IBM z16™
Single Frame & Rack Mount

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IBM z16 is built to build

We built a powerful and secure platform for business

What if you could speed innovation with increased decision velocity?

What if you could increase business resiliency with trust and transparency?

What if you could reduce energy usage for your IT sustainability goals?

IBM z16 product portfolio

IBM z16 Multi-Frame

Designed to support the growth in IT requirements for multi-frame clients, with superior scalability & efficiency with up to 200 cores

IBM z16 Single Frame

Designed for roll-in, roll-out single-frame clients, providing enriched capabilities and improved performance per core

IBM z16 Rack Mount

New entry point Rack Mount option, components designed for colocation with other technologies.
Parallel scalability to Single Frame
SSR-installed for high reliability & serviceability

IBM z16 Rack Mount

Why offer Rack Mount options?

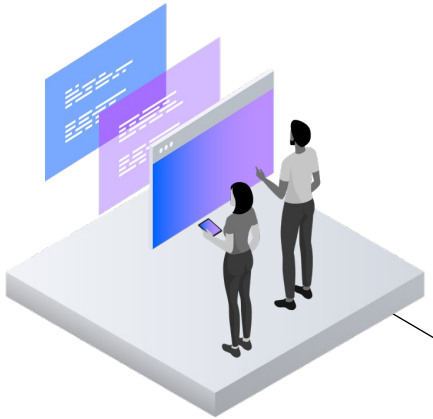
- Flexibility for “system-in-a-box” footprints
  - Opportunities to include storage, SAN, switches in one single converged solution
  - Can assist with data center consolidation
- Allows installation to structured rack aisles
  - Optimize colocation center sustainability & services experience
  - Integrate into existing hot/cold aisle thermal management data center configurations

Thermal Containment Unit with top air cap and standardized rack tateinc.com

IBM Cloud – 50U tall racks ibm.com

Enterprise-grade AI on IBM z16 and LinuxONE

Infusing AI into business-critical applications



- Intersection of transaction and data
- Minimize latency for real-time insights
- Avoid risks and cost of data copies
- Embed AI while meeting stringent SLAs
- Leverage existing AI models and skills

Applying AI for operational excellence

- Accurately identify emerging problems across the Hybrid Cloud
- Diagnose & fix problems fast in dynamic and complex environments
- Resolve swiftly with intelligent automation

IBM z16: industry-first quantum-safe system[1]

Quantum-safe cryptography to protect your business against “harvest now, decrypt later” quantum attacks

Industry first quantum-safe system

Protected by quantum-safe technologies through multiple layers of firmware and enhanced Crypto Express8S HSM capabilities

Protect sensitive data

Quantum-safe APIs to modernize existing and build new applications leveraging quantum-safe cryptography

Create crypto inventory

Discover where and what crypto is used in applications to aid in migration planning

“Act now – it will be less expensive, less disruptive, and mistakes caused by rushing and scrambling are less likely to be made.” – NIST

