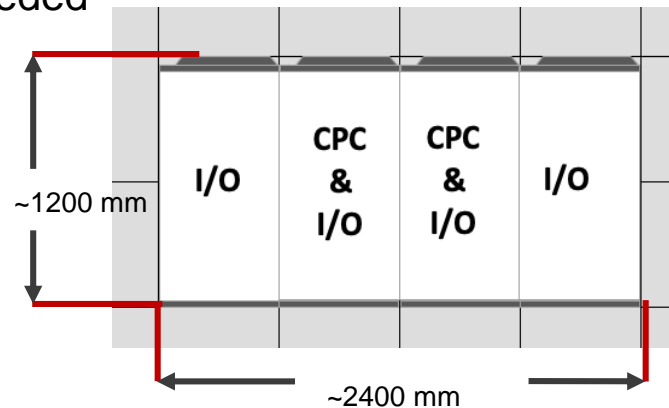
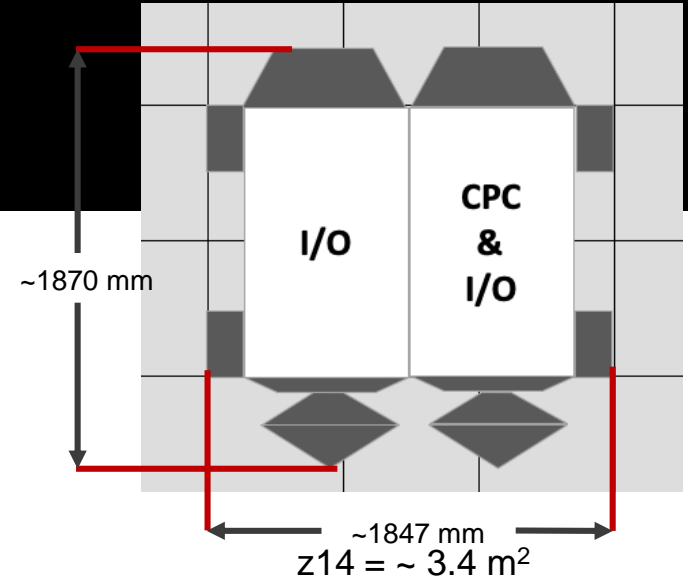
Designed to align with data center trends, to optimize cost, density and flexibility

- **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



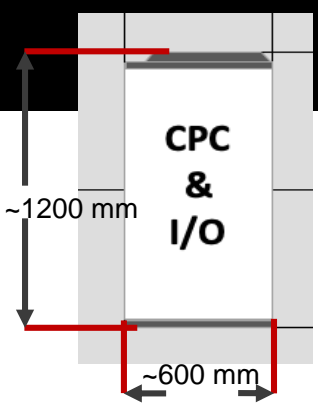
Space savings / New Layout

- 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

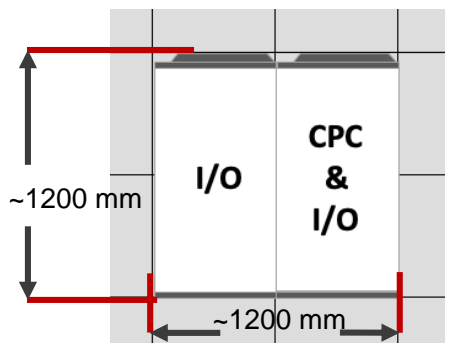
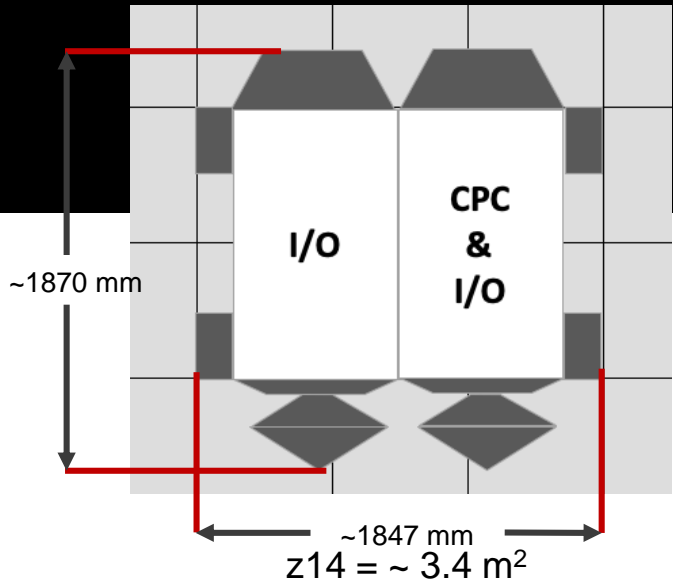


~ 2.9 m²
About equivalent to the
z14

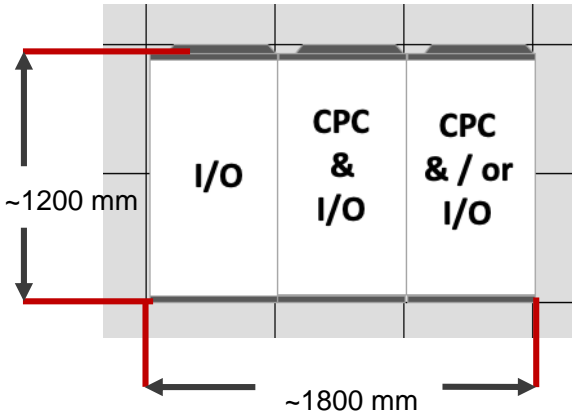
Space savings / New Layout



~ 0.72 m²
 ~75% Reduction in floor space



~ 1.44 m²
 ~50% Reduction in floor space



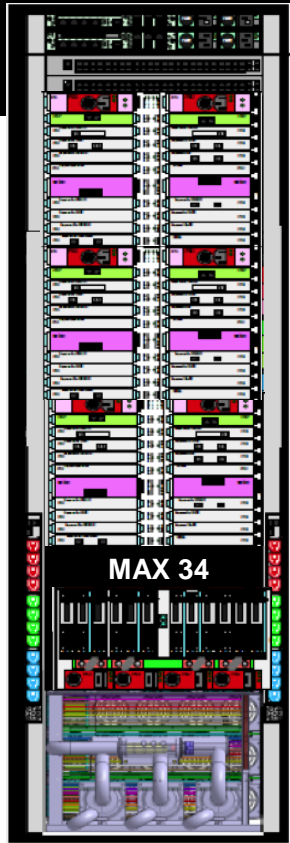
~ 2.2 m²
 ~25% Reduction in floor space

Frame considerations

Single frame

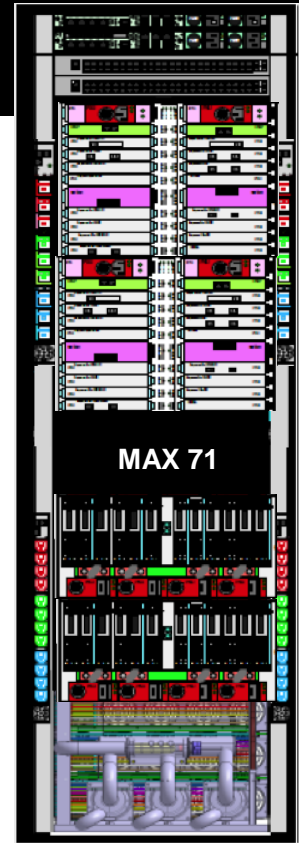


z15 Configuration: iPDU based single frame Rear View



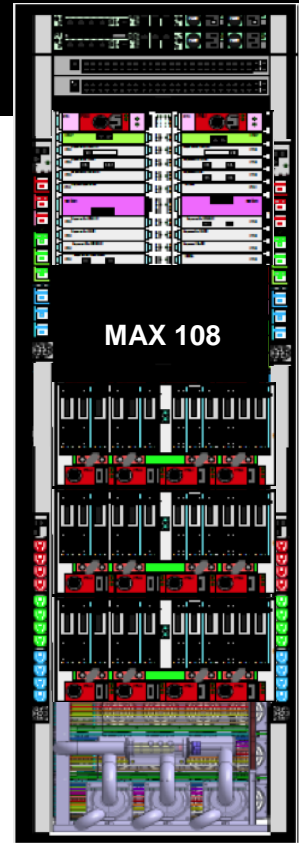
- 2 line cords required
- Up to 34 CPs
- Up to 3 I/O Drawers (48 I/O Cards) without CPC Reserve FCs 2271 and 2272

