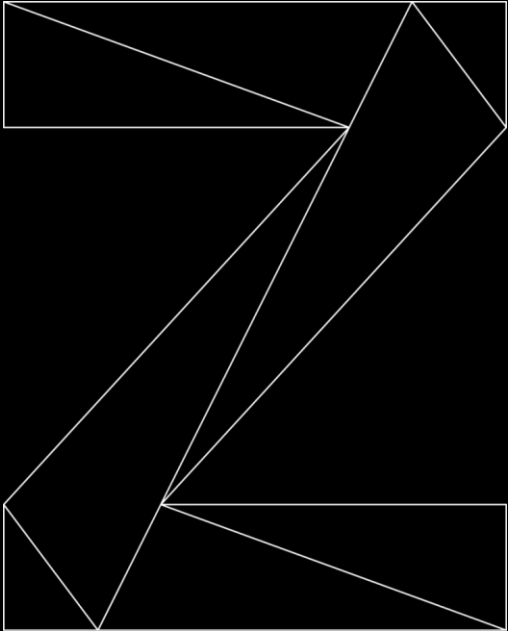


IBM z14 ZR1— Hardware Innovation



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Notes:

Performance is in Internal Throughput Rate (ITR) ratio based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput improvements equivalent to the performance ratios stated here. IBM hardware products are manufactured from new parts, or new and serviceable used parts. Regardless, our warranty terms apply.

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Contents

IBM Z®: Designed for Trusted Digital Experiences

Introducing the IBM z14™ (z14 ZR1)

Achieving Pervasive Encryption

Designed for a Cognitive World

Systems administration simplified

Operating System Support



IBM Z: Designed for trusted digital experiences

The world's premier system for enabling data as the new security perimeter

- Pervasive encryption
- No application changes
- Protect from internal and external threats



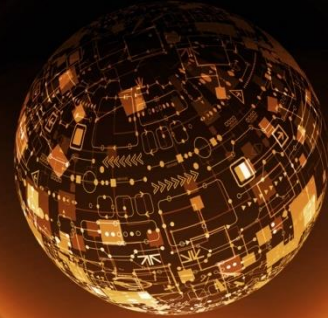
Designed for data serving in a cognitive world

- Speed, scale and reduced latency
- Efficiency for managing data
- Secure and flexible access to data



The best infrastructure to support an open and connected world

- 'From anywhere' mobile access
- Simplified sys admin of z/OS®
- Standardization for skills transfer



Extending the IBM z14 Family



Built on the same
technology of IBM z14

Addressing new markets

Standardization and
Simplicity

One strong platform and
family for the future

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

Platform Simplification

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

Processor Units (PUs)

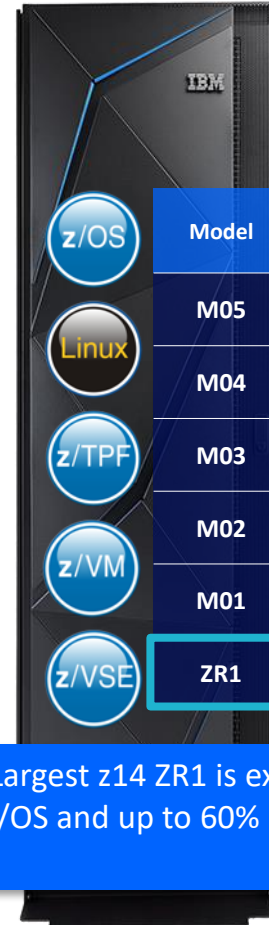
- 8, 16, 28, 34 PU cores per CPC drawer
- Feature based sizing - 4, 6/12, 6/24 or 6/30 CP/PU cores available for characterization
- Up to 2 SAPs per system
- 1 spares designated per system
- 40 LPARs

Memory

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

I/O

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

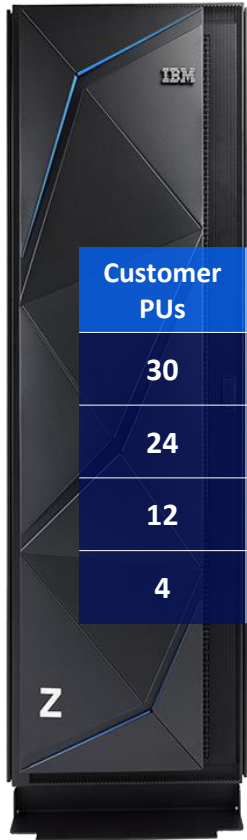


IBM z14 Model ZR1
Machine Type: 3907

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

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

IBM z14 Model ZR1 – Flexible new way to configure



IBM z14 Model ZR1
Machine Type: 3907

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

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

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

New entry level – 88 MIPS for capacity setting A01

Full Z01 **uniprocessor running up to 1570 MIPS** with z/OS total capacity available over 8000 MIPS

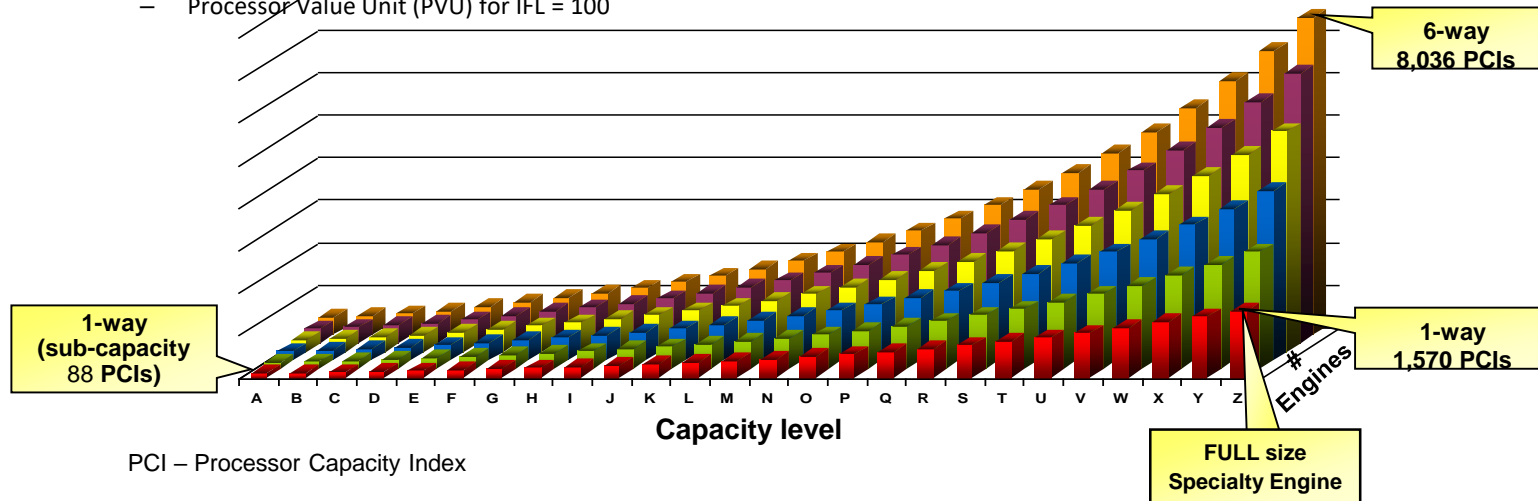
Same granularity for right sizing – 26 capacity levels x 6 CPs equals 156 settings

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

z14 ZR1 Sub-capacity Processor Granularity*

- The z14 ZR1 has 26 CP capacity levels (26 x 6 = 156)
 - Up to 6 CPs at any capacity level
 - All CPs must be the same capacity level
- zAAPs are not available on z14 ZR1
- The ratio of zIIPs for each CP purchased is the same for CPs of any speed.
 - 2:1 zIIP to CP ratio – unchanged from z13s/zBC12
 - All specialty engines run at full speed
 - Processor Value Unit (PVU) for IFL = 100

Number of CPs (full capacity CP)	Base Ratio z13s	Ratio z13s to z14 ZR1 (Z0x)
1 CP	z13s Z01	1.09
2 CPs	z13s Z02	1.10
3 CPs	z13s Z03	1.10
4 CPs	z13s Z04	1.10
5 CPs	z13s Z05	1.10
6 CPs	z13s Z06	1.10



*See Speaker Notes

What's new with z14 Model ZR1

IBM z13s

Machine Type

- 2965

2 Models

- N10 and N20
- Single 24" frame, air cooled
- Non-raised floor feature
- Overhead Cabling required
- DC Power Options

Processor Units (PUs)

- N10: 10 Client Configurable, 13PUs
- N20: 20 Client Configurable, 26PUs
- 6 CPs max

Memory

- Up to 4 TB, Min 64G, 8-256GB increments
- Virtual Flash Memory 4x1.4TB increments

I/O

- 64 PCIe Gen3 channel features
- HCA and New Coupling



IBM z14 Single Frame

Machine Type

- 3907

1 Model

- ZR1
- Single 19" frame, air cooled
- Non-raised floor support
- Top Exit and/or Bottom Exit Cabling feature enhancements
- PDU based power

Processor Units (PUs)

Feature Driven: 6 CPs Max

- Max4: 4 Client Configurable, 8PUs
- Max12: 12 Client Configurable, 16PUs
- Max24: 24 Client Configurable, 28PUs
- Max30: 30 Client Configurable, 34PUs

Memory

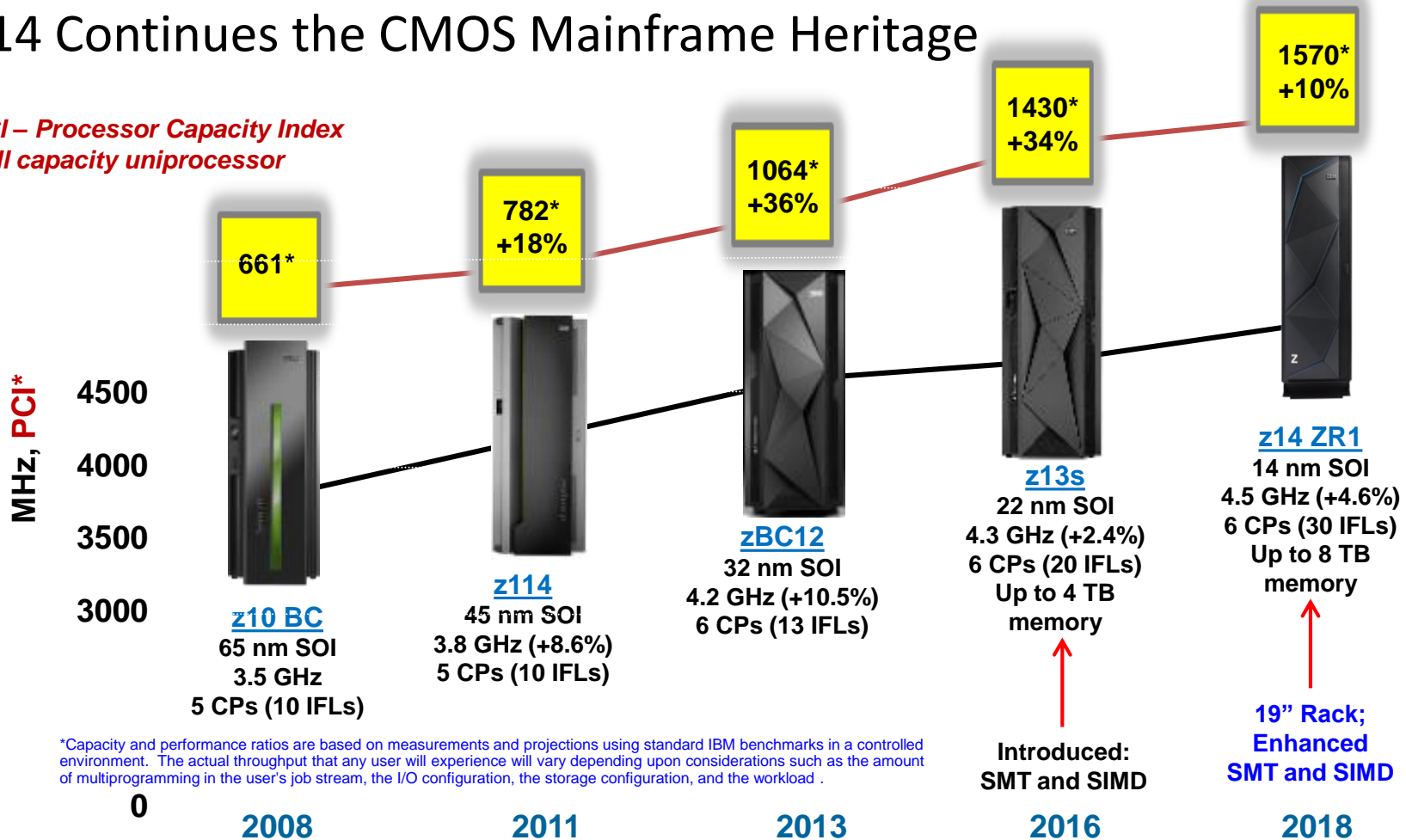
- Up to 8 TB, Min 64G, 8-512GB increments
- Virtual Flash Memory 4x512GB increments