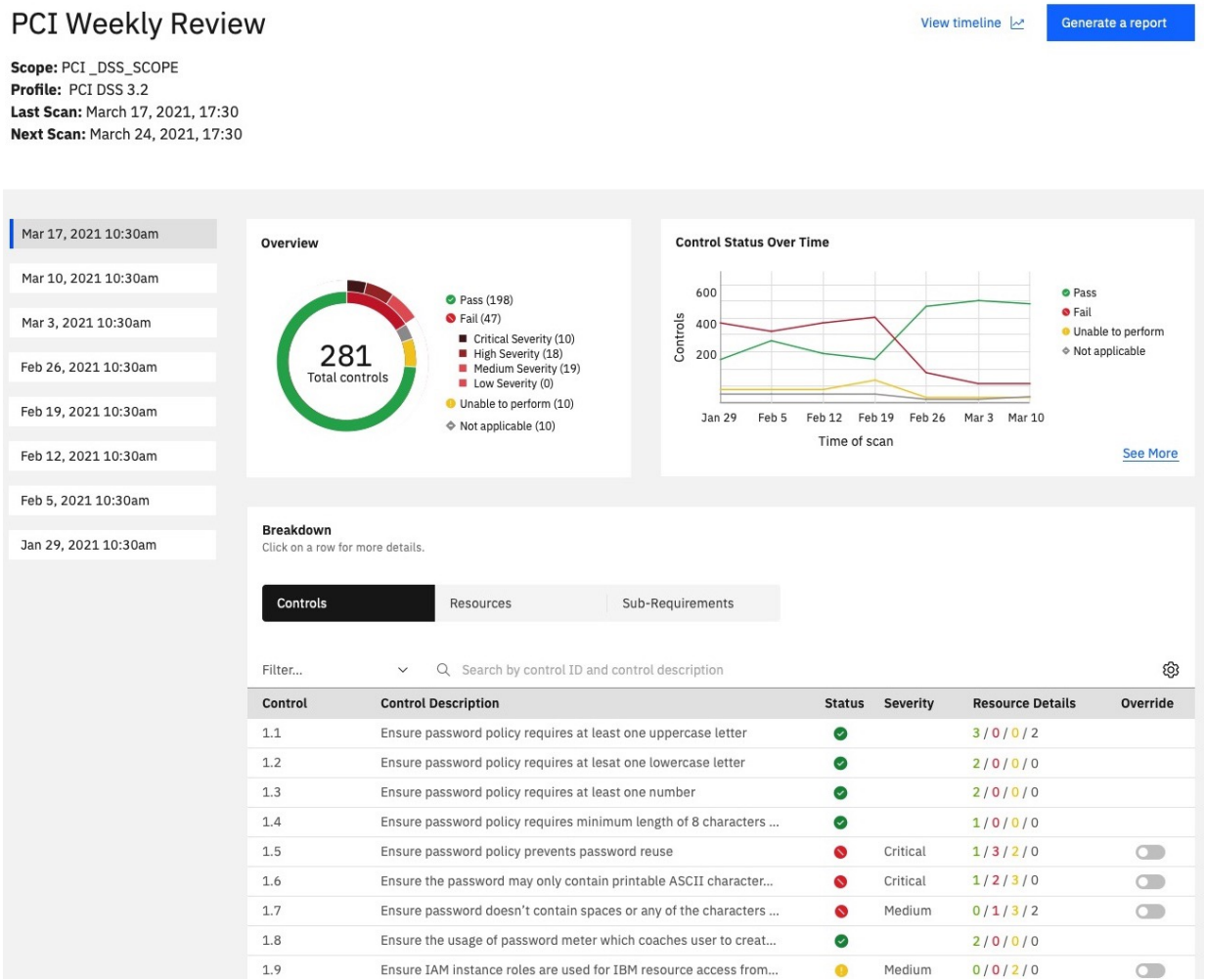
IBM Z Security and Compliance Center

Assess enterprise-level compliance posture

Control to the level you need

Present your reports in a readable way

Identify & track compliance drift



IBM Flexible Capacity for Cyber Resiliency

Designed to enable a proactive approach to address business continuity requirements

Greater flexibility

Dynamically shift production capacity between IBM z16 systems at different locations within seconds

Complete client control

Remotely transfer capacity up to 12 times per year and remain at the alternate site for up to one year

Simplified compliance

Improve audit readiness by using the same procedures for DR testing and real unplanned disasters

IBM System Recovery Boost

Restore service and recover workloads substantially with
zero increase in IBM software licensing costs

Available on IBM z15

Faster shutdown and startup
Accelerate the shutdown, restart and recovery of images, middleware environments and client workloads to accelerate return to pre-shutdown SLAs[1]

Faster sysplex recovery
Accelerate Parallel Sysplex recovery processes to minimize disruption and expedite return to steady-state operations

Faster GDPS automation
Drive faster and more efficient GDPS automation actions to rapidly reconfigure and recover your environment

Faster elimination of backlog
Utilize additional capacity for a fixed period during recovery, so you can process backlog faster after planned or unplanned downtime

New with IBM z16

Faster middleware restart
Accelerate the restart and recycle of client-specified middleware environments to rapidly return to steady-state operations

Faster SVC dump processing
Accelerate the SVC dump capture process so you can gather the diagnostics and return to normal operations quickly

Boosted HyperSwap Configuration Load
Accelerate the process of loading/re-loading HyperSwap configuration and policy information, and/or to reduce the system impact while the load is in progress

1. Accelerated shutdown applies only to planned shutdown of z/OS images
2. SRB Upgrade Record **not** available on IBM z16 A02, AGZ or IBM z15 T02

IBM z16 sustainability

Built for the modern data center to optimize flexibility and sustainability

Product Lifecycle

Product Attribute to Impact Algorithm (PAIA) carbon footprint reports for understanding lifecycle carbon emissions and sustainability

PAIA

Energy Efficiency

- Flexibility of UX energy trend dashboards or API management
- Partition **partition-level power statistics** providing operational insights into workloads on the platform
- Integration with commercial DCIM tools

Circular Economy

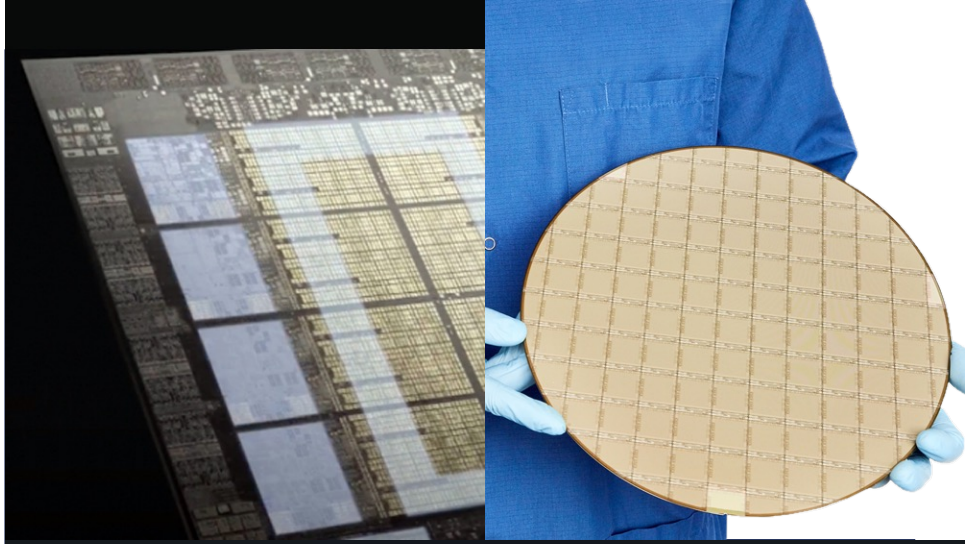
Increase renewable / reusable / recyclable material content