A Frame



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

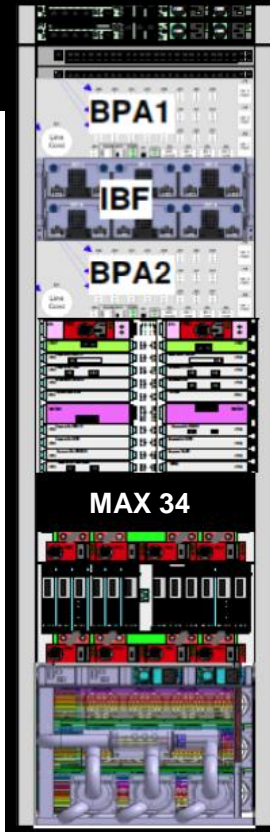
A Frame



- 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

A Frame

z15 Configuration: BPA based single frame Rear View



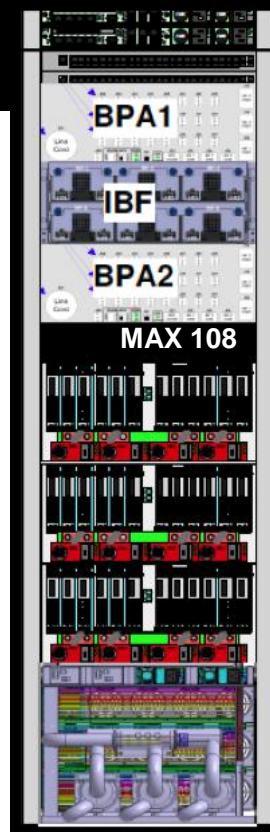
- 2 line cords required
- Up to 34 CPs
- Up to 1 I/O Drawers (16 I/O Cards Max) without CPC Reserve FCs 2271 and 2272

A Frame



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

A Frame



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

A Frame

Frame considerations

Four frames

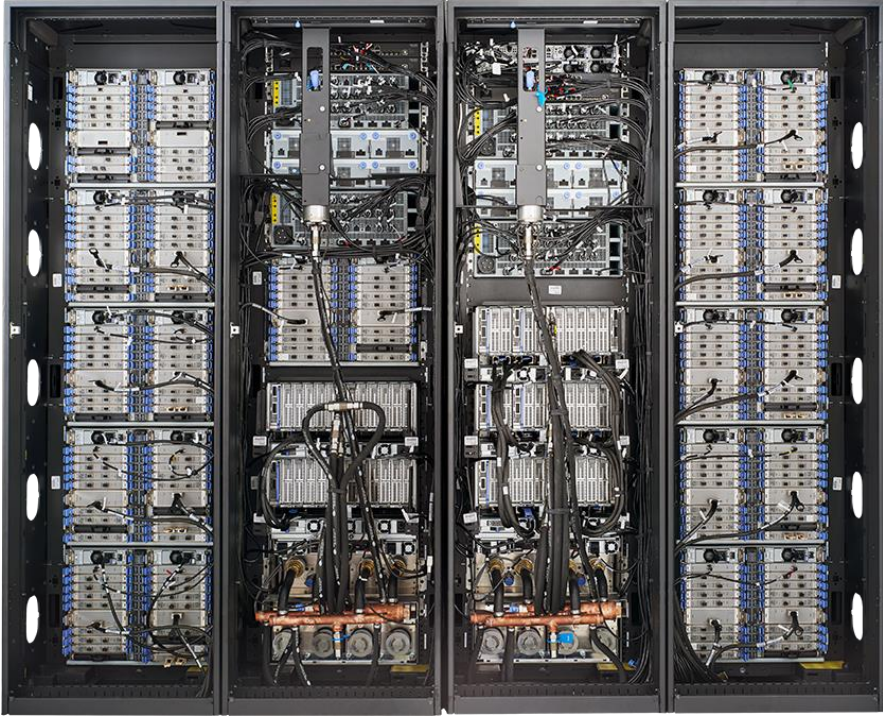


iPDU versus BPA configuration

Four Frame iPDU



Four Frame BPA configuration



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

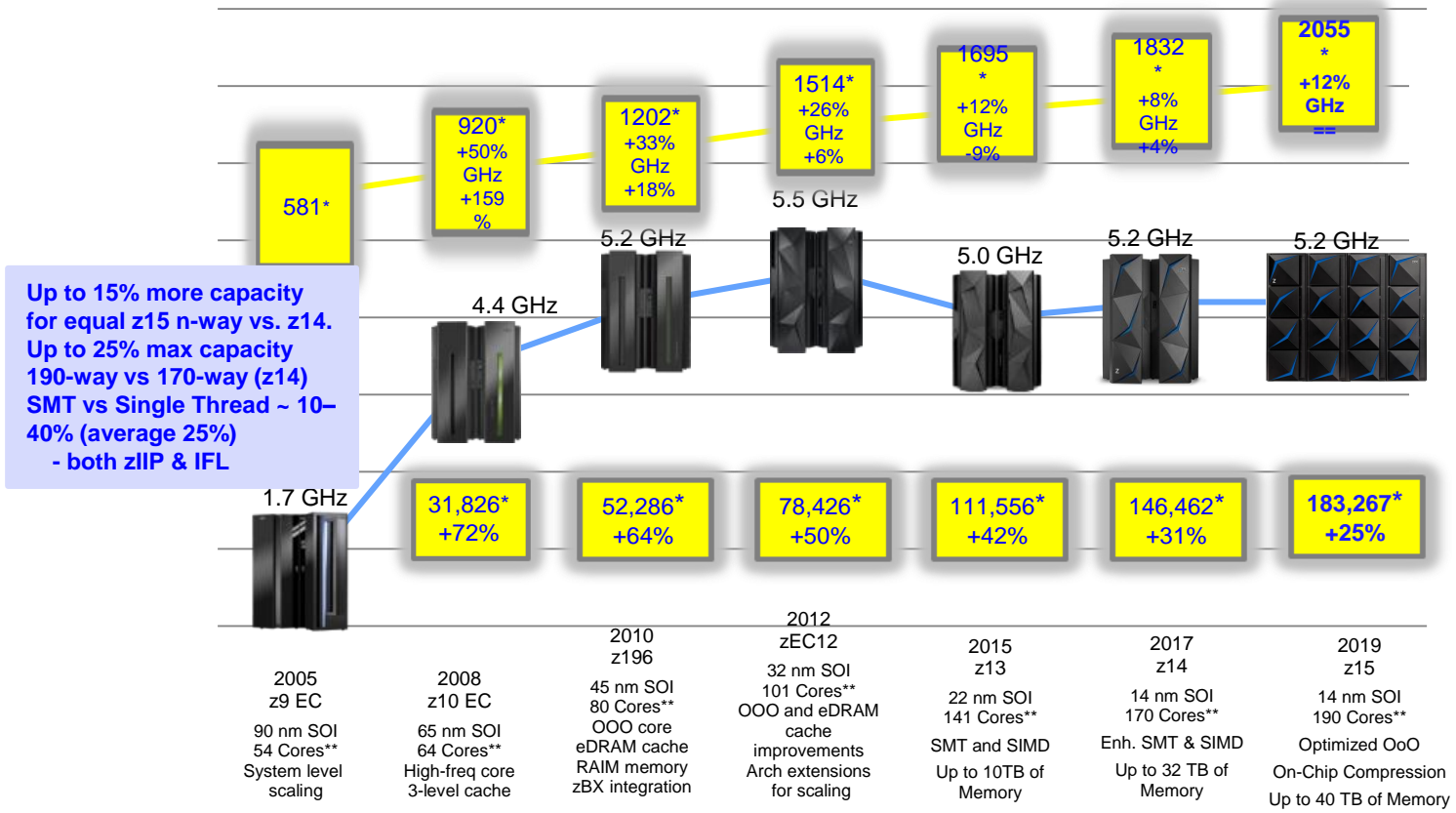
IBM z15™
Machine Type: 8561
Model T01

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 Continues the CMOS Mainframe Heritage



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

IBM z15 at a glance 1 of 2

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 IBM Integrated Accelerator for zEDC (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



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 Express16SA
25GbE and 10 GbE RoCE Express2.1
Integrated Coupling Adapter (ICA SR1.1) and Coupling express LR for coupling links
Support for up to 384 coupling CHPIDs per CPC Support for 64 Internal Coupling CHPIDs
CFCC Level 24 (HMC 2.15.0, Driver Level 41)
Crypto Express7S and IBM Integrated Accelerator for zEDC (On-chip compression (DEFLATE))
STP configuration and usability enhancements (GUI)
IBM zHyperLink Express1.1
OSA-Express7S
IBM Secure Service Container