I/O

- 64 PCIe Gen3 channel features
- New 19" I/O Drawer
- New I/O features: zHyperlink
- Coupling – ICA SR and Coupling Express only (no InfiniBand)

z14 Continues the CMOS Mainframe Heritage

*PCI – Processor Capacity Index
Full capacity uniprocessor*



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

*NOTE: PCI (MIPS) Tables are NOT adequate for making comparisons of IBM Z processors in proposals

Imagine the possibilities of building an “all in one” solution

With smaller I/O configurations – a new 16U Reserved feature code can be added that tags 16U of space in rack as “Available”

This creates a *new opportunity* to customize a comprehensive solution that fixes your requirements¹

Populate with your choice of server, switch or storage elements ²

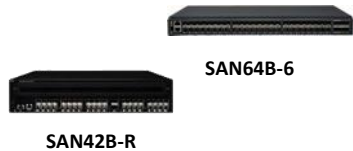
Available only on the IBM z14 ZR1

- ¹ Hardware service to these IBM or non IBM options may be provided by a 3rd party – but must be able to manage analysis of power, thermal, air flow and other requirements as listed in the IMPP guide. Training may be offered via IBM as negotiated.
- ² Requirements for physical structures as well as interactions with the ‘mainframe server’ will be provided



IBM Z and Storage synergy

Storage Networking



Flash and Hybrid Storage Systems

z/VM®, Linux on Z (FCP only)

z/OS, z/VM, z/TPF, zVSE®,
Linux on Z



FlashSystem™
A9000



Storwize®
V7000 / V7000F



FlashSystem
V9000



FlashSystem
FS900



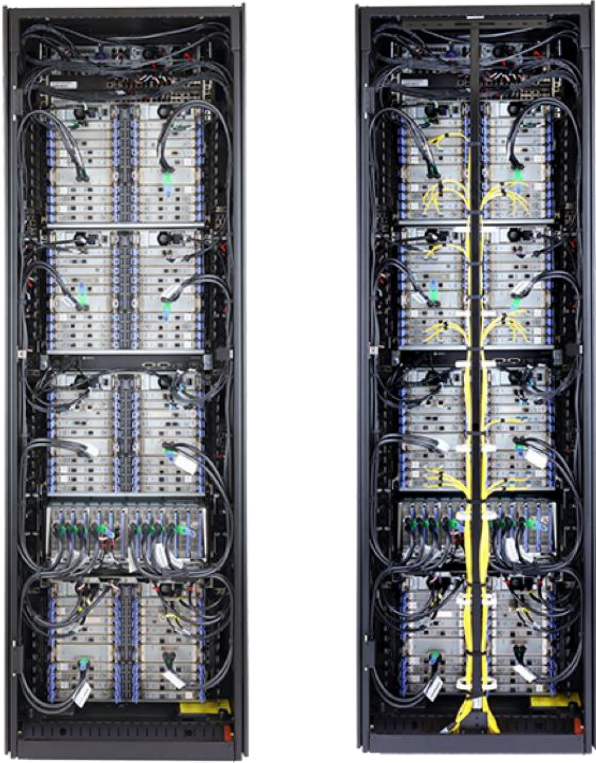
Other examples of uses for 16u Reserved include IBM 1u HMC, TKE, Power Systems™, NVMe

IBM z14 ZR1 Hardware layout

z14 ZR1 front view



z14 ZR1 rear view



Differentiated value at the core

Leader in performance and scale

- New 10-core Processor Design in 14nm Silicon Technology
- Up to 6 configurable z/OS cores and up to 30 total cores allow the z14 Model ZR1 up to **13%** and **60%** more capacity for z/OS and Linux respectively than the largest z13s
- **1.5x** more on-chip cache¹ per core optimized for data serving

More performance with innovation that helps the full stack

- New instructions in the SIMD Facility gives boost for traditional workloads using decimal arithmetic and new applications like analytics
- Pause-less garbage collection enables enterprise scale Java[®] applications to run with fewer and shorter pauses for garbage collection on larger and larger heaps
- Next generation SMT improves performance up to **25%** vs non-SMT for an IFL or zIIP to benefit Linux and zIIP exploiters

IBM z14 Models

10-core processor chip

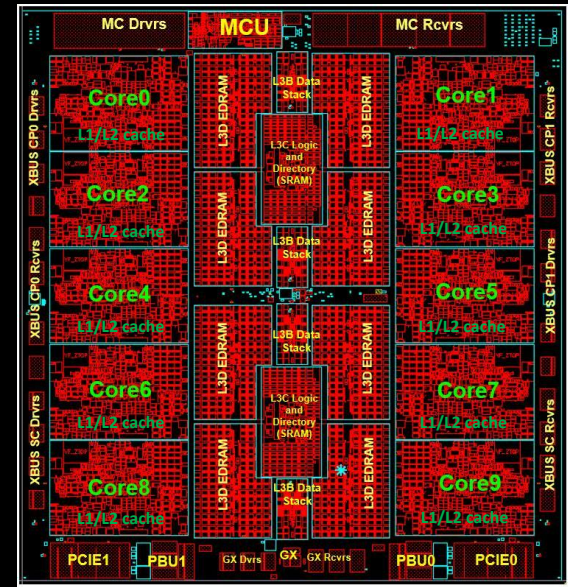
Same chip technology as the z14 Models M01-M05

Up to ten cores (PUs) per chip

4.5 GHz versus 5.2 GHz for the IBM z14 M01-M05

Improved instructions per cycle (IPC) with microarchitecture enhancements

Note: Chip technology also applies to IBM LinuxONE™ Rockhopper™ II



- 14nm SOI Technology
 - 17 layers of metal
 - 6.1 Billion Transistors vs. 3.99 Billion on z13
- Chip Area
 - 26.5 x 27.8 mm

Designed for data protection

Market View

- Over 5 million records stolen per day, 214,060 per hour and 3,568 per minute.¹
- Of the 9.7 Billion records breached since 2013 only 4% were encrypted.¹
- 1 in 4 companies is likely to experience a breach.²
- The greatest security mistake organizations make is failing to protect their networks and data from internal threats.³

¹ <http://breachlevelindex.com/>

² <https://www.ibm.com/security/infographics/data-breach/>

³ Steve Marsh in article: <https://digitalguardian.com/blog/expert-guide-securing-sensitive-data-34-experts-reveal-biggest-mistakes-companies-make-data>

The world's premier system
for enabling data as the
new security perimeter

- Pervasive encryption
- No application changes
- Protect from internal and external threats



Crypto Express6S

General availability in z14 and z14 ZR1

- Based on IBM PCIe Cryptographic Coprocessor (PCIeCC), available as machine type model 4768

Enhanced Performance

- PCI Express Gen2 (vs. Crypto Express5S @ Gen 1)
- DDR3 1600
- Persistent Memory Management for faster boot time (FPGA)



¹ All performance information was determined in a controlled environment. Actual results may vary. Performance information is provided "AS IS" and no warranties or guarantees are expressed or implied by IBM.

Crypto Express6S

Enhanced Public Key Cryptography Algorithms performance

Upgraded secure module tamper detection technology

- Improved thermal capabilities for increased performance
- Continued support for temperature and voltage detection



IBM z14: Performance that changes the game for security

Performance with Integrated Cryptographic Hardware

- **6x** faster encryption for like modes and data sizes with enhanced on-chip (CPACF) cryptographic performance compared to IBM z13s¹
- **2X** the SSL handshake performance on z14 ZR1 with Crypto Express6S compared to z13s with Crypto Express5S²

Datasets automatically protected with z/OS Dataset Encryption

- Protect z/OS data sets automatically throughout their life cycle
- Enforce consistent policy over access to encrypted content

Protection in the sysplex

- Data is encrypted/decrypted at a host and is protected in flight and at rest inside the Coupling Facility (CF)

¹ This performance claim is extrapolated from IBM internal tests comparing CPACF throughput rates on z14 to z13. It is based on the assumption that the only factor that has a significant influence on CPACF throughput is cycle time. Further, that the cycle time ratio between z14 and z13 is within 1% of the cycle time ratio between z14 ZR1 and z13s.

² This performance claim is extrapolated from IBM internal tests comparing SSL handshake throughput rates on z14 with CEX6S to z13 with CEX5S. It is based on the fact that the CEX6S in a z14 ZR1 is the very same device as the CEX6S in a z14, with no difference in components, clock speed, features or anything else that would have an impact on the CEX6S throughput.



More security enhancements on IBM z14



Ensure stronger security in the payment card industry using Crypto Express6S compliance with security standards

Stronger cryptographic computation using True Random Number generator support on CPACF

Performance boost for Java with new Galois Counter Mode (GCM) encryption for minimum latency and operation overhead

New **audit log application** and other performance improvements on TKE 9.0

Audit network encryption attributes within z/OS network traffic using new z/OS Encryption Readiness Technology (zERT)¹ tool

¹ zERT is not limited to the IBM z14

IBM Secure Service Container

For secure deployment of software virtual appliances



Provides ***IBM Z as a viable platform for hosting modern, cloud-native, container-based applications*** in line with the organization's overall Docker container strategy

Offers the potential for clients to ***create enriched services and product offerings*** that are built on a security-rich container foundation

Isolate and protect the container data from privileged users, helping to protect the data and execution code from inside or external threats, inadvertent or malicious

Minimize the risk of tampering or malware to the solution code

Supports ***pervasive encryption*** principles

Designed for data serving

Market View

- Cognitive businesses use insight from all data to enhance their digital intelligence and disrupt industries.
- Over 90% of the world's data cannot be Googled.¹
- Accelerating time to market is essential – success is measure in days, not weeks.
- Data gravity – analyze data where it resides.


