IBM z14 Hardware Overview

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Agenda

• Availability Dates
• z14 Design Principals
• z14 Details
• z14 Processor Design and Structure
• z14 Memory Design and Structure
• z14 New and Interesting
• z14 I/O
• z14 Power and cooling
• Site Tools
• HMC
• z14 Upgrades and MES
• Software support for the z14
• Statements of Direction
Availability Dates
IBM z14 availability Dates – Driver Level 32

Planned GA - September 13, 2017

• New features and functions for the IBM z14 (Type number: 3906)
  – IBM z14 Models M01, M02, M03, M04, and M05
  – zEC12 air-cooled upgrades to IBM z14 air-cooled
  – zEC12 air-cooled upgrades to IBM z14 water-cooled
  – zEC12 water-cooled upgrades to IBM z14 water-cooled
  – z13 air-cooled upgrades to IBM z14 air-cooled
  – z13 air-cooled upgrades to IBM z14 water-cooled
  – z13 water-cooled upgrades to IBM z14 water-cooled
  – Field installed features and conversions on IBM z14 that are delivered solely through a modification to the machine's Licensed Internal Code (LIC)
  – TKE 9.0 LIC (FC #0879)
  – TKE HW (new order, w/4768 Cryptographic Adapter):
    • Tower: FC #0086
    • Rack mount: FC #0085
  – HMC Tower FC #0082 for z14, z13 and z13s
  – HMC Rack Mount FC #0083 for z14, z13 and z13s
  – Coupling Express LR (#0433) on z14, z13, and z13s
IBM z14 availability Dates – Driver Level 32

Planned GA - September 13, 2017

• Secure Service Container (SSC) appliances*
  – z/VSE Network Appliance
  – Blockchain
  – IBM Operational Analytics for Z (IBM zAware is supported only on z13/z13s)

December 31, 2017

• MES features for Models M01, M02, M03, M04, and M05
• IBM HMC Mobile for Z
IBM z14 Key Dates – 2017

• July 18, 2017 – ITSO Redbooks – Draft Versions
  – New – IBM z14 Technical Introduction, SG24-8450
  – New – IBM z14 Technical Guide, SG24-8451
  – Updated – IBM Z Connectivity Handbook, SG24-5444
  – Updated – IBM Z Functional Matrix, REDP-5157

• August 1st, 2017 – ITSO Redbooks – Draft Versions
  – IBM z14 Configuration Setup, SG24-8460
z14 Design Principals
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
z14 Details
## IBM z14 at a glance

### System, Processor, Memory

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Five hardware models: M01, M02, M03, M04, M05</td>
<td></td>
</tr>
<tr>
<td>10 core 5.2GHz 14nm PU SCM</td>
<td></td>
</tr>
<tr>
<td>1 - 170 PUs configurable as CPs, zIIPs, IFLs, ICFs</td>
<td></td>
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<tr>
<td>Increased Uniprocessor capacity</td>
<td></td>
</tr>
<tr>
<td>Up to 33 sub capacity CPs at capacity settings 4, 5, or 6</td>
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</tr>
<tr>
<td>CPC Drawers and backplane Oscillator</td>
<td></td>
</tr>
<tr>
<td>Enhanced SMT and new instructions for SIMD</td>
<td></td>
</tr>
<tr>
<td>Enhanced processor/cache design with 1.5x more on-chip cache sizes</td>
<td></td>
</tr>
<tr>
<td>Up to 32 TB DRAM, protected by Redundant Array of Independent Memory (RAIM)</td>
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</tr>
<tr>
<td>Virtual Flash Memory (VFM)</td>
<td></td>
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<tr>
<td>192 GB HSA</td>
<td></td>
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<tr>
<td>Improved pipeline design and cache management</td>
<td></td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCIe Gen3 I/O fanouts with 16 GBps Buses</td>
<td></td>
</tr>
<tr>
<td>6 CSS, 4 Subchannel sets per CSS</td>
<td></td>
</tr>
<tr>
<td>0 – 5 PCIe I/O Drawer Gen3 (no I/O Drawer)</td>
<td></td>
</tr>
<tr>
<td>Next generation FICON Express16S+</td>
<td></td>
</tr>
<tr>
<td>10 GbE RoCE Express2</td>
<td></td>
</tr>
<tr>
<td>Integrated Coupling Adapter (ICA SR) and Coupling express LR for coupling links</td>
<td></td>
</tr>
<tr>
<td>Support for up to 256 coupling CHPIDs per CPC</td>
<td></td>
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<tr>
<td>CFCC Level 22</td>
<td></td>
</tr>
<tr>
<td>Crypto Express6S and CMPSC compression and Huffman Coding compression</td>
<td></td>
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<tr>
<td>STP configuration and usability enhancements (GUI)</td>
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<tr>
<td>IBM zHyperLink Express</td>
<td></td>
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<tr>
<td>OSA-Express6S</td>
<td></td>
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<tr>
<td>Secure Service Container</td>
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</tr>
</tbody>
</table>

### RAS, simplification and others

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>L3 Cache Symbol ECC</td>
<td></td>
</tr>
<tr>
<td>N+1 radiator design for Air Cooled System</td>
<td></td>
</tr>
<tr>
<td>ASHRAE Class A3 design</td>
<td></td>
</tr>
<tr>
<td>Support for ASHRAE Class A3 datacenter</td>
<td></td>
</tr>
<tr>
<td>Largesum TCP/IP hardware Checksum (OSA-Express6S)</td>
<td></td>
</tr>
<tr>
<td>Universal Spare SCM s (CP and SC)</td>
<td></td>
</tr>
<tr>
<td>Enhanced Dynamic Memory Relocation for EDA and CDR</td>
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<td></td>
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<tr>
<td>Enhanced Dynamic Memory Relocation for EDA and CDR</td>
<td></td>
</tr>
<tr>
<td><strong>Acoustic and thin covers (space saving)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Drop “Classic” HMC UI</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Enhanced SE and HMC Hardware (security)</strong></td>
<td></td>
</tr>
<tr>
<td><strong>TKE 9.0 LICC</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Pause-less garbage collection</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Simplified and enhanced functionality for STP configuration</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Virtual Flash Memory (replaces IBM zFlash Express)</strong></td>
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</tbody>
</table>

### PR/SM

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Up to 170 CPUs per partition</td>
<td></td>
</tr>
<tr>
<td>IBM Dynamic Partition Manager updates</td>
<td></td>
</tr>
<tr>
<td>Up to 85 LPARs</td>
<td></td>
</tr>
<tr>
<td>16 TB Memory per partition</td>
<td></td>
</tr>
</tbody>
</table>

*Announce: July 17, 2017*
IBM Z – Processor Roadmap

Leadership Single Thread, Enhanced Throughput
Improved out-of-order
Transactional Memory
Dynamic Optimization
2 GB page support
Step Function in System Capacity