IBM z15 at a glance 2 of 2



RAS, simplification and others

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

PR/SM

Up to 190 CPUs per partition

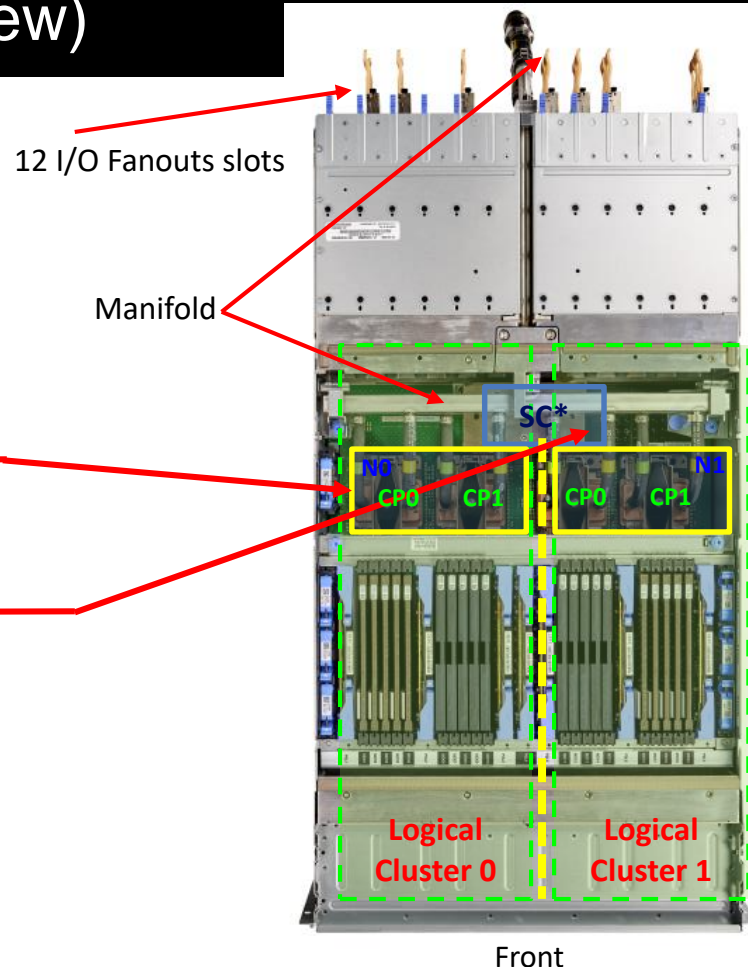
IBM Dynamic Partition Manager updates

Up to 85 LPARs

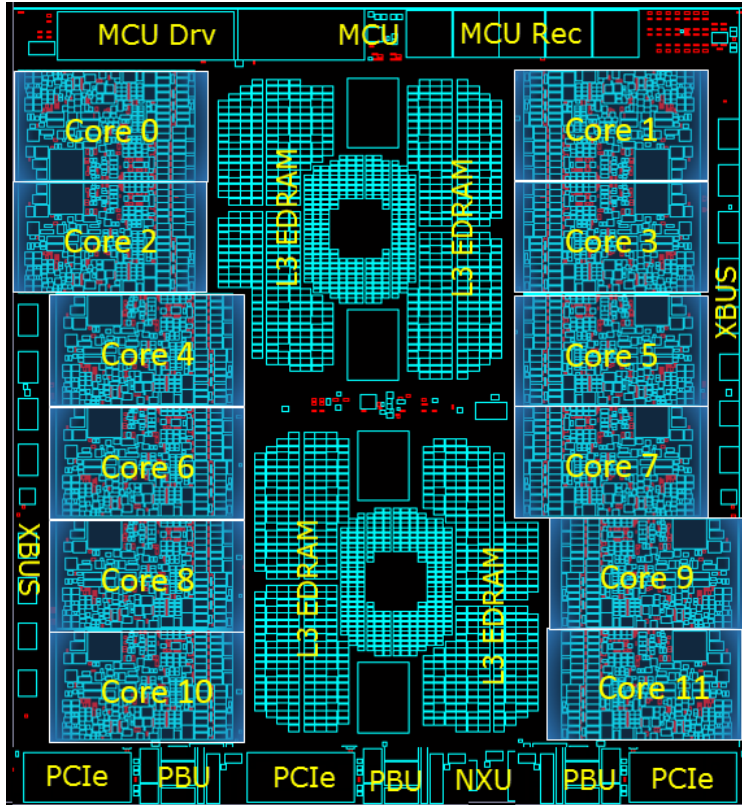
16 TB Memory per partition

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 SR1.1).



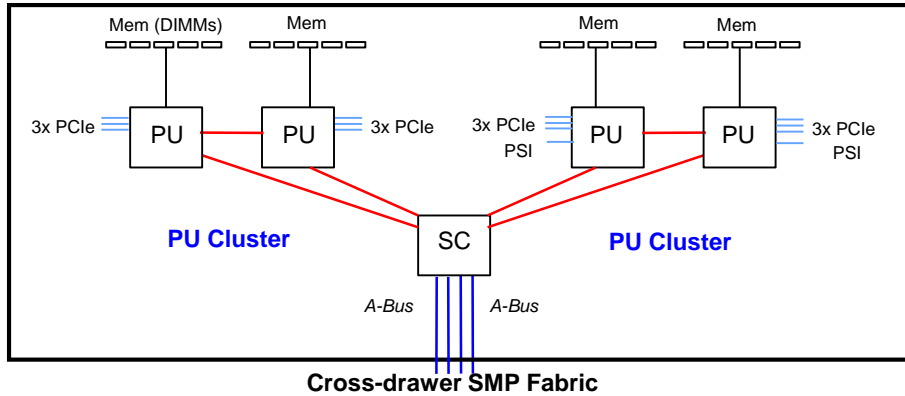
z15 Processor Design Summary



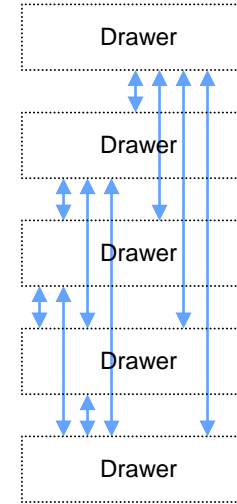
- More than 9.1 Billion transistors
- 696 mm² chip area
- 14nm SOI technology,
- 17 layers of metal
- 12 cores per CP-chip design
- 5.2 GHz core frequency
- Optimize core to enable performance and capacity growth
 - 20% reduction in core area
 - 20% reduction in core power
- New EDRAM macro design with 2x macro density
 - Grow L3 from 128MB to 256MB per chip
 - Grow L2-I from 2MB to 4MB per core
 - L2-L3 Protocol changes to reduce latency
- **IBM Integrated Accelerator for zEnterprise Data Compression (zEDC) (On-chip compression accelerator (NXU)*)**
- Re-optimize nest-core staging

z15 On-Drawer and System Topology

Fully Populated Drawer



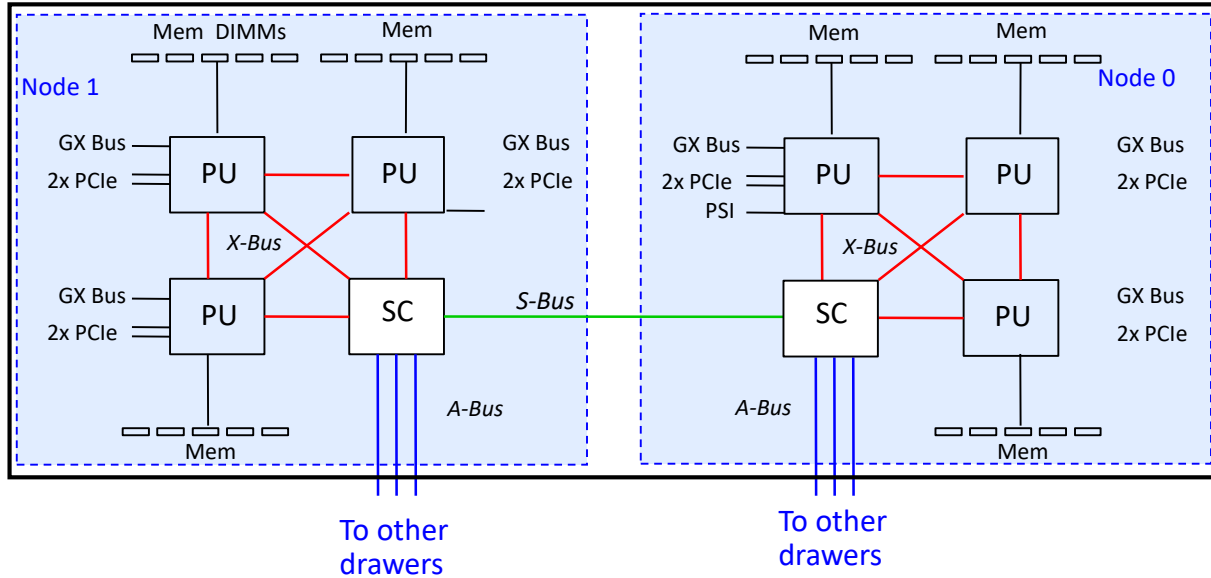
- PU Chip: 12 SMT2 cores per PU chip, core frequency @ 5.2 GHz, SC with 960MB L4 per Drawer
- Cores count: 24 cores per cluster, 48 cores in a drawer, 240 way 5-drawer system (with all core chips active*, actual design has max. 215 active cores)
- Fabric: Multi-layer (X and A) peer-peer fabric protocol
- 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**

z13 On-Drawer and System Topology

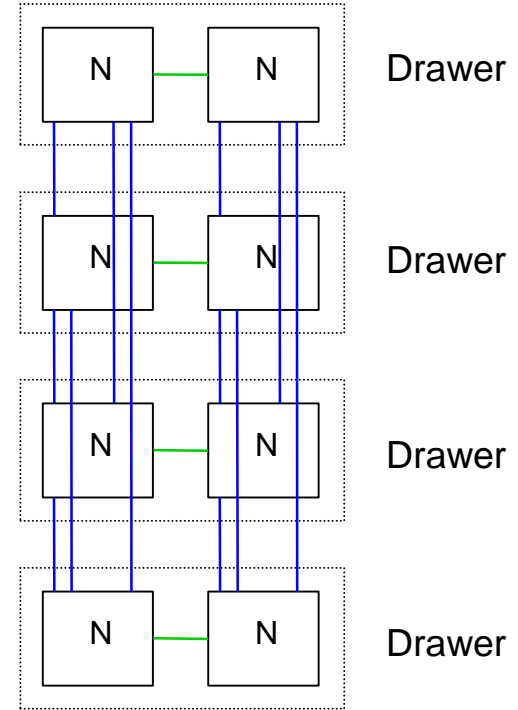
Fully Populated Drawer



Physical node: (Two per drawer)