¹ SOURCE: <http://www.tennessean.com/story/money/tech/2014/05/02/jj-rosen-popular-search-engines-skim-surface/8636081/>

Designed for data serving in a cognitive world

- Speed, scale and reduced latency
- Efficiency for managing data
- Secure and flexible *access* to data



Speed and scale getting to the data



FICON Express16S+

- Up to **3x¹** SIO/sec for small data transfer I/O operations and **25%¹** SIO/sec increase with mix of large sequential read and write data transfer options
- Batch Elapsed time improves **17%¹** running I/O intensive batch workloads versus same workload using FICON Express16S on a z13s
- Provides increased scalability by increasing number of devices per channel without degrading performance

zHyperLink Express

- A new direct connect short distance link designed to deliver low latency connectivity between z14 and FICON[®] storage systems
- zHyperLink improves application response time, cutting I/O sensitive workload response time by **up to 50%** without requiring application changes²

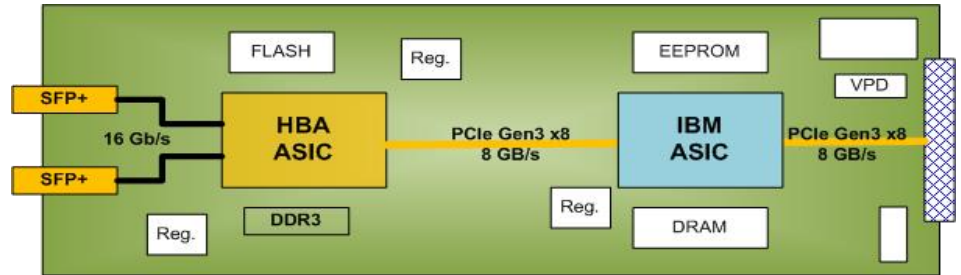
¹ Performance results are extrapolated from benchmark measured in a controlled environment. The actual throughput or performance that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed.

² This performance data was measured in a controlled environment. The actual throughput or performance that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed.

FICON Express16S+

For FICON, zHPF and FCP

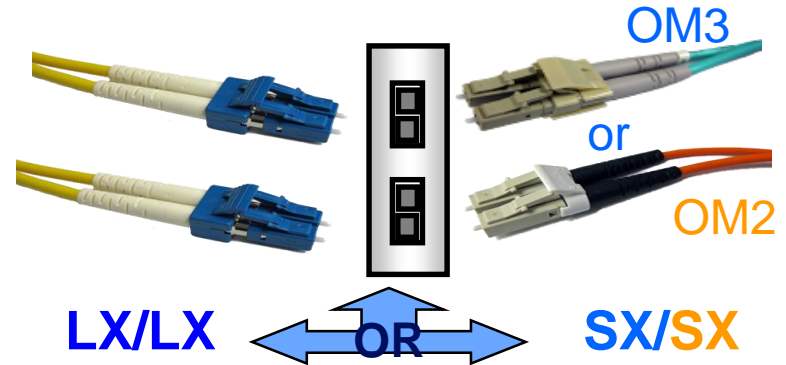
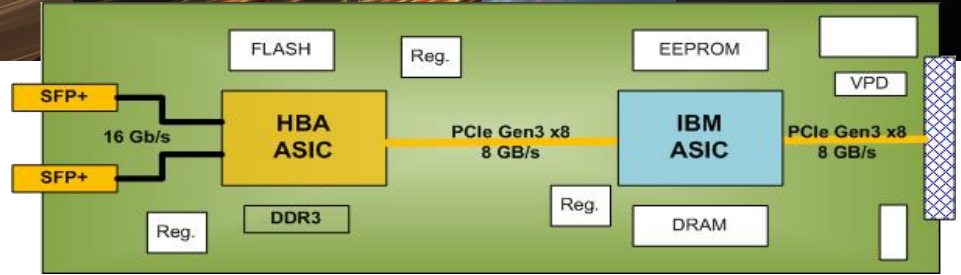
- CHPID types: FC and FCP
- Both ports must be defined as the same CHPID type
 - 2 PICHs per Feature
- Auto-negotiates to 4, 8 or 16Gbps
 - 2 Gbps connectivity is no NOT supported
- Supports either LX or SX
 - Configuration at ordering



FICON Express16S+

Small form factor (SFP) optics

- Concurrent repair/replace action for each SFP
- 100KM LX – 9 micron single mode fibre
 - Unrepeated distance – 10KM (6.2 miles)
- SX – 50 or 62.5 micron fibre
 - Distance variable with link data rate and fiber type



Improved speed for development and applications on z14

Compilers

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

Java SDK 8 SR5

- Faster user response times for Java
- **4.2x⁴** improvement to AES-GCM crypto to enable best-of-breed security for the API-economy using Java
- Pause-less garbage collection baked into the processor, reducing pause times by up-to **3x⁵** for predictable high-perform transaction processing at-scale
- 50+ new instructions on the z14 co-designed and exploited by Java

¹COBOL v6.2 fully support the Packed Decimal Facility to reduce CPU usage for decimal intensive applications by up to 38%, and on average 19%

²Automatic Binary Optimizer v1.3 reduces CPU usage of applications built with COBOL v4 (and below) without source recompilation by up to 47%

³z/OS 2.3 XL C/C++ reduces CPU usage of compute intensive applications on average 13%

⁴z14 z/OS WAS Liberty with GCM Mode Encryption: Customers running WebSphere Liberty for z/OS, using clear key encryption AES_128_GCM cipher, can get up to 4.2X improvement in throughput per core with IBM Java 8 SR5 on z14 compared to Java 8 SR3 on z13

⁵Performance results based on IBM internal tests running Java Store Inventory and Point-of-Sale in COMPOSITE mode application benchmark on standalone dedicated IBM z14 and z13 machines using z/OS 2.2.2 with APAR OA51643 and no other workloads running in the LPAR under test. Both z14 and z13 were configured with 1CP and 8 SMT z1IPs with total 17 hardware threads. Capacity projections were done to estimate the benefit of moving from z13 z/OS 2.2 Java 8 SR3 to z14 z/OS 2.2 Java 8 SR5 with Pause-less garbage collection enabled by java option -Xgc:concurrentScavenge. The response-time constrained Service Level Agreements (SLAs) metric used for this claim was based on geometric mean of (throughput @ 10ms, 25ms, 50ms, 75ms and 100ms response time SLAs). Hardware instrumentation data was collected and analyzed on all benchmarks to verify performance results. IBM 64-bit SDK for z/OS Java Technology Edition, Version 8 SR3 on z13 was used as the baseline. IBM 64-bit SDK for z/OS Java Technology Edition, Version 8 SR5 is scheduled to GA September 2017.

Capacity and features to manage more data

Up to 8 TB memory

- Support new workloads, in-memory databases and efficiently process huge amounts of information for real-time business insights

IBM Virtual Flash Memory

- Next generation of Flash Express to provide higher levels of availability and performance during workload transitions and spikes

Single Instruction Multiple Data

- Enhanced math libraries provide performance improvements for analytical workloads

Shared Memory Communications – Direct Access Method (SMC-D)

- Up to **61%** CPU savings for FTP file transfers for z/OS versus HiperSockets™¹



¹ All performance information was determined in a controlled environment. Actual results may vary. Performance information is provided "AS IS" and no warranties or guarantees are expressed or implied by IBM.

Efficiency managing data movement to improve access time

On-chip compression coprocessor

- Enhancements enable further compression of data including Db2[®] indices, improving memory, transfer and disk efficiency
- In the future¹ Db2 plans to enable new order-preserving compression for Db2 indices using compression coprocessor to support index compression

zEDC

- Compression further reduces cost to pervasively encrypt data with less data to encrypt
- More data active and effective compression with a dedicated compression accelerator
- Disk savings with improved utilization of storage tiers with DFSMSdss[™] use of compression

¹ IBM's statements regarding its plans, directions, and intent are subject to change or withdrawal without notice at IBM's sole discretion.

Sharing the data



OSA-Express6S

- Technology refresh of OSA-Express6S

10GbE RoCE Express2

- Technology refresh used with SMC-R
- Provides increased virtualization / sharing capability allowing RoCE to be extended to more workloads

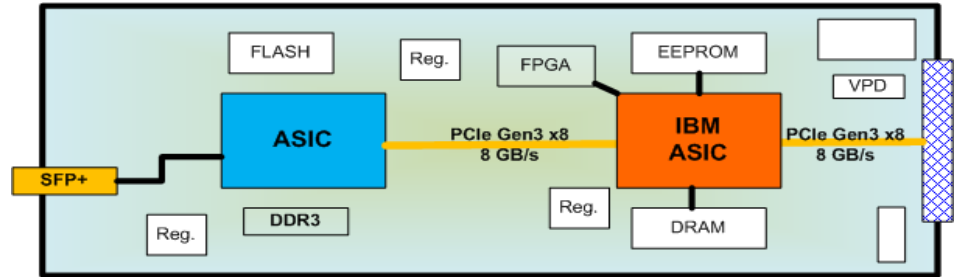
Coupling Technology Enhancements

- **New** Ethernet based Coupling Links using 10GbE RoCE technology - Coupling Express LR
- Better utilization of Coupling Facility (CF) processors with scalability improvements
- Faster problem resolution with additional CF Request Diagnostics
- Additional physical and logical coupling links offers Coupling Link Constraint Relief

OSA-Express6S Fiber Optic Features*

■ 10 Gigabit Ethernet (10 GbE)

- CHPID types: OSD, OSX
- Single mode (LR) or multimode (SR) fiber
- One port of LR or one port of SR
 - 1 PCHID/CHPID
- Small form factor pluggable (SFP+) optics
- LC duplex



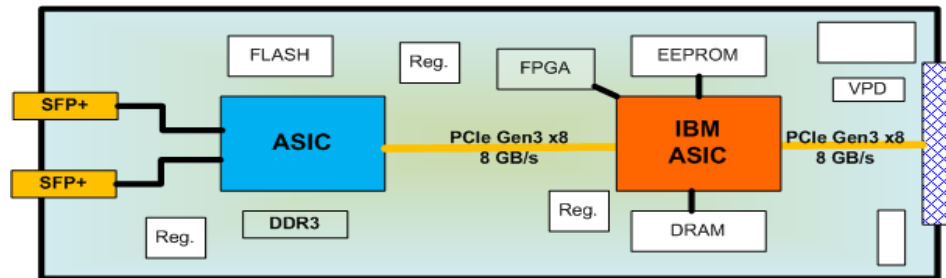
FC 0424 – 10 GbE LR, FC 0425 – 10 GbE SR



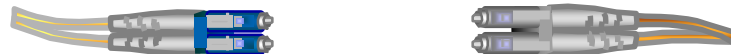
OSA-Express6S Fiber Optic Features*

■ Gigabit Ethernet (1 GbE)

- CHPID types: OSD (OSN not supported)
- Single mode (LX) or multimode (SX) fiber
- Two ports of LX or two ports of SX
 - 1 PCHID/CHPID
- Small form factor pluggable (SFP+) optics
 - Concurrent repair/replace action for each SFP
- LC Duplex

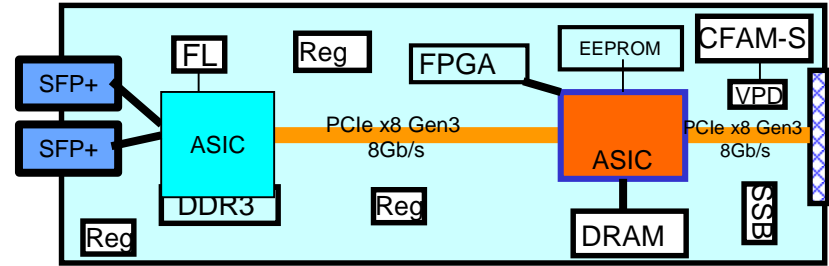


FC 0422 – GbE LX, FC 0423 – GbE SX



OSA-Express6S 1000BASE-T Ethernet feature

- PCIe form factor feature supported by PCIe I/O drawer
 - One two-port CHPID per feature
 - Half the density of the OSA-Express3 version
- Small form factor pluggable (SFP+) transceivers
 - Concurrent repair/replace action for each SFP
- Exclusively Supports: Auto-negotiation to 100* or 1000 Mbps and full duplex only on Category 5 or better copper
 - No 10Mbps
 - RJ-45 connector
 - Operates at “line speed”