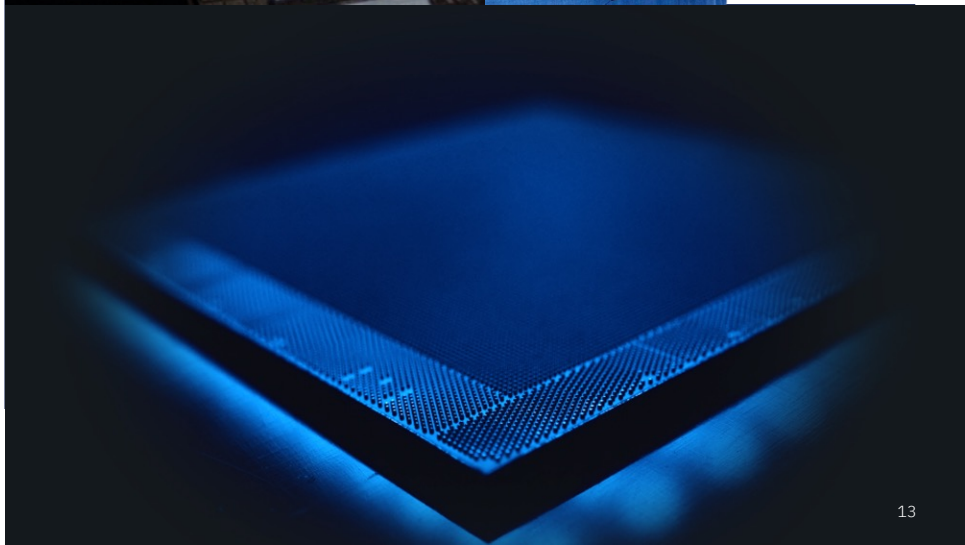
Recycle or reuse at least 97% of end-of-life product waste

Goal to eliminate nonessential plastics from product packaging by 2024

Reduce shipping size and weight

IBM z16
Single Frame & Rack Mount technical overview





IBM z16 Single Frame & Rack Mount

IBM Telum Processor

- New Integrated AI Accelerator for high-speed inferencing, in addition to accelerators for encryption and compression
- 7nm technology @ 4.6GHz, up to 4 Dual Chip Modules (DCMs) per CPC drawer
- 8 cores/chip, 2 chips/DCM
- **13% single-thread performance improvement** over z15 T02
- Quantum-Safe system, leveraging new Crypto Express8S HSMs

Flexible compute design

- Up to 68 client-configurable cores
  - Up to 6 standard CPs, up to 67 zIIPs, up to 68 IFLs or ICFs
- Up to **14% max system capacity growth** over z15 T02 with z/OS
- Up to **21% max system capacity growth** over z15 T02 with Linux on Z
- IBM-provided Single Frame for roll-in, roll-out ease, or Rack Mount configuration for client-supplied rack infrastructure
- Up to 3 I/O PCIe+ drawers available for I/O expansion up to 48 adapters
- FICON Express32S for enhanced speed and consolidation opportunities

Memory

- Up to 16 TB RAIM memory with physical memory encryption
- 2 TB Virtual Flash Memory

IBM z16 4.6GHz

Machine Type 3932
Single Frame offering A02
& Rack Mount offering AGZ

Drawer Sizing

CPC Drawer	Client PUs	Max Memory
1	32	8 TB
2	68	16 TB

Feature-Based Sizing

CPC Feature	Client PUs	Max Memory
Max 5	5	4 TB
Max 16	16	4 TB
Max 32	32	8 TB
Max 68	68	16 TB