- Chips
 - Three PU chips
 - One SC chip (480 MB L4 cache)

- RAIM Memory
 - Three Memory Controllers: One per CP Chip
 - Five DDR3 DIMM slots per Controller: 15 total per logical node
 - Populated DIMM slots: 20 or 25 per drawer
- SC and CP Chip Interconnects
 - X-bus: SC and CPs to each other (same node)
 - S-bus: SC to SC chip in the same drawer
 - A-bus: SC to SC chips in the remote drawers



4 Drawer System Interconnect

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 Compression

*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 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

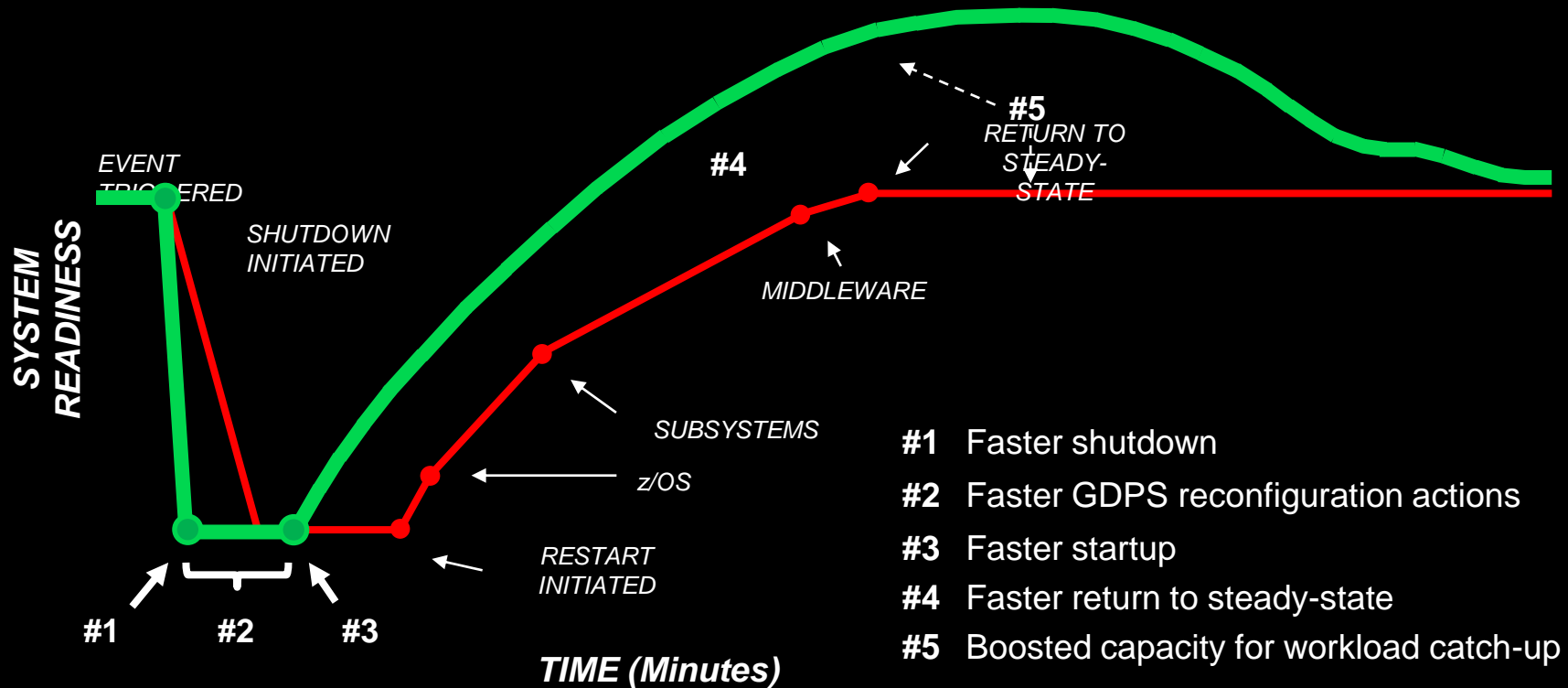
*Processing
of batch
backlog*

2.5x Faster

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

Anatomy of a planned outage

Visualizing benefits with System Recovery Boost



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

zIIP Processor Capacity Boost

Temporarily use client's entitled zIIP capacity, plus (optionally) additional zIIPs provided by a new type of Boost temporary capacity record, to provide a short-term processing capacity Boost

Clients will configure a system parameter to control whether or not a particular image should opt-in for the zIIP processor Boost

```
IEASYSxx  
BOOST=SYSTEM | ZIIP |  
SPEED | NONE
```

HMC/SE will show images that are currently opted-in for Boost

z/OS images configured to exploit this capability will automatically opt-in at IPL time and opt-out at the end of their Boost period (60 min startup boost period)

- Start and End of Boost period is signaled via console message, ENF signal (84), and cutting an SMF record
- Start and End of Boost period starts new SMF interval
- A system command or PROC (IEABE) will be provided to allow for early opt-out if desired

zIIP Processor Capacity Boost

Activating Temporary Capacity for the Boost

System Recovery Boost provides clients with an optional new Boost type of temporary capacity record to add additional physical zIIP capacity to the machine, with Terms and Conditions for limited use specifically for System Recovery Boost

- These additional zIIP processors are activated out of unused processing resources on the machine, and provide additional processor capacity and parallelism

Client activates the Boost temporary capacity record to provide additional physical zIIPs prior to a change window that involves IPL or Shutdown activities being performed

- Once activated, LPAR shares the extra physical zIIP capacity normally across LPARs during the limited time the Boost temporary capacity record remains activated
- Clients will have set up the LPAR image profile for z/OS images in advance with planned additional reserved logical zIIP processors to enable the effective use of the additional physical zIIP processor capacity that is provided (for the set of z/OS images that will opt-in to use it)
- The customer must have at least one entitled zIIP on the machine to be able to add additional zIIPs via this record

Client deactivates the Boost temporary capacity record at the end of the change window, once the IPLs or Shutdown actions for which they intend to provide a Boost have finished

- If not otherwise deactivated, the Boost temporary capacity record will auto-deactivate itself at the expiration of its specified time interval

Properties of Boost Temporary Capacity Record

Priced and Prepaid –

based on an Annual Subscription model for “recharging” the record indefinitely during that period

zIIP processor type only

Number of activations – *the record has a fixed number of activations, but this can be “recharged” dynamically based on the Annual Subscription*

- Each activation has a **fixed 6-hour time period** - the record supports planned change activity windows of up to 6 hours during which one or more system shutdown/startup actions are being performed on the machine
- Each activation can activate **up to 20 zIIPs**, and it could permit the violation of the 2:1 ratio rule between zIIPs and GPs

Auto-deactivation at the end of the time period the record is configured for (it could be deactivated sooner if desired)

Planned Shutdown Boost

The same Boost technologies will be applied to accelerate planned Shutdown processing for system images

Shutdown Boost duration will be up to **30 minutes**

A new z/OS system PROC (IEASDBS) will be provided to signify the beginning of the planned shutdown, for Boost purposes

- In response to starting the PROC, driven either manually or via shutdown automation, z/OS will opt-in to the allowed Boosts
- Start and end of Boost period is signaled via console message, ENF signal (84), and cutting an SMF record
- Start and end of Boost period will start a new SMF interval

Boost applicability will be re-evaluated at start of the shutdown Boost, to determine whether zIIP boost is possible at shutdown time

All SMF records, metrics, SCRT/pricing implications, etc., are the same as for startup boost

GDPS Scripting Enhancements

Address multiple systems in same script command:

*SYSPLEX BCPII_Command System_Criterias
Command_Options*

- **BCPII_Command** can be:
 - ACTIVATE, DEACTIVATE, RESET, LOAD, STOP, PSWRESTART
- **System_Criterias** can be:
 - List of systems with or without generic names:
System (TSYS1, TSYS2, PS*, VM*)
 - Logical Group of systems:
GROUP(SITE1), GROUP(ALL), GROUP(ZOS), etc.
 - Customize group of systems using system type, site parms:
GROUP(Type=YV,Site=*) or GROUP(Type=*, Site=*) or
GROUP(Type=N,Site=1), etc.

