IBM z13 Hardware Innovation

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NA-Mid-Atlantic Client Technical Specialist-z Systems
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<table>
<thead>
<tr>
<th>Trademark</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BladeCenter*</td>
<td>DSFSM</td>
</tr>
<tr>
<td>BlueMix</td>
<td>DFSMSdfp</td>
</tr>
<tr>
<td>CICS*</td>
<td>ECKD</td>
</tr>
<tr>
<td>COGNOS*</td>
<td>FlashSystem</td>
</tr>
<tr>
<td>DB2*</td>
<td>FICON*</td>
</tr>
<tr>
<td>DS8000*</td>
<td>GDPS*</td>
</tr>
<tr>
<td>Easy Tier*</td>
<td>HiperSockets</td>
</tr>
<tr>
<td>DFSMS</td>
<td>hyperSwap</td>
</tr>
<tr>
<td>DFSMSshm</td>
<td>IBM*</td>
</tr>
<tr>
<td>DFSMSdss</td>
<td>IBM (logo)*</td>
</tr>
<tr>
<td>GDPS*</td>
<td>Infiband*</td>
</tr>
<tr>
<td>IMS</td>
<td>LinkedIn</td>
</tr>
<tr>
<td>System Storage*</td>
<td>Tivoli*</td>
</tr>
<tr>
<td>z/OS*</td>
<td>z Systems</td>
</tr>
<tr>
<td>z/VM*</td>
<td>z/VSE*</td>
</tr>
</tbody>
</table>

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• Notes:
• Performance is in Internal Throughput Rate (ITR) ratio based on measurements and projections using standard IBM benchmarks in a controlled environment. The actual throughput that any user will experience will vary depending upon considerations such as the amount of multiprogramming in the user's job stream, the I/O configuration, the storage configuration, and the workload processed. Therefore, no assurance can be given that an individual user will achieve throughput improvements equivalent to the performance ratios stated here.
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IBM z13 platform positioning

Platform Core Capabilities:

• Transaction Processing
• Data Serving
• Mixed Workloads
• Operational Efficiency
• Trusted and Secure Computing
• Reliable, Available, Resilient
• Virtually Limitless Scale

• The world’s premier transaction and data engine now enabled for the mobile generation

• The integrated transaction and analytics system for right-time insights at the point of impact

• The world’s most efficient and trusted cloud system that transforms the economics of IT
Introducing the IBM z13 for digital business

- **Performance and scale helping improve client experience**
  - 141 configurable cores
  - Larger cache for improved data serving
  - New SIMD vector facility for faster mathematical computation
  - Up to 10 TB memory to reduce latency (3X more than zEC12)
  - Simultaneous multithreading expand IFL and zIIP capacity
  - Industry leading resilient and intelligent I/O
  - Standalone zBX

- **Focused on enterprise Linux**
  - Extending Linux to wider audience with Linux/KVM on mainframe *
  - Continuous data availability for z/OS and Linux guests hosted by z/VM with new GDPS Appliance *
  - Faster diagnosis with IBM zAware now extended to Linux on z

- **Better Economics, Flexibility and Efficiency**
  - 40% more total capacity
  - 40% more logical partitions to host more cloud tenants (85 vs. 60)
  - 4x data access with zEDC

- **Trustful, reliable and secure for less risk**
  - Improved recovery time using zHPF
  - Insure protection and integrity with next generation cryptography
  - New PCIe based short range coupling links

**IBM z13: The trusted enterprise platform for integrating data, transactions and insight**

* All statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.
### IBM z Systems High End Generations