IBM Telum processor design

Performance and Scale

- Optimized core
- New, flexible virtual cache hierarchy

Embedded accelerators

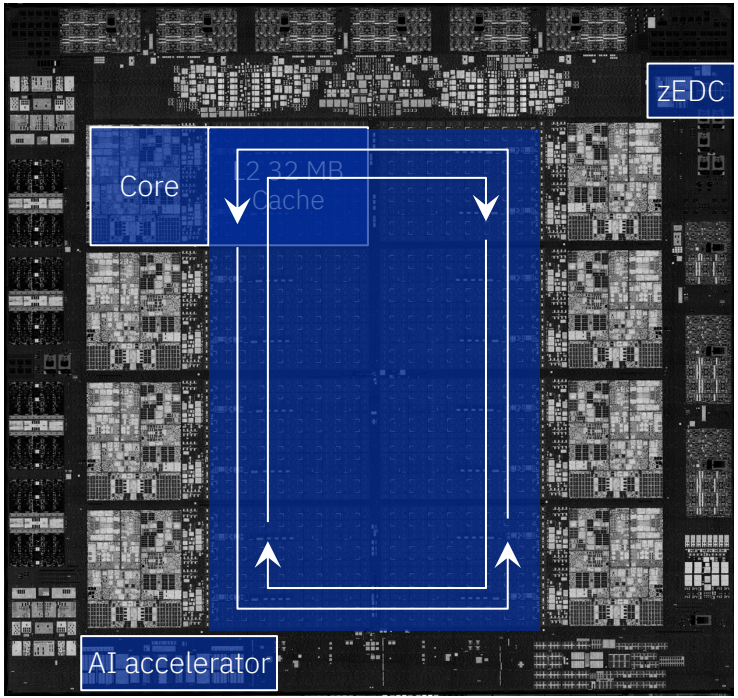
- Integrated accelerator for AI
- Sort, compression, cryptography

Industry-leading security

- Transparent memory encryption
- Improved Trusted Execution Environment

Unmatched reliability and availability

- Error correction and sparing
- Redundant Array of Independent Memory



IBM z16 zIIPs

More options to innovate

IBM z16 scales zIIPs more than ever before

- 2:1 zIIP to CP ratio **removed**
- Clients can expand from development into production quickly

zIIPs can help accelerate development

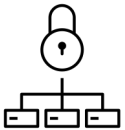
- AI and analytics workloads like Db2
- Hybrid cloud interfaces and containers including z/OS Container Extension (zCX)
- Java, Python, and more

No IBM software charges on zIIP capacity

- TCO opportunities for new projects

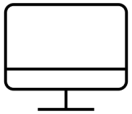
IBM z16 family technical enhancements

Validated Boot for z/OS



- Optional ability to digitally sign z/OS executables to prevent tampering before IPL
- Two modes:
  - Enforce: stop IPLs if anomalies detected
  - Audit: produce errors if anomalies detected

Partition-level monitoring



- HMC dashboards and Web Services API can now measure power consumption at LPAR level, providing increased granularity over prior systems
- Enhanced dashboards provide additional historical power data

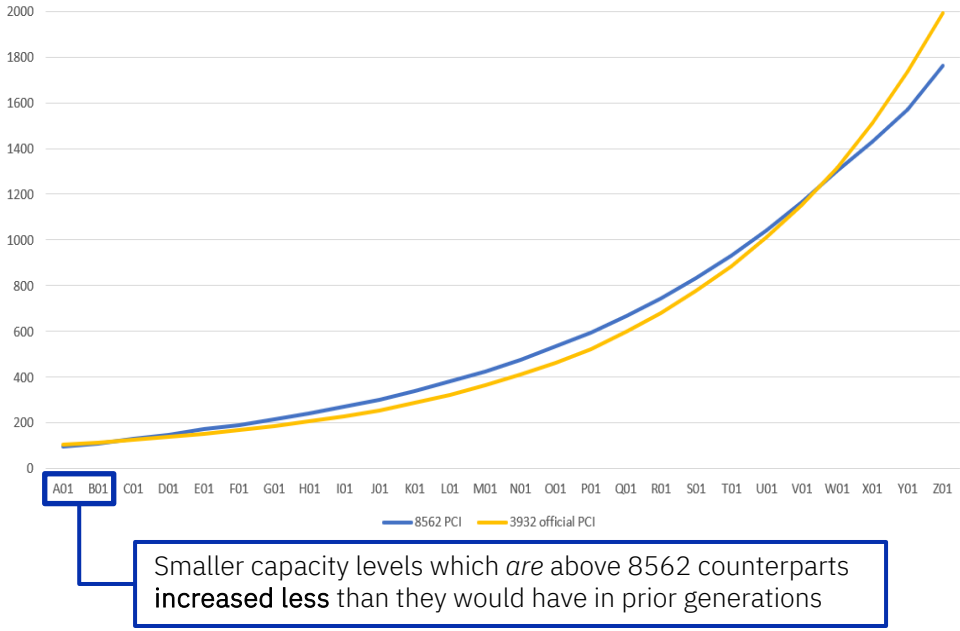
Quantum-Safe CFCC

- CFCC automatically digitally signed using quantum-resilient and classical hybrid scheme
- Transparent to end users; no key management required