FC 0426

Connector = RJ-45

CHPID TYPE Support:

Operation Mode	TYPE	Description
OSA-ICC	OSC	TN3270E, non-SNA DFT, OS system console operations
QDIO	OSD	TCP/IP traffic when Layer 3, Protocol-independent when Layer 2
Non-QDIO	OSE	TCP/IP and/or SNA/APPN/HPR traffic
Unified Resource Manager	OSM	Connectivity to intranode management network (INMN)
OSA for NCP (LP-to-LP)	OSN	NCPs running under IBM Communication Controller for Linux (CCL)

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

Integrated Coupling Adapter (ICA SR)

- Integrated Coupling Adapter SR (ICA SR) Fanout in the CPC drawer
- Recommended for Short Distance Coupling z13/z13s to z13/z13s or newer, not available on older servers
- No performance degradation compared to Coupling over InfiniBand 12X IFB3 protocol



Integrated Coupling Adapter (ICA SR)

■ Hardware Details

- Short reach adapter, distance up to 150 m
- Up to 16 ports (z14 ZR1) maximum
- IOCP Channel Type = CS5

■ Feature code 0172, 2 ports per adapter

- Up to 4 CHPIDs per port, 8 per feature, 8 buffers (i.e. 8 subchannels) per CHPID

■ ICA requires new cabling for single MTP connector

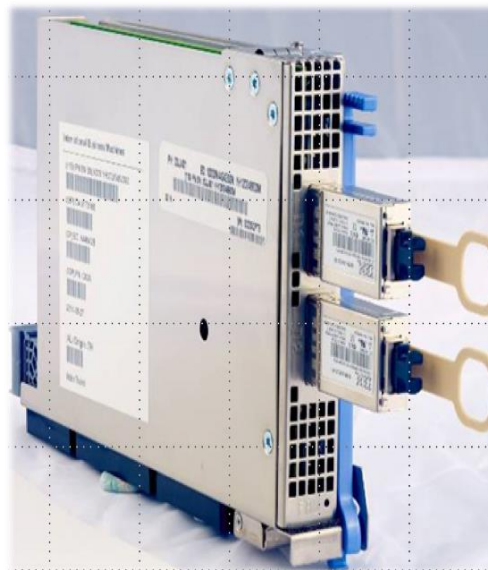
- Differs from 12X Infiniband split Transmit/Receive connector



Integrated Coupling Adapter (ICA SR)

■ Requirements

- CF: z13/z13s; z/OS: z13/z13s
- z/OS V2.2, V2.1, V1.13, or V1.12 with PTFs for APARs OA44440 and OA44287



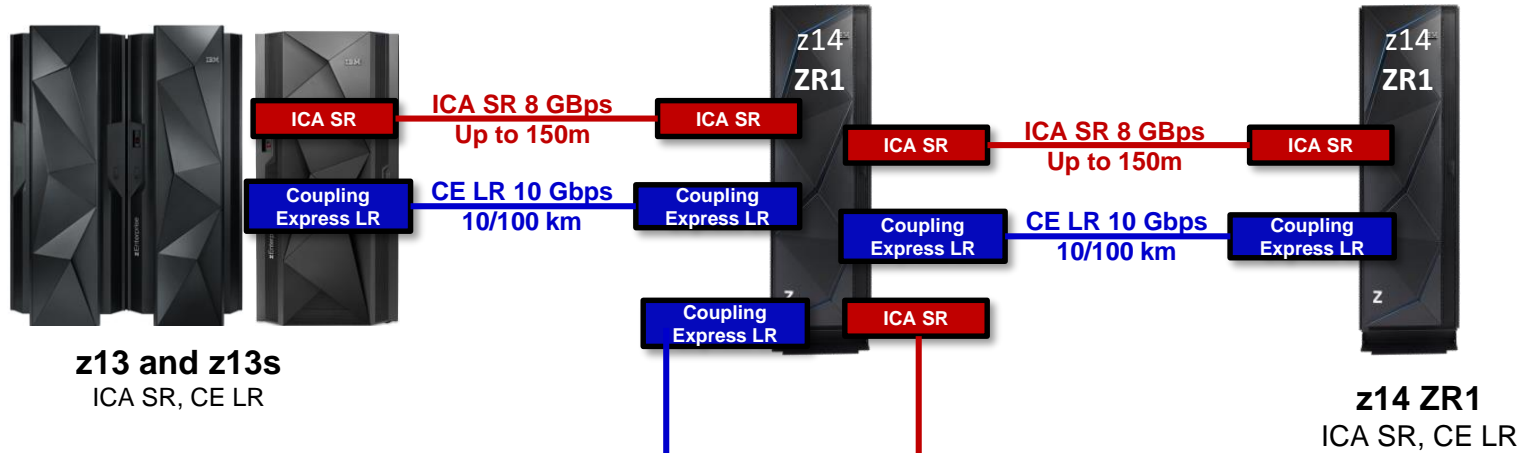
Coupling Express Long Reach

Overview

- **New adapter and channel type for long distance coupling**
- **Coupling Express LR adapter in PCIe/PCIe+ I/O drawer**
 - 32 features per system for z14 and z13 (Two ports per feature)
 - 16 features for z14 ZR1 and z13s (Two ports per feature)
 - Long-distance optics/fiber
 - Fiber is same single-mode fiber as used for ISC and PSIFB-1x (9/125 μm)
 - 10km unrepeated distance, up to 100 km with qualified DWDM,
[More than 100 km requires RPQ 8P2781.](#)
 - 10 Gbps link speed*
 - Point-to-point only (no switching)
- **Single PCHID identifies card/slot**
- **Four channels (CHPIDs) per port**
 - Each channel is identified by VCHID/CSS.CHPID
 - CHPID type (CL5)

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

z14 ZR1 Coupling Connectivity



Coupling Express LR (CE LR)
 10 Gbps, 10/100 km
z13, z13s, z14 to z13/z13s/z14 Connectivity ONLY

Integrated Coupling Adapter (ICA SR)
 8 GBps, up to 150 m
z13, z13s, z14 to z13/z13s/z14 Connectivity ONLY



z196, z114, and older CPCs CANNOT coexist in the same Parallel Sysplex or STP CTN with z14 ZR1 (no coupling connectivity)
zEC12 or zBC12 can coexist in the same Parallel Sysplex with z14 ZR1 **only** if the CPC hosting the CFs has coupling connectivity to both the zEC12/zBC12 and z14 ZR1 CPCs

IC (Internal Coupling Link):
 Only supports IC-to-IC connectivity
 HCA2-O and HCA2-O LR and ISC-3 are NOT supported on z13, z13s and z14 M/T 3906
 HCA3-O and HCA3-O LR are NOT supported on z14 ZR1 (M/T 3907)
 Note: The link data rates do not represent the performance of the links. The actual performance is dependent upon many factors including latency through the adapters, cable lengths, and the type of workload.

Designed for simplification

Market View

- 38% of HR managers surveyed said training and developing employees is their greatest staffing concern¹
- Simplified management of mainframe systems.
- Majority of large enterprises have multiple virtualization technology silos, each managed with its own administrative solutions and skills, which may increase overall operational cost and complexity.²

¹ Business Management Daily – Dec 21, 2015

² IDC – July 2015 #257441

The best infrastructure to support
an **open and connected** world

- ‘From anywhere’ mobile access
- Simplified sys admin of z/OS
- Standardization for skills transfer



Infrastructure simplified for a modern workspace experience



Improved user experience with Hardware Management Console

- New security enhancements including multifactor authentication
- New mobile capabilities that push notifications and allow secure monitoring and management from anywhere
- Enhanced tasks with built in guidance and instructions can reduce 'research' time
- Visualization for system time management



Managing z/OS with z/OSMF

- End to end z/OS management including new logon experience
- Simplified process to add new products using portable packages and guided activities
- Tools to simplify management of sysplex infrastructure



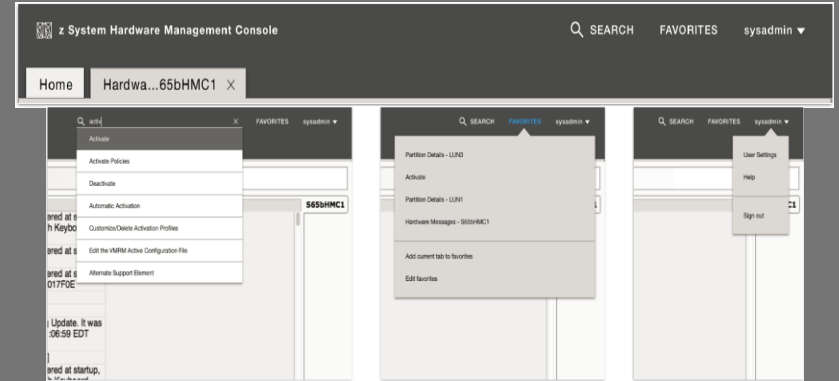
Configuration setup with IBM Dynamic Partition Manager

- Quickly and dynamically configure and manage system resources
- Guided storage setup, provisioning, admin
 - SOD: FICON ECKD™ support
- Provides the foundation that enables IaaS and secure, private clouds
- Ease installation with auto configuration of devices during Linux installation¹

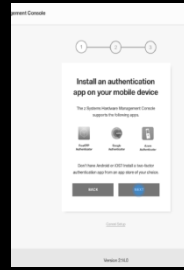
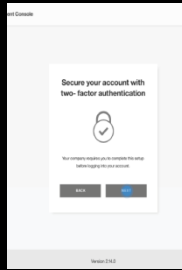
Next generation Hardware Management Console

Empowering users by providing them with a modern workspace that equips them to securely and confidently manage system hardware from anywhere

Tree structure



Multi-factor authentication



New mobile capabilities



Simplified workflow for system time management

Improved help tools to compliment and improve system admin skills

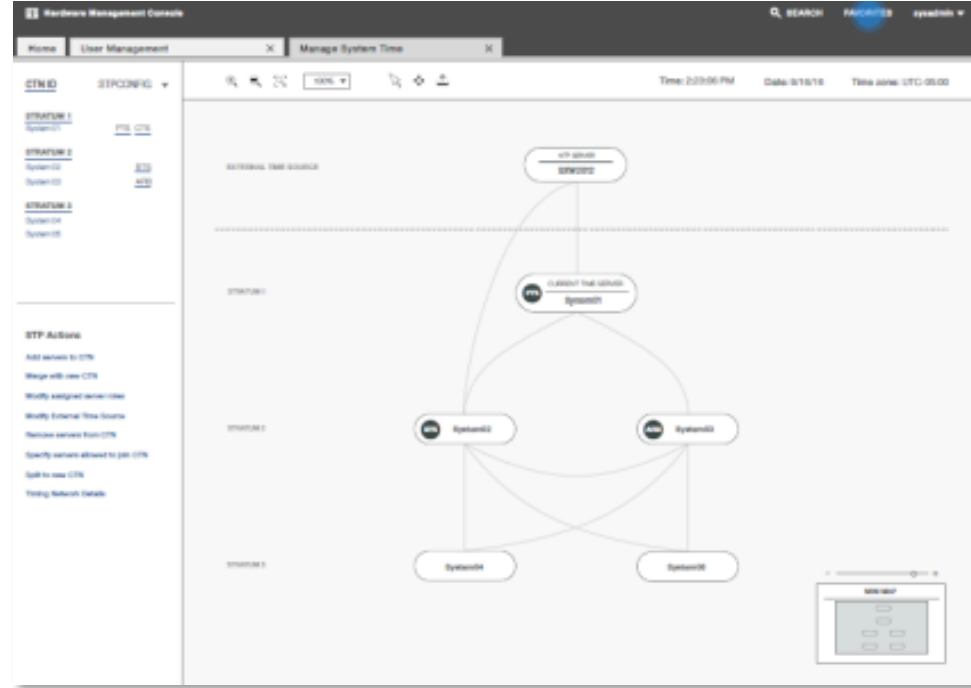
- Inline definition of technical terms

Improved user experience with visual representation of configuration panels

- Guidance provided within the workflows
- Topology displays of system time networks
- Errors surfaced in visualization for easier problem resolution of setup errors

