IBM Z and IBM LinuxONE
Take the next step forward

Jim Elliott
Senior IT Consultant
Take the next step forward with IBM z15 and LinuxONE III

Service Level Excellence
Industry’s highest level of business uptime to meet SLA and regulatory compliance

Data Protection and Privacy
Industry-first solution to protect sensitive data across your multicloud

Mission Critical Cloud
Integrate seamlessly into hybrid multicloud, blockchain and AI

Standardized and Flexible for the Cloud Data Center
Modular, scalable and proven cloud-ready infrastructure
Building on earlier generations of IBM mainframes

IBM z13/z13s and IBM LinuxONE

- Built for the mobile enterprise
- Introduction of SMT for Linux and zIIP workloads
- Introduction of SMC-R for memory to memory communication
- Single Instruction Multiple Data (SIMD) for vector processing

IBM z14 and IBM LinuxONE II

- Pervasive Encryption 100% encryption with no application changes
- Cognitive Solutions integration with insight from Z data delivers new business value
- Simplified user experience without mainframe skills requirements

IBM z14 ZR1 and IBM LinuxONE II

- Industry Standard Form Factor environmental savings and increased options for datacenter planning
- Foundation for Integrated Designs new form factor creates ability to build integrated solutions with other hardware
Purpose built for mission-critical applications

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

**Memory**
- 40 TB Max Per System – RAIM Memory design

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

IBM z15
*Machine Type: 8561, Model: T01*

<table>
<thead>
<tr>
<th>CPC Drawers</th>
<th>Customer PUs</th>
<th>Max Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>190</td>
<td>40 TB</td>
</tr>
<tr>
<td>4</td>
<td>145</td>
<td>32 TB</td>
</tr>
<tr>
<td>3</td>
<td>108</td>
<td>24 TB</td>
</tr>
<tr>
<td>2</td>
<td>71</td>
<td>16 TB</td>
</tr>
<tr>
<td>1</td>
<td>34</td>
<td>8 TB</td>
</tr>
</tbody>
</table>

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

Purpose built for mission-critical applications

**Processor**
- Up to 190 client configurable cores (0-1 CP, 6-190 IFLs)
- 14% Single Thread Performance Improvement
- 25% maximum system capacity growth over LinuxONE Emperor II
- New on-chip acceleration of compression for faster processing and more efficient storage of data
- More investments in pause-less garbage collection, 30+ new instructions codesigned and exploited by Java, vector enhancements for analytics applications, and new instructions for sort acceleration

**Memory**
- 40 TB Max Per System – RAIM Memory design

**To the Data**
- Significant scalability improvements – up to 20% more I/O channels over LinuxONE Emperor II
- Faster SSL/TLS handshake performance on LinuxONE III with Crypto Express7S compared to LinuxONE Emperor II with Crypto Express6S

IBM LinuxONE III
Machine Type: 8561, Model: LT1

<table>
<thead>
<tr>
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<th>Customer PUs</th>
<th>Max Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
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<tr>
<td>1</td>
<td>34</td>
<td>8 TB</td>
</tr>
</tbody>
</table>

Ready for cloud data center
Designed to align with data center trends

- **Modular and Scalable** 1-4 19” racks depending on capacity requirements
- A z15 single system enables **reduced overall system power consumption by 40% versus the equivalent x86 configuration**
- Both **raised and non-raised floors** as well as top and bottom exit I/O and power
- **Intelligent Power Distribution Units (preferred) or Bulk Power Assembly**
  - BPA normally used only if the Internal Battery Feature and/or customer water cooling is required

![iPDU max config](image1)
![BPA/Water max config](image2)

- Single rack with 1 processor drawer and 3 I/O drawers
- With iPDU you can have up to 12 I/O drawers
- With BPA you can have up to 11 I/O drawers
- To see more details use the [Interactive Product Demo](#) or the [z15 Virtual Tour](#)
z15 system design changes

- 14 nm processor with optimized Out-of-Order, new DEFLATE and Modulo Arithmetic
- 12 cores per PU SCM design
- 4 CP SCMs per drawer, up to five CPC drawers
- Integrated I/O with PCIe+ Gen3
- Single System Controller Chip, 960MB L4, per drawer
- Simplified CPC drawer SMP fabric
- Integrated (on-chip) compression
- Crypto Express7S (single/dual port)
- OSA-Express7S (all features)
- FICON Express16SA
- 25GbE and 10GbE RoCE Express2.1
- IBM zHyperLink Express1.1
- Integrated Coupling Adapter SR1.1
z15 continues the mainframe heritage

<table>
<thead>
<tr>
<th></th>
<th>z9 EC</th>
<th>z10 EC</th>
<th>z196</th>
<th>zEC12</th>
<th>z13</th>
<th>z14</th>
<th>z15</th>
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</thead>
<tbody>
<tr>
<td><strong>701, zIIP, IFL MIPS</strong></td>
<td>560</td>
<td>902</td>
<td>1,202</td>
<td>1,514</td>
<td>1,695</td>
<td>1,832</td>
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<tr>
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<tr>
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<td>64</td>
<td>80</td>
<td>101</td>
<td>141</td>
<td>170</td>
<td>190</td>
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<tr>
<td></td>
<td>19%</td>
<td>25%</td>
<td>26%</td>
<td>40%</td>
<td>21%</td>
<td>12%</td>
<td></td>
</tr>
<tr>
<td><strong>GHz</strong></td>
<td>1.7</td>
<td>4.4</td>
<td>5.2</td>
<td>5.5</td>
<td>5.0</td>
<td>5.2</td>
<td>5.2</td>
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<tr>
<td></td>
<td>159%</td>
<td>18%</td>
<td>6%</td>
<td>-9%</td>
<td>4%</td>
<td>0%</td>
<td></td>
</tr>
<tr>
<td><strong>Memory (TB)</strong></td>
<td>0.5</td>
<td>1.5</td>
<td>3</td>
<td>3</td>
<td>10</td>
<td>32</td>
<td>40</td>
</tr>
<tr>
<td></td>
<td>200%</td>
<td>100%</td>
<td>0%</td>
<td>233%</td>
<td>220%</td>
<td>25%</td>
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**IBM Z – Processor roadmap**

<table>
<thead>
<tr>
<th>45 nm</th>
<th>32 nm</th>
<th>22 nm</th>
<th>14 nm</th>
<th>14 nm</th>
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<tr>
<td>z196/z114</td>
<td>zEC12/zBC12</td>
<td>z13/z13s</td>
<td>z14</td>
<td>z15</td>
</tr>
</tbody>
</table>

- **45 nm**
  - Top Tier Single Thread Performance System Capacity
  - Accelerator Integration
  - Out of Order Execution
  - Water Cooling
  - PCIe I/O Fabric
  - RAIM
  - Enhanced Energy Management