Leadership System Capacity and Performance
Modularity & Scalability
Dynamic SMT
Supports two instruction threads
SIMD
PCIe attached accelerators
Business Analytics Optimized

Workload Consolidation and Integration Engine for CPU Intensive Workloads
Decimal FP
Infiniband
64-CP Image
Large Pages
Shared Memory

Pervasive encryption
Low latency I/O for acceleration of transaction processing for DB2 on z/OS
Pause-less garbage collection for enterprise scale JAVA applications
New SIMD instructions
Optimized pipeline and enhanced SMT
Virtual Flash Memory

65 nm
z10
2/2008

45 nm
z196
9/2010

32 nm
zEC12
8/2012

22 nm
z13
1/2015

14 nm
z14
7/2017

65 nm
45 nm
32 nm
22 nm
14 nm

IBM Z TLL812
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z14 Continues the CMOS Mainframe Heritage

~ 10% for equal z13 n-way
Up to 35% max capacity 170-way vs 141-way (z13)
SMT vs Single Thread ~ 10–40% (average 25%)
- both zIIP & IFL
SMT z14 vs z13 ~ 15% (z/VM Guests)

* MIPS Tables are NOT adequate for making comparisons of IBM Z processors. Additional capacity planning required
** Number of PU cores for customer use
Balanced system design

RAW I/O Bandwidth

PCI for 1-Way

Memory

10 TB
3 TB
1.5 TB

32 TB
10 TB
3 TB
1.5 TB

N-Way

170
141
80
64
101
832
384
288
384
832

z14
z13
zEC12
z196
z10EC
z14 Radiator-based Air cooled – Front View (Model M04 or M05)

- Overhead Power Cables (option)
- Internal Batteries (optional)
- Power Supplies
- Displays and keyboards for Support Elements
- PCIe I/O drawers numbers 1 to 4

- Overhead Power Cables
- PCIe I/O drawer number 5
- System Control Hubs (used to be BPHs)
- CPC Drawers, PCIe Fanouts, Cooling water manifold and pipes, PCIe I/O interconnect cables, FSPs and Ethernet cables
  
  **Note:** CPC Drawer plugging numbers are on the left and logical numbers on the right

- Radiator Pumps
- Overhead I/O feature is a co-req for overhead power option
z14 Water cooled – Front View (Model M04 or M05)

- **Internal Batteries (optional)**
- **Power Supplies**
- **Displays and keyboards for Support Elements**
- **PCle I/O drawers numbers 1 to 4**

- **2 x 1U Support Elements**
- **PCle I/O drawer number 5**
- **System Control Hubs (used to be BPHs)**
- **CPC Drawers, PCle Fanouts, Cooling water manifold and pipes, PCle I/O interconnect cables, FSPs and Ethernet cables**
  - Note: CPC Drawer plugging numbers are on the left and logical numbers on the right
- **Overhead Power and I/O options not shown. Same as for the Air Cooled System**
- **N+1 Water Cooling Units**

Overhead Power and I/O options not shown. Same as for the Air Cooled System.
z14 Processor Design and Structure
z14 Processor Drawer (Top View)

- **Each PU SCM:**
  - 14nm
  - One Memory Controller per CP Chip
  - Five DDR4 DIMM slots per Memory Controller: 15 total per logical cluster

- **Each drawer:**
  - Two logical CP clusters (0 and 1)
  - Five PU Chips: 41 active PUs – M01 – M04
  - Six PU Chips: 49 Active PUs – M05
  - One SC Chip (672 MB L4 cache)
  - Populated DIMM slots: 25 DIMMs to support up to 8 TB of addressable memory (10 TB RAIM)
  - Water cooling for PU SCMs, air cooled SC SCM
  - Two Flexible Support Processors
  - Ten fanout slots for PCIe I/O drawer fanouts or PCIe coupling fanouts
  - Four fanout slots for PSIFB coupling link fanouts
z14 processor design summary

- Up to 7, 8, 9 or 10 active cores (PUs) per chip
- **Cache Improvements:**
  - New power efficient logical directory design
  - 33% larger L1 I$ (128K)
  - 2x larger L2 D$ (4MB)
  - 2x larger L3 Cache with symbol ECC
- **New Translation/TLB2 design**
  - 4 concurrent translations
  - Reduced latency
  - Lookup integrated into L2 access pipe
  - 2x CRSTE growth
  - 1.5X PTE growth
  - New 64 entry 2gig TLB2
- **Pipeline Optimizations**
  - Improved instruction delivery
  - Faster branch wakeup
  - Reduced execution latency
  - Improved OSC* avoidance
  - Optimized 2nd generation SMT2
- **Better Branch Prediction**
  - 33% Larger BTB1 & BTB2
  - New Perceptron Predictor
  - New Simple Call Return Stack

- **14nm SOI technology**
  - 17 layers of metal
  - 10 cores per CP-chip,
  - 5.2GHz
  - 6.1 billion transistors versus 3.99 billion on z13
z14 SC Chip

- SC Chip area:
  - 25.3 x 27.5 mm
- 14nm SOI technology, 17 layers of metal
- 672 MB shared eDRAM L4 Cache
### z14 On-Drawer and System Topology

**Fully populated drawer**

- **Chips**
  - Five or six PU chips
  - One SC chip (672 MB L4 cache)

- **RAIM Memory**
  - One Memory Controller per CP Chip
  - Five DDR4 DIMM slots per Controller, 25 total per drawer

- **SC and CP Chip Interconnects**
  - X-bus: SC and CPs to each other
  - A-bus: SC to SC chips in the remote drawers

---

**4 Drawer System Fully Interconnected**
Cache topology comparison

**z13 (Per Node – ½ CPC drawer)**

- **L1:** 96KI + 128KD
  - 8w DL1, 6w IL1
  - 256B line size

- **L2:** Private 2 MB inclusive of DL1
  - Private 2 MB inclusive of IL1

- **L3:** Shared 64MB Inclusive of L2s
  - 16w Set Associative
  - 256B cache line size

- **L4:** 480MB + 224MB NonData Inclusive
  - Coherent Directory
  - 30w Set Associative
  - 256B cache line size

**z14 (Per CPC drawer)**

- **L1:** 128KI + 128KD
  - 8w DL1, 6w IL1
  - 256B line size

- **L2:** Private 4 MB inclusive of DL1
  - Private 2 MB inclusive of IL1

- **L3:** Shared 128 MB Inclusive of L2s
  - 32w Set Associative
  - 256B cache line size

- **L4:** 672MB Inclusive of L3’s, 42w Set Assoc
  - 256B cache line size
### z14 Processor Allocation/Usage – zIIP to CP 2:1 ratio