Single point of system time management for multiple systems

No more requirement for sysplex timers



IBM z/OS Management Facility (z/OSMF)

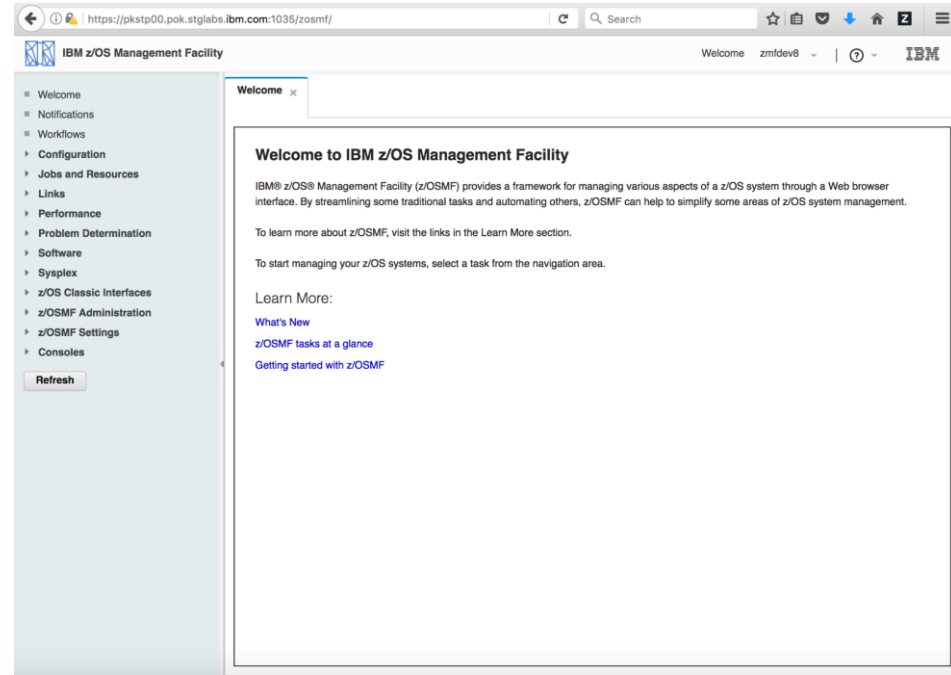
Modernization: Support for new browser-based management console

Productivity: Embedded active user assistance (such as wizards)

Always on: z/OS V2.3 change so z/OSMF is available all the time

Standardize: Software installation and configuration experience enhanced in V2.3

Sysplex Management: New z/OSMF plug-in provides detailed views of sysplex infrastructure resources such as CFs and CF structures, CF Structure Connectors, couple datasets and policies, and Coupling links



IBM Dynamic Partition Manager

Simplified configuration of logical partitions

Standardizes configuration and management of all system resources from a single management endpoint

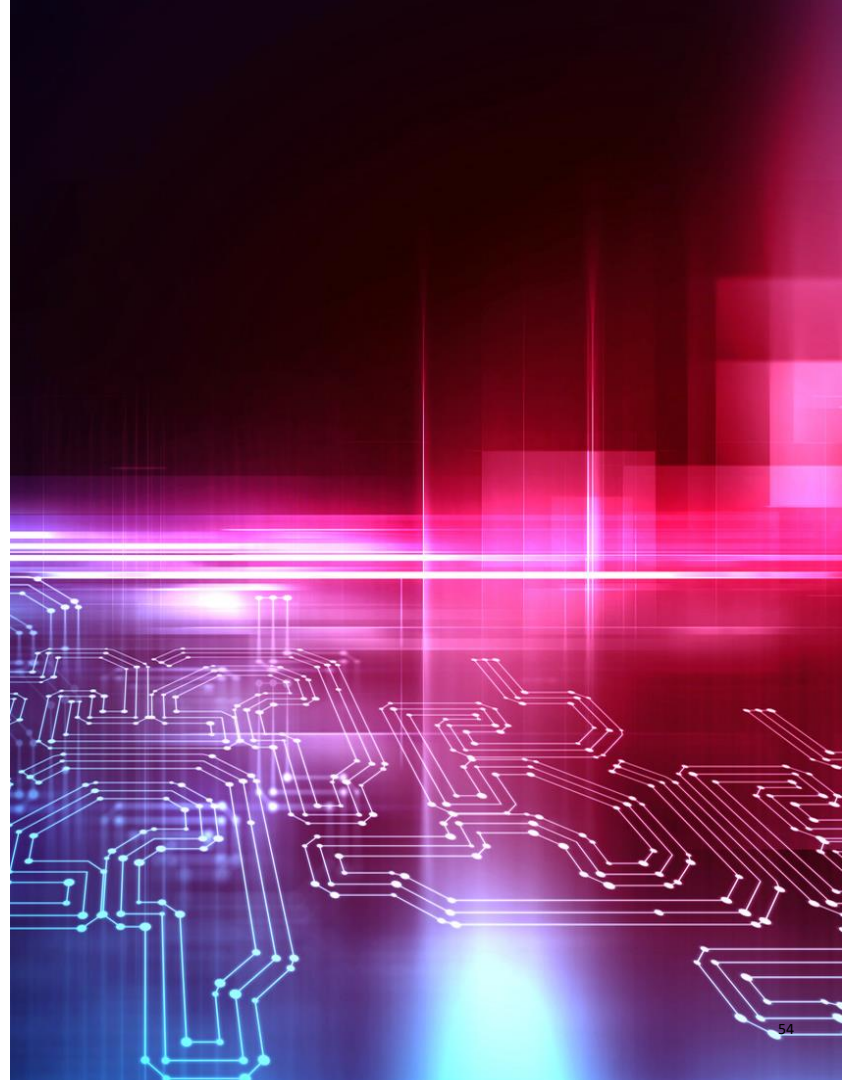
Developed for servers with z/VM 6.4, KVM and/or Linux as a partition-hosted operating system

Ease Linux installation with auto configuration of devices¹

Guided storage setup, provisioning and management – SOD: FICON ECKD support

Secure FTP through HMC for booting and installing an operating system via FTP

¹Where Linux distro installers exploit function



IBM z14 operating system support

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

z/OS

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

z/VSE

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

z/TPF

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



Linux on Z

Minimum Distributions *

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

KVM running on Z

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

z/VM

- z/VM 6.4 with PTFs

NOTE: For minimum required distribution levels see the IBM tested and supported Linux environments:

ibm.com/it-infrastructure/z/os/linux-tested-platforms

IBM cannot legally discuss z14 exploitation prior to GA from distributors.

IBM is working with the open source community and the Linux distribution partners to get new z14 ZR1 functionality supported with Linux for Z

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**
 - New in DPM: FICON ECKD support - Guided storage setup, provisioning and management
- Assured **workload isolation** with the highest EAL5+ security certification
- New dynamic optimization and scalability enhancements



z/VM v6.4 and v7.1



- **Enables extreme scalability, security and efficiency** – Support for 2TB of memory 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
- **Increase efficiency and reduce complexity** – Reliability, availability and serviceability enhancements remove the need for a SAN Volume Controller allowing low end devices such as Storwize, SAN Volume Controller, V7000, V840 and V9000 to be directly connected to z/VM host use
- **z14 Security features** – Pervasive encryption support: encrypting data moving between active memory and z/VM paging volumes. Enable guests to improve application program security by exploiting new z14 encryption features
- **z14 Performance features** – Allowing guests to improve the performance of Java garbage-collection processes
- **Introducing z/VM 7.1** – Delivering a new release cadence that improves z/VM's **Continuous Delivery (CD)** model. Includes Single System Image (SSI) support in the base product, improving availability of z/VM systems by allowing clients to schedule outages without disrupting business critical applications

KVM running on IBM



- Support of **8TB memory per guest** for greater processing scale and performance
- Support new analytics workloads with **Single Instruction Multiple Data (SIMD)** for competitive advantage
- **Improved performance** for guests, Java workloads, and cryptographic processing
- Secure and protected business data with **Crypto exploitation**
- **Technology developed by IBM ... product offered by Linux Distribution partners**

IBM z14 ZR1

Creating leadership for digital trust

Designed with **pervasive encryption** for piece of mind that data and privacy is always protected

Designed with improvements in speed, efficiency and access improvements to both **serve up data** to build services and new offerings and to **perform analytics and insight** on the data because this is where it resides

Designed to be **open and industry standard** to bridge the skills gap and make the infrastructure easier to manage





IBM z14

Extending the IBM z14 Family

Breakthrough technologies

Designed for the Secure Cloud



Thank you

Franco Pinto
Client Technical Specialist

—

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ibm.com

Additional IBM z14 ZR1 charts

IBM z14 ZR1 Functional Comparison to IBM zBC12

Performance and Scale	<ul style="list-style-type: none"> • Uni Performance • System Capacity • Models • Processing cores • Granular Capacity • Memory • SIMD 	<ul style="list-style-type: none"> • New up to 50% performance improvement over IBM zEnterprise® Business Class (zBC12¹) • New up to 240% (30-way to 13-way) more capacity for z/OS system total z/OS capacity performance improvement over zBC12¹ • Six CPC feature combinations versus zBC12 has five CPC models • Up to six (10-core) chips and two (6-core) chips on zBC12 • Up to 156 capacity settings on the z14 ZR1 and also on zBC12 for the precise capacity you need • New up to 8 TB RAIM memory vs. 512 GB RAIM memory on zBC12, ideal for analytics • z14 vector processing provides richer, complex analytics models, faster analytics to traditional workloads
Virtualization	<ul style="list-style-type: none"> • LPAR virtualization • RoCE adapter • Simplified LPAR mgt 	<ul style="list-style-type: none"> • 40 partitions on z14 ZR1 versus 30 on zBC12 to allow for more customer workloads • New 10 GbE RoCE Express2 with additional virtual functions per port vs. dedicated zBC12 10GbE Express ports • Enhanced IBM Dynamic Partition Manager configuration and management of system resources – not on zBC12
Infrastructure Efficiency	<ul style="list-style-type: none"> • Networking • FICON • IBM zHyperLink • WWPN • HMC • JAV • IBM Virtual Flash Memory 	<ul style="list-style-type: none"> • New OSA-Express6S with ASIC improvements over zBC12 using OSA-Express4S • New FICON Express16S+ versus FICON Express 8S on zBC12 • New IBM zHyperLink – New short distance z14 channel that on IBM DS8880 System Storage® for lower latency • I/O serial number migration allows keeping same serial number on replacement server not on zBC12 • New next gen HMC on z14 ZR1– simplified panels, new mobile capabilities, security enhancements, easier help • Enterprise Java applications run with reducing pause from garbage collection activities on heaps – not on zBC12 • New memory for server side availability and support for large pages – not available on zBC12
Sysplex-Coupling	<ul style="list-style-type: none"> • Coupling Express LR • ICA-SR • STP 	<ul style="list-style-type: none"> • Coupling with CE LR in PCIe I/O drawer versus HCA-3 InfiniBand in processor drawer, helps free up slots • Short distance coupling with PCIe-based links (ICA SR) • New Simplified STP management with HMC simplification not available on zBC12
Data Center Efficiency	<ul style="list-style-type: none"> • Accessible frame • Environmental • DC Footprint 	<ul style="list-style-type: none"> • New accessible frame to support private cloud and customer equipment for efficient data center use • More choice in top and bottom exit cabling; New ASHRAE A3 rating vs. ASHRAE 2 on zBC12 • New 19 inch rack takes up only 2 floor tiles, 40% less space than z13s
Security	<ul style="list-style-type: none"> • Cryptographic Coprocessor • Crypto Express adapter • IBM SSC • Secure Console Access 	<ul style="list-style-type: none"> • CPACF for improved performance and new true Random Number Generator • Crypto Express6S high performance + new algorithms for ECC, SHA, VISA Format preserving encryption • Secure deployment of software virtual appliances not available on zBC12 • Protect sensitive data with TLS support in the OSA-ICC; this is not available on zBC12