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

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

- **14 nm**
  - 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

- **14 nm**
  - Focus on power efficiency and new on-chip architectures
  - Improved and enlarged caches
  - Optimized Out-of-Order architecture
  - Binary Floating-point enhancements
  - IBM Integrated Accelerator for zEDC (On-chip compression support (DEFLATE))
  - Enhanced Cryptographic Coprocessor (CPACF)
IBM z15 functional comparison to IBM z13

### Performance and Scale
- **Uniprocessor Performance**
- **System Capacity**
- **SMT**
- **Cache**
- **Models**
- **Processing cores**
- **Granular Capacity**
- **Memory**
- **Compression**

- New up to 25% performance improvement over IBM z13 (z13)\(^1\)
- New up to 63% system total z/OS capacity performance improvement over z13\(^1\)
- New 2nd generation SMT delivers up to 56% performance improvement for IFLs and zIIP workloads vs non-SMT on z13
- New z15 has 263% more on-chip cache per core versus z13
- Five feature based sizes with up to five CPC drawers (z13 has five models and four drawers)
- New up to 190 cores to configure, up to 141 on z13
- New up to 292 capacity settings versus 231 on the z13
- New up to 40 TB RAIM memory versus 10 TB RAIM memory on z13
- CMPSC compression and new Integrated Acceleration for ZEDC versus CMPSC compression and zEDC Express on z13

### Virtualization
- **LPAR virtualization**
- **RoCE adapter**
- **Simplified LPAR management**

- 85 partitions – same as z13
- 2X the maximum number of RoCE features (up to 16) allowing RoCE to be extended to more workloads vs 8 on z13 (also no 25 GbE Express2.1 on z13)
- Enhanced IBM Dynamic Partition Manager allows for config and management of system resources on both

### Security
- **Cryptographic Coprocessor**
- **Crypto Express**
- **IBM Secure Service Container**
- **Secure Console Access**

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

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1. Disclaimer: Based on preliminary internal measurements and projections and compared to the z13. Official performance data will be available upon announce. 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/lsprindex.
### IBM z15 functional comparison to IBM z13

#### Infrastructure Efficiency
- Networking
- HiperSockets and SMC-D
  - New OSA-Express7S with improvements over z13 using OSA-Express5S
  - Up to 32 HiperSockets and memory-to-memory communications with SMC-D offers within-the-box communications for z/OS – same as z13
- FICON
  - FICON Express16S+ versus FICON Express16S on z13
- zHPF
  - zHPF extended distance II offers faster remote site recovery with improved I/O service time improvement when writing data remotely (GDPS® HyperSwap®) same as z13
- IBM zHyperLink
  - IBM zHyperLink1.1 - short distance z15 channel that can be installed on IBM DS8880 System Storage for lower latency not on z13
- Forward Error Correction
- FICON dynamic routing
  - Dynamic Routing allows for sharing of switches between FICON and FCP without creating separate virtual switches same on z13
- LCSS/Subchannel sets
- WWPN
- HMC
  - Next generation HMC with simplified panels, new mobile capabilities, security enhancements (including multi-factor authentication), easier help panels – not on z13. (No Classic Style User Interface on z13)
- Pause-less garbage collection
  - New enterprise scale Java applications to run without periodic pause for garbage collection on larger & larger heaps not on z13
- IBM Virtual Flash Express
  - New memory replacement for Flash Express helping improve availability – not available on z13

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

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### IBM z15 functional comparison to IBM z14

#### Performance and Scale
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- New z15 has 86% more on-chip cache per core versus z14
- Five feature based sizes with up to five CPC drawers (z14 has five models and four drawers)
- New up to 190 cores to configure, up to 170 on z14
- New up to 292 capacity settings versus 269 on the z14
- New up to 40 TB RAIM memory versus 32 TB RAIM memory on z14
- CMPSC compression and new Integrated Acceleration for ZEDC versus CMPSC and zEDC Express on z14

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- **IBM zHyperLink**
  - IBM zHyperLink1.1 - short distance z15 channel that can be installed on IBM DS8880 System Storage for lower latency same on z14
- **Forward Error Correction**
  - Industry standard FEC for optical connections for substantially reduced I/O link errors same as z14
- **FICON dynamic routing**
  - Dynamic Routing allows for sharing of switches between FICON and FCP without creating separate virtual switches same on z14
- **LCSS/Subchannel sets**
  - Up to six LCSS and 4 Subchannel sets – same as z14
- **WWPN**
  - I/O serial number migration allows keeping same serial number on replacement server same as z14
- **HMC**
  - Next generation HMC with simplified panels, new mobile capabilities, security enhancements (including multi-factor authentication), easier help panels – not on z13. (No Classic Style User Interface on z14)
- **Pause-less garbage collection**
  - New enterprise scale Java applications to run without periodic pause for garbage collection on larger & larger heaps same on z14
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#### Resiliency and Availability
- **System Recovery Boost**
  - Enables faster recovery and restoration of service from any planned or unplanned operating system outages not on z14
- **Coupling – ICA SR**
  - Short distance coupling with PCIe-based links (ICA SR) – same as z14
- **Coupling Express LR**
  - Coupling Express LR – Coupling Express LR will be available on z14
- **Coupling scale**
  - 50% increase in logical coupling CHPIDs per CPC over z14
- **STP**
  - New Simplified STP management with HMC enhancements same as z14
- **Sparing**
  - Enhanced integrated sparing on z15 and z13 reducing the number of on site service and maintenance events
- **Rack Mounted Accessories**
  - Rack-mounted HMC and TKE options to save space in the data center
- **Environemntals**
  - New 19” frame packaging and optional non raised floor, overhead cabling, water cooling, ASHRAE 3 rating - 24” frame packing on z14
- **Coupling – HCA-3**
  - No InfiniBand Coupling with HCA-3 InfiniBand Coupling Links on z15 – available on z14
Performance drivers for the z15

- **Processor**
  - Up to 12 processor units (cores) per chip versus 10 on z14 (3906)
  - Up to 190 configurable processor units (cores) versus 170 on z14 (3906)
  - Improved IPC with microarchitecture enhancements including but not limited to:
    - Pipeline optimizations
    - Optimized Out of Order execution
    - Improved branch prediction
    - Improved prefetch
  - 3rd generation SMT for zIIPs and IFLs provides minor tweaks
  - SIMD architecture extensions adds eight new vector register-based instructions
  - Integrated Accelerator for zEDC Compression (1 per CP chip)
    - Optimized asynchronous execution provides drop-in replacement for zEDC Express I/O card with equal or less CPU time and minor elapsed time improvements expected
    - New synchronous execution for zlib based applications with equal or less CPU time and significant elapsed time improvements expected
Performance drivers for the z15

- **Memory subsystem**
  - Focused on keeping data "closer" to the processor unit
    - Larger L2, L3, and L4 caches
    - Contributes to improved IPC (Instructions Per Cycle)
  - X-Bus protocol changes designed to improve performance
  - 1.25x more configurable memory (40TB versus 32TB for z14 (3906))