<table>
<thead>
<tr>
<th>Generation</th>
<th>Model</th>
<th>Key Features</th>
</tr>
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</table>
| N-4        | z9 Enterprise Class | • Announced 7/2005  
• Withdrawn 6/30/2010  
• Chip: 2 core, 1.7 GHz  
• Up to 54 client cores  
• CP, IFL, ICF, zAAP, zIIP  
• Single thread  
• zAAP-zIIP to CP ratio 1x1  
• Uni MIPS: 560  
• Max MIPS: 18,505  
• Max mem 512 GB - HSA  
• Max/LPAR: 512 GB - HSA  
• LCSS: 4, LPARs: 60  
• Subchannel Sets: 2/LCSS  
• Max I/O slots: 84  
• Max FICON channels: 336  
• Max FICON Express4 (GA2)  
• Max OSA Ports: 48  
• OSA-Express2  
• Coupling: ISC3, IFB, PSIFB: 12x SDR |

| N-3        | z10 Enterprise Class | • Announced 2/2008  
• Withdrawn 6/30/2012  
• Chip: 4 core, 4.4 GHz  
• Up to 64 client cores  
• CP, IFL, ICF, zAAP, zIIP  
• Single thread  
• zIIP-zAAP to CP ratio 1x1  
• Uni MIPS: 902  
• Max MIPS: 31,826  
• Max mem 1.5 TB  
• Max per LPAR: 1 TB  
• LCSS: 4, LPARs: 60  
• Subchannel Sets: 3/LCSS  
• Max I/O slots: 84  
• Max FICON channels: 336  
• FICON Express4  
• Max OSA Ports: 96  
• OSA-Express3  
• Crypto Express3 (GA3)  
• Coupling: ISC3, IFB, PSIFB: 12x DDR, 1x DDR  
• ASHRAE Class A1 |

| N-2        | zEnterprise 196 | • Announced 7/22/2010  
• Withdrawn 6/30/2014  
• Chip: 4 core, 5.2 GHz  
• Up to 80 client cores  
• CP, IFL, ICF, zAAP, zIIP  
• Single thread  
• zIIP-zAAP to CP ratio 1x1  
• Uni MIPS: 1,202  
• Max MIPS: 52,286  
• Max mem 3 TB (RAIM)  
• Max per LPAR: 1 TB  
• LCSS: 4, LPARs: 60  
• Subchannel Sets: 3/LCSS  
• Max I/O Slots: 160*  
• Max FICON channels: 320  
• FICON Express8S  
• Max OSA Ports: 96  
• OSA-Express4S (GA2)  
• Crypto Express4S  
• Coupling: ISC3  
• PSIFB: 12x DDR, 1x DDR  
• ASHRAE Class A1 |

| N-1        | zEnterprise EC12 | • Announced 8/28/2012  
• Chip: 6 core, 5.5 GHz  
• Up to 101 client cores  
• CP, IFL, ICF, zAAP, zIIP  
• Single thread  
• zIIP-zAAP to CP ratio 1x1  
• Uni MIPS: 1,514  
• Max MIPS: 78,426  
• Max mem 3 TB (RAIM)  
• Max per LPAR: 1 TB  
• LCSS: 4, LPARs: 60  
• Subchannel Sets: 3/LCSS  
• Max I/O Slots: 160*  
• Max FICON channels: 320  
• FICON Express8S  
• Max OSA Ports: 96  
• OSA-Express4S (GA2)  
• Crypto Express4S  
• Coupling: ISC3  
• PSIFB: 12x DDR, 1x DDR  
• ASHRAE Class A1  
• Native PCIe: zEDC, Flash Express  
• 10 GbE RoCE |

| N          | IBM z13 | • Announced 1Q2015  
• Chip: 8 core, 5.0 GHz  
• Up to 141 client cores  
• CP, IFL, ICF, zIIP  
• SMT: zIIP, IFL  
• zIIP to CP ratio 2x1  
• Uni MIPS: 1,695  
• Max MIPS: 111,556  
• Max mem: 10 TB (RAIM)  
• Max per LPAR: 10 TB  
• LCSS: 6, LPARs: 85  
• Subchannel Sets: 4/LCSS  
• Max I/O Slots: 160*  
• Max FICON Channels: 320  
• FICON Express16S  
• Max OSA Ports: 96  
• OSA-Express5S  
• Crypto Express5S  
• Coupling: PSIFB: 12x DDR, 1x DDR  
• ASHRAE Class A2  
• PCIe: Gen3 16 Gbps  
• Native PCIe: zEDC, Flash Express  
• 10GbE RoCE with SR-IOV |
z13 – Redesigned for the scale and speed of a mobile generation