IBM z16 Single Frame & Rack Mount capacity highlights

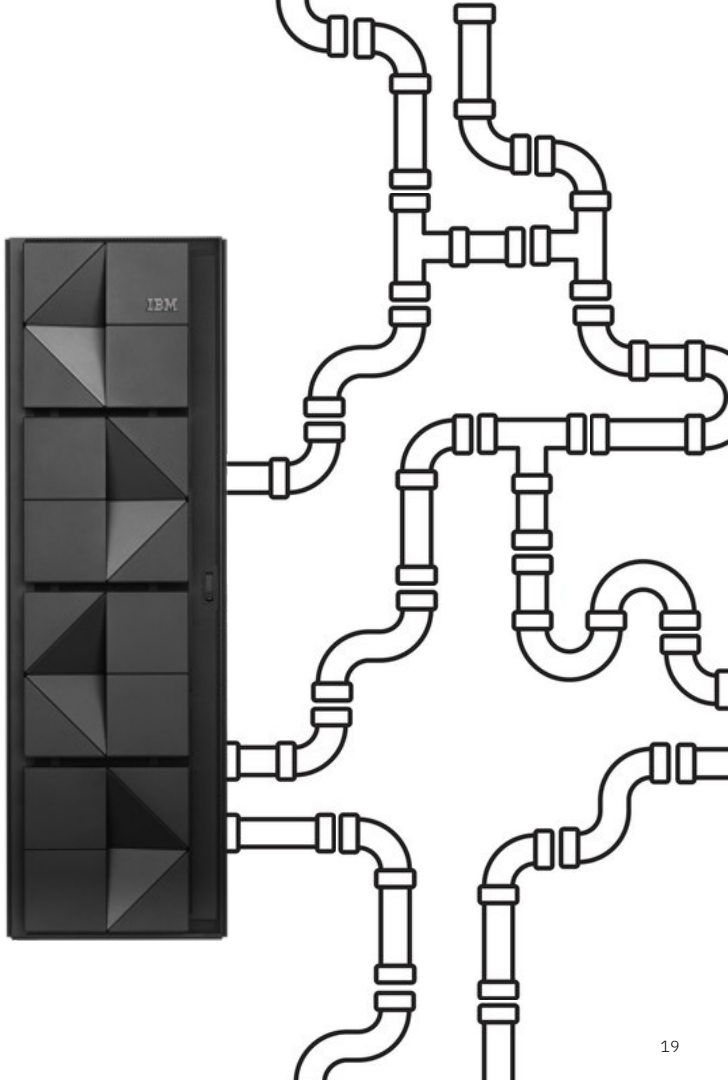
- 3932 PCI numbers are a departure from traditional PCI curves on previous generations
- Some sub-capacity models on 3932 have **less capacity** than their 8562 counterparts
  - J01 capacity setting on 3932: 257 PCI, 32 MSUs
  - J01 capacity setting on 8652: 303 PCI, 38 MSUs
- Additional lower-capacity options to allow for **improved granularity**
- This is a **one-time event**; plan to carry this model forward to future generations

3932 vs 8562 capacity by uniprocessor model



Utilize capacity planning tools (zPCR & CP3000) to properly size upgrades!

IBM z16 Single Frame & Rack Mount I/O features & roadmap



New Build I/O Features

Description	Feature Code	Ports	Max Features	Comments
Coupling Express2 LR	0434	2	32	LinuxONE: timing only
ICA SR 1.1	0176	2	24	LinuxONE: timing only
10GbE RoCE Express3 SR	0440	2	8	
10GbE RoCE Express3 LR	0441	2	8	
25GbE RoCE Express3 SR	0452	2	8	
25GbE RoCE Express3 LR	0453	2	8	
zHyperLink 1.1	0451	2	16	
Crypto Express8S	0909	N/A	16	1 HSM
Crypto Express8S	0908	N/A	20	2 HSM

New Build I/O Features (continued)

Description	Feature Code	Ports	Maximum Features
OSA Express7S 1.2 25GbE SR	0459	1	48
OSA Express7S 1.2 25GbE LR	0460	1	48
OSA Express7S 1.2 GbE LX	0454	2	48
OSA Express7S 1.2 GbE SX	0455	2	48
OSA Express7S 1.2 10GbE LR	0456	1	48
OSA Express7S 1.2 10GbE SR	0457	1	48
OSA Express7S 1.2 1000BASE-T	0458	2	48
FICON Express32S LX	0461	2	48
FICON Express32S SX	0462	2	48

End-to-end solution for data-in-flight protection

IBM Fibre Channel Endpoint Security enables FICON® or Fibre Channel Protocol (FCP) Links from the IBM z16 family to the IBM DS8900F storage family to be encrypted and protected

Challenges

- Encrypt all data in-flight by corporate directive
- Protect the integrity and
- Confidentiality of data in-flight

Client Value

- Gain confidence that all data flowing within and across data centers is traveling between trusted entities
- Ensure ability to provide auditable information verifying that client data is only accessed by trusted IBM Z and storage devices
- Use on all IBM Z operating systems