¹Based on preliminary internal measurements and projections and compared to the z13s and zBC12. 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/resourcelink/lib03060.nsf/pages/lspindex>

IBM z14 ZR1 functional comparison to IBM z13s

Performance and Scale	<ul style="list-style-type: none"> • Uniprocessor Performance • System Capacity • SMT • Cache • Processing cores • Granular Capacity • Memory • Compression • SIMD 	<ul style="list-style-type: none"> • New up to 10% performance improvement over IBM z13s (z13s)¹ • New up to 60% system (30-way to 20-way) total z/OS capacity performance improvement over z13s¹ • Next gen SMT delivers up to 25% performance improvement over z13s and newly available for SAP processors • New z14 ZR1 has 1.5x more on-chip cache per core versus z13s • Up to 30 configurable cores to configure, up to 20 on z13s • New up to 156 capacity settings (same as z13s) • Up to 8 TB RAIM memory vs. 4 TB RAIM memory on z13s • Improved CMPSC compression and Huffman Coding compression ratio using zEDC Express versus on z13s • New instructions for perform boost to traditional workloads and new analytics workloads versus SIMD on z13s
Virtualization	<ul style="list-style-type: none"> • LPAR virtualization • RoCE adapter Virtualization • Simplified LPAR management 	<ul style="list-style-type: none"> • 40 partitions – same as z13s • New 10 GbE RoCE Express2 with additional virtual functions (31 VFs) per physical port (same as 10 GbE Express on z13s) • Enhanced IBM Dynamic Partition Manager for config and mgt of system resources – new z/VM and ECKD disk support
Infrastructure Efficiency	<ul style="list-style-type: none"> • Networking • FICON • zHPF • IBM zHyperLink • LCSS/Subchannel sets • HMC • Pause-less garbage collection • IBM Virtual Flash Memory 	<ul style="list-style-type: none"> • New OSA-Express6S with improvements over OSA-Express5S on z13s • FICON Expresss16S+ on z14ZR1 offers up to three times the I/Os / second compared to FICON16S • zHPF extended distance II – faster remote site recovery through improved I/O service time for remote data writes • New IBM zHyperLink short distance channel for IBM DS8880 System Storage for low latency; not on z13s • Up to 3 LCSS and 3 Subchannel sets – same as z13s • Simplified HMC with new panels, mobile capabilities, security enhancements replacing classic UI on z13s • New enterprise scale Java applications support for larger heaps with less pause delay for garbage collection • New VFM replacement for Flash Express helping improve availability – available only on z14 family
Sysplex-Coupling	<ul style="list-style-type: none"> • Coupling Express LR • Coupling – ICA SR • STP 	<ul style="list-style-type: none"> • Coupling with Coupling Express LR Links vs. z13s HCA3 IFB links (CE LR now available on z13s) • Short distance coupling with PCIe-based links (ICA SR) – same as z13s • New Simplified STP management with HMC enhancements and improved user interface not available on z13s
Data Center Efficiency	<ul style="list-style-type: none"> • Accessible frame • Environmental • DC Footprint 	<ul style="list-style-type: none"> • New accessible frame to support private cloud and efficiently use data center space • More choice in top exit and bottom exit cabling on z14 ZR1. New ASHRAE A3 rating • New 19 inch rack takes up only 2 floor tiles, 40% less space than z13s
Security	<ul style="list-style-type: none"> • Cryptographic Coprocessor • Crypto Express • Firmware Integrity monitoring • IBM Secure Service Container 	<ul style="list-style-type: none"> • CPACF for improved performance (~2-6X faster) and new true Random Number Generator versus z13s • Crypto Express6S performance increase plus new algorithms for elliptic curve, SHA, VISA FPE vs. on Crypto Express5S • New Optional integrity monitoring on Support Element and HMC to protect against tampering • Secure deployment of software virtual appliances

Data center planning and service updates

A man in a light blue shirt is working on a server rack in a data center. He is looking at a component in the rack and appears to be adjusting it. The background shows other server racks and cables, indicating a typical data center environment.

Standardization across many components – including Industry standard 19” rack

16U free space in frame

Save space in the data center with 1U rack-mounted HMC and TKE

Non-raised floor option, overhead power and cabling

New – lowering costs and raising RAS with ASHRAE A3 envelope

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

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

IBM z14
Machine Type: 3907
Model ZR1

IBM z14 Model ZR1
IBM LinuxONE Rockhopper II

Extending the IBM z14 and
LinuxONE Families

Building on the breakthrough
technologies and strong
2017 launches

Designed for the Secure Cloud

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

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

IBM LinuxONE Rockhopper II
Machine Type: 3907
Model LR1

Differentiated value at the core

Leader in performance and scale

- New 10-core Processor Design in 14nm Silicon Technology
- Up to 6 configurable z/OS cores or up to 30 configurable Linux cores on z14 Model ZR1 for up to **13%** and **60%** more capacity for z/OS and Linux respectively than the largest z13s AND up to 170 configurable cores on the z14 Models M01-M05 for up to **35%** total capacity improvement over the largest IBM z13 (z13)
- **1.5x** more on-chip cache¹ per core optimized for data serving

More performance with innovation that helps the full stack

- New instructions in the SIMD Facility gives boost for traditional workloads using decimal arithmetic and new applications like analytics
- Pause-less garbage collection enables enterprise scale Java applications to run with fewer and shorter pauses for garbage collection on larger and larger heaps
- Next gen SMT improves performance up to **25%** vs non-SMT for an IFL or zIIP to benefit Linux® and zIIP exploiters

IBM zHyperLink Express

Speed Matters: Breakthrough I/O link technology

- A direct connect short distance link designed to deliver low latency **connectivity between z14 servers and FICON storage systems**
- zHyperLink improves application response time, cutting I/O sensitive workload response time by **up to 50%**

Typical Client Use Cases:

- Performance improvements are achieved seamlessly **without need for application changes**
- Dramatic **improvement in data access** for OLTP workloads
- Faster Db2 index splits helps **reduce the batch processing window** for heavy insert work
- Better client experience with lower I/O latencies
- Additional business opportunities for top line growth with more functional applications



Modernize and transform with IBM zHyperLink

IBM zHyperLink delivers less than 20us response time¹, to help organizations accelerate their core transaction processes while expanding their business operations into next-gen applications using AI to extract value from data

IBM zHyperLink is now enabled for all the DS8880F offerings, providing the **lowest application response time** for IBM Z in the market.

zHyperLink reduces 10x the application response time compared to High-Performance FICON (zHPF)

Same application response time across the DS8880F offerings



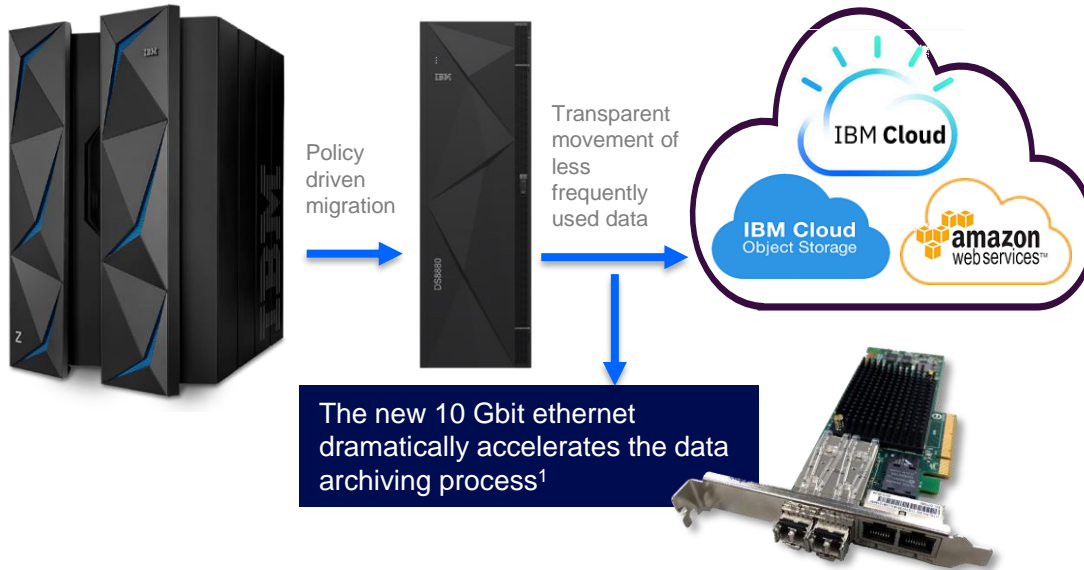
System ²	DS8884F	DS8886F	DS8888F
Capacity (min / max)	6.4TB / 1459.2 TB	6.4 TB / 2918.4 TB	6.4 TB / 5836.8 TB
Max IOPs	550,000	1,800,000	3,000,000
Average response time	← 16μsec →		

¹ zHyperLink Express is designed for up to 10x lower read latency than High Performance FICON. Less than 20 microseconds response time is based on z14 and zHyperLink test results conducted by IBM

² Existing DS8880F can be upgraded to enable zHyperLink

Streamline data archiving operations to the cloud

Extremely reduce the data transfer time to multi-cloud environments while providing more than 50% savings in CPU utilization when archiving large data sets³



Transparent Cloud Tiering is the leader in data set archiving for IBM Z. Now a faster connectivity provides greater throughput, increasing the overall data archiving performance²

¹ Existing DS8880 systems can be upgraded to use the 10 Gbps Ethernet card

² Compared to the previous 1 Gbit ethernet card.