- **141** cores and **40%** more capacity in a single system
- **2X** performance improvement with crypto coprocessors for more secure transactions
- **10 TB** memory plus **2X** increase in cache size
- **320** separate channels dedicated just to driving I/O throughput
- **16 Gbps** FICON links for faster throughput
- **Performance, scale, intelligent I/O, and security**
  - enhancements to support transaction growth in the mobile world
- **z/OS Connect** provides consolidated REST APIs for all z/OS transactions
- Seamlessly channel z/OS transactions to mobile devices with MobileFirst Platform
- IBM MobileFirst Platform for iOS specifically for iOS mobile apps
- Enable end to end security from mobile device to mainframe with z/OS, RACF® and MobileFirst products
z13 helping deliver insights at the point of impact

- IBM DB2 Analytics Accelerator further accelerates queries for faster insight
- SIMD delivers accelerated analytics processing for mathematical optimization
- zEDC reduces data transfer time and storage cost by up to 75%
- 16 Gbps FICON links reduce latency for workloads such as DB2
- zIIPs help to lower the cost of ownership helping to help connect, manage, extend, and protect data

- Mega-memory and new opportunities for in-memory computing
- New machine architecture boosts complex mathematical model performance
- Use Hadoop to explore z Systems within the secure zone of the mainframe
- Evolving support for new and innovative use cases, such as in-database transformation and advanced predictive analytics
z13 Redesigned for efficient and trusted cloud services

• Open support extended with OpenStack®, PostgreSQL, Node.js, and KVM*

• Enterprise-grade Linux provides the foundation for public, private, and hybrid cloud

• Patterns for Linux on z Systems to quickly build out complex cloud workload instances

• Improved overall system performance leads to a lower TCO compared to public cloud deployments and deployments on x86 architectures

• Enabling next generation cloud applications

• With IBM Bluemix™ on z Systems

• Up to 8,000 virtual servers per system, more than 50 per core

• Open virtualization with new KVM support *

• z13 brings faster processing and higher throughput of secure transactions (2X more throughput on crypto coprocessor)

• Business continuity and IT analytics with enterprise grade Linux solution

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Simultaneous Multithreading (SMT)

- Simultaneous multithreading allows instructions from one or two threads to execute on a zIIP or IFL processor core.
- SMT helps to address memory latency, resulting in an overall capacity* (throughput) improvement per core.
- Capacity improvement is variable depending on workload. For AVERAGE workloads the estimated capacity* of a z13:
  - zIIP is 38% greater than a zEC12 zIIP
  - IFL is 32% greater than a zEC12 IFL
  - zIIP is 72% greater than a z196 zIIP
  - IFL is 65% greater than a z196 IFL

- SMT exploitation: z/VM V6.3 + PTFs for IFLs and z/OS V2.1 + PTFs in an LPAR for zIIPs
- SMT can be turned on or off on an LPAR by LPAR basis by operating system parameters. z/OS can also do this dynamically with operator commands.

Notes:

1. SMT is designed to deliver better overall capacity (throughput) for many workloads. Thread performance (instruction execution rate for an individual thread) may be faster running in single thread mode.
2. Because SMT is not available for CPs, LSPR ratings do not include it.

*Capacity and performance ratios are based on measurements and projections using standard IBM benchmarks in a controlled environment. Actual throughput that any i 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.

Which approach is designed for the highest volume** of traffic? Which road is faster?