<table>
<thead>
<tr>
<th>Model</th>
<th>CPs</th>
<th>IFLs</th>
<th>Unassigned IFLs</th>
<th>zIIP*</th>
<th>ICFs</th>
<th>IFPs</th>
<th>Std SAPs</th>
<th>Add'I SAPs</th>
<th>Spares</th>
</tr>
</thead>
<tbody>
<tr>
<td>M01</td>
<td>0-33</td>
<td>0-33</td>
<td>0-32</td>
<td>0-22</td>
<td>0-33</td>
<td>1</td>
<td>5</td>
<td>0-4</td>
<td>2</td>
</tr>
<tr>
<td>M02</td>
<td>0-69</td>
<td>0-69</td>
<td>0-68</td>
<td>0-46</td>
<td>0-69</td>
<td>1</td>
<td>10</td>
<td>0-8</td>
<td>2</td>
</tr>
<tr>
<td>M03</td>
<td>0-105</td>
<td>0-105</td>
<td>0-104</td>
<td>0-70</td>
<td>0-105</td>
<td>1</td>
<td>15</td>
<td>0-12</td>
<td>2</td>
</tr>
<tr>
<td>M04</td>
<td>0-141</td>
<td>0-141</td>
<td>0-140</td>
<td>0-94</td>
<td>0-141</td>
<td>1</td>
<td>20</td>
<td>0-16</td>
<td>2</td>
</tr>
<tr>
<td>M05</td>
<td>0-170</td>
<td>0-170</td>
<td>0-169</td>
<td>0-112</td>
<td>0-170</td>
<td>1</td>
<td>23</td>
<td>0-16</td>
<td>2</td>
</tr>
</tbody>
</table>

- z14 Models M01 to M04 use drawers with 41 cores. The Model M05 has 4 drawers with 49 cores.
- The maximum number of logical ICFs or logical CPs supported in a CF logical partition is 16.
- The integrated firmware processor (IFP) is used for PCIe I/O support functions.
- Concurrent Drawer Add is available to upgrade in steps from model M01 to model M04.
- Field upgrade to model M05 NOT supported (M05 is Factory built only).

1. At least one CP, IFL, or ICF must be purchased in every machine.
2. Two zIIPs may be purchased for each CP purchased if PUs are available. This remains true for sub-capacity CPs and for “banked” CPs.
3. On an upgrade from zEC12, installed zAAPs are converted to zIIPs by default. (Option: Convert to another engine type)
4. The IFP is conceptually an additional, special purpose SAP.
Integrated System Design for z14

- Up to 170 cores on a CPC
- Share up to 170 processors with up to 85 LPARS
- Configure the processors as CPs, IFLs, zIIPs, or ICFs

- Up to 23 cores for offload system processing

- Plus up to 320 POWER® cores: I/O and Coprocessors

- Plus up to 322 RAS cores

New on z14 – SAPs now SMT

23 SAPs
1 IFP

320 I/O
RAS cores
2 Spares
Memory Design and Structure
**z14 Purchased Memory Offering Ranges**

<table>
<thead>
<tr>
<th>Model</th>
<th>Standard Memory GB</th>
<th>Flexible Memory GB</th>
</tr>
</thead>
<tbody>
<tr>
<td>M01</td>
<td>320 - 8000</td>
<td>NA</td>
</tr>
<tr>
<td>M02</td>
<td>320 - 16192</td>
<td>320 - 8000</td>
</tr>
<tr>
<td>M03</td>
<td>320 - 24384</td>
<td>320 - 16192</td>
</tr>
<tr>
<td>M04</td>
<td>320 - 32576</td>
<td>320 - 24384</td>
</tr>
<tr>
<td>M05</td>
<td>320 - 32576</td>
<td>320 - 24384</td>
</tr>
</tbody>
</table>

- **Purchased Memory** – Memory available for assignment to LPARs
- **Hardware System Area** – Standard 192 GB of addressable memory for system use outside customer memory
- **Standard Memory** – Provides minimum physical memory required to hold customer purchase memory plus 192 GB HSA
- **Flexible Memory** – Provides additional physical memory needed to support activation base customer memory and HSA on a multiple CPC drawer z14 with one drawer out of service.
- **Plan Ahead Memory** – Provides additional physical memory needed for a concurrent upgrade (LIC CC change only) to a preplanned target customer memory
z14 New and Interesting
Virtual Flash Memory

- The "storage class memory" provided by Flash Express (FC #0402 and #0403) adapters is replaced with Virtual Flash Memory (VFM) which is part of the main memory
- VFM is offered as a priced hardware feature.
  - Customer can buy one to four "units" of VFM via eConfig at initial purchase.
- A “unit” will be 1.5 TB (1536 GB) on z14
  - Approximately same size as a Flash Express pair of adapters
- Much simpler management of VFM resource (HMC task)

- RAS: Memory protected by RAIM and ECC (internal / main memory)
- Allocation of VFM storage moves to LPAR activation since LPAR hypervisor “owns” management of partition memory.
- Customer specifies initial and maximum amount of VFM
- VFM will be relocated during CDR in a manner identical to that previously used for “expanded storage”
- No change in CDR processing. Customer has the option to choose whether main storage or VFM is relocated to surviving drawers, subject to LICCC capabilities.

Note: Use cases and exploitation for VFM have not been changed (e.g. z/OS paging, CF shared queue overflow), they just transparently benefit from the changes in the hardware implementation.
Managing VFM - Considerations

• Concurrent add of VFM fully supported subject to LICCC and hardware installed
• Concurrent downgrade not supported, as in “regular memory”
• Plan ahead memory feature for VFM available
• VFM allocations are specified on the Storage Tab
  – Initial and Maximum values are specified in 16GB increments
  – Values specified can be between 0 and the amount of entitled VFM
  – Profiles imported from earlier releases set the Initial and Maximum VFM values to 0
• VFM allocations cannot be dynamically changed. The partition(s) must be activated (or re-activated) for VFM allocations to go into effect
• VFM is not supported in Dynamic Partition Manager mode
What is IBM zHyperLink™?

- zHyperLink Express is a direct connect short distance IBM Z I/O feature designed to work in conjunction with a FICON or High Performance FICON SAN infrastructure.

- IBM zHyperLink™ dramatically reduces latency by interconnecting the z14 CPC directly to the I/O Bay of the DS8880.

- zHyperLink improves application response time, cutting I/O sensitive workload response time in half without significant application changes.
**zHyperLink Express® at a Glance**

- **Feature Code #0431**
  - Two ports per feature
  - Maximum of 16 features (32 ports)
  - Function ID Type = HYL
  - Up to 127 Virtual Functions (VFs) per port (254 per feature)
  - Point to point connection using PCIe Gen3
  - Maximum distance: 150 meters

- **DS8880 models 984, 985, 986 and 988.**

- A standard FICON channel (CHPID type FC) is required for exploiting the zHyperLink Express feature
IBM 10GbE RoCE Express2

What is it?