- **Crypto Express7S**
  - Designed to provide improved performance for asymmetric encryption (e.g. TLS/SSL)

- **PR/SM**
  - 85 customer partitions, same as z14 (3906)
  - Up to 190 LCPs and 16 TB memory per partition supported architecturally
    - Each operating system has limits
  - Improved partition placement algorithms based on z14 experience
  - HiperDispatch
    - Exploits new chip configuration
    - Required for SMT on zIIP
z15 processor design summary

- More than 9.1 billion transistors
- 696 mm² chip area
- 14nm SOI technology, 17 layers of metal
- 12 cores per CP-chip design
- 5.2 GHz core frequency

- Optimize core to enable performance and capacity growth
  - 20% reduction in core area
  - 20% reduction in core power

- New EDRAM macro design with 2x macro density
  - Grow L3 from 128MB to 256MB per chip
  - Grow L2-L from 2MB to 4MB per core
  - L2-L3 Protocol changes to reduce latency

- IBM Integrated Accelerator for zEnterprise Data Compression (zEDC) with on-chip compression accelerator (NXU)
- Re-optimize nest-core staging
z15 SC chip

- 696 mm² chip area
- 9.7 billion transistors
- 14nm SOI technology, 17 layers of metal
- 960 MB shared eDRAM L4 cache
- System interconnect
- System coherency manager
- X and A bus – support for:
  - 4 CP-chips using 4 X-buses
  - 5 drawers using 4 A-buses (point-to-point)
## z15 vs. z14 hardware and topology comparison

<table>
<thead>
<tr>
<th></th>
<th>z14 (3906)</th>
<th>z15 (8561)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CPU</strong></td>
<td>14nm SOI at 5.2 GHz</td>
<td>14nm SOI at 5.2 GHz</td>
</tr>
<tr>
<td><strong>L1 cache private per core</strong></td>
<td>128 KB instruction, 128 KB data</td>
<td>128 KB instruction, 128 KB data</td>
</tr>
<tr>
<td><strong>L2 cache private per core</strong></td>
<td>2 MB instruction, 4MB data</td>
<td>4 MB instruction, 4 MB data</td>
</tr>
<tr>
<td><strong>L3 cache shared per chip</strong></td>
<td>128 MB</td>
<td>256 MB</td>
</tr>
<tr>
<td><strong>L4 cache shared per drawer</strong></td>
<td>672 MB</td>
<td>960 MB</td>
</tr>
<tr>
<td><strong>Chip topology</strong></td>
<td>10 cores + 1 L3 per PU chip</td>
<td>12 cores + 1 L3 per PU chip</td>
</tr>
<tr>
<td><strong>Cluster topology</strong></td>
<td>2 or 3 PU chip per cluster</td>
<td>2 PU chips per cluster</td>
</tr>
<tr>
<td><strong>Drawer topology</strong></td>
<td>2 clusters per drawer</td>
<td>2 clusters per drawer</td>
</tr>
<tr>
<td><strong>CPC topology</strong></td>
<td>1, 2, 3, or 4 drawers per CPC</td>
<td>1, 2, 3, 4, or 5 drawers per CPC</td>
</tr>
</tbody>
</table>
z15 vs. z14 cache topology comparison

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### z15 processor allocation/usage – zIIP to CP 2:1 ratio

<table>
<thead>
<tr>
<th>Feature</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'l SAPs</th>
<th>Spares</th>
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<td>0-22</td>
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<td>22</td>
<td>0-8</td>
<td>2</td>
</tr>
</tbody>
</table>

- z15 Max34 to Max145 use drawers with 41 cores. Max190 has 5 drawers with 43 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 Max34 to model Max108 (Reserve FC 2271 and/or 2272 required for field add of CPC drawers).
- Field upgrade to Features Max145 and/or Max190 NOT supported (Max145 and Max190 are 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. The IFP is conceptually an additional, special purpose SAP.
  4. CP:zIIP ratio can exceed 2:1 during recovery boost periods if FC 6802 is ordered/used.
Workloads eligible to run on zIIPs

- Centralized data serving eligible for zIIP: Portions of BI, ERP, and CRM remote connectivity to Db2 (V8 and newer), as well as portions of long running parallel queries, and select utilities.
- Network encryption on zIIP – IPsec network encryption/decryption (starting with z/OS V1.8)
- XML parsing – z/OS XML System Services eligible on zAAP or zIIP (starting with z/OS V1.9, V1.8 and V1.7 with maintenance)
- Remote mirror – zIIP-assisted z/OS Global Mirror function (starting with z/OS V1.9)
- HiperSockets™ – HiperSockets Multiple Write operation for outbound large messages (starting with z/OS V1.9)
- Business Intelligence – IBM Scalable Architecture for Financial Reporting provides a high-volume, high performance reporting – can be eligible for zIIP processing.
- Intra-server communications – z/OS CIM Server processing eligible for zIIP (starting with z/OS V1.11).
- Db2 sort utility – Db2 utilities sorting fixed-length records using IBM’s memory object sorting technique
- “zAAP on zIIP” capability – Optimize the purchase of a new zIIP or maximize your investment in existing zIIPs.
- Select Tivoli® products – for DASD scans and Performance Expert/Performance Monitor
- Select RMF™ processing – (starting with z/OS V2.1) small portion of RMF monitoring eligible for zIIP
- Java – for WebSphere® Application Server and Java technology-based applications
- Supported for z/OS running under z/VM as a guests
- Select XML System services workloads
- Select ISV applications
- z/OS Container Extensions (starting with z/OS 2.4, z/OS 2.3 with PTFs)
- System Recovery Boost – CP work dispatched on zIIPs for the duration (limited) for the boost period
## z15 and LinuxONE III I/O Features

<table>
<thead>
<tr>
<th>Description</th>
<th>FC</th>
<th>Description</th>
<th>FC</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 GbE RoCE Express2.1</td>
<td>0432</td>
<td>OSA-Express7S 10 GbE SR</td>
<td>0445</td>
</tr>
<tr>
<td>Coupling Express LR(^1)</td>
<td>0433</td>
<td>OSA-Express7S 1000BASE-T</td>
<td>0446</td>
</tr>
<tr>
<td>FICON Express16SA LX</td>
<td>0436</td>
<td>IBM Adapter for NVMe1.1(^2)</td>
<td>0448</td>
</tr>
<tr>
<td>FICON Express16SA SX</td>
<td>0437</td>
<td>OSA-Express7S 25 GbE SR1.1</td>
<td>0449</td>
</tr>
<tr>
<td>FCP Express 32S LX(^2)</td>
<td>0438</td>
<td>25GbE RoCE Express2.1</td>
<td>0450</td>
</tr>
<tr>
<td>FCP Express 32S SX(^2)</td>
<td>0439</td>
<td>zHyperLink Express1.1(^1)</td>
<td>0451</td>
</tr>
<tr>
<td>OSA-Express7S GbE LX</td>
<td>0442</td>
<td>Crypto Express7S (2 port)</td>
<td>0898</td>
</tr>
<tr>
<td>OSA-Express7S GbE SX</td>
<td>0443</td>
<td>Crypto Express7S (1 port)</td>
<td>0899</td>
</tr>
<tr>
<td>OSA-Express7S 10 GbE LR</td>
<td>0444</td>
<td>ICA SR1.1(^1)</td>
<td>0176</td>
</tr>
</tbody>
</table>