** Two lanes at 50 carry 25% more volume if traffic density per lane is equal
Designed for transaction processing and data serving

- Substantial economies of scale with *simultaneous multi-threading delivering more throughput* for Linux and zIIP-eligible workloads
  - Cognos® on Linux under z/VM® could see up to 60% increase in throughput with SMT on a z13 IFL

- Larger *caches to optimize* data serving environments
  - *Single Instruction Multiple Data (SIMD)* improves performance of complex mathematical models
  - Up to 2X *improved cryptographic performance* with enhanced Central Processor Assist for Cryptographic Functions (CPACF)

- *Compress more data* helping to save disk space and cut data transfer time with improved *on chip hardware compression*

- Better and faster memory management and execution time with new hardware instructions and functional facilities to optimize compilers

- New *8-core* Processor Design in *22nm Silicon Technology* with wider instruction pipeline

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1 Results are based on internal lab measurements on a 4-core configuration on a single Linux guest running under z/VM and accessing DB2 on z/OS. Results may vary significantly depending on the workload and other factors.
More memory makes a difference

- Enable totally new types of applications
  - Perform faster table scans with in memory data for faster response time; reduce CPU by avoiding IO, make possible new types of analysis
- Accommodate growing workloads without changes to applications to gain benefits
  - Run sorts using large memory to improve elapsed times
  - Keep the entire Cognos Dynamic Cubes end-to-end application online for faster decision making
- Support modern memory heavy computing languages and architectures
  - Larger Java® heaps without an increase in paging
  - Improves IBM MQSeries® V8 ability to manage increasing messaging volumes generated by today's mobile and cloud applications
- Reduce need to fine tune memory and leverage the tuning capabilities in DB2®, IMS™ and CICS®

**NEW**

DB2 Buffer Pool simulator tool available as a DB2 (V11) deliverable. Provides an accurate benefit estimation of increasing buffer pool size for DB2.
Trusted, secure and available

- **Securely transfer more data across the internet** with performance enhanced CPACF and next generation Crypto Express5S
- Extend *enhanced public key support for constrained digital environments* using hardware accelerated Elliptic Curve Cryptography (ECC) helping applications like Chrome, Firefox, and Apple’s iMessage
- Avoid reformatting of databases with new exploitation of VISA *format preserving encryption* (VFPE) for credit card numbers
- **Continuous Availability and Disaster Recovery functions for Linux** on IBM z Systems™ and z/VM customers with new GDPS virtual appliance*
- IBM zAware extended to Linux on z to increase availability by *detecting unusual application or system behaviors* for faster problem resolution
- IBM intends to support the use of cryptography algorithms and equipment from selected providers in conjunction with z Systems in specific countries

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Resilient and intelligent I/O

- New FICON Express16S links reduce latency for workloads such as DB2

- Reduce up to 43% of DB2 write operations with IBM zHyperWrite—technology for DS8000® and z/OS for Metro Mirror environment

- First system to use a standards based approach for enabling Forward Error Correction for a complete end to end solution

- Clients with multi-site configurations can expect I/O service time improvement when writing data remotely which can benefit GDPS or TPC-R HyperSwap®

- Extend z/OS workload management policies into SAN fabric to manage the network congestion
- New Easy Tier® API removes requirement from
  - application/administrator to manage
  - hardware resources performance for mission

- Optimized for enterprise-scale data from multiple platforms and devices

IBM
Flexible connectivity

*Enhanced interoperability across platforms, improved configuration flexibility, reduced cost of data center infrastructure*

- **Clustering for availability**
  - New PCIe short range link
  - InfiniBand® Coupling Links – 1x and 12x
  - STP enhanced user interface

- **Controlled and simplified management**
  - IBM zAware V2.0 analytics to improve problem resolution – New Linux for z support
  - Rack mounted Hardware Management Console (HMC)
  - Central management of heterogeneous resources with zManager
  - Connectivity of IBM z BladeCenter® Extension (zBX) for Hybrid Computing:
    - Intraensemble data network