• IBM Z introduces the next generation of RoCE technology with the IBM 10GbE RoCE Express2

• The 10GbE RoCE Express2 provides a technology refresh for RoCE on IBM Z. Most of the technology updates are related to internal aspects of the RoCE (RNIC) architecture (e.g. Queue Pair related technology).

Why?

• RoCE is an evolving technology. It is critical to keep the IBM Z RoCE technology current within the industry.

• Technology currency provides many improvements in the base technology that will provide benefits for application workloads.
z14: Shared Memory Communications – (SMC-R and SMC-D)

On z14, each 10 GbE RoCE FC #0412 can support up to 63 instances per port (Two or more features for each server recommended)

- This configuration allows SMC-D connectivity among LPAR C, LPAR D, and LPAR E.
- SMC-D within one machine is better than using HiperSockets alone.
- For LPAR to LPAR, HiperSockets or OSD connections are required to establish the SMC-D communication.
- ISM = Internal Shared Memory
- No additional hardware purchase required.
- z/VM Guest support
## RoCE Express

<table>
<thead>
<tr>
<th>Description</th>
<th>Feature Code</th>
<th>Ports</th>
<th>Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>10GbE RoCE Express2</td>
<td>0412</td>
<td>2</td>
<td>New</td>
</tr>
</tbody>
</table>

**New 10GbE RoCE Express2 → FC0412 (2-Ports)**

**New Capabilities**
- Improved performance with 10GbE
- Improved virtualization - 63 Virtual Functions per port (126 VFs per feature)
- Improved RAS - ECC double bit correction

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

<table>
<thead>
<tr>
<th>Description</th>
<th>Feature Code</th>
<th>Ports</th>
<th>Available</th>
</tr>
</thead>
<tbody>
<tr>
<td>10GbE RoCE Express</td>
<td>0411</td>
<td>2</td>
<td>Carry Forward</td>
</tr>
</tbody>
</table>

**Note:** Max. Number of RoCE Express and RoCE Express2 features (combined) per system is 8 (16 ports).
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 HiperSockets*

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 HiperSockets*

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

* 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.
Guarded Storage Facility (GSF) for Pause-less Garbage Collection

- Problem:
  - When garbage collection occurs today, all threads running under a JVM must stop
  - Customers are consolidating from multiple to single JVM environments to increase productivity and save money.
  - The consolidation effort generates heap sizes >100GB where garbage collection pauses can take minutes!
  - Long pause times cause transactional application failures and SLA violations.

- Solution:
  - Define flexible new architecture that provides hardware assisted read barriers for guarded storage involved in a garbage collection/compaction event.
  - Whenever a Pointer is loaded from memory, the pointer is checked against a pending GC, and in case of a “hit”, the control flow is redirected
  - The Dynamic Runtime can then assist in GC-ing the pointed-to object, before resuming the SW thread.
  - Software exploitation of fast hardware barrier detection and acceleration will allow application threads to run concurrently during the majority of garbage collection events

- Impact:
  - Reduces worst case latency impacts for critical applications like financial trading platforms
  - Maintains SLAs, and keeps IBM Z servers in our customers modernization roadmaps.
Parallel Sysplex Coupling Links – CE LR

- Coupling Express Long Reach (CE LR) FC #0433
  - Coupling Connectivity into the Future (Long Distance)
    - Coupling Express LR is recommended for Long Distance Coupling z13/z13s to z13/z13s and up
  - New coupling channel type: CL5
  - Performance is similar to Coupling over InfiniBand 1x
  - PCIe I/O drawer required for CL5 adapter – even for standalone CF usage
  - Feature (2-port card) with Coupling Optics and Firmware
  - 10 Gbps*, Up to 4 CHPIDs per port, 32 buffers (i.e. 32 subchannels) per CHPID
  - Distance: 10 kM Unrepeated; up to 100 kM with a qualified DWDM
    - RPQ 8P2197 is required for 20 km support, while more than 100 km requires RPQ 8P2981.
  - Maximum configuration supported:
    - 64 ports (32 features) for z14 and z13, 32 ports (16 features) for z13s
  - Point-to-Point just like InfiniBand 1X and ISC-3;
    - CANNOT be utilized in a switched environment
  - Cabling: Utilizes same 9u, Single Mode fiber type as 1X IFB and ISC-3
  - z13 GA2+, z13s GA+ and z14 availability
  - No Going Away Signal for STP
z14 Coupling Connectivity

z13 and z13s
12x IFB, 12x IFB3, 1x IFB
ICA SR, CE LR

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

z196, z114
z10, z9 EC, z9 BC,
z890, z990
Not supported in same Parallel Sysplex
or STP CTN with z14

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

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.
Dynamic Partition Manager

- **IBM z14, z13 or z13s, IBM LinuxONE Emperor or Rockhopper**
  - Feature Code #0016: Hardware Requirements for IBM DPM
  - Two dedicated OSA-Express5/6S 1000BASE-T Ethernet

- **Supported Features**
  - FICON Express (Type FCP)
  - OSA Express5S, 6S
  - Crypto Express5S, 6S
  - zEDC Express
  - RoCE Express RoCE Express2 (as NIC)
  - Hipersockets

- **Hypervisors and Operating Systems**
  - KVM and/or Linux on z Systems & LinuxONE
  - z/VM support for FCP-only configurations with z/VM 6.4
  - **IBM Secure Service Container Appliances**

- **No support yet for**
  - GDPS Virtual Appliance

- **Planned support (SoD)**
  - FICON Express (Type FC)
  - Import an existing IOCP file
    - Limited ECKD paths
    - FCP / FICON adapter configuration
z14 I/O
Ten PCIe fanout slots per drawer (40 maximum per system)

- ICA (ICA SR) two-port 8 GBps PCIe Gen3 fanout 150 meter fiber optic coupling link

- PCIe Gen3 one-port 16 GBps PCIe fanout connects to a switch card for an 8-slot PCIe I/O domain (plugs in pairs)

Four IFB* HCA fanout slots per drawer
(16 maximum on a four drawer system)

- HCA3-O 2-port 12x IFB Coupling Link fanout
- HCA3-O LR 4-port 1x IFB Coupling Link fanout

* LAST IBM Z server to support InfiniBand features (SoD)

Note: The link data rates do not represent the actual performance of the link. The actual performance is dependent upon many factors including latency through the adapters, cable lengths, and the type of workload.
z14 “New Build” I/O and MES Features Supported

- **Features – PCIe I/O drawer**
  - FICON Express16S+ LX, SX (FC #0427, #0428)
  - OSA-Express6S: 1 GbE (LX, SX), 10 GbE (LR, SR), and 1000BASE-T (FC #0422, 0423, 0424, 0425, 0426)
  - 10GbE RoCE Express2 (FC #0412)
  - zEDC Express (FC #0420)
  - Crypto Express6S (FC #0893)
  - Regional Crypto Enablement (RCE) (FC #0901)
  - zHyperLink Express (FC #0431)
  - Coupling Express LR (FC #0433)