³ Results are based on internal IBM data measurements on an EC12 when migrating data sets exceeding 6000 3390 tracks in size. Results will vary by customer based on particular workloads, configurations, software levels and the quantity and size of data sets being migrated



Innovation for analytics with Linux on IBM Z

Massive scale up of JVMs with higher capacity IFLs, pause-less garbage collection and 50+ new instructions co-designed and exploited by Java

New SIMD instructions improve running analytics on IBM Z with increased parallelism

A comprehensive portfolio of cognitive and analytics solution is available for Linux, allowing Linux to become the analytics hub in the enterprise

More memory for greater processing scale and performance, enables more in-memory workloads and in-line analytics for delivering richer transactional experiences

Performance, networking and efficiencies running Linux side-by-side with z/OS

Capacity and features to manage more data

Up to 8 TB memory for z14 Model ZR1 and up to 32 TB memory for z14 M01-M05

- Support new workloads, in-memory databases and efficiently process huge amounts of information for real-time business insights

IBM Virtual Flash Memory

- Next generation of Flash Express to provide higher levels of availability and performance during workload transitions and spikes

Single Instruction Multiple Data

- Enhanced math libraries provide performance improvements for analytical workloads

Shared Memory Communications – Direct Access Method (SMC-D)

- Up to **61%** CPU savings for FTP file transfers for z/OS versus HiperSockets¹

FREE

¹ All performance information was determined in a controlled environment. Actual results may vary. Performance information is provided “AS IS” and no warranties or guarantees are expressed or implied by IBM.

Enterprise service agility with improved IT economics



IFL Linux engines will benefit from next generation SMT for improved virtualization performance with up to **25%** vs non-SMT on z14

More configurable Linux cores provide efficiency at scale and improve price/performance – 30 on the z14 Model ZR1 and up to 170 on the z14 Models M01-M05

z14 has a redesigned cache architecture with **1.5x** more on-chip cache per core – compared to the z13 or z13s

More memory to support large VM consolidations, provide a higher ceiling for vertical scale needs and to support data-in-memory applications

FICON Express16S+ with FCP protocol for small data transfer I/O operations achieved a greater than **3x** improvement over FICON Express16S¹

Simplicity with Linux on IBM Z

Efficient and economic operation



Easier system administration using IBM Dynamic Partition Manager with simplified hardware configuration and provisioning tools enables greater time to value

Comprehensive open source software portfolio with such products as Docker, Go, Chef, Puppet, MongoDB, PostgreSQL, Apache Spark, or Node.js to modernize your applications

Improved on chip and coprocessor cryptographic performance to ensure your data can be protected from external and internal breaches

Massive scale up of JVMs with pause-less garbage collection

More memory for greater processing scale and performance, enables more in-memory workloads and in-line analytics for delivering richer transactional experiences

New DBaaS reference architectures to support cloud deployments

Designed for data

I/O options that protect, access, share



Pervasive Encryption

- New** CF Encryption
- New** Crypto Express6S
- Speed of CPACF
- Update** Payment Card Industry (PCI) HSM
- TKE 9.0
- New**



Getting to Data

- New** zHyperLink Express
- New** IBM Virtual Flash Memory
- New** FICON Express16S+
- zHPF – Extended Distance II
- zEDC Express



Accessing the Web

- New** 10GbE RoCE Express2
- New** OSA-Express6S
- HiperSocket
- SMC-D



Clustering to Protect

- New** Coupling Express LR
- ICA SR
- InfiniBand Coupling Links – LR and SR¹
- Plus** Improved CF scalability, constraint relief and diagnostic enhancements

¹ No InfiniBand on IBM z14 ZR1

New networking enhancements



OSA-Express6S

- OSA-Express6S for direct connection to network
- Technology refresh

10 GbE RoCE Express2

- Technology refresh for RoCE
- Provides increased virtualization / sharing capability allowing RoCE to be extended to more workloads

z/OS Encryption Readiness Technology (zERT) for Networking¹

- Tool that reviews cryptographic attributes to determine what's been encrypted within z/OS network traffic
- Provides information that is critical to security auditors via a new SMF119 record

¹ zERT does not require a z14

Coupling facility enhancements



Ethernet based Coupling Links using 10GbE RoCE technology

– **New** Coupling Express LR and Integrated Coupling Adapter (ICA SR)

Better utilization of Coupling Facility (CF) processors with scalability improvements

Faster problem resolution with additional CF Request Diagnostics

Additional physical and logical coupling links offers Coupling Link Constraint Relief

Shared memory communications architecture

Memory-to-memory communications using high speed protocols and direct memory placement of data for faster communications

Shared Memory Communications *Remote Direct Memory Access (SMC-R)*

- **New** RoCE Express2 enables SMC-R
- Helps to reduce both latency and CPU resource consumption
- Up to **50%** CPU savings for FTP file transfers across z/OS systems versus standard TCP/IP¹

Shared Memory Communications *Direct Memory Access (SMC-D)*

FREE

- Optimizes LPAR to LPAR inter-system operating system communications
- Valuable for communications within a single server without requiring extra hardware
- Up to **61%** CPU savings for FTP file transfers for z/OS versus HiperSockets²

Any z/OS TCP sockets-based workload can **seamlessly use SMC without application changes**
SMC Applicability Tool (SMCAT) helps assess benefit for your environment

¹ Based on internal IBM benchmarks in a controlled environment using z/OS V2R1 Communications Server FTP client and FTP server, transferring a 1.2GB binary file using SMC-R (10GbE RoCE Express feature) vs. standard TCP/IP (10GbE OSA Express4 feature). The actual CPU savings any user will experience may vary.

² All performance information was determined in a controlled environment. Actual results may vary. Performance information is provided "AS IS" and no warranties or guarantees are expressed or implied by IBM.

Shared memory architecture

Faster communications that preserve TCP/IP qualities of service

Shared Memory Communications – Direct Memory Access (SMC-D) optimizes z/OS for improved performance ‘**within-the-box**’ communications versus standard TCP/IP over HiperSockets or Open System Adapter

Typical Client Use Cases:

- Valuable for multi-tiered work co-located onto a single IBM Z server without requiring extra hardware
- Any z/OS TCP sockets based workload can seamlessly use SMC-D without requiring any application changes
- With z/VM 6.3 or higher guest exploitation, you can understand the value for your z/OS SMC-R and SMC-D workloads before going into production

SMC Applicability Tool (SMCAT) is available to assist in gaining additional insight into the applicability of SMC-D (and SMC-R) for your environment

*Up to **61%** CPU savings for FTP file transfers across z/OS systems versus HiperSockets¹*

*Up to **9x** improvement in throughput with more than a **88%** decrease in CPU consumption and a **90%** decrease in response time for streaming workloads versus using HiperSockets¹*

*Up to **91%** improvement in throughput and up to **48%** improvement in response time for interactive workloads versus using HiperSockets¹*

¹ All performance information was determined in a controlled environment. Actual results may vary. Performance information is provided “AS IS” and no warranties or guarantees are expressed or implied by IBM.

Optimize server-to-server networking – Transparently Exploitation of RDMA over Converged Ethernet (RoCE)

- Designed to take advantage of high speed protocols and direct memory placement of data for faster communications
- Increased sharing / virtualization with **new** 10Gbe RoCE Express2 feature

Typical Client Use Cases:

- Helps to reduce both latency and CPU resource consumption over traditional TCP/IP for communications across z/OS systems
- **Any** z/OS TCP sockets based workload can **seamlessly** use SMC-R without requiring any application changes
- With z/VM 6.3 or higher guest exploitation, you can understand the value for your z/OS workloads before going into production

SMC Applicability Tool (SMCAT) is available to assist in gaining additional insight into the applicability of SMC-R (and SMC-D) for your environment

Up to **50%** CPU savings for FTP file transfers across z/OS systems versus standard TCP/IP¹

Up to **48%** reduction in response time and **10%** CPU savings for a sample CICS® workload exploiting IPIC using SMC-R versus TCP/IP²

Up to **40%** reduction in overall transaction response time for WAS workload accessing z/OS Db2³

Up to **3X** increase in WebSphere® MQ messages delivered across z/OS systems⁴

¹Based on internal IBM benchmarks in a controlled environment using z/OS V2R1 Communications Server FTP client and FTP server, transferring a 1.2GB binary file using SMC-R (10GbE RoCE Express feature) vs. standard TCP/IP (10GbE OSA Express4 feature). The actual CPU savings any user will experience may vary.

²Based on internal IBM benchmarks using a modeled CICS workload driving a CICS transaction that performs 5 DPL (Distributed Program Link) calls to a CICS region on a remote z/OS system via CICS IP Interconnectivity (IPIC), using 32K input/output containers. Response times and CPU savings measured on z/OS system initiating the DPL calls. The actual response times and CPU savings any user will experience will vary.

³Based on projections and measurements completed in a controlled environment. Results may vary by customer based on individual workload, configuration and software levels.

⁴Based on internal IBM benchmarks using a modeled WebSphere MQ for z/OS workload driving non-persistent messages across z/OS systems in a request/response pattern. The benchmarks included various data sizes and number of channel pairs. The actual throughput and CPU savings users will experience may vary based on the user workload and configuration.

Memory for the digital enterprise

Turbo charge system performance with mega memory

More memory to support new workloads, data-in-memory applications, efficiently process huge amounts of information for real-time business insights.

In memory databases are critical to enable faster insightful analysis by enabling correlations and other analyses not otherwise made possible.

Large memory can aid compression by providing large buffers to stage processing.

Shift in new types of applications, that perform random access on data versus sequential access, require more data in memory to sustain SLAs.

Large VM consolidations can use memory to provide a higher ceiling for vertical scale needs.

IBM Virtual Flash Memory cuts away at availability lapses

Next generation of Flash Express to provide **higher levels of availability and performance**

Moved to RAIM storage – **doesn't require PCIe slots**

Slashes latency for critical application processing such as **diagnostics collection**

Typical Client Use Cases:

- **Improve availability and performance** during workload transition and spikes
- **Faster, less disruptive** diagnostics with faster first failure data capture time
- **Less paging** with use of pageable large pages for Java or Db2
- **Cost effective, resilient solution** for overflow of MQ shared queues in Coupling Facility



zEnterprise Data Compression (zEDC)

Helps you keep more active data

Capture new opportunities with lower cost of keeping data online

Efficiently **compress active data** using a dedicated compression accelerator
Industry standard compression for cross platform data distribution

Typical Client Use Cases:

- **Disk savings** with improved utilization of storage tiers with DFSMSdss use of compression
- **Compression for sequential files** with less CPU costs
- **Automatically leverage** when archiving data with Content Manager OnDemand

DFSMShsm™¹

Use up to **58%** less disk space and up to **80%** less CPU compared to using DFSMShsm with the COMPACT keyword **BSAM/QSAM²**

Compress data up to **4X**, with up to **80%** reduced CPU ¹

IBM Content Manager OnDemand V9.5³

MIPs reduction of up to **75%** when compared to existing software based compression

Connect:Direct for z/OS 5.2⁴

Up to **80%** reduction in elapsed time for z/OS to z/OS file transfers

¹Measurements for comparisons were completed as part of a formal performance evaluation on a dedicated, isolated test system.

²These results are based on projections and measurements completed in a controlled environment. Results may vary by customer based on individual workload, configuration and software levels

³Results based on internal controlled measurements using IBM Content Manager OnDemand and various document types. Results may vary by customer based on individual workload, data, configuration, and software levels.