- **Efficient data access**
  - New zHPF – Extended Distance II
  - zEDC Express
  - Flash Express
  - New FICON Express16S
  - FICON Express8S
  - Carry forward only - FICON Express8

- **Linking up to Speed Up**
  - 10GbE RoCE Express
  - OSA-Express5S
  - HiperSocket™ - “network in a box”
  - Carry forward only - OSA-Express4S

*Improved I/O Backbone to drive transaction throughput 50-80% more bandwidth per*
Continuing to deliver technologies that can transform your business

• **Applications and Economics**
  Specialty engines expand the use of the mainframe and can help to lower the cost of ownership

• **Communicating**
  Optimize communications using **10 GbE RoCE Express** to reduce latency and CPU resource consumption for FTP file transfers, CICS workloads and WAS

• **Availability**
  Use **Flash Express** and see up to 10x faster response time and 37% increase in throughput compared to disk for morning transition

• **Resiliency**
  Use IT analytics to reduce service disruptions with **IBM zAware V2.0** for z/OS and Linux on z Systems

• **Secure, active data**
  Shorten encryption time with **zEDC Express** hardware compression and IBM Encryption Facility for z/OS
Specialty engines expand the use of the mainframe
While lowering the cost of ownership

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

**IFLs and Enterprise Linux Server**

- Special engine dedicated to **Linux workloads** on z Systems servers
- **IT optimization and cloud computing** can deliver enhanced economics
- Attractively priced and supported by the z/VM virtualization, the IBM Wave virtualization management and the Linux operating system

**Coupling Facility**

- CF allows multiple processors to access the same data
- New with z13 is support for 256 CHPIDs (2X available on zEC12)
- **New PCIe** based short range coupling links

*zIIP and IFLs get throughput increase with simultaneous multithreading*

* Supports 2:1 ratio for zIIP to CP
z13 Data center planning and service updates

- Improved scaling, reliability and simplicity with **new modular CPC drawer**
- **Enhanced integrated sparing** designed to reduce the complexity and number of repair actions
- Save space in the data center with optional 1U **rack-mounted** Hardware Management Console (HMC)
- A new renewable, custom-engineered cushion used for shipping --- completely compostable with less waste
- Gain flexible possibilities for the data center with **non-raised-floor option**, overhead power and cabling
- **Managing energy** usage in the data center – using air cooling with radiator-based system, optional water cooling or optional HV DC power
Protecting your investment in z Systems technology

- Designed to protect your investment
  - Offering upgrades from zEC12 and z196 to the z13
  - Upgrades from zBX Model 002 and zBX Model 003 to zBX Model 004

- Full upgradeability within the z13 family
  - Upgrade to Model NE1 will require a planned outage

- On demand offerings offer temporary or permanent growth when you need it
## Operating Systems focused on exploiting hardware innovation

<table>
<thead>
<tr>
<th>Operating System</th>
<th>Features</th>
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<tbody>
<tr>
<td><strong>z/OS</strong>&lt;br&gt;Version 2.1</td>
<td>- Improved price performance for zIIP workloads with SMT&lt;br&gt;- Support new analytics workloads with SIMD&lt;br&gt;- New crypto capabilities for faster encryption&lt;br&gt;- Large memory to improve performance and enable new applications</td>
</tr>
<tr>
<td><strong>z/VM</strong>&lt;br&gt;Version 6.3</td>
<td>- Improved price performance with simultaneous multithreading technology support for twice as many processors&lt;br&gt;- Improved systems management and economics&lt;br&gt;- Embracing Open Standards and Open Source Interoperability&lt;br&gt;- Supports more virtual servers than any other platform in a single footprint</td>
</tr>
<tr>
<td><strong>z/VSE</strong>&lt;br&gt;Version 5.1</td>
<td>- Reduced risk of access from unauthorized users&lt;br&gt;- Reduced memory constraints&lt;br&gt;- Wide portfolio using Linux on z&lt;br&gt;- Continued system usability enhancements with CICS Explorer&lt;br&gt;- More efficient communications</td>
</tr>
<tr>
<td><strong>Linux on z Systems</strong></td>
<td>- Multithreading allows for per core software savings&lt;br&gt;- Ability to host and manage more workloads efficiently and cost-effectively&lt;br&gt;- Automatic identification of unusual messages&lt;br&gt;- Integrated continuous availability &amp; disaster recovery solution</td>
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**IBM.**
Operating System Support for z13