- **PCIe Coupling Link Feature (CPC Drawer PCIe Fanout)**
  - ICA SR - two 8GBps PCIe Gen3 Coupling Links (FC #0172)

- **InfiniBand Coupling Features (CPC Drawer HCA Fanouts)***
  - HCA3-O two 12x 6GBps** InfiniBand DDR Coupling Links (FC #0171)
  - HCA3-O LR four 1x 5Gbps InfiniBand DDR or SDR Coupling Links (FC #0170)

*Note: z14 is the LAST server to support InfiniBand features
**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 Carry Forward I/O Features Supported

• Features – PCIe I/O drawer
  – FICON Express16S
  – FICON Express8S
  – OSA-Express5S
  – OSA-Express4S 1000Base-T
  – 10GbE RoCE Express (FC #0411)
  – zEDC Express
  – Crypto Express5S
  – Regional Crypto Enablement (RCE)
  – Coupling Express LR

• PCIe Coupling Link Feature (Fanout)
  – ICA SR two 8GBps** PCIe Gen3 Coupling Links

• InfiniBand Coupling Features (HCA Fanouts)*
  – HCA3-O two 12x 6GBps** InfiniBand DDR Coupling Links
  – HCA3-O LR four 1x 5Gbps** InfiniBand DDR or SDR Coupling Links

*Note: z14 is the LAST IBM Z server to support InfiniBand features
**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.
FICON Express16S+

- For FICON, zHPF, and FCP
  - CHPID types: FC and FCP
  - Both ports must be same CHPID type
    - 2 PCHIDs / CHPIDs

- Auto-negotiates to 4, 8, or 16 Gbps
  - 2 Gbps connectivity not supported
  - FICON Express8S will be available for 2Gbps (carry forward only)

- Increased performance compared to FICON Express16S

- Small form factor pluggable (SFP) optics
  - Concurrent repair/replace action for each SFP
  - 10KM LX - 9 micron single mode fiber
    - Unrepeated distance - 10 kilometers (6.2 miles)
  - SX - 50 or 62.5 micron multimode fiber
    - Distance variable with link data rate and fiber type

- 2 channels of LX or SX (no mix)
FICON Considerations Example

- Lets say you’re upgrading a z13 to a z14
  - You have 6 FICON Express16S Cards you’re upgrading to FICON Express16S+
**zHPF and FICON Performance**

*I/O driver benchmark*

I/Os per second
4k block size
Channel 100% utilized

*This performance data was measured in a controlled environment running an I/O driver program under z/OS. 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.*

---

**I/O driver benchmark**

MegaBytes per second
Full-duplex
Large sequential read/write mix

*6% increase

620 z196 z10
770 z196 z10
620 zEC12 zBC12
620 z13 z14
1600 zEC12 zBC12 z196,z114
3000 z13 z14
3200 z13 z14
30000 FICON Express 16S+
306% increase
FCP Performance* for z14

*This performance data was measured in a controlled environment running an I/O driver program under z/OS. 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.
OSA-Express6S Fiber Optic Features – PCIe Drawer

- **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

- **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
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”

CHPID TYPE Support:

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

* 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.
### Crypto Express6S – Feature Code 0893

- One PCIe adapter per feature
  - Initial order – two features
- Designed to be compliant with FIPS 140-2 Level 4
- Installed in the PCIe I/O drawer
- Up to 16 features per server
- Prerequisite: CPACF enabling microcode (FC3863)
- Support for SHA-3
- Average 1.5X to 2X performance increase over Crypto Express5S

### Three configuration options for the PCIe adapter

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

### Feature Code 0893

<table>
<thead>
<tr>
<th></th>
<th>Accelerator</th>
<th>CCA Coprocessor</th>
<th>EP11 Coprocessor*</th>
</tr>
</thead>
<tbody>
<tr>
<td>TKE</td>
<td>N/A</td>
<td>TKE OPTIONAL</td>
<td>TKE REQUIRED</td>
</tr>
<tr>
<td>CPACF</td>
<td>NO</td>
<td>CPACF REQUIRED</td>
<td>CPACF REQUIRED</td>
</tr>
<tr>
<td>UDX</td>
<td>N/A</td>
<td>UDX YES</td>
<td>UDX NO</td>
</tr>
<tr>
<td>CDU</td>
<td>N/A</td>
<td>CDU YES(SEG3)</td>
<td>CDU NO</td>
</tr>
</tbody>
</table>

**Clear Key RSA operations and SSL acceleration**

**Secure Key crypto operations**

*TKE is required for EP11 mode*
Security Certifications

• Physical Security Standards in progress/planned:

  ✓ FIPS 140-2 level 4

  ✓ Common Criteria EP11 EAL4

  ✓ Payment Card Industry (PCI) HSM

  ✓ German Banking Industry Commission (GBIC, formerly DK)

Note: PCI-HSM certification is new for Crypto Express6S. The others also apply to Crypto Express5S.
TKE 9.0 Hardware at a Glance

• Ships with z14
• TKE 9.0 LIC requires the new 4768 crypto adapter
• TKE 9.0 required to manage Crypto Express6 on z14

• MES
  – Any TKE 8.0 workstation can be upgraded to TKE 9.0 with purchase of a 4768
  – TKE 7.3 workstation feature 0842 can be upgraded TKE 9.0 workstation feature with purchase of a 4768
  – Omnikey Cardman 3821 smart card readers can be carried forward to any TKE 9.0 workstation  (Carry forward required in most cases.  See blue text below)
  – Previously initialized and personalized smart cards can be carried forward and used on any TKE 9.0 workstation  (Carry forward of Omnikey readers required in most cases)

• New TKE 9.0 Purchase:
  – TKE 9.0 tower workstation is feature code 0086
  – TKE 9.0 rack-mounted workstation is feature code 0085
# TKE Hardware Support and Migration Information

On z14, if TKE workstation is required, TKE 9.0 must be used

<table>
<thead>
<tr>
<th>TKE Workstation</th>
<th>Server Supported</th>
<th>Manage Host Crypto Module</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TKE Release (LIC)</strong></td>
<td><strong>HW Feature Code</strong></td>
<td><strong>LIC</strong></td>
</tr>
<tr>
<td><strong>TKE 7.3</strong></td>
<td>0842</td>
<td>0872</td>
</tr>
<tr>
<td><strong>TKE 8.0</strong></td>
<td>0847</td>
<td>0877</td>
</tr>
<tr>
<td><strong>TKE 8.1</strong></td>
<td>0847, 0097 or 0098</td>
<td>0878</td>
</tr>
<tr>
<td><strong>TKE 9.0</strong></td>
<td>0849, 0085 or 0086</td>
<td>0879</td>
</tr>
</tbody>
</table>

Table Notes:

1. A Crypto Express4S running in IBM Enterprise PKCS #11 (EP11) mode, as a CXE4P, requires smart cards to hold administrator certificates and master key material. The smart card must be part #74Y0551.