⁴Achieve up to up 80% reduction in elapsed time for z/OS to z/OS file transfers with minimal CPU increase. Results vary by data set type and characteristics of the data

IBM Dynamic Partition Manager

Simplified configuration of logical partitions

Standardizes configuration and management of all system resources from a single management endpoint

Developed for servers with z/VM 6.4, KVM and/or Linux as a partition-hosted operating system

Ease Linux installation with auto configuration of devices¹

Guided storage setup, provisioning and management – SOD: FICON ECKD support

Secure FTP through HMC for booting and installing an operating system via FTP

Benefits for users new to IBM Z²:

- Modify system resources without disrupting running workloads
- Create alarms for events, conditions, and state changes
- Update individual partition resources to adjust capacity, redundancy, availability, or isolation

¹Where Linux distro installers exploit function

² Not available for z/OS, z/VSE or z/TPF



Boost your application resiliency with IBM Z clustering technologies

Securable, Consumable, and Adaptable to Changing Business

Encryption of Sysplex Data

Encrypt all data flowing over CF links or stored in the Coupling Facility (CF) to improve data security and meet regulatory or compliance requirements

Pervasive Encryption



Simplified Operations

Arm IT administrators of all skills levels with a holistic view of the sysplex environment to implement next best administrator actions with speed

*Dynamic I/O for Standalone CFs
Graphical Network View*



Data Sharing Efficiency at Distance

Transform synchronous processes to asynchronous to negate latency penalties and improve data sharing performance

*Asynchronous CF Duplexing
Asynchronous XI Processing*



Application Availability

Accelerate problem determination and expand time synchronization while minimizing disruption and improving service times

*Improved RAS & Resiliency
Flexible Timing Configuration
GDPS*



Sysplex Performance & Scale

Optimize workload balancing and realize greater sysplex performance and scale from existing investments without re-architecting or re-configuring resources

*CF Processor Scalability
Optimized Notification Schemes
Increased Coupling Connectivity
IBM zHyperLink*





z/VSE Network Appliance

Better communications between z/VSE and other systems

Existing z/VSE Linux Fast Pass (LFP) allows selected TCP/IP applications to communicate via the TCP/IP stack on Linux on z System without requiring a TCP/IP stack on z/VSE

New no-charge z/VSE Network Appliance is an integrated solution providing TCP/IP stack functionality for TCP/IP applications running on z/VSE in LPAR

Runs in IBM Secure Service Container LPAR

No Linux license, No TCP/IP³ product, No z/VM required

Supported on z/VSE 6.1, 5.2 and 5.1

Typical Client Use Cases:

- Clients running z/VSE and Db2 on Linux, may increase performance and reduce costs
- For heavy loaded environments can free up z/VSE resources bypassing the TCP/IP stack on z/VSE
- Clients running z/VSE under z/VM can either use LFP with the z/VSE z/VM IP Assist (VIA) or a Linux on Z server under z/VM

Improved performance:
up to 3x¹ faster vs. TCP/IP stack on z/VSE

Cost savings:
up to 20%² z/VSE MSU reduction vs. TCP/IP stack on z/VSE

¹Based on IBM measurements with high FTP workload

²IBM measurements: averaged value based on FTP and socket application use, bi-directional (z/VSE → Linux & Linux → z/VSE) Actual results are heavily workload dependent and may vary for individual environments

³For selected TCP/IP applications

Specialty Engines expand the use of the server

While lowering the cost of ownership



Linux core



- Dedicated Linux core on IBM Z
- **IT optimization and cloud computing** delivering enhanced economics
- Supported by z/VM and KVM virtualization, tooling such as IBM Wave and third parties and the Linux distributions

zIIP¹

- **Relieves** central processors of running specific workloads
- Optimized for strategic web based applications with support for **Java and XML** processing
- Focused on data and supporting workloads can help **connect, manage, extend, and protect** data

Coupling Facility

- CF allows multiple processors to access the same data
- **New PCIe** based long range coupling links
- Coupling Facility (CF) traffic is **protected in-flight and at-rest** in the CF by policy driven host-based encryption

**Linux cores and zIIPs get throughput increase
with simultaneous multithreading**

¹Supports 2:1 ratio for zIIP to CP

zBX and zManager – Hybrid computing environment

Support for multi-platform infrastructure with single resource management



Effective March 31, 2017:

- Model conversations to the IBM zEnterprise BladeCenter® Extension (zBX) Model 004 will no longer be available from IBM 2458 Model 002 or IBM 2458 Model 003
- IBM will no longer support any hardware MES features applied to an existing zBX Model 004

IBM z14 functions available across all z14 models

I/O

FICON Express16S+, zHyperLink Express, OSA-Express 6S, Crypto Express6S, zEDC Express, RoCE Express2, zHPF ... including IFP to support the PCIe IO features

RAIM memory

HiperSockets

Specialty engines

IFL, zIIP, ICF

Security

CPACF, Crypto Express6S, GCM Encryption (Java), TKE

Pause-less garbage collection

SIMD

SMC-R and SMC-D

IBM Virtual Flash Memory (VFM)

IBM Dynamic Partition Manager (DPM)

IBM Secure Service Container

On chip compression

Coupling

- ICA-SR
- CE LR

HMC Mobile app

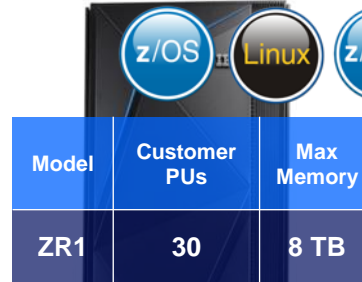
Physical planning

- Overhead cabling and power
- ASHRAE A3

IBM z14

Machine Type: 3907

Model: ZR1

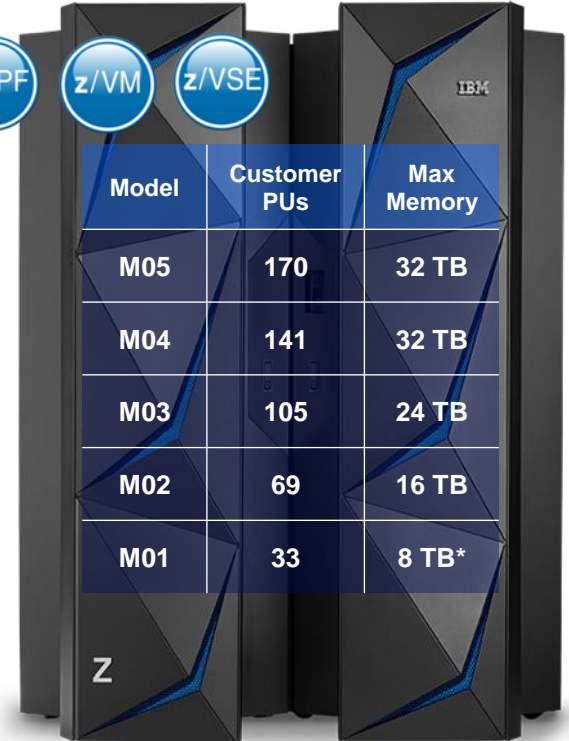


Model	Customer PUs	Max Memory
ZR1	30	8 TB

IBM z14

Machine Type: 3906

Models: M01, M02, M03, M04, M05



Model	Customer PUs	Max Memory
M05	170	32 TB
M04	141	32 TB
M03	105	24 TB
M02	69	16 TB
M01	33	8 TB*

IBM Z and Storage synergy

Designing, developing and testing together is key to unlocking true value

**Large IBM Z
M01-M05**

IBM z14 ZR1

**Linux¹
offerings**



IBM System Storage DS8880 ²	<ul style="list-style-type: none"> • zHPF and Extended Address Volumes • GDPS/PPRC HyperSwap³ • zDAC on z/OS for easy configuration¹ • zHyperWrite for accelerated DB2 writes¹ • FICON Express16S+ with Forward Error Correction Codes, FICON Dynamic Routing, Read Diagnostic Parameters, Enhanced Write Protocol 	✓	✓ (DS8884)	✓
TS7700	<ul style="list-style-type: none"> • Library Automation Integration (i.e., OAM in z/OS) • z/OS, z/VM, z/TPF and z/VSE support • Linux on Z requires Z partition • FICON connectivity only 	✓	✓	✓
IBM FlashSystem A9000/A9000R	<ul style="list-style-type: none"> • KVM running on IBM Z, IBM z/VM, Linux on Z • FCP connectivity only 	✓	✓	✓
Storwize V7000/V7000F	<ul style="list-style-type: none"> • KVM running on Z, z/VSE, z/VM and Linux on Z – FCP connectivity only 		✓	✓
SVC	<ul style="list-style-type: none"> • KVM running on Z, z/VSE, z/VM and Linux on Z – FCP connectivity only 		✓	✓
IBM FlashSystem V9000	<ul style="list-style-type: none"> • KVM running on Z, z/VSE, z/VM and Linux on Z – FCP connectivity only 		✓	✓
IBM FlashSystem 900	<ul style="list-style-type: none"> • KVM running on Z, IBM z/VM, Linux on Z – FCP connectivity only 	✓	✓	✓
TS1150, TS4500	<ul style="list-style-type: none"> • FCP can attach to Linux on Z • Support for z/OS, Linux on Z, z/VM, and z/VSE via FICON if TS7700 is front end 	✓	✓	✓

¹ Not all capabilities supported on Linux on IBM Z

² Not all listed capabilities will be supported by z/VSE. All releases of z/VSE will support FICON Express16S+ when available. z/VSE V6.2 when available 4Q17 will be the only z/VSE version to support zHPF

³ GDPS support for HyperSwap via the GDPS Virtual Appliance for Linux running under z/VM or KVM (GDPS appliance not available for native Linux on z)

An IBM z14 for everyone

“Right size” your mainframe to fit your needs

IBM z14 Model ZR1 – if you ...

- Currently have an IBM z13s, zBC12, IBM zEnterprise 114 (z114), IBM Systems z10® Business Class (z10 BC)
- Have a requirement to scale up to 7,800 MIPS for current and future growth
- Require 30 or less specialty engines – IFLs, zIIPs, Coupling Facility
- Have smaller Coupling and/or I/O attachment requirements – including zHyperLink Express
- Have a data center strategy that is PDU-based with 200v-240v power with air cooling
- Want a 19” industry standard form factor allowing clients to lower power costs and have a 40% smaller footprint cost that fits freely in any data center
- Want to customize servers by adding storage, server or switch options in optional 16u of available frame space

IBM z14 Models M01-M05 – if you ...

- Currently have an IBM z13, zEC12, z196, z10EC
- Have a requirement for current and future growth for capacity that scales up to 146,000 MIPS
- Have a large disk installment with large I/O requirements – including zHyperLink Express
- Have a data center strategy that is bulk power based on 480v with either air or water cooling
- Need new ways to address your ‘green’ requirements – i.e. water cooling
- Have a large Capacity Back Up (CBU) requirement – and like the control of having your disaster recovery site right in your own shop

The pace of digital transformation continues to accelerate

The world's premier system for enabling data as the new security perimeter

- Pervasive encryption
- No application changes
- Protect from internal and external threats



Designed for data serving in a cognitive world

- Speed, scale and reduced latency
- Efficiency for managing data
- Secure and flexible access to data



The best infrastructure to support an open and connected world

- 'From anywhere' mobile access
- Simplified sys admin of z/OS
- Standardization for skills transfer



Creating extraordinary opportunities and relationships are being redefined
The new digital economy depends on trust – security will continue to be key
Cognitive, IoT & Blockchain are all delivered through the cloud

IBM z14 was designed for trusted digital transformation



Pervasive encryption is a simplified way to protect data

Ensure stronger security in the payment card industry

Mitigate risks of undiscovered or misclassified sensitive data

Manage exposure to data breaches



Vast assortment of open source applications

IBM Secure Service Containers with Docker Support

Java applications run with fewer and shorter pauses

Support for compilers that can reduce CPU usage of applications



Re-packaged infrastructure with flexible co-location options

Mobile app to monitor and manage from anywhere

Simplified workflow for Sysplex management

Simplified hardware configuration for Linux partitions

Plus Container Pricing for IBM Z