Note: A KP, KX, KG, or KR System will never be addressed by a Group criteria

Examples

- SYSPLEX ACTIVATE GROUP(SITE1)
- SYSPLEX LOAD GROUP (Type=YN,Site=*)
- SYSPLEX RESET SYSTEM(G0C1,G0P*,SVM*)

z/OS APARs

Summary

- “Umbrella” APAR – OA57849
 - BCP / SADMP – OA57326
 - WLM – OA56055
 - CIM – OA57478
 - CPM – OA57552
 - RMF – OA56683
- z/OS Exploitation via z/OS 2.4 and 2.3 with PTFs
- GDPS exploitation via GDPS 4.2
- Firmware support delivered on the z15 machine

A person wearing a white lab coat is shown from the chest down. They are holding a gold credit card in their right hand, which is positioned over a tablet computer. Their left hand is resting on the tablet screen, with fingers slightly spread. The background is a soft, out-of-focus blue. The overall scene suggests a professional or medical setting where digital technology is being used.

Data Protection & Privacy

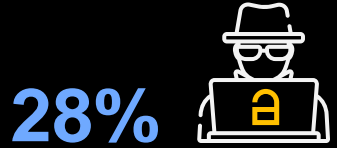
*Elevating protection for
the data driven
enterprise*

Consumable Privacy: The Next Big Thing

Simplifying data privacy by improving data protection



Average cost of a data breach in 2018 ²



Likelihood of an organization having a data breach in the next 24 months ¹



Data privacy regulations, varying by industry, location, and geo ³

2/3 of established companies are leveraging FinTech capabilities for growth. That number is expected to increase by

20% in the next three years

- *Harvard Business Review Analytic Services*

59% of companies in the US and UK say they experienced a data breach via a third party.

—*2018 Ponemon Study on Global Megatrends in Cybersecurity*



The EU GDPR is the most important change in data privacy regulation in 20 years



Payment Card Industry Data Security Standard (PCI-DSS)



Health Insurance Portability and Accountability Act (HIPAA)



California Consumer Privacy Act

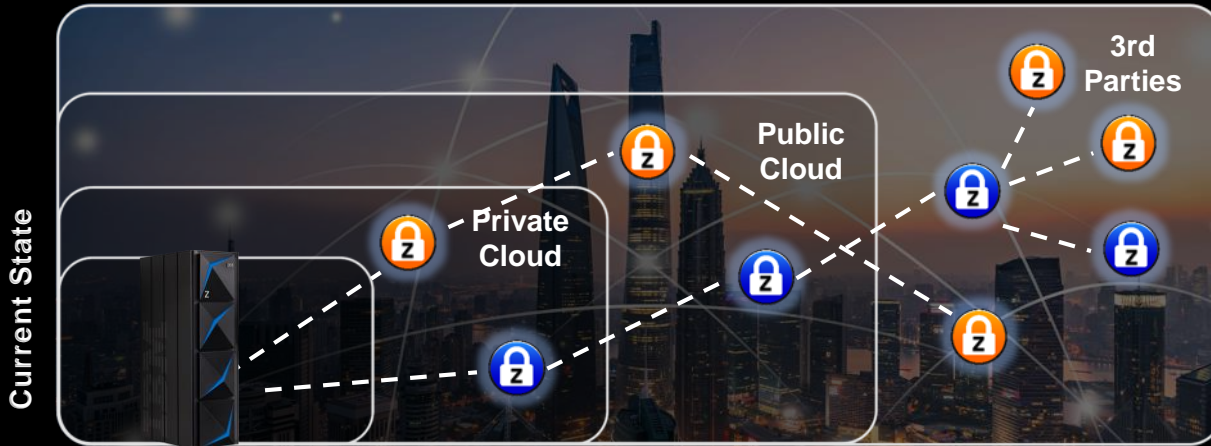
Protect individuals' identity in a digitized world with *Data Privacy Passports*

- **Protection** – Encryption and Revocation
- **Privacy** – Controls and Consent
- **Proof** – Audit and Compliance

\$40 to start an attack vector, \$40,000/HR for an attack recovery

-- Source: Eduard Kovacs, *Security Week*

Desired State



Current State	Data protected within Z
Desired State	Data protected for the life of the data

Desired State: Trusted Data Objects *End-to-end protection via "Trusted Data Objects"*

Desired State: Enforced Data *Controlling the usage of data and auditability of data*

IBM Z
with pervasive encryption

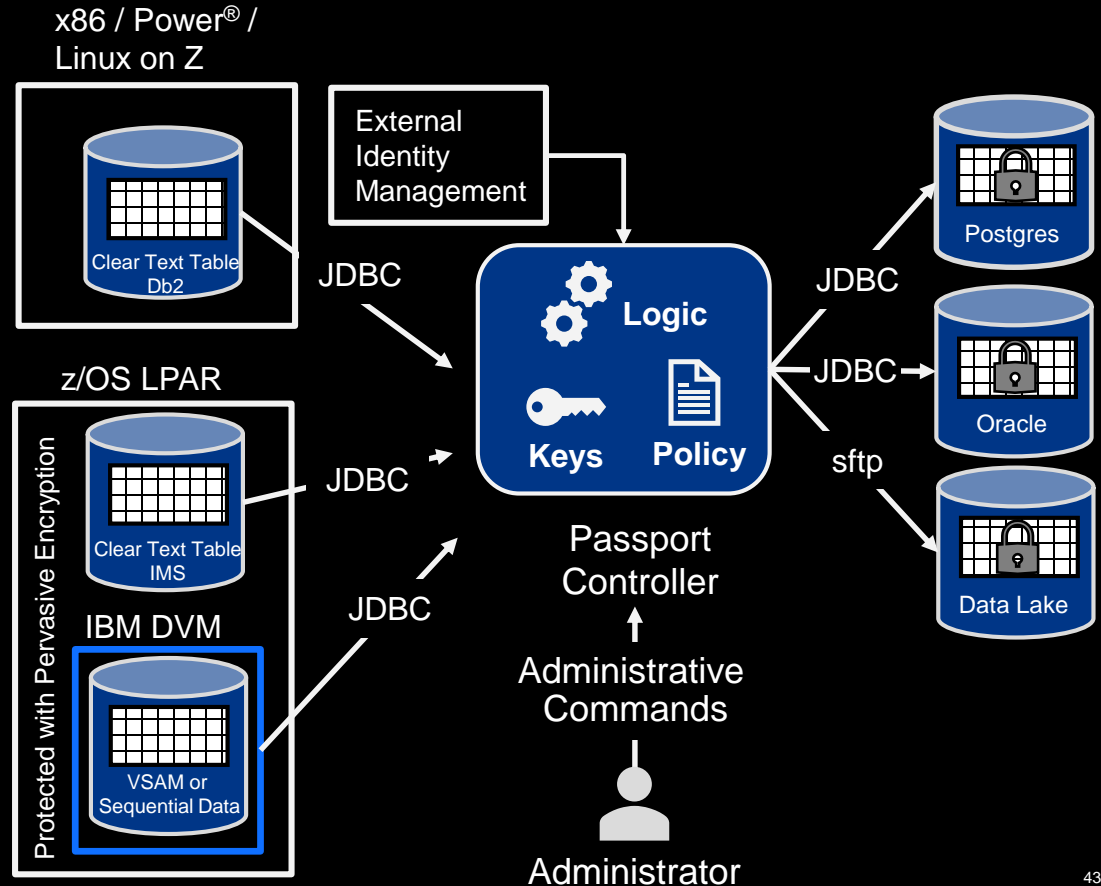
Current State: Protected data within Z using Z pervasive encryption

Introducing IBM Data Privacy Passports

Protected, Private, Provable

- The data is protected at the point of extraction and is enforced at the point of consumption
- Move data from IBM Z to distributed as Trusted Data Objects – Start with SQL data sources on IBM Z
- Passport Controller deployed in an SSC LPAR
- Policy for enforcement can be changed dynamically to revoke or entitle users to data
- Create a single protected table to provide multiple views of data

Runs on IBM z15



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 1st 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

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

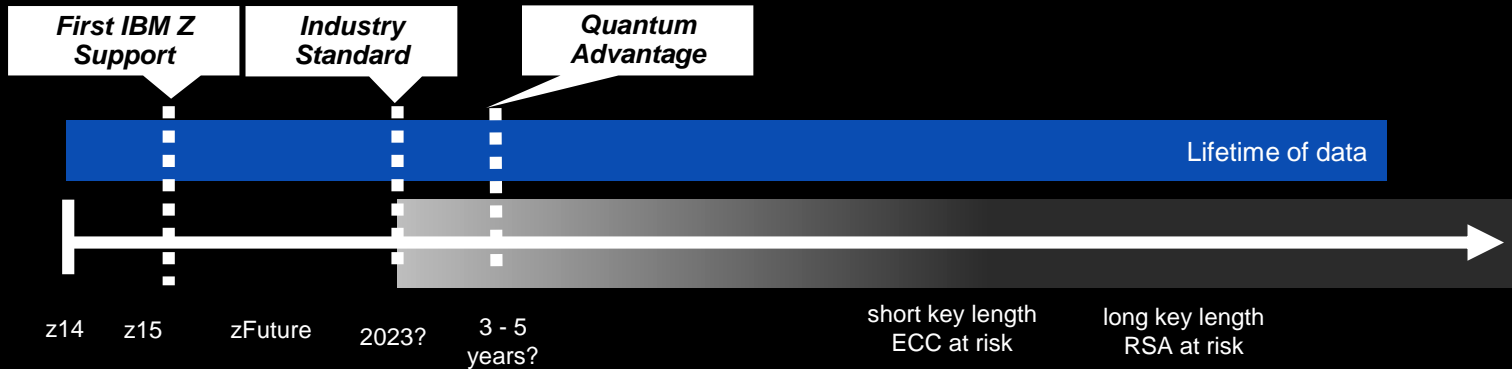
Designed for EAL5+ and FIPS 140-2 Level 4