2. Older smart cards 45D3398 (FC 0884) and 74Y0551 (FC 0884) may be used on TKE 8.0 (Available from System z10)

The **TKE is unaware** of the type of CPC where the host crypto module is installed. That is, the TKE does not care whether a Crypto Express3 is running on a z10, z196/z114 or zEC12/zBC12. This means that TKE LIC can support any CPC where the coprocessor is supported, but the TKE LIC must support the specific crypto module.

For more information about the TKE or upgrade paths read [Techdoc:TD106231](https://www.ibm.com/support/docview.product?rs=541&ln=en&id=TD106231)
z14 Power and cooling
Max power for z14 (vs. z13)

• z14 max power slightly higher, at least for max configuration
  – 5.2 Ghz vs 5.0 Ghz
  – 48 additional physical cores on max system
  – max memory = 32TB vs 10TB

• Estimated maximums:
  – z13 - 28.3kW
  – z14 - 30kW

• Typical configurations will have approximately the same power as the equivalent z13
• Customer chilled water saves approx. 2KW (6.6%) on a maximum configuration system.

• Nameplate rating unchanged:
  200V 3 phase AC 50/60hz  50 amps
  208-240V 3 phase AC 50/60hz  48 amps
  380-480V 3 phase AC 50/60hz  26 amps
  480V 3 phase AC 60hz  21 amps
  380-520V DC  44 amps
# z14 Power Supplies / Cords

Consider the need for adding additional line cords, 2 vs 4?

- Based upon the following table, how soon will additional cords be required
- Best time to address is during upgrades

<table>
<thead>
<tr>
<th>CPC Drawers</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2x60A</td>
<td>2x60A</td>
<td>2x60A</td>
<td>2x60A</td>
<td>2x60A</td>
<td>2x60A</td>
</tr>
<tr>
<td>2</td>
<td>2x60A</td>
<td>2x60A</td>
<td>2x60A</td>
<td>2x60A</td>
<td>2x60A</td>
<td>4x60A</td>
</tr>
<tr>
<td>3</td>
<td>2x60A</td>
<td>2x60A</td>
<td>4x60A</td>
<td>4x60A</td>
<td>4x60A</td>
<td>4x60A</td>
</tr>
<tr>
<td>4</td>
<td>4x60A</td>
<td>4x60A</td>
<td>4x60A</td>
<td>4x60A</td>
<td>4x60A</td>
<td>4x60A</td>
</tr>
</tbody>
</table>

**Blue = 1 line cord pair (2 plugs), Red = 2 line cord pair (4 plugs)***

1. Balanced Power Plan Ahead (FC 3003) will add two additional power cords
2. Line Cord Plan Ahead FC 2000 still available to order 4 cords versus 2 (new orders only)
3. Installation of the two additional power cords as part of an MES is designed to be concurrent
4. 60A line cords are voltage group 200-240V AC and the DC power option. For 380-415V AC (EMEA) and the 480V AC, the power cords are 30A.

*) Note: I/O drawers NOT supported on z14
z14 dimensions and weights

- Base overall system dimensions are identical to z13.
- z14 has a thin cover option (non-acoustic) which will shorten the system depth by approximately 15.5" and reduce the system weight by 108 lbs. when this option is selected.
- System weights for z14 are close to the same as for z13

### z14 system weights (lbs.)

<table>
<thead>
<tr>
<th>Model</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Water add</th>
<th>Top exit I/O add</th>
<th>Battery feature add</th>
<th>Balanced power add</th>
<th>Earthquake feature add</th>
<th>Thin door add</th>
</tr>
</thead>
<tbody>
<tr>
<td>M01</td>
<td>2772</td>
<td>3378</td>
<td>3677</td>
<td>127</td>
<td>156</td>
<td>447*</td>
<td>239</td>
<td>180</td>
<td>-108</td>
</tr>
<tr>
<td>M02</td>
<td>2951</td>
<td>3885</td>
<td>4742</td>
<td>127</td>
<td>156</td>
<td>671</td>
<td>109</td>
<td>180</td>
<td>-108</td>
</tr>
<tr>
<td>M03</td>
<td>3228</td>
<td>4549</td>
<td>5020</td>
<td>104</td>
<td>156</td>
<td>671</td>
<td>55</td>
<td>180</td>
<td>-108</td>
</tr>
<tr>
<td>M04</td>
<td>3486</td>
<td>4800</td>
<td>5248</td>
<td>104</td>
<td>156</td>
<td>671</td>
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<td>180</td>
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<tr>
<td>M05</td>
<td>3499</td>
<td>5126</td>
<td>5290</td>
<td>104</td>
<td>156</td>
<td>671</td>
<td>0</td>
<td>180</td>
<td>-108</td>
</tr>
</tbody>
</table>

The above weights are what the current estimator contains. This may be refined slightly before GA.
Thin Covers

• Why the design change?
  – Requirement was driven from customer feedback about the dimensions of the system.
  – System physically takes up ~2.5 x 3 Floor Tiles*

• What does Thin Cover save you?
  – 8.5in (21.59cm) in the front
  – 6.3in (16.002cm) in the back

• Migration Considerations?
  – Only available on radiator air cooled models
  – Will increase the noise generated by the system
    • Thin door will not meet Statskontoret Technical Standard 26:6 for “Generally Attended Data Center”
    • Typical Configurations will meet the standard for a Generally Unattended Data Center.

* Assuming 2’ x 2’ (60.9x60.9 cm) Tile
Thin Cover Service Clearance

Example D

467.4 mm (18.4 in)

Example D

213.4 mm (8.4 in)
Site Tools
Fill and Drain Kit

- For sites installing a z14 and will have a zEC12 “Fill and Drain Kit” (FC 3378) remaining onsite, only need to order the “Fill and Drain Adapter Kit” (FC 3379).

  - FC 3380 available to order for z14/z13

1. Currently supported on zEC12 servers
2. z196 Drain and Fill Kit 3377 is not supported on other servers

1. This feature supplies new hose attachments which are required for the service of z14/z13 systems when carrying forward FC 3378 from zEC12 systems.