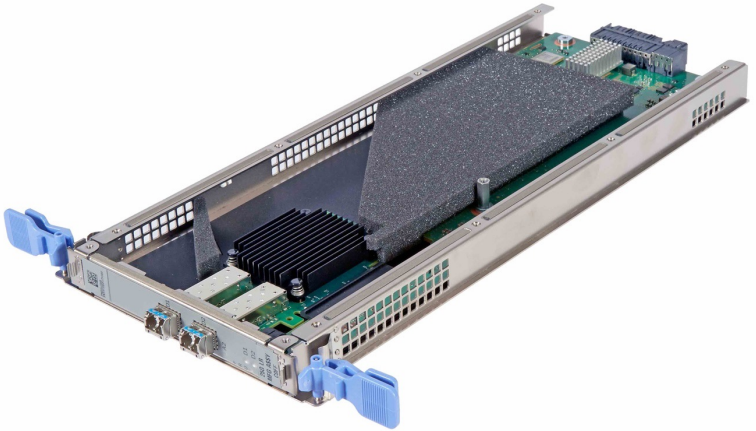
- Reduce insider threats of unauthorized access to data in-flight
- The FICON Express16SA and the FICON Express32S channel with Fibre Channel Endpoint Security protects your data in flight, offloading encryption processing to the channel hardware with less than 4% impact on maximum High Performance FICON® for IBM z Systems® (zHPF) throughput

OSA Express updates and strategy

- OSA Express7S 1.2 family includes 1000BASE-T, 1 GbE (LX, SX), 10 GbE (LR, SR), and 25 GbE (SR, LR) varieties
- CHPID type OSE will not be supported after z16 generation
- OSA Express 1000BASE-T cards will not be supported after z16 generation
  - CHPID type OSC supported on 1 GbE cards today
  - **Recommendation**: begin migrating functionality off 1000BASE-T cards to 1 GbE cards during z16 timeframe

RoCE Express updates and strategy

- New RoCE Express3 family includes 10 GbE (SR, LR) and 25 GbE (SR, LR)
- RoCE Express features on IBM z16 provide remote memory-to-memory communications between servers, reducing network latency and CPU consumption compared to TCP/IP
- RoCE Express adapters will be the strategic direction for direct-access networking on Linux on IBM Z after IBM z16
  - This change will not affect z/VM VSwitch clients
- SMC-Rv2 with RoCEv2 and SMC-Dv2 with ISMv2 are available with z/OS 2.4 and 2.5 and allow for connections to be routed, no longer restricting connections to the same IP subnet



Recommendation: Linux on IBM Z clients should consider moving to RoCE Express adapters in the IBM z16 timeframe for their network connectivity

Crypto Express8S

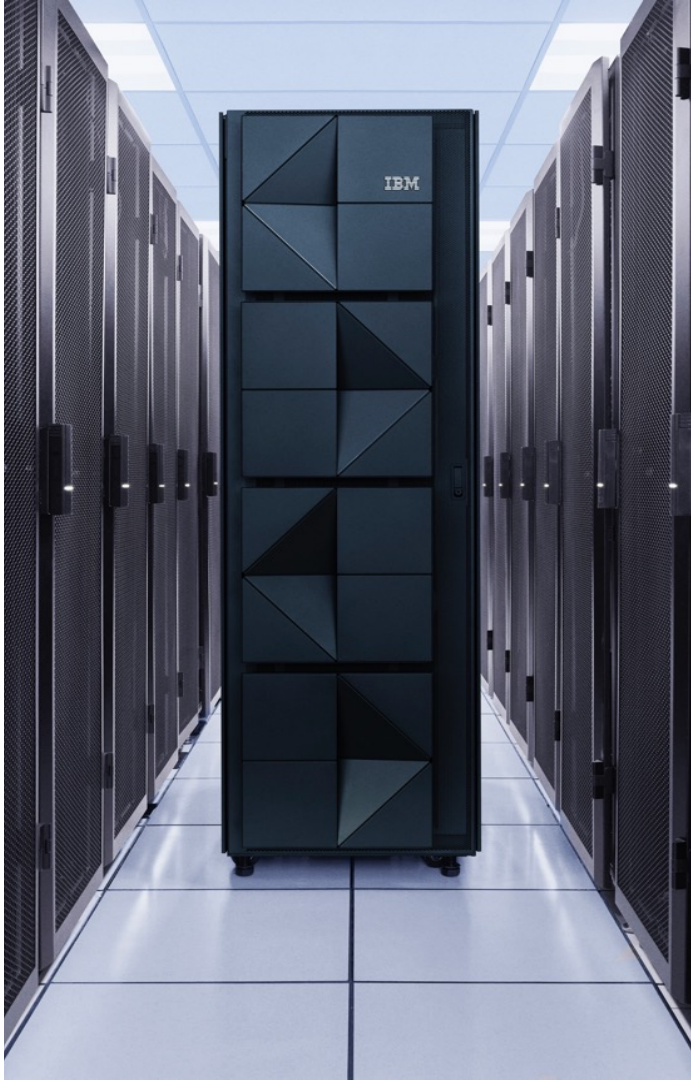
Invoke Quantum-Safe Crypto APIs accelerated by Crypto Express8S to build Quantum-Safe cryptography into your applications

- Asymmetric algorithms:
  - CRYSTALS-Kyber requires CEX8S
  - CRYSTALS-Dilithium requires CEX7S+
  - Both selected for NIST standardization
- Symmetric algorithm: AES-256
- Hashing algorithms: SHA-2 and SHA-3