1. z15 (8561-T01) only
2. LinuxONE III (8561-LT1) only

“Plan Ahead” for PCIe+ I/O Drawers and CPC Drawers available for future expansions
IBM Z Hardware Management Appliance

- **z15 introduces Hardware Management (Virtual) Appliance**
  - HMC and SE packaged redundantly inside Z CPC frame
  - Eliminates the need for managing separate HMC boxes outside of CPC package
  - No change in general user experience (most use cases involve remote browser access)
  - Can be used to manage N-2 systems (z13/z13s, z14, z15)
  - No standalone HMCs are needed for this environment
IBM System Recovery Boost

*Unleash your capacity to maximize your availability*

- Diminish the impact of any event, planned or unplanned, so you can achieve service level excellence with **zero increase in IBM software licensing costs**.
- Recover workloads substantially faster than on prior Z machines by unleashing additional processing capacity during a fixed-period performance increase on an LPAR-by-LPAR basis.
- With System Recovery Boost\(^1\), you can achieve up to:

<table>
<thead>
<tr>
<th>2.0x Faster</th>
<th>2.0x Faster</th>
<th>2.5x Faster</th>
<th>2.5x Faster</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return to pre-shutdown service levels</td>
<td>Processing of transactional backlog</td>
<td>Processing of batch backlog</td>
<td>GDPS automated startup, shutdown, site switches, etc.</td>
</tr>
</tbody>
</table>

Performance for the System Recovery Boost period

1. **Processor Capacity Boost using zIIPs**
   Provides parallelism and a boost in processor capacity for processing any kind of work during the Boost.

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

3. **GDPS Reconfiguration**
   Increases the speed at which GDPS drives hardware actions, along with the speed of the underlying hardware services

4. **System Recovery Boost Turbo**
   Unlock additional “dark cores” for up to 20 additional zIIP cores (annual charge)
A. Boost period – Faster planned shutdown
B. Faster GDPS-driven HW Reconfiguration Activities (especially around DR and site switch)
C. Boost period - Faster IPL
D. Boost period - Faster Middleware Restart and Recovery
E. Boost period - Boosted Capacity to do work following IPL

No increase in IBM software costs!
Capping summary

- Some forms of capping are managed in LPAR, some in z/OS; some forms of capping apply to GPs, some to zIIPs, some to both
- Some forms of capping (Resource Group capping) apply to apportioning usage of capacity within a z/OS image, by different tenants, to avoid monopolization by particular tenants
- Our general approach to capping is:
  - **Speed boost**: during boost, count GPs as if they were still subcapacity speed, and cap normally based on that understated view of GP capacity
  - **zIIP processor boost**: during boost, do not count boosting partition’s entitled zIIPs or boost zIIPs for capping purposes; do not suspend boosting partition based on zIIP capacity (essentially, ignore the cap)
  - **Ignore Resource Group capping**: during the Boost period, do not suspend particular TRG “tenants” for exceeding capping limits within a z/OS image
Manage growth of data with compression

*Reduce data sizes by and improve workload execution time*

<table>
<thead>
<tr>
<th>Get started with compression now</th>
<th>Do more without limits</th>
<th>Optimized Security and Compliance</th>
</tr>
</thead>
</table>
| ▪ **6x Compression ratio** for storage savings, reduced bandwidth, faster transfer times  
▪ BSAM/QSAM compression saves space, elapsed time, and CPU.  
▪ Compression for file transfer: Compress data with zlib **42x faster** with Integrated Accelerator for zEDC compared to using software compression. | ▪ Integrated Accelerator provides better reliability and eliminates complex planning and setup  
▪ Standard on IBM z15 – replacement for zEDC Express adapter  
▪ Full Linux virtualization – **100%** access for all LPARS and virtual machines  
▪ No change to applications is required | ▪ Combine Pervasive Encryption with Integrated Acceleration for zEDC and get optimized and secure infrastructure  
▪ **Save CPU and cost by combining compression with Pervasive Encryption** |

**Pervasive Compression**  
*Up to 17x more compression throughput than a max configured z14*
Integrated Accelerator for zEnterprise Data Compression on z15 delivers easier compression setup compared to z14, requiring no application changes, no I/O configuration changes, and no additional hardware.

Historically written data and new data interoperability:
- All data interchange will remain compatible
- z15 and machines configured with zEDC Express will co-exist (accessing same data)
- Data compressed and written with zEDC Express will be read and decompressed by z15
z15 Integrated Accelerator for zEnterprise Data Compression (zEDC)

- Compression/Decompression implemented in Nest Accelerator Function
  - Replacement for existing zEDC Express adapter in I/O drawer
  - Nest accelerator unit per processor chip, shared by cores on this chip
  - Supports DEFLATE compliant compression/decompression + GZIP CRC/ZLIB Adler

- Brand new concept of sharing and operating an accelerator function in the nest
  - Low latency
  - High bandwidth
  - Problem State execution
  - Hardware/Firmware interlocks to ensure system responsiveness

- Architected instruction
  - Executed in millicode
  - Operating shared hardware accelerator on behalf of issuing core

- zEDC Express features will NOT CARRY FORWARD
Integrated Accelerator for zEDC – Dual execution modes

- Synchronous execution in Problem State for z/OS and Linux on Z (zlib)
  - User application invokes instruction in its virtual address space
  - Easy and straightforward exploitation
  - No special hypervisor support needed
  - Low latency
  - High bandwidth

- Asynchronous optimization for Large Operations under z/OS
  - Authorized application (e.g. BSAM/QSAM) issues I/O for asynchronous execution
  - SAP invokes instruction (synchronously as above) on behalf of application
  - Enables load balancing of high compression loads
  - Low latency and high bandwidth compared to zEDC Express
  - Maintains current user experience on compression
  - Transparent implementation for existing authorized users
  - Requires z/OS EDC feature
## Integrated Accelerator for zEDC provides value for existing and new compression users