1. New for z14/z13 replaces zEC12 FC 3378.
2. Contains new hose attachments to support z14/z13
3. Backward compatible with older zEC12 server
Universal Tool / Ladder Kit

- For sites installing a z14 and will have a “Universal Tool / Ladder Kit” (FC 3759) remaining onsite, only need to order the “Lift Tool Upgrade Kit” (FC 3103).
- FC 3105 available to order for z14/z13 and zEC12/zBC12

1. Currently supported for System z9, System z10, z196 and zEC12 servers

1. Provides additional server brackets to support z14/z13.
2. Use of FC 3759 and FC 3103 equivalent to FC 3105

1. New for z14/ z13, replaces FC 3759.
2. Contains new service brackets to support z14/z13
HMC
Available HMC configurations

**FC 0083 (1U HMC)**
- z14 only - maximum of 10
- Customers responsibility to order rack for mounting
- Customer should also order keyboard/display/mouse

**FC 0082 (MiniTower)**
- Can be ordered as new for z14, maximum of 10

**FC 0092/ FC 0095 (MiniTower)**
- Carry forward only from z13, maximum of 10
- Will be checked for proper driver and memory

**FC 0094 / FC 0096 (1U HMC)**
- Carry Forward only - Includes chassis/server/keyboard/display
- Will be checked for proper driver and memory maximum of 10 allowed
**HMC 2.14.0 System support**

- The new HMC Version 2.14.0 will support the systems shown in the table.
- z9 EC/BC (Driver 67, SE version 2.9.2) systems are no longer supported.

<table>
<thead>
<tr>
<th>Machine Family</th>
<th>Machine Type</th>
<th>Firmware Driver</th>
<th>SE Version</th>
<th>Ensemble Node Potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>z14 HMC</td>
<td>3906</td>
<td>32 GA</td>
<td>2.14.0</td>
<td>Yes</td>
</tr>
<tr>
<td>z13s</td>
<td>2965</td>
<td>27 GA</td>
<td>2.13.1</td>
<td>Yes</td>
</tr>
<tr>
<td>z13</td>
<td>2964</td>
<td>27</td>
<td>2.13.0</td>
<td>Yes</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>2.13.1</td>
<td></td>
</tr>
<tr>
<td>zBX Node</td>
<td>2458-004</td>
<td>22</td>
<td>2.13.0</td>
<td>Required</td>
</tr>
<tr>
<td>zBC12</td>
<td>2828</td>
<td>15</td>
<td>2.12.1</td>
<td>Yes</td>
</tr>
<tr>
<td>zEC12</td>
<td>2827</td>
<td>15</td>
<td>2.12.1</td>
<td>Yes</td>
</tr>
<tr>
<td>z114</td>
<td>2818</td>
<td>93</td>
<td>2.11.1</td>
<td>Yes</td>
</tr>
<tr>
<td>z196</td>
<td>2817</td>
<td>93</td>
<td>2.11.1</td>
<td>Yes</td>
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<tr>
<td>z10 BC</td>
<td>2098</td>
<td>79</td>
<td>2.10.2</td>
<td>No</td>
</tr>
<tr>
<td>z10 EC</td>
<td>2097</td>
<td>79</td>
<td>2.10.2</td>
<td>No</td>
</tr>
</tbody>
</table>
Rack mounted Options for TKE and HMC

The System unit and tray must be mounted in a **customer rack** in two adjacent 1U locations in the “**ergonomic zone**” between 21U and 26U

---

Customer Supplied Rack
(Cannot configure or order using system z eConfig)

Install between 21U & 26U

---

HMC and TKE System Unit:

---

HMC Display and Keyboard:
IBM 1U 18.5-inch Standard Console (1723-8BX)

---

Feature Codes:
0083 TKE 9.0
0085 HMC z14
0092 Carry Forward HMC
0095 Carry Forward HMC
z14 Upgrades and MES
**z14 System Upgrades**

- **z14 to z14 model upgrades**
  - z14 Models M01, M02, M03, M04 cannot be upgraded to M05 (M05 is Factory shipped only).
  - Conversion* from Radiator-based air to Water cooled or Water to Radiator-based air cooling *not available*

- **Any* zEC12 to any z14**
  - Feature conversion of installed zAAPs to zIIPs (default) or another processor type
  - For installed On Demand Records, change temporary zAAPs to zIIPs. Stage the record

- **Any* z13 to any z14**

  - Conversion of a zBX Model 003 (attached to a zEC12) to a zBX Model 004 is not supported during an upgrade from zEC12 to a z14.

*Notes:*

- Air to Water Conversions
- Conversions from zEC12 & z13 Air to z14 Water will be supported with a frame roll (as was done on zEC12 & z13).
- Water to Air conversions
- Conversions from water to air are NOT supported for either zEC12, z13 to z14.
- Only PCIe Gen3 I/O Drawer is supported
- No carry forward of I/O Drawer or HCA2 features
Software support for the z14
Supported z/OS Releases

• z14 capabilities differ depending on z/OS Release

• Tolerance Support
  – z/OS 1.13 (Must have IBM Software Support Services offering purchased)
    • September 2016 EoS

• Exploitation Support on z/OS V2R1 and higher
  – z/OS V2R1 + PTFs
    • Exploitation support of selected functions
  – z/OS V2R2 + PTFs
    • Exploitation support of more selected functions
  – z/OS V2R3
    • Further exploitation
## Summary – z/OS Support for z14

<table>
<thead>
<tr>
<th></th>
<th></th>
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<tr>
<td></td>
<td>IBM.Z TLLB</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Supported Functions</td>
<td>Must Be Exploited</td>
</tr>
<tr>
<td>z/OS V1.13S</td>
<td>P</td>
<td>W</td>
</tr>
<tr>
<td>z/OS V2.1</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>z/OS 2.2</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>z/OS 2.3</td>
<td>Y</td>
<td>Y</td>
</tr>
</tbody>
</table>

Notes:
- **S**: IBM Software Support Services required for extended z/OS V1.13 support.
- **P**: PTF is required, use SMP/E FIXCAT for identification.
- **Y**: Support is in the base.
- **C**: Coexistence support is required, if exploited.
- **AO**: Requires the ICSF web deliverable for FMID HCR77A0 minimally, with PTF.

Coexistence support is required, if exploited. Dependent upon the specific function. There could be partial support on lower levels. Full support in z/OS V2.3.