- Currency is key to operating system support and exploitation of future servers
- The following releases of operating systems will be supported on z13
  (Please refer to PSP buckets for any required maintenance):

<table>
<thead>
<tr>
<th>Operating System</th>
<th>Supported levels</th>
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| z/OS                   | ▪ z/OS V2.1 with PTFs (Exploitation)  
                        ▪ z/OS V1.13 with PTFs (Limited Exploitation)  
                        ▪ z/OS V1.12* with PTFs (End of service support 9/30/2014) |
| Linux on z Systems     | ▪ SUSE SLES 11 (Later releases: GA support TBD by SUSE.)  
                        ▪ Red Hat RHEL 6 and 7 (Later releases: GA support TBD by Red Hat.) |
| z/VM                   | ▪ z/VM V6.3 with PTFs – Exploitation support  
                        ▪ z/VM V6.2 with PTFs – Compatibility plus Crypto Express5S support |
| z/VSE                  | ▪ z/VSE V5.2 with PTFs – Compatibility plus Crypto Express5S (up to 85 LPARs)  
                        ▪ z/VSE V5.1 with PTFs – Compatibility |
| z/TPF                  | ▪ z/TPF V1.1 – Compatibility |

**Note:**
- * z/OS V1.12 will run on z13 provided the customer has IBM Software Support Services to get the PTFs
- Beginning with z/OS V1.12, IBM Software Support Services replaces the IBM Lifecycle Extension for z/OS offering for extended support coverage for z/OS. The TSS Service Extension for z/OS is a fee-based Defect support (a fix, bypass, or restriction to a problem) for users who have not completed their migration to a newer z/OS release.
- Service extension support for z/OS V1.12 is provided for up to three years, beginning October 1, 2014 and available through September 30, 2017.
- Going forward, when support for a z/OS release is withdrawn, IBM Software Support Services intends to provide service extension support for the given z/OS release for up to three years. The intention is to provide an accommodation where additional time is needed to migrate to a newer z/OS release within the service support period. This does not alter the z/OS coexistence, migration, fallback, or service policy.
Extending Business Continuity to Linux on z Systems
GDPS Virtual Appliance for Linux on z clients (SOD)*

- Fully integrated Continuous Availability and Disaster Recovery solution for Linux on z Systems
- GDPS helps customers avoid outages both planned, and unplanned due to single component failures or whole site failures
- Self contained and pre-configured virtual machine image
  Contains an operating environment (little or no z/OS skills required), GDPS/PPRC, Tivoli® NetView® and Systems Automation**, an appliance management layer, and APIs / UIs for customization, administration, and operation tailored to the appliance function
- Improves both consumability and time-to-value for customers

GDPS/PPRC is capable of providing:
- Near continuous disk availability
- Highly automated D/R solution
- Recovery Time Objective less than an hour
- Recovery Point Objective of zero
- Protection against localized area disasters

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** The z/OS and Tivoli products are available only for GDPS Virtual Appliance use only
IBM zAware V2.0 delivers smarter message monitoring
*IT analytics to reduce service disruptions*

- Leading-edge pattern recognition can intercept application and system problems before they cause future disruptions
- Real-time, self-learning solution accurately represents your environment – automatically

**Typical Client Use Cases:**

- Diagnose complex problems **quickly** and restore service **faster**
- Extended to **Linux on z Systems** for enhanced management
- **Accelerate problem determination** across IT functions
  - Real-time, self-learning solution accurately represents your environment – **automatically**