<table>
<thead>
<tr>
<th>Feature</th>
<th>IBM z14™ with zEDC Express</th>
<th>z15 with Integrated Accelerator for zEDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application elapsed time</td>
<td>Application elapsed time is affected by the time required for the data to be offloaded to and retrieved from the zEDC adapter (PCIe infrastructure in the PCIe I/O Drawer))</td>
<td>Up to 8x faster application elapsed time with no additional CPU time using IBM z15 Integrated Accelerator for zEDC compared to z14 zEDC Express for both compression and decompression</td>
</tr>
<tr>
<td>Total CEC Throughput</td>
<td>Fully Configured z14 – 16 GB/s</td>
<td>Compress up to 260 GB/sec with the Integrated Accelerator for zEDC on the largest IBM z15</td>
</tr>
<tr>
<td>Virtualization</td>
<td>15 LPARs or VMs per adapter</td>
<td>All LPARs and VMs have 100% access</td>
</tr>
<tr>
<td>Capacity Planning</td>
<td>Clients run zEDC cards at 30-50% to handle LPAR consolidation for DR</td>
<td>Enable everything – More than enough throughput</td>
</tr>
<tr>
<td>Compatibility</td>
<td>Full compatible with z15 on-chip compression</td>
<td>Fully compatible with zEDC</td>
</tr>
<tr>
<td>Sequential Data Sets</td>
<td>Selectively enabled by application</td>
<td>Enable everything – More than enough throughput</td>
</tr>
<tr>
<td>Migration to Tape or VTS</td>
<td>Balanced against data set compression</td>
<td>Enable everything – More than enough throughput</td>
</tr>
<tr>
<td>Network Traffic (e.g. Connect:Direct)</td>
<td>Enabled only if enough capacity available</td>
<td>Enable everything</td>
</tr>
<tr>
<td>Linux on Z Support</td>
<td>Limited client adoption, virtualization layer adding complexity and affecting throughput</td>
<td>Fully available for Open Source software – NO virtualization employed (on-chip engine)</td>
</tr>
</tbody>
</table>
z/OS considerations for zEDC feature migration to z15

- **No z/OS Feature Required on z15 for:**
  - In application – IBM Java
  - IBM Content Manager OnDemand
  - IBM Encryption Facility
  - Data transfer:
    - IBM Sterling Connect:Direct
    - z/OS HTTP Server
    - OpenSSH
    - IBM MQ for z/OS

- **Needs Existing z/OS zEDC Feature:**
  - Storage Savings:
    - z/OS SMF Logstream
    - z/OS QSAM/BSAM
    - z/OS DFHSM / DFDSS
  - DB Storage Compression
  - Db2 for z/OS V12 LOBs
  - zFS in V2R3
Integrated Accelerator for zEDC and Linux on Z

- zEDC Express I/O adapter was not a great fit in many Linux on Z environments
  - SR-IOV does not provide a high degree of virtualization
  - Required pick and choose for which guest gets access to the accelerator
  - Limited use-case available with LoZ – IBM Java support only

- z15 solves the virtualization limitations that exists with zEDC
  - No longer an I/O device
  - Available as a problem state instruction to all Linux on Z guests without constraints
  - Avoids having to pick and choose which Linux on Z guests may use accelerator
  - Enables pervasive usage in highly virtualized environments

- IBM is working with the Linux distribution partners to get the functionality included in their distribution for Linux on Z
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 which has been introduced with z14.
- z15 Introduces an updated feature, the IBM zHyperLink Express1.1.
- IBM zHyperLink™ reduces latency by interconnecting the Z CPC directly to the I/O bay of the DS8884F, DS8886F, DS8888F, DS8910F, or DS8950F – DS8882F is NOT supported.
- zHyperLink improves application response time, cutting I/O sensitive workload response time in half without significant application changes.
In today's Digital Age of “always on” interconnected networks, businesses demand near-flawless and uninterrupted connectivity to conduct business operations. This Digital Age is marked by dramatic increases in ...
IBM Z – Transformational Resilience

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

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

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

New – z/OS Workload Interaction Correlator and Navigator

Enriched Data
- Generates high frequency (5 seconds) standardized, summarized, and synchronized activity for workload components
- Provides response time interdependencies for CICS, IMS, and Db2
- Embodies First-Failure Data Capture (FFDC) for workload / performance diagnosis

Intuitive Analytics
- Visually intuitive, interactive analytics identifies cause and victim workload component peers
- Make more timely, informed decisions from code and test, to system configuration and maintenance, to problem analysis
- User experience delivered as part of Zowe open source framework

Capture all essential Key Performance Indicators
- The combination captures essential Key Performance Indicators (KPIs)
- Gain insight into current and potential future issues by diagnosing the problem faster

Statement of Direction in the z15 announcement: New offerings for Middleware interdependency data generation, and automated z/OS cross stack analytics
## IBM Z Service level excellence

<table>
<thead>
<tr>
<th>IBM Z Transformed Resiliency</th>
<th>Parallel Sysplex</th>
<th>GDPS</th>
<th>IBM System Recovery Boost</th>
<th>zOperational Data Gen and Analytics</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Minimal disruptions</strong></td>
<td><strong>Scale</strong> up to 32 systems</td>
<td><strong>Drives</strong> <em>long distance</em> failure recovery</td>
<td><strong>Reduce</strong> impact of downtime</td>
<td><strong>Cross component</strong> generation of high frequency standardized, summarized, and synchronized activity</td>
</tr>
<tr>
<td><strong>Concurrent replace, repair, and upgrade functions</strong></td>
<td><strong>Concurrent database access</strong></td>
<td><strong>Consistency</strong> across z/OS and open system data</td>
<td><strong>Faster</strong> recovery</td>
<td><strong>Visually intuitive</strong> display of interactive analytics for timely, informed decisions</td>
</tr>
<tr>
<td><strong>Better throughput</strong></td>
<td><strong>Record-level control</strong></td>
<td><strong>Create secure point-in-time copies</strong></td>
<td><strong>Unlock</strong> dark capacity when you need it</td>
<td><strong>No</strong> additional IBM software MSU charge</td>
</tr>
<tr>
<td><strong>Reduce I/O latency</strong></td>
<td><strong>99.999% availability</strong></td>
<td><strong>Offers real time health checks</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Dynamic balancing</strong></td>
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</tbody>
</table>

GlassHouse Systems

Introducing the IBM z15 for CMG Canada
Consumable Privacy: The Next Big Thing

Simplifying data privacy by improving data protection

$3.8M
Average cost of a data breach in 2018 ²

28%
Likelihood of an organization having a data breach in the next 24 months ¹

59%
Data privacy regulations, varying by industry, location, and geo ³

2/3 of established companies are leveraging fintech capabilities for growth. That number is expected to increase by 20% in the next three years — Harvard Business Review Analytic Services

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

—2018 Ponemon Study on Global Megatrends in Cybersecurity

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

Payment Card Industry Data Security Standard (PCI-DSS)

Health Insurance Portability and Accountability Act (HIPAA)

California Consumer Privacy Act

1. 2018 Ponemon Study on Global Megatrends in Cybersecurity
2. Breach Level Index http://breachlevelindex.com
Protect individuals’ identity in a digitized world with *IBM Data Privacy Passports*

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

**Current State**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Data protected within Z</td>
<td></td>
</tr>
</tbody>
</table>

**Desired State**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Data protected for the life of the data</td>
<td></td>
</tr>
</tbody>
</table>

**Current State**

- **3rd Parties**
- **Private Cloud**
- **Public Cloud**

**Desired State**

- **End-to-end protection via “Trusted Data Objects”**
- **Controlling the usage of data and auditability of data**


---

*GlassHouse Systems*

*Introducing the IBM z15 for CMG Canada*

2019-10-22

Page 41
IBM Data Privacy Passports allows clients to create a single, protected table, using a policy on Z, that can grant multiple views of data from a single data source.
The data is protected at the point of extraction and is enforced at the point of consumption.