Generate secure keys for Pervasive Encryption using Crypto Express8S

- z/OS Data Set Encryption
- Coupling Facility Encryption
- JES2 Spool Encryption
- Encrypted RACF Database

Improve operational performance using protected keys generated from secure keys with Crypto Express8S



Utilize Quantum-Safe Secure Boot hybrid schemes on Crypto Express8S to protect system initialization

- CRYSTALS-Dilithium + ECDSA

Protect digital wallets on your Digital Assets Platform using Crypto Express 8S

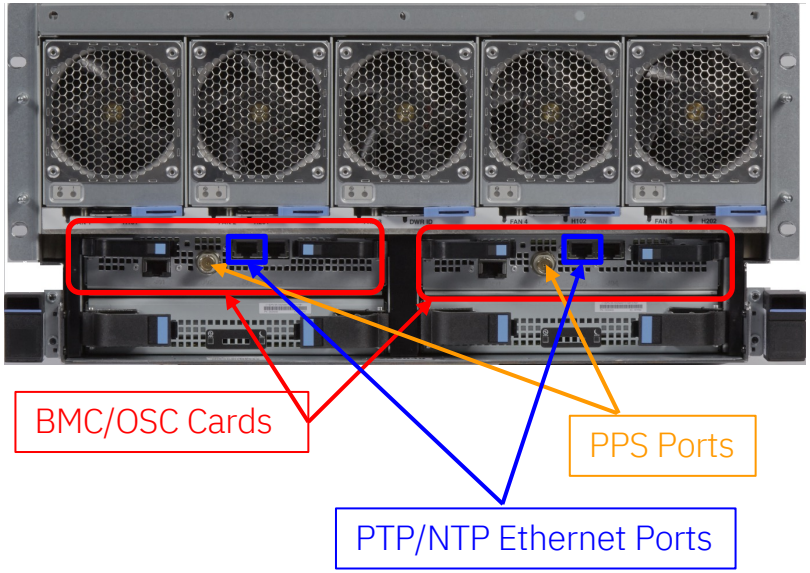
Enhance and simplify key management with:

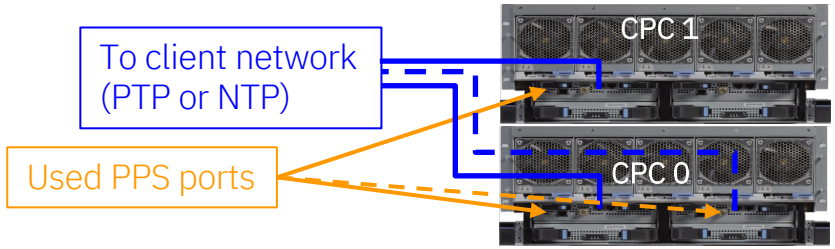
- EKMF Workstation support for Quantum-Safe keys
- Unified Key Orchestrator (UKO) for z/OS for Pervasive Encryption key management
- TKE Workstation support for Quantum-Safe mini-boot, and inbound & outbound communications to Crypto Express8S
- GKLM Container Edition for secure key management

Timing: ETS plugging changes
(NTP & PTP)

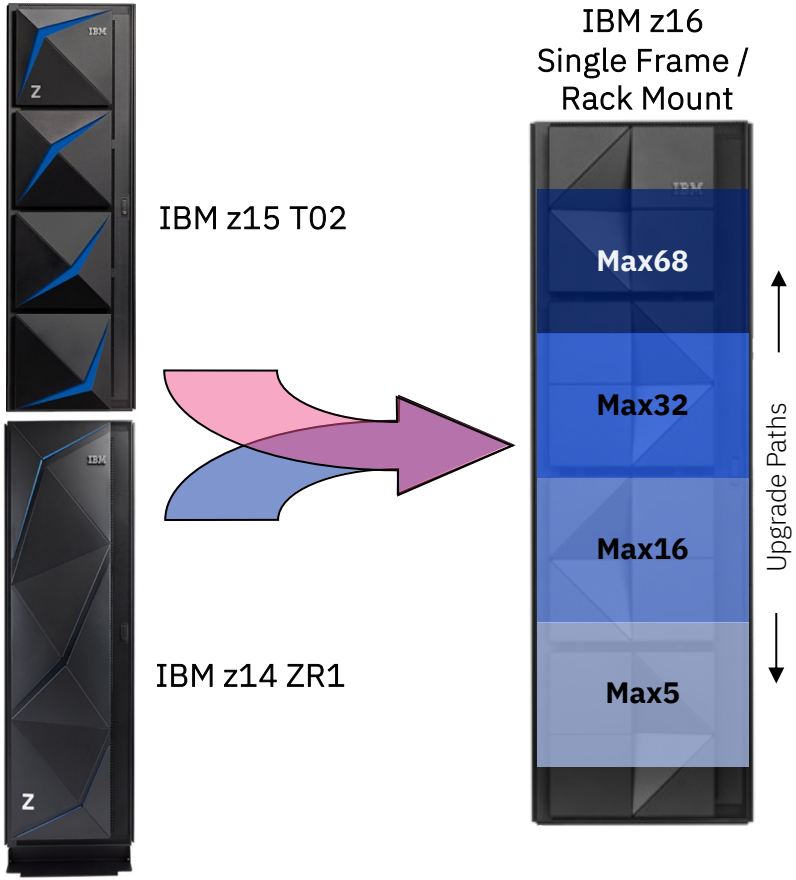
- IBM z16 Single Frame & Rack Mount configurations can have one or two CPC drawers
- On IBM z16, connections to an External Time Source (ETS) will be plugged directly into the CPC drawer, **not the SE**
- Each CPC drawer has two combined BMC/OSC cards, each with one PPS port and one ETS port (RJ45 Ethernet, for both PTP and NTP)
- For timing signal redundancy, two links must be used
  - For a single CPC drawer system, both ports must be connected and configured for timing and/or PPS
  - For a system with two CPC drawers, only the first ports in the first and second CPC drawer can be used, and only two ports (one in CPC 0 and one in CPC 1)