• Difficult or unusual z/OS problems can be found in
  - **2 clicks**
  - **not hours**

• Same **GUI** used for monitoring z/OS or Linux on z Systems

• **Tivoli® NetView for z/OS** and **Tivoli OMEGAMON® XE** *
  can be used for automation and situation handling

• IBM zAware provides APIs to allow consumption by IBM and ISV products
zEnterprise Data Compression (zEDC)
*Helps you keep more active data*

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

**Typical Client Use Cases:**
- **Disk savings** with improved utilization of storage tiers with DFSMSdss™ use of compression
- **Compression for sequential files** with less CPU costs
- **Shorten encryption time** with hardware compression and IBM Encryption Facility for z/OS
- **Fast, secured data transfer across the enterprise** with IBM Sterling Connect:Direct for z/OS Standard Edition V5.2
- **Transparent acceleration** of Java compressed applications

* Measurements for comparisons were completed as part of a formal performance evaluation on a dedicated, isolated test system.
** These results are based on projections and measurements completed in a controlled environment. Results may vary by customer based on individual workload, configuration and software levels.
*** Exploited through standard Java APIs java.util.zip in the latest releases of Java 7.0.0 and Java V7R1
**** Achieve up to up 80% reduction in elapsed time for z/OS to z/OS file transfers with minimal CPU increase. Results vary by data set type and characteristics of the data.
Flash Express cuts away at availability lapses
Smarter availability for critical processing times

- Integrated in storage hierarchy to provide **higher levels of availability and performance**
- Slashes latency for critical application processing such as **diagnostics collection**

**Typical Client Use Cases:**
- **Improve availability and performance** during workload transition and spikes
- **Faster, less disruptive** diagnostics with faster first failure data capture time
- **Less paging** with use of pageable large pages for Java or DB2
- **Cost effective, resilient solution** for overflow of MQ shared queues in Coupling Facility

<table>
<thead>
<tr>
<th>SVC dump elapsed time</th>
<th>~25% less than with DASD</th>
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<tbody>
<tr>
<td>10x faster response time and 37% increase in throughput compared to disk for morning transition</td>
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<tr>
<td>28% improvement in DB2 throughput leveraging Flash Express with Pageable Large Pages (PLP)</td>
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<tr>
<td>19% reduction in total dump time for 36 GB standalone dump</td>
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</table>
Optimize server to server networking transparently
Exploitation of RDMA over Converged Ethernet (RoCE)

- Designed to take advantage of high speed protocols and direct memory placement of data for faster communications
- Can be used for cross server and internal communications

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

*New tool called SMC-AT is available to assist in gaining additional insight into the applicability of SMC-R for your environment*

- **Up to 50%** CPU savings for FTP file transfers across z/OS systems versus standard TCP/IP *
- **Up to 48%** reduction in response time and
- **10%** CPU savings for a sample CICS® workload exploiting IPIC using SMC-R versus TCP/IP **
- **Up to 40%** reduction in overall transaction response time for WAS workload accessing z/OS DB2® ***
- **Up to 3X** increase in WebSphere® MQ messages delivered across z/OS systems ****

* Based on internal IBM benchmarks in a controlled environment using z/OS V2R1 Communications Server FTP client and FTP server, transferring a 1.2GB binary file using SMC-R (10GbE RoCE Express feature) vs. standard TCP/IP (10GbE OSA Express4 feature). The actual CPU savings any user will experience may vary.
** ** Based on internal IBM benchmarks using a modeled CICS workload driving a CICS transaction that performs 5 DPL (Distributed Program Link) calls to a CICS region on a remote z/OS system via CICS IP interconnectivity (IPIC), using 32K input/output containers. Response times and CPU savings measured on z/OS system initiating the DPL calls. The actual response times and CPU savings any user will experience will vary.
*** Based on projections and measurements completed in a controlled environment. Results may vary by customer based on individual workload, configuration and software levels.
**** Based on internal IBM benchmarks using a modeled WebSphere MQ for z/OS workload driving non-persistent messages across z/OS systems in a request/response pattern. The benchmarks included various data sizes and number of channel pairs. The actual throughput and CPU savings users will experience may vary based on the user workload and configuration.
Performance delivered through multiple dimensions