Move data from IBM Z to distributed as Trusted Data Objects – Start with SQL data sources on IBM Z.

Passport Controller deployed in a Secure Service Container (SSC) LPAR.

Policy for enforcement can be changed dynamically to revoke to entitle users to data.

Create a single protected table to provide multiple views of data.

**Runs on IBM z15**
Future *IBM Fibre Channel Endpoint Security* to allow FICON or FCP Links from the z15 to the new IBM DS8900F storage family to be encrypted and protected

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Client Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Corporate directive to encrypt all data in-flight.</td>
<td>▪ Knowledge that all data flowing within and across datacenters are traveling between trusted entities</td>
</tr>
<tr>
<td>▪ Ensure the integrity and confidentiality of data that is in-flight is protected.</td>
<td>▪ Be able to provide auditable data verifying that customer data is only being accessed by trusted IBM Z and storage devices</td>
</tr>
<tr>
<td>▪ Be able to provide auditable data verifying that customer data is only being accessed by trusted IBM Z and storage devices</td>
<td>▪ Supports all IBM Z operating systems</td>
</tr>
<tr>
<td>▪ Reduces and eliminates insider threats of unauthorized access to data in flight</td>
<td>▪ Supports all IBM Z operating systems</td>
</tr>
</tbody>
</table>

Statement of Direction – To be delivered post GA

For additional information see https://www.ibm.com/downloads/cas/B8VW1RJW
### Protection of data that must be shared

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

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Client Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Protection from accidentally sharing sensitive data when sending diagnostic information to vendors</td>
<td>▪ Sensitive data tagging APIs combined with machine learning (ML) to detect, tag and redact all tagged data from diagnostic dumps</td>
</tr>
<tr>
<td>▪ Concern for organizations who must comply with the GDPR laws and/or other data privacy laws and company mandates</td>
<td>▪ z/OS is working with 1st set of exploiters (Db2 and some DFSMS components) to provide the infrastructure to tag sensitive data in z/OS</td>
</tr>
<tr>
<td></td>
<td>▪ Tagging does not impact dump times</td>
</tr>
<tr>
<td></td>
<td>▪ Supported on IBM z15 running z/OS 2.3 or 2.4</td>
</tr>
</tbody>
</table>

Cryptographic acceleration with z15 hardware

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

- **Cryptographic coprocessor on every core with CP Assist for Cryptographic Function (CPACF):**
  - Enhanced with elliptic curve cryptographic (ECC) algorithms that can help reduce CPU consumption for applications like Blockchain
  - Enable an EP11 secure key to be converted to a protected key that can be used by CPACF

- **Designed for EAL5+ and FIPS 140-2 Level 4**
IBM Z investments in Quantum Safe Cryptography

- **Initial z15 capability**
  - Initially delivered via Quantum safe digital signatures for z/OS SMF records
  - Agility in algorithms to update as standards evolve
  - Acceleration coming in HSM for essential primitives for Quantum Safe cryptography

---

**Timeline of Quantum Advantage vs. Data Lifecycle**

- **First IBM Z Support**
- **Industry Standard**
- **Quantum Advantage**

<table>
<thead>
<tr>
<th></th>
<th>z14</th>
<th>z15</th>
<th>zFuture</th>
<th>3 - 5 years?</th>
<th>short key length</th>
<th>long key length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ECC at risk</td>
<td>RSA at risk</td>
</tr>
</tbody>
</table>

Lifetime of data
## IBM z15
### Data protection and privacy

<table>
<thead>
<tr>
<th>Built on pervasive encryption</th>
<th>Data Privacy Passports</th>
<th>Fibre Channel Endpoint Security</th>
<th>Data Privacy for Diagnostics</th>
<th>Beginning a Journey to the Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>Broadly protect Linux and z/OS</td>
<td>Protect individuals’ identity in a digitized world</td>
<td>End-to-end solution for data in flight protection</td>
<td>Protection when sending to vendors</td>
<td>Quantum-safe digital signing algorithms as part of base</td>
</tr>
<tr>
<td>z/OS Coupling Facility data</td>
<td>System becomes the trusted center for data</td>
<td>All Z operating systems and access methods</td>
<td>Detection, tagging and redaction of all tagged data from dumps</td>
<td>Coming: Acceleration in HSM for essential primitives for Quantum Safe cryptography</td>
</tr>
<tr>
<td>Protect network traffic</td>
<td>Protection enforced at consumption</td>
<td>Reduces and eliminates insider threats</td>
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<tr>
<td>Real-time secure key management</td>
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</tbody>
</table>

IBM z15 offers integrated cryptographic hardware
IBM Z is the core of your secure Hybrid Cloud

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

<table>
<thead>
<tr>
<th>Transform the Cloud</th>
<th>Cloud Native Experience</th>
<th>Private Cloud</th>
<th>Public Cloud</th>
</tr>
</thead>
<tbody>
<tr>
<td>z/OS Connect EE</td>
<td>Zowe</td>
<td>IBM Cloud Private</td>
<td>IBM Blockchain Platform</td>
</tr>
<tr>
<td>Z APM Connect</td>
<td>Z Open Development</td>
<td>z/OS Cloud Broker</td>
<td>IBM Cloud Hyper Protect Services</td>
</tr>
<tr>
<td>Z Service Automation Suite</td>
<td>z/OS Container Extensions</td>
<td>Secure Services Container for ICP</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>IBM Blockchain for ICP</td>
<td></td>
</tr>
<tr>
<td>elastic</td>
<td>Jenkins</td>
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<tr>
<td>splunk</td>
<td>git</td>
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<td>APPDYNAMICS</td>
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<td>OPENAPI INITIATIVE</td>
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<td></td>
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</tbody>
</table>

Provide open access and extend the platform value with open standards and tooling across all cloud deployment and service models.
# Linux on Z – Highly reliable and trustful

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

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Client Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Complex IT infrastructures are hard to backup and recover – often the backup is not tested</td>
<td>▪ Linux benefits from the IBM Z server capabilities to avoid and recover from failures for minimal business disruption – Concurrent replace, repair, and upgrade functions for processors, memory, drawers, and I/O</td>
</tr>
<tr>
<td>▪ Can you trust your Linux infrastructure?</td>
<td>▪ z/VM Single System Image enables Live Guest Relocation for continuous Linux availability</td>
</tr>
<tr>
<td></td>
<td>▪ Near-continuous availability and disaster recovery solutions with IBM GDPS® and IBM Spectrum Scale™</td>
</tr>
</tbody>
</table>

For more information see [https://www.ibm.com/it-infrastructure/z/os/linux](https://www.ibm.com/it-infrastructure/z/os/linux)
Extended scope of pervasive encryption with Linux enables more customers and solutions to benefit from the Pervasive Encryption features, and speeds up the protection of data-in-flight, for signing and key exchange protocols as required by TLS and Blockchain

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

Efficiency with Linux on IBM Z

Simple and economic operation

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

IBM intends to deliver the Red Hat OpenShift Container Platform on Linux on IBM Z and IBM LinuxONE. This offering will accelerate the transformation to greater portability and agility through integrated tooling and a feature-rich ecosystem for cloud native development on Linux on IBM Z and LinuxONE offerings.