## z/OS Support Summary

<table>
<thead>
<tr>
<th>Release</th>
<th>z/OS V1.13</th>
<th>z/OS V2.1</th>
<th>z/OS V2.2</th>
<th>z/OS V2.3²</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td>X X X X X X</td>
<td>X X X X X X</td>
<td>X X X X X X</td>
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<td></td>
<td>9/16</td>
<td>9/18*</td>
<td>9/20*</td>
<td>9/22*</td>
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<tr>
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<td>X/19*</td>
<td>X/21*</td>
<td>X/23*</td>
<td>9/25</td>
</tr>
</tbody>
</table>

### Notes:

1. The IBM Software Support Services for z/OS V1.13, offered as of October 1, 2016, provides the ability for customers to purchase extended defect support service for z/OS V1.13
2. Planned to be Generally Available in September 2017

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

---

**Legend**

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

- WdfM – Server has been withdrawn from Marketing
- OoS -- Out of support
# z/VM Release Status Summary

<table>
<thead>
<tr>
<th>z/VM Level</th>
<th>GA</th>
<th>End of Service</th>
<th>End of Marketing</th>
<th>Minimum Processor Level</th>
<th>Maximum Processor Level</th>
<th>Security Level</th>
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<tr>
<td>6.4</td>
<td>Nov 11, 2016</td>
<td></td>
<td></td>
<td>IBM System z196 &amp; z114®</td>
<td>-</td>
<td></td>
</tr>
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</table>

**4 Releases in Service Dec 2016**
1 Release in Service Jan 2018


Marketed & Serviced
Serviced, but not Marketed
End of Service & Marketing

See the “Why Migrate?” presentation
http://www.vm.ibm.com/devpages/bitner/presentations/gotovm64.pdf
<table>
<thead>
<tr>
<th>VSE Release</th>
<th>z9</th>
<th>z10</th>
<th>z196 / z114 / zEC12 zBC12 / z13 / z13s</th>
<th>z14</th>
<th>VSE EoM</th>
<th>VSE EoS</th>
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</thead>
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<tr>
<td>z/VSE V6.2</td>
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<td>No</td>
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<td>tbd</td>
<td>tbd</td>
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<tr>
<td>z/VSE V6.1</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>tbd</td>
<td>tbd</td>
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<tr>
<td>z/VSE V5.2</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td>10/31/2018</td>
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<td>z/VSE V5.1</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<td>06/30/2016</td>
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<td>z/VSE V4.3</td>
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<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>06/25/2012</td>
<td>10/31/2014</td>
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<td>z/VSE V4.2</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>10/26/2010</td>
<td>10/31/2012</td>
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<td>z/VSE V4.1</td>
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<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>10/17/2008</td>
<td>04/30/2011</td>
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<td>z/VSE V3.1</td>
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<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>05/31/2008</td>
<td>07/31/2009</td>
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<td>VSE/ESA V2.7</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>09/30/2005</td>
<td>02/28/2007</td>
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<tr>
<td>VSE/ESA V2.6</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
<td>03/14/2003</td>
<td>03/31/2006</td>
</tr>
</tbody>
</table>
z/TPF V1.1 Support

- z/TPF V1.1 (with PTFs) supports z14
  - z/TPF will not be updated to exploit new functionality, toleration only
  - z/Architecture mode only (ESA/390 TPF mode has been eliminated)

- Implicit benefits on z14:
  - Per-engine performance
  - FICON Express16S+ increased bandwidth
  - OSA Express6S improved network performance
  - Crypto Express6S improved performance
  - Improved performance diagnostic capabilities with expanded CPUMF functionality

- z/TPF V1.1 with all APARs released prior to June 30, 2017 continues to support the following servers:
  - z13, z13s, zEC12, zBC12, z196, z114, z10 EC, z10 BC

- z/TPF APARs released after June 30, 2017 are only supported on
  - z14, z13, z13s, zEC12, zBC12
End of Presentation

Questions and Comments

please send to:

kjstine@us.ibm.com
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Statements of General Direction

• **Stabilization of z/VM V6.3 support**: IBM z14 is planned to be the last z Systems and IBM Z high-end server and z13s is planned to be the last mid-range z Systems server supported by z/VM V6.3 and the last z Systems and IBM Z servers that will be supported when z/VM V6.3 is running as a guest (second level). z/VM V6.3 will continue to be supported until December 31, 2017, as announced in announcement letter # 915-025.

• **Future z/VM release guest support**: z/VM V6.4 will be the last z/VM release supported as a guest of z/VM V6.2 or older releases.

• **Disk-only support for z/VM dumps**: z/VM V6.4 will be the last z/VM release to support tape as a media option for stand-alone, hard abend, and snap dumps. Subsequent releases will support dumps to ECKD DASD or FCP SCSI disks only.

• **IBM intends to deliver IMS exploitation of IBM z14 and DS8880 zHyperLink™ WRITE operations.** zHyperLink Express is a direct connect short distance IBM Z I/O adapter designed to work in conjunction with a FICON or High Performance FICON San infrastructure.

• **IBM z14 will be the last z Systems and IBM Z high-end server to support FICON Express8S**: z14 will be last z Systems and IBM Z high-end server to support FICON Express8S (#0409 and #0410) channels. Enterprises should begin migrating from FICON Express8S channels to FICON Express16S+ channels (#0427 and #0428). FICON Express8S will not be supported on future high-end IBM Z servers as carry forward on an upgrade.
Statements of General Direction (Cont.)

• IBM z14 will be the last z Systems and IBM Z server to support HCA3-O and HCA3-O LR adapters: z14 will be last z Systems and IBM Z server to support HCA3-O fanout for 12x IFB (#0171) and HCA3-O LR fanout for 1x IFB (#0170). As announced previously, z13s is the last mid-range z Systems server to support these adapters. Enterprises should begin migrating from HCA3-O and HCA3-O LR adapters to ICA SR and/or Coupling Express Long Reach (CE LR) adapters on z14, z13, and z13s. For high-speed short-range coupling connectivity, enterprises should migrate to the Integrated Coupling Adapter (ICA-SR). For long-range coupling connectivity, enterprises should migrate to the new Coupling Express LR coupling adapter. For long-range coupling connectivity requiring a DWDM, enterprises will need to determine their desired DWDM vendor’s plan to qualify the planned replacement long-range coupling link.

• OSA-Express6S 1000BASE-T adapters: 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.

• Dynamic Partition Manager support of ECKD: IBM intends to deliver support for adding and configuring ECKD FICON disks to partitions created in Dynamic Partition Manager (DPM) mode for Linux running in LPAR, under KVM on z, and under z/VM 6.4.
Statements of General Direction (Cont.)

• **New DB2 Analytics Accelerator deployment option on the IBM Z infrastructure**: The DB2 Analytics Accelerator for z/OS extends IBM Z and DB2 for z/OS to form a hybrid environment, which is capable of running both transactional and analytical SQL query workload. This extension is currently delivered via two deployment options: either as an appliance, based on IBM PureData System for Analytics, or as a hosted cloud environment. In addition to these two form factors, IBM intends to deliver a new DB2 Analytics Accelerator deployment option on the IBM Z infrastructure. This would further extend deployment options available to DB2 Analytics Accelerator clients. This new deployment option would allow for deeper integration with the IBM Z infrastructure. Clients would benefit with the flexibility to deploy the form factor that best suits their requirements to enable unified homogeneity of service, support and operations and deeper integration with their processes, e.g. for their disaster recovery.

• **IBM intends to deliver VSAM exploitation of z14 and DS8880 zHyperLink Express.** zHyperLink Express is a short distance mainframe attach link designed for up to 10x lower latency than High Performance FICON.