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



Mission Critical Cloud

*Integrate seamlessly into
hybrid multicloud,
blockchain and AI*





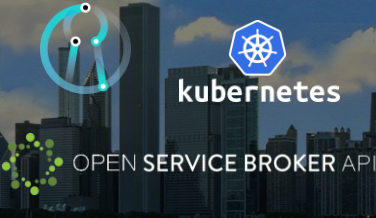

IBM Z is the core of your secure hybrid cloud

- Unparalleled trust and security for mission critical workloads and data
- Delivers single-point secure management and integration across environments and cloud platforms
- Agility in operations and development across the cloud ecosystem
- Remove skills barriers with open technology and tooling
- Support mobility of workloads, services and data across the hybrid cloud ecosystem



Hybrid Multicloud for the Enterprise with IBM Z

Open access and extend the platform value with open standards and tooling across all cloud consumption models. Enterprise Cloud when you want, how you want, and wherever you want with ease.

Transform for Cloud	Cloud native experience	Private Cloud	Public Cloud
 <ul style="list-style-type: none">• IBM ADDI• IBM z/OS® Connect EE• IBM Z Operations Insight Suite• IBM Z APM Connect• IBM Z Service Automation Suite	 <ul style="list-style-type: none">• IBM Z Open Development• IBM Z Open Unit Test• IBM z/OS Container Extensions	 <ul style="list-style-type: none">• IBM Cloud Paks• IBM z/OS Cloud Broker• Secure Services Container for ICP• IBM Blockchain for ICP	 <ul style="list-style-type: none">• IBM Blockchain Platform• IBM Cloud Hyper Protect

Expanding the z/OS Software Ecosystem

New **z/OS Container Extensions** delivers unmodified Linux on Z Docker images running inside z/OS

Challenges

- Porting desired software to z/OS requires effort and presents time-to-value and currency concerns
- Requirement to deploy dependent software hosted on separate Linux servers leads to complicated z/OS operational procedures and hinders the ability to take full advantage of z/OS Qualities of Service.

Client Value

- Modernize z/OS workloads by providing flexibility for development and operations on Z
- Integration with other DevOps tools and Linux applications all in z/OS
- Maintain operational control and extend z/OS Qualities of Service to Linux software
- Make use of existing IT investments by employing Linux within the Z platform

BONUS – workloads run on zCX are zIIP eligible

Better business decisions by modernizing and transforming the journey to hybrid cloud via Data and AI on IBM z15

Leverage IBM Db2 and AI Offerings

Db2 Analytics Accelerator for z/OS with Integrated Synchronization

- Reduce data latency **up to 120x²**
- Deliver up to **7x CPU reduction²**

Watson Machine Learning for z/OS

- Build models on your **platform of choice**
- Score in real-time for insight at the **point of transaction**




To bring client value

- Real-time business insight from real-time transactional data with **no-compromise HTAP¹**
- Guaranteed data coherency by **directly accessing Db2 log changes**
- Actionable insight by **embedding AI within transactional applications**

¹ Hybrid transactional and analytic processing (HTAP) source: <https://www.gartner.com/doc/2657815/hybrid-transactionanalytical-processing-foster-opportunities>

²Based on IBM internal testing

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

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

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.

Sources (Draft):

[Redbook IBM z15 Technical Introduction](#)

[Redbook IBM z15 Technical Guide](#)

[Redbook IBM Z Connectivity Handbook](#)

[Redpaper Introducing IBM Z System Recovery Boost](#)

[Redpaper IBM Z Functional Matrix](#)

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

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.

The conditional-SSKE facility: IBM z15 will be the last high end server to support the conditional-SSKE facility.

Statements of general direction announced with z/VM 7.1

z/VM New Function Portal

The [z/VM Continuous Delivery News](#) web page will be the primary vehicle used by IBM to describe new functions that are planned for z/VM. It is the recommended way to keep track of future development and support plans for the z/VM product. z/VM clients should consider subscribing to this page. Instructions are included on the [VM Site File Change Notification](#) web page.

Stabilization of z/VM Support for the IBM EC12 and BC12 server family

z/VM V7.1 is the last z/VM release that is planned to support the EC12 or BC12 family of servers. Consequently, either an IBM z13[®] or an IBM z13s[®] will be the required minimum level of server for future z/VM releases. See the [IBM Support Portal](#) for the most current z/VM support lifecycle information.

Discontinuance of support for separately ordered EREP licensed product: z/VM V7.1 is planned to be the last z/VM release to support EREP as a separately orderable and serviceable IBM licensed product. EREP functionality will continue to be delivered as part of the z/VM offering.

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.



Backup

IBM z15 Integrated Accelerator for zEDC - Exploitation

At GA – Sept 2019 (z/OS)		4Q 2019 (LoZ)	Future
<p>Needs Existing z/OS Feature</p> <p>Storage Savings:</p> <ul style="list-style-type: none"> • z/OS SMF Logstream • z/OS QSAM/BSAM • z/OS DFHSM / DFDSS <p>DB Storage Compression</p> <ul style="list-style-type: none"> • Db2 for z/OS V12 LOBs • z/FS in V2R3 	<p>New - No z/OS Feature Required on z15</p> <p>In Application - IBM Java</p> <p>DB Storage Compression</p> <ul style="list-style-type: none"> • IBM Content Manager OnDemand • IBM Encryption Facility <p>Data Transfer:</p> <ul style="list-style-type: none"> • IBM Sterling Connect:Direct® • z/OS HTTP Server • OpenSSH • IBM MQ for z/OS 	<ul style="list-style-type: none"> • RHEL 8.1* • SLES 12 SP5* • Ubuntu 19.10* • Java 8.0.6* • WAS 8.5.5* • WAS 9.0.5* 	<ul style="list-style-type: none"> • RHEL 8.2* • Db2 Backup*
		<div style="border: 1px solid black; padding: 5px;"> <p>* IBM is working with the Linux distribution partners to get the functionality included in their distribution for Linux on z</p> </div>	

ISV products using zEDC Express on z14 transparently migrates to the Integrated Accelerator for zEDC on z15



Linux on Z – Highly reliable and trustful

Reliability, availability and failover capabilities can be expected for Linux on Z, unlike with distributed systems or public clouds



Challenges

- Complex IT infrastructures are hard to backup & recover – often the backup is not tested
- Can you trust your Linux infrastructure?

Client Value

- Linux benefits from the IBM Z server capabilities to avoid and recover from failures for minimal business disruption
 - Concurrent replace, repair, and upgrade functions for processors, memory, drawers, and I/O
- z/VM Single System Image enables Live Guest Relocation for continuous Linux availability
- Near-continuous availability and disaster recovery solutions with IBM GDPS and IBM Spectrum Scale™

Securing the Enterprise

Extended scope of pervasive encryption with Linux enables more customers and solutions to benefit from the Pervasive Encryption features, and speeds up the protection of data-in flight, for signing and key exchange protocols as required by TLS and Blockchain



- CPACF acceleration of Elliptic-curve crypto (ECC)
 - Applications using clear ECC keys benefit from increased performance and workload throughput
- New Crypto Express7S feature supports for new algorithms and increases performance
- EP11-based protected keys allows the usage of protected key dm-crypt without requiring a CCA coprocessor
- Support of protected key cryptography for dm-crypt volumes in standard LUKS2 format
- IBM Secure boot integrity validates that a Linux kernel is from an official Linux partner

Efficiency with Linux on IBM Z

Simple and economic operation



- More and faster IFLs, PCI improvements and Shared Memory Communication allow for better efficiency at scale, performance and improve price/performance
- More memory allow more in-memory workloads and in-line analytics for richer transactional experiences
- On-chip accelerated compression allows for ‘pervasive usage’ for Linux workloads
- Extended scope of pervasive encryption enables more customers and solutions to benefit from the IBM Z pervasive encryption features
- Easier system administration with extended hardware configuration capabilities using IBM Dynamic Partition Manager

IBM z15 functional comparison to IBM z14

Performance and Scale

- Uniprocessor Performance
- System Capacity
- SMT
- Cache
- Models
- Processing cores
- Granular Capacity
- Memory
- Compression
- New up to **14%** performance improvement over IBM z14 (z14)¹
- New up to **25%** system total z/OS capacity performance improvement over z14¹
- New 2nd generation SMT delivers up to **25%** performance improvements for IFLs and zIIP workloads vs non-SMT on z14
- New z15 has **86%** more on-chip cache per core versus z14
- Five feature based sizes with up to five CPC drawers (z14 has five models and four drawers)
- New up to 190 cores to configure, up to 170 on z14
- New up to 292 capacity settings versus 269 on the z14
- New up to 40 TB RAIM memory versus 32 TB RAIM memory on z14
- CMPSC compression and new Integrated Acceleration for ZEDC versus CMPSC and zEDC Express on z14