IBM intends to deliver IBM Cloud Pak offerings to Linux on IBM Z and LinuxONE offerings. These offerings will accelerate the rich IBM software ecosystem that is necessary for enterprise clients to adopt hybrid multi deployment.

These offerings, combined with the IBM premier enterprise platforms, IBM Z and LinuxONE, will reinforce and further strengthen the IBM focus on hybrid cloud to unlock business value and drive growth for clients by providing a secure and open hybrid, multicloud platform.
Expanding the z/OS software ecosystem

New z/OS Container Extensions in z/OS 2.4 delivers unmodified Linux on Z Docker images running inside z/OS (zIIP eligible!)

<table>
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<tr>
<th>Challenges</th>
<th>Client Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Porting desired software to z/OS requires effort and presents time-to-value and currency concerns</td>
<td>▪ Modernize z/OS workloads by providing flexibility for development and operations on Z</td>
</tr>
<tr>
<td>▪ Requirement to deploy dependent software hosted on separate Linux servers leads to complicated z/OS operational procedures and hinders the ability to take full advantage of z/OS Qualities of Service</td>
<td>▪ Integration with other DevOps tools and Linux applications all in z/OS</td>
</tr>
<tr>
<td>▪ Maintain operational control and extend z/OS Qualities of Service to Linux software</td>
<td>▪ Make use of existing IT investments by employing Linux within the Z platform</td>
</tr>
</tbody>
</table>

▪ Requires hardware FC 0104 Container Hosting Foundation on z14 (3906 or 3907) or z15 (8561), and is not available on z13 or earlier systems
▪ IBM software running on zCX is licensed by PVU where each zIIP is 100 PVUs on the 3907 and 120 PVUs on the 3906/8561 (same as for IFLs)
Modernizing and transforming the journey to hybrid cloud via Data and AI on IBM z15

Leverage IBM Db2 and AI Offerings

- Db2 Analytics Accelerator for z/OS with Integrated Synchronization
  - Reduce data latency \textit{up to 120x}\textsuperscript{2}
  - Deliver up to \textit{7x CPU reduction}\textsuperscript{2}
- Watson Machine Learning for z/OS
  - Build models on your \textit{platform of choice}
  - Score in real-time for insight at the \textit{point of transaction}

Client Value

- Real-time business insight from real-time transactional data with \textit{no-compromise HTAP}\textsuperscript{1}
- Guaranteed data coherency by \textit{directly accessing Db2 log changes}
- Actionable insight by \textit{embedding AI within transactional applications}

\textsuperscript{1} Hybrid transactional and analytic processing (HTAP)  

\textsuperscript{2} Early IBM internal testing shows that this capability delivers up to 120x reduction in latency and up to 7x improvement in CPU consumption, as compared to the prior architecture that used replication technology.
Compilers enable modernization and increases performance of critical business applications

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

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

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

## IBM z15
### Ready for mission critical cloud

<table>
<thead>
<tr>
<th>Industry leading cloud management</th>
<th>Optimized deployment for critical workloads</th>
<th>Standardization through containers</th>
<th>Closing the technology skills gap</th>
<th>Security at the core of the hybrid cloud</th>
</tr>
</thead>
<tbody>
<tr>
<td>▪ Consistent management and orchestration across your hybrid cloud</td>
<td>▪ Delivering ZaaS as part of an end-to-end cloud native experience</td>
<td>▪ Extreme Agility with lightweight and portable containers for applications</td>
<td>▪ Removing skills barriers with open technology and tooling</td>
<td>▪ Unparalleled trust and security for mission critical workloads</td>
</tr>
</tbody>
</table>
IBM DS8900F
The next generation of DS8000

- Built on Power 9 Servers
  - Power 9 MTM 9009-22A Business Class – DS8910F
  - Power 9 MTM 9009-42A Enterprise Class – DS8950F
- Power System Upgrade
  - Replace DC-UPS with iPDU
  - NVDIMM for Write Cache retention
- Performance
  - 38-60% IOPs increase
  - Double cache for DS8910F (256GB to 512GB)
  - Double the write cache for 2TB cache configuration
- Built from the DS8880 code base
  - Inherits Advanced Function from DS8880
- New 19” Rack
  - Reduced footprint and height
- Reduced DS8k configurations
  - Offer 3 Models (down from 9 Models)
  - Flash only offering follows industry direction and growth
  - Improved quality through use of simplified infrastructure and parts
- New 32 Gb Host Adapter
  - Double front-end bandwidth with FCP and FICON
  - Fibre Channel Endpoint Security – Authentication and Encryption of Data in Flight
- Future enablement for
  - 30TB Flash Drive, 4TB Cache Config

38-60% Faster IOPs
POWER 9 processors, 2x front-end bandwidth with 32 Gb Host Adapter, and Industry's fastest response time of 18µs

2X Write Cache with 2TB cache configuration giving more buffering for write workload

28%
Physical Capacity Increase
In same physical space with 30 TB flash drives, and true 19” rack with more efficient power system improving OPEX

100%
Peace of Mind
Encryption of data everywhere Cyber Resiliency More than 7-9s availability

For more information see https://www.ibm.com/ca-en/marketplace/ds8000f
IBM DS8900F

Family comparison summary

Designed to address with less complexity, a wide variety of business and mission critical workloads across your hybrid multicloud