- 40% more total capacity
- 2X performance boost for cryptographic coprocessors
- 50-80% more bandwidth per I/O domain
- 2X increase in channel speed
- 3X increase in memory
- 2X increase in cache

• Lower cloud cost
• Faster fraud detection
• More scale for mobile transactions
• Faster data sharing between systems
• Less exposure to regulatory penalties
• Faster decision making with data-in-memory
The superscalar design allows the z13 to deliver a record level of capacity over the prior IBM z Systems

<table>
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<tr>
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<th>zEC12</th>
<th>z196</th>
<th>I/O</th>
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<tbody>
<tr>
<td></td>
<td>• More than <strong>111,000</strong> millions of instructions per second (MIPS) compared to 78,426 MIPS on the largest zEC12</td>
<td>• More than <strong>111,000</strong> millions of instructions per second (MIPS) compared to 52,286 MIPS on the largest z196</td>
<td>• Using FICON Express16S on a z13, large data transfer I/O operations with zHPF (reads + writes) can achieve 2600 MB/sec a <strong>63%</strong> increase in throughput over FICON Express8S on a zEC12.¹</td>
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<td>• z13 delivers up to <strong>40%</strong> more total z/OS processing capacity than the zEC12.</td>
<td>• z13 delivers up to <strong>110%</strong> more total z/OS processing capacity than the z196.</td>
<td>• Using FICON Express16S on a z13, large data transfer I/O operations with FCP (reads + writes) can achieve 2560 MB/sec a <strong>60%</strong> increase in throughput over FICON Express8S on a zEC12.¹</td>
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<td>• The z13 delivers up to <strong>10%</strong> more capacity for z/OS per core compared to the zEC12.</td>
<td>• The z13 delivers up to <strong>38%</strong> more capacity for z/OS per core compared to the z196.</td>
<td>• Clients using multi-site business continuity solutions can experience improved I/O service times when writing data remotely allowing them to achieve service level agreements after a disaster or storage control unit failure causes a TPC-R or GDPS HyperSwap event to occur.</td>
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<td>• zIIPs have an average capacity improvement of <strong>38%</strong> performance improvement compared to zEC12</td>
<td>• zIIPs have an average capacity improvement of <strong>72%</strong> performance improvement compared to z196.</td>
<td>• 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.</td>
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<td>• IFLs have an average capacity improvement of <strong>32%</strong> performance improvement compared to zEC12</td>
<td>• IFLs have an average capacity improvement of <strong>65%</strong> performance improvement compared to z196.</td>
<td>•... or twice the performance improvement] more performance improvement over CPACF on the zEC12. Hashing functions in CPACF will deliver up to <strong>250%</strong> more performance improvement over zEC12.</td>
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<td></td>
<td>• The Central Processor Assist for Cryptographic Function (CPACF) has been optimized to deliver <strong>100%</strong> performance improvement [...or twice the performance improvement] over CPACF on the zEC12.</td>
<td>• The Central Processor Assist for Cryptographic Function (CPACF) has been optimized to deliver <strong>100%</strong> performance improvement over CPACF on the z196. Hashing functions in CPACF will deliver up to <strong>250%</strong> more performance improvement over zEC12.</td>
<td>**...or twice the performance improvement] over CPACF on the zEC12. Hashing functions in CPACF will deliver up to <strong>250%</strong> more performance improvement over zEC12.</td>
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<td>• Technology Update Pricing delivers on average <strong>5%</strong> savings on MLC costs</td>
<td>• Technology Update Pricing delivering on average <strong>10%</strong> savings on MLC costs</td>
<td><em>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.</em></td>
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THANK YOU