Virtualization

- LPAR virtualization
- RoCE adapter
- Simplified LPAR management
- 85 partitions – same as z14
- 2X the maximum number of RoCE features (up to 16) allowing RoCE to be extended to more workloads versus 8 on z14
- Enhanced IBM Dynamic Partition Manager allows for config and management of system resources on both

Infrastructure Efficiency

- Networking
- HiperSockets® and SMC-D
- FICON
- zHPF
- IBM zHyperLink
- Forward Error Correction
- FICON dynamic routing
- LCSS/Subchannel sets
- WWPN
- HMC
- Pause-less garbage collection
- IBM Virtual Flash Express
- New OSA-Express7S with improvements over z14 using OSA-Express6S
- Up to 32 HiperSockets and memory-to-memory communications with SMC-D offers within-the-box communications for z/OS – same as z14
- FICON Express16S+ same as IBM z14
- zHPF extended distance II offers faster remote site recovery with improved I/O service time improvement when writing data remotely (GDPS® HyperSwap®) same as z14
- IBM zHyperLink1.1 - short distance z15 channel that can be installed on IBM DS8880 System Storage® for lower latency same on z14
- Industry standard FEC for optical connections for substantially reduced I/O link errors same as z14
- Dynamic Routing allows for sharing of switches between FICON and FCP without creating separate virtual switches same on z14
- Up to six LCSS and 4 Subchannel sets – same as z14
- I/O serial number migration allows keeping same serial number on replacement server same as z14
- Next generation HMC with simplified panels, new mobile capabilities, security enhancements (including multi-factor authentication), easier help panels – not on z13. (No Classic Style User Interface on z14)
- New enterprise scale Java applications to run without periodic pause for garbage collection on larger & larger heaps same on z14
- New memory replacement for Flash Express helping improve availability – same as z14

Resiliency and Availability

- System Recovery Boost
- Coupling – ICA SR
- Coupling Express LR
- Coupling scale
- STP
- Sparing
- Rack Mounted Accessories
- Environmentals
- Coupling – HCA-3
- Enables faster recovery and restoration of service from any planned or unplanned operating system outages not on z14
- Short distance coupling with PCIe-based links (ICA SR) – same as z14
- Coupling Express LR – Coupling Express LR will be available on z14
- 50% increase in logical coupling CHPIDs per CPC over z14
- New Simplified STP management with HMC enhancements same as z14
- Enhanced integrated sparing on z15 and z13 reducing the number of on site service and maintenance events
- Rack-mounted HMC and TKE options to save space in the data center
- New 19" frame packaging and optional non raised floor, overhead cabling, water cooling, ASHRAE 3 rating - 24" frame packing on z14
- No InfiniBand Coupling with HCA-3 InfiniBand Coupling Links on z15 – available on z14

Security

- Cryptographic Coprocessor
- Crypto Express
- IBM Secure Service
- Container
- Secure Console Access
- CPACF for improved performance and true Random Number Generator available on z14
- New Crypto Express7S with performance increase in accelerator mode plus new algorithms for elliptic curve, SHA, VISA FPE versus z14 Crypto Express6S
- Secure deployment of software virtual appliances – available on z14
- Protection of sensitive data by using Transport Layer Security (TLS) support in the Open Systems Adapter-Integrated Console Controller (OSA-ICC)

¹ Disclaimer: Based on preliminary internal measurements and projections and compared to the z14. Official performance data will be available upon announcement. Results may vary by customer based on individual workload, configuration and software levels. Visit LSPR website for more details at: <https://www-304.ibm.com/servers/resourcecenter/inrlb03060.nsf/pages/lspindex>.

IBM z15 functional comparison to IBM z13

Performance and Scale

- Uniprocessor Performance
- System Capacity
- SMT
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- Models
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- Granular Capacity
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- Compression
- New up to **25%** performance improvement over IBM z13 (z13)¹
- New up to **63%** system total z/OS capacity performance improvement over z13¹
- New 2nd generation SMT delivers up to **56%** performance improvement for IFLs and zIIP workloads vs non-SMT on z13
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- Simplified LPAR management
- 85 partitions – same as z13
- 2X the maximum number of RoCE features (up to 16) allowing RoCE to be extended to more workloads vs 8 on z13 (also no 25 GbE Express2.1 on z13)
- Enhanced IBM Dynamic Partition Manager allows for config and management of system resources on both

Infrastructure Efficiency

- Networking
- HiperSockets and SMC-D
- FICON
- zHPF
- IBM zHyperLink
- Forward Error Correction
- FICON dynamic routing
- LCSS/Subchannel sets
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- HMC
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- New OSA-Express7S with improvements over z13 using OSA-Express5S
- Up to 32 HiperSockets and memory-to-memory communications with SMC-D offers within-the-box communications for z/OS – same as z13
- FICON Express16S+ versus FICON Express16S on z13
- zHPF extended distance II offers faster remote site recovery with improved I/O service time improvement when writing data remotely (GDPS® HyperSwap®) same as z13
- IBM zHyperLink1.1 - short distance z15 channel that can be installed on IBM DS8880 System Storage for lower latency not on z13
- Industry standard FEC for optical connections for substantially reduced I/O link errors same as z13
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- Rack-mounted HMC and TKE options to save space in the data center
- New 19" frame packaging and optional non raised floor, overhead cabling, water cooling ASHRAE 3 rating - 24" frame packing and no ASHRAE 3 on z13
- No InfiniBand Coupling with HCA-3 InfiniBand Coupling Links on z15 – available on z13

Security

- Cryptographic Coprocessor
- Crypto Express
- IBM Secure Service
- Container
- Secure Console Access
- CPACF for improved performance and true Random Number Generator versus z13
- New Crypto Express7S with a performance increase in accelerator mode plus new algorithms for elliptic curve, SHA, VISA FPE versus z13 Crypto Express5S
- Secure deployment of software virtual appliances – available on z13
- Protection of sensitive data by using Transport Layer Security (TLS) support in the Open Systems Adapter-Integrated Console Controller (OSA-ICC)

Operating systems exploiting hardware innovation

IBM z/OS Version 2.4



- Introducing IBM z/OS Container Extensions (zCX) which enables almost any Linux on IBM Z Docker container in z/OS to run alongside existing z/OS applications and data without a separate Linux server.
- Delivers a more robust and highly available IBM Cloud™ Provisioning and Management for z/OS and Cloud Storage Access for z/OS Data to enable hybrid cloud implementation
- Continues to simplify and modernize the z/OS environment for a better user experience and improved productivity by reducing the level of IBM Z specific skills that are required by eliminating and automating various activities with the z/OS Management Facility (z/OSMF)

z/VSE Version 6



- Performance and functional enhancements for online processing plus faster I/O with FICON Express16S+ with link rate of 16 Gbps
- Improved network performance with OSA Express7S and security with firewall functionality, including z/VSE Network Appliance deployable in the IBM Secure Service Container
- Better and faster HW Encryption with Crypto Express7S
- Wide portfolio of new modern workloads using z/VSE Connectors and Linux on IBM Z
- Even more capabilities with the latest z/VSE V6.2 ¹ PTFs.

Linux



- Efficiency at scale and improved price/performance to run the 'data center-in-a-box', including fast integration with core transaction systems
- On-chip compression enabled for 'pervasive usage' in highly virtualized Linux environments
- Boot securely with signature based boot validation
- Improved I/O stack for faster communication with minimal latency and less application waits
- Extended scope of pervasive encryption, including fibre channel encryption and new variants for protected key cryptography

z/TPF



- Management of extreme transaction volumes up to hundreds of thousands of transactions and millions of DASD operations per second
- Fast / consistent response across predictable and unpredictable peaks
- Low cost per transaction for large applications
- Centralized database handling routines to effectively manage databases
- HiperDispatch workload balancing to optimize processor utilization
- Dynamic CPU to accommodate variable processor capacity demands

¹[z/VSE V6.2 Announcement](#)

Hypervisors and Virtualization for IBM Z

PR/SM-LPARs IBM DPM



- Virtualization is **built into the DNA of IBM Z**
- PR/SM™ **manages and virtualizes all** the installed and enabled system resources as a single large SMP system
- **Full sharing/partitioning of the installed resources** with the highest levels of efficiency and utilization
- **Scale up or scale out on demand** with support for up to 85 partitions
- IBM Dynamic Partition Manager **simplifies provisioning and management experience**
- **Workload isolation** with design for highest EAL5+ security certification
- New dynamic optimization and scalability enhancements

z/VM v7.1




- **Enables extreme scalability, security and efficiency** – Support for 2TB of memory, Dynamic Memory Downgrade,, 80 logical processors, and improved z/VM paging enabling workload consolidation, growth in memory-intensive applications, and superior levels of elasticity.
- **Operational improvements** by providing guest large page support and Guest TX (Transactional eXecution) support
- **Z15 Support** – Crypto Express7S, crypto enhancements, On-chip compression enabled for guest exploitation; Also supported by z/VM 6.4.
- **IBM System Recover Boost** – Boost general purpose processor speed during workload bring-up, quiesce, and system shutdown, with particular focus for z/VSE and z/TPF Guest environment
- **z/VM 7.1** – Delivering a release cadence that improves z/VM's **Continuous Delivery (CD)** model. Includes Single System Image (SSI) support in the base product providing improved availability of z/VM systems by allowing clients to schedule outages without disrupting business critical applications