<table>
<thead>
<tr>
<th>System</th>
<th>DS8910F</th>
<th>DS8950F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor complex (CEC)</td>
<td>2 x IBM Power Systems Power 9 MTM 9009-22A</td>
<td>2 x IBM Power Systems Power 9 MTM 9009-42A</td>
</tr>
<tr>
<td>Racks (min / max)</td>
<td>0 / 1</td>
<td>1 / 2</td>
</tr>
<tr>
<td>POWER 9 cores per CEC (min / max)</td>
<td>8</td>
<td>10 / 20</td>
</tr>
<tr>
<td>System memory (min / max)</td>
<td>192 GB / 512 GB</td>
<td>512 GB / 2,048 GB</td>
</tr>
<tr>
<td>Host Adapter Ports (min / max)</td>
<td>4 / 64</td>
<td>4 / 128</td>
</tr>
<tr>
<td>Flash Drives (min / max)</td>
<td>16 / 192</td>
<td>16 / 384</td>
</tr>
<tr>
<td>Capacity (min / max) (w/ 30TB Flash Drive)</td>
<td>12.8 TB / 2,880 TB (5,760 TB)</td>
<td>12.8 TB / 5,760 TB (8,000 TB)</td>
</tr>
<tr>
<td>Max IOPs (4K 70/30 R/W mix)</td>
<td>860 K</td>
<td>2,320 K</td>
</tr>
<tr>
<td>Max Sequential Read – Write</td>
<td>22 GB/s – 17 GB/s</td>
<td>47 GB/s – 27 GB/s</td>
</tr>
<tr>
<td>Minimum response time (4K read hit)</td>
<td>90 µsec</td>
<td></td>
</tr>
<tr>
<td>Minimum response time w/ zHyperLink (4K read)</td>
<td>18 µsec</td>
<td></td>
</tr>
</tbody>
</table>
# Performance tools for the z15

<table>
<thead>
<tr>
<th>Tool name</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>zPCR</strong> v9.3</td>
<td>Processor Capacity Reference for IBM Z</td>
</tr>
<tr>
<td>zCP3000</td>
<td>Performance Analysis and Capacity Planning for IBM Z</td>
</tr>
<tr>
<td><strong>zBNA</strong> v2.0.1</td>
<td>IBM Z Batch Network Analyzer</td>
</tr>
<tr>
<td><strong>CP3KEXTR</strong> v3.1</td>
<td>z/OS Data Extraction Tool for CPS Tools</td>
</tr>
<tr>
<td><strong>CP3KVMXT</strong> v2.8g</td>
<td>z/VM Data Extraction Tool for CPS Tools</td>
</tr>
<tr>
<td><strong>zSoftCap</strong> v5.5</td>
<td>Software Migration Capacity Planning aid for IBM Z</td>
</tr>
<tr>
<td>zSCON</td>
<td>Server Consolidation on IBM Z</td>
</tr>
<tr>
<td>zPSG</td>
<td>Processor Selection Guide for IBM Z</td>
</tr>
<tr>
<td>zMCAT</td>
<td>IBM Z Migration Capacity Analysis Tool</td>
</tr>
</tbody>
</table>

Note: Tools in **Blue** are available to customers
See my presentation on [zBNA from CMG Canada in April 2018](#) for more detailed information on these performance tools
IBM provides capacity comparisons among IBM Z processors based on a variety of measured workloads which are published in the Large Systems Performance Reference (LSPR)
− Now based on z/OS 2.3, Db2 12, CICS 5.3, IMS 14, COBOL 6.2, WAS 9.0.0.8
  • Note: Capacity ratios may vary if using older versions of these subsystems
− Minor tweaks to the three workload categories based on customers’ CPU MF data for z13 to z14 migrations

Old and new processors are measured in the same environment with the same workloads at high utilizations

Over time, workloads and environment are updated to stay current with customer profiles
− Old processors measured with new workloads/environment may have different average capacity ratios compared to when they were originally measured

LSPR presents capacity ratios among processors

Single number metrics include PCI/MIPS, MSUs, and SRM Constants
− PCI/MIPS is based on the ratios for the “Average” workload category with a median customer LPAR configuration
GlassHouse Systems Noteworthy App

- **Noteworthy z** is an Android app based on the MIPS chart formerly published by GlassHouse Systems Inc. available at Google Play.
- This app is used for approximate comparative sizing of IBM mainframe servers.
- GlassHouse Systems provides complete capacity planning analysis using workload characterization, zPCR, zCP3000, zBNA, and other tools.
IBM z15 operating system support

- **z/OS**
  - z/OS 2.4 with PTFs
  - z/OS 2.3 with PTFs
  - z/OS 2.2 with PTFs

- **z/VSE**
  - z/VSE 6.2

- **z/TPF**
  - z/TPF 1.1

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

- **Linux on Z**
  - Red Hat RHEL 8.0, 7.7, and 6.10
  - SUSE SLES 15.1 and 12.4
  - Ubuntu 18.04 LTS and 16.04 LTS

- **KVM running on Z**: KVM hypervisor for IBM Z is offered with the following Linux distributions:
  - Red Hat RHEL 8.0
  - SUSE SLES 15.1 and 12.4
  - Ubuntu 18.04 LTS and 16.04 LTS

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

IBM cannot legally discuss z15 exploitation prior to GA from distributors. IBM is working with the open source community and the Linux distribution partners to get new z15 functionality supported with Linux for Z and KVM.
# z/OS Support for the z15

<table>
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<tr>
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<tbody>
<tr>
<td></td>
<td>Base Support</td>
<td>CPU Measurement Facility (hops)</td>
<td>FICON Express 1.6+</td>
</tr>
<tr>
<td>z/OS V2.1s</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>z/OS 2.2</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>z/OS 2.3</td>
<td>P</td>
<td>P</td>
<td>P</td>
</tr>
<tr>
<td>z/OS 2.4</td>
<td>Y</td>
<td>P</td>
<td>Y</td>
</tr>
</tbody>
</table>

Notes:
- S IBM Software Support Services required for extended support of z/OS 2.1
- P PTF is required, use SMP/E FIXCAT for identification
- Y Support is in the base
- D1 Requires the ICSF web deliverable for FMID HCR77D1 minimally
IBM LinuxONE III operating system support

- **z/OS**
  - As part of the GDPS Virtual Appliance with capacity setting 401

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

- **Linux on Z**
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IBM z15 Redbooks

- **IBM z15 Technical Introduction, SG24-8850-00**
  Last updated 9 Oct 2019
- **IBM z15 Technical Guide, SG24-8851-00**
  Last updated 3 Oct 2019
- **IBM Z Connectivity Handbook, SG24-5444-20**
  Last updated 11 Sep 2019
- **IBM Z Functional Matrix, REDP-5157-05**
  Last updated 11 Sep 2019
- **IBM z15 (8561) Configuration Setup, SG24-8860-00**
  Last updated 22 Sep 2019
- **Introducing IBM Z System Recovery Boost, REDP-5563-00**
  Last updated 22 Sep 2019
### Take the next step forward with IBM z15

<table>
<thead>
<tr>
<th>Service Level Excellence</th>
<th>Data Protection and Privacy</th>
<th>Mission Critical Cloud</th>
</tr>
</thead>
<tbody>
<tr>
<td>Industry’s highest level of business uptime to meet SLA and regulatory compliance</td>
<td>Industry-first solution to protect sensitive data across your multicloud</td>
<td>Integrate seamlessly into hybrid multicloud, blockchain and AI</td>
</tr>
</tbody>
</table>

### Standardized and Flexible for the Cloud Data Center

*Modular, scalable and proven cloud-ready infrastructure*
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Senior IT Consultant  

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