CPC Drawer, front view
(bezel not installed)





IBM z16 Single Frame and Rack Mount MES upgrades



- Within-family upgrades:
  - **Concurrent** upgrade from Max5 → Max16 (A02, AGZ, LA2, AGL)
  - **Disruptive** upgrades from Max5 or Max16 → Max32 or Max68
  - **Concurrent** upgrade from Max32 → Max68 (for AGZ, AGL: only concurrent if client has Plan Ahead feature)
    - Upgrades to Max68 offerings will add a 2nd CPC drawer
  - Additional I/O drawers can be added via MES based on available space in frame
- **Any IBM z15 T02** to IBM z16 Single Frame or Rack Mount
- **Any IBM z14 ZR1** to IBM z16 Single Frame or Rack Mount
- **No LinuxONE frame-roll MES** to LinuxONE Rockhopper 4

IBM z16 and LinuxONE Rockhopper 4 operating system support

z/OS

- z/OS 3.1 with PTFs
- z/OS 2.5 with PTFs
- z/OS 2.4 with PTFs
- z/OS 2.3 (compatibility only)
  - IBM Software Support Services purchase required
- z/OS 2.2 (compatibility only)
  - IBM Software Support Services purchase required

z/VM

- z/VM 7.3 with PTFs
- z/VM 7.2 (compatibility only)

z/VSE

- VSE^{n} V6.3 – 21st Century Software

z/TPF

- z/TPF 1.1 with PTFs

Linux on IBM Z

Minimum Distributions:

- SUSE SLES 15 SP3
- SUSE SLES 12 SP5
- Red Hat RHEL 9.0
- Red Hat RHEL 8.4
- Red Hat RHEL 7.9
- Canonical Ubuntu 22.04.0x LTS
- Canonical Ubuntu 20.04.0x LTS

IBM cannot legally discuss z16 exploitation prior to GA from distributors.

Officially Tested list here.

Hardware Management Appliance (HMA)

- The HMC code runs as an appliance on two high performance top-of-rack servers
- HMCs are peers and support data replication
- One HMA feature code provides two HMAs
- All ordered HMAs must be configured and maintained
  - **Recommendation:** order a maximum of 2 HMAs per site to ensure redundancy while avoiding unnecessary complexity
- Logon to HMC remotely from your browser, logon to SE from the HMC
- IBM z14 and z15 HMCs can be upgraded to current code level to manage z16 systems
- FC 0129 (new, optional feature code)
  - No external HMCs unless carried forward
  - Last machine to support carry-forward HMC
  - HMA can now be added via MES post-install

Machine Family	Machine Type	Firmware Driver	SE Version
z16 A02/AGZ	**3932**	**51**	**2.16.0**
z16 A01	3931	51	2.16.0
z15 T02	8562	41	2.15.0
z15 T01	8561	41	2.15.0
z14 M0x	3906	36	2.14.1
z14 ZR1	3907	36	2.14.1

Add V2.16.0 code to existing HMCs. Obtain from the SSR at GA

IBM z16 Single Frame & Rack Mount

Physical planning

IBM z16 Single Frame footprint overview

- 19” rack design factory-installed into standard 42U IBM frame (same as z15 T02)
- Powered with 2 or 4 IBM iPDUs
  - IBM recommendation: power via redundant sources
  - Single-CPC drawer systems: single-phase or 3-phase power; dual-CPC drawer systems: 3-phase power required
- 8 configuration options; each component has a fixed location within frame
  - 1-2 CPC drawers, 0-3 I/O drawers
- No 16U Reserve feature or plan-ahead features available

IBM z16 Rack Mount footprint overview

- Modular 19” design SSR-installed into client frame
- Powered with client’s PDUs
  - Client’s PDUs must account for service clearances
  - IBM recommendation: power via redundant sources
- 8 configuration options; height ranges from 10U-39U
  - 1 or 2 CPC drawers; 0-3 I/O drawers
  - Component stack order is pre-defined
- One or more system (z16 Rack Mount, storage, networking, etc.) may be installed within one rack
  - IBM z16 Rack Mount components must be contiguous

Requires additional pre-planning for successful install!

Questions?

Thank you!