KVM on IBM Z



- Pass-through of Crypto Express adapter domains in KVM guests
- On-chip compression enabled for 'pervasive usage' with Linux guests
- Support of 16TB of host memory
- Improved performance via new vector instructions for different workloads
- Secure and protected business data with exploitation of elliptic-curve crypto (ECC)



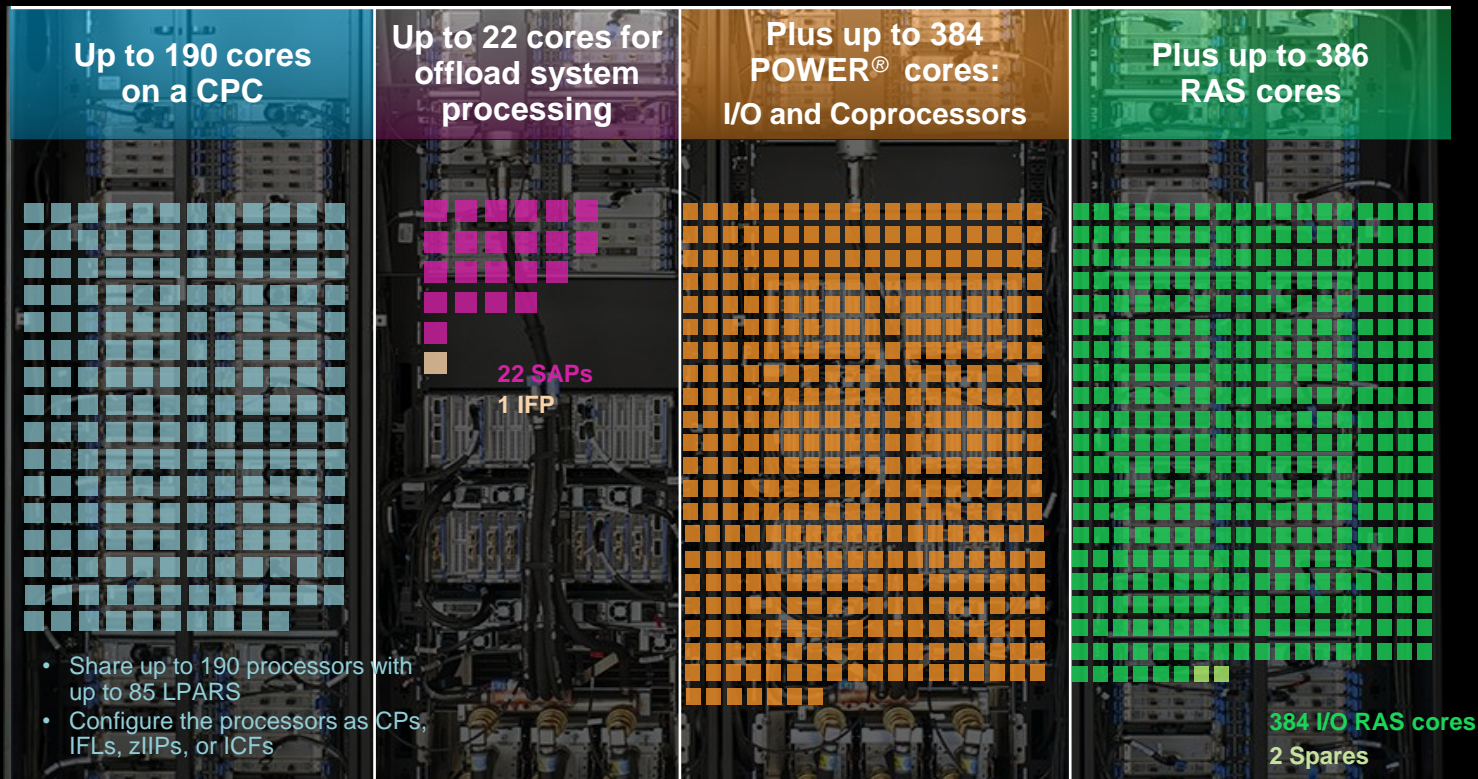
Designed to align with data center trends

- optimizing cost, density and flexibility

- New system footprint in a one to four 19” frame enclosure
- Enables floor space reduction for most clients while maintaining approximately same maximum floor space area for larger configuration
- Two Power options:
 - Intelligent Power Distribution Unit (iPDU) offers highest density, highest electrical efficiency and highest I/O slot count
 - Bulk Power Assembly (BPA) is required for client water cooled systems, use of Internal Battery Feature or balanced power
- Supports both raised and non raised floors as well as top and bottom exit I/O and power (or any combination) and all cable routing is located to back of frame

Integrated system design for z15

I/O and coprocessors bring RAS, cost savings and added compute power to workloads



IBM z15

Elevate your hybrid multicloud



Mission critical cloud



Data protection and privacy



Service level excellence

IBM z15

Ready for mission critical cloud

Industry leading cloud management	Optimized deployment for critical workloads	Standardization through containers	Closing the technology skills gap	Security at the core of the hybrid cloud
<ul style="list-style-type: none">Consistent <i>management and orchestration</i> across your hybrid cloud	<ul style="list-style-type: none">Delivering ZaaS as part of an <i>end-to end cloud native experience</i>	<ul style="list-style-type: none">Extreme Agility with <i>lightweight and portable containers</i> for applications	<ul style="list-style-type: none">Removing skills barriers with <i>open technology and tooling</i>	<ul style="list-style-type: none">Unparalleled <i>trust and security</i> for mission critical workloads

IBM z15

Data protection and privacy

Statement
of Direction

Built on pervasive encryption

- **Broadly protect** Linux and z/OS
- **z/OS Coupling Facility** data
- Protect **network** traffic
- **Containers for secure deployment of appliances**

Data Privacy Passports

- **Protect individuals' identity** in a digitized world
- System becomes the **trusted center for data**
- **Protection and enforcement** for IBM Z data on and off the platform

Fibre Channel Endpoint Security

- End-to-end solution for **data in flight protection**
- **All Z** operating systems and access methods
- Reduces and **eliminates** insider threats

Data Privacy for Diagnostics

- **Protection** when sending diagnostic data to vendors
- **Detection, tagging and redaction** of all tagged data from dumps

IBM z15 offers integrated cryptographic hardware

IBM Z

Service level excellence

IBM Z Transformed Resiliency	Parallel Sysplex	GDPS	IBM System Recovery Boost	zOperational Data Gen and Analytics <small>Statement of Direction</small>
<ul style="list-style-type: none">• Minimal disruptions• Concurrent replace, repair, and upgrade functions• Better throughput• Reduce I/O latency	<ul style="list-style-type: none">• Scale up to 32 systems• Concurrent database access• Record-level control• 99.999% availability• Dynamic balancing	<ul style="list-style-type: none">• Drives long distance failure recovery• Consistency across z/OS and open system data• Create secure point-in-time copies• Offers real time health checks	<ul style="list-style-type: none">• Reduce impact of downtime• Faster recovery• Unlock dark capacity when you need it• No additional IBM software MSU charge	<ul style="list-style-type: none">• Cross component generation of high frequency standardized, summarized, and synchronized activity• Visually intuitive display of interactive analytics for timely, informed decisions

IBM z13®/IBM z13s®



IBM z14



IBM z14 ZR1



Built for the **Mobile Enterprise**

Introduction of SMT
for Linux workloads

Introduction of SMC-R
for memory to memory communication

**Single Instruction
Multiple Data (SIMD)**

Pervasive Encryption
100% encryption with no application changes

Cognitive Solutions
integration with insight from z data delivers new business value

Simplified user experience
without mainframe skills requirements

Introduce 19" Form Factor
Environmental savings and increased options for datacenter planning.

Foundation for Integrated Designs New form factor creates ability to build integrated solutions with other HW.

Z services delivered through IBM Public Cloud

Blockchain

**Hyper Protect
Crypto Services**

**Hyper Protect
DBaaS**

**Hyper Protect
Virtual Servers**

IBM z15 Systems Lab

Services to help you plan and
deploy the cloud you want –
with the privacy and security
you need

Currency & Migration Services for IBM Z®

Upgrades & maintenance for your IBM Z

IBM Data Privacy Passports & Pervasive Encryption

Portfolio of readiness and adoption services

Performance & Tuning

*Enhanced with new z/OS® Workload
Interaction Navigator*

IBM zCX Container Extensions

*Planning, implementation and skill transfer to help
you get started faster with this new capability*

Redhat OpenShift Implementation

Planning and implementation services

IBM Cloud Paks™ for IBM Z

Enhanced with new z/OS Workload Interaction Navigator

Storage Enabled Cyber Resiliency

Reduce risks and impacts of security incidents

For more information visit: ibm.com/it-infrastructure/services/lab-services Or contact your Z IBM or Z Business Partner representative