IBM System z10 Enterprise Class

Technical Overview

February 26, 2008 Announcement
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IBM System z10 EC Announcement
IBM System z: System Design Comparison

System I/O Bandwidth

Balanced System CPU, nWay, Memory, I/O Bandwidth*

Memory

1.5 TB**

ITR for 1-way

~920

~600

~920

512 GB

256 GB

64 GB

300

450

288 GB/sec*

172.8 GB/sec*

96 GB/sec

24 GB/sec

16-way

32-way

54-way

64-way

Processors

*Servers exploit a subset of its designed I/O capability

** Up to 1 TB per LPAR

*1-way

z10 EC

z9 EC

zSeries 990

zSeries 900

IBM Systems
z10 EC Overview

- **Machine Type**
  - 2097

- **5 Models**
  - E12, E26, E40, E56 and E64

- **Processor Units (PUs)**
  - 17 (17 and 20 for Model E64) PU cores per book
  - Up to 11 SAPs per system, standard
  - 2 spares designated per system
  - Dependant on the H/W model - up to 12, 26, 40, 56 or 64 PU cores available for characterization
    - Central Processors (CPs), Integrated Facility for Linux (IFLs), Internal Coupling Facility (ICFs), System z10 Application Assist Processors (zAAPs), System z10 Integrated Information Processor (zIIP), optional - additional System Assist Processors (SAPs)

- **Memory**
  - System Minimum of 16 GB
  - Up to 384 GB per book
  - Up to 1.5 TB GB for System and up to 1 TB per LPAR
    - Fixed HSA, standard
    - 16/32/48/64 GB increments

- **I/O**
  - Up to 48 I/O Interconnects per System @ 6 GBps each
  - Up to 4 Logical Channel Subsystems (LCSSs)

- **ETR Feature, standard**
### z10 EC New Functions and Features (February 2008)

<table>
<thead>
<tr>
<th>New Functions</th>
</tr>
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<tbody>
<tr>
<td>Five hardware models</td>
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<tr>
<td>Faster Uni Processor</td>
</tr>
<tr>
<td>Up to 64 customer PUs</td>
</tr>
<tr>
<td>36 CP Subcapacity Settings</td>
</tr>
<tr>
<td>Star Book Interconnect</td>
</tr>
<tr>
<td>Up to 1.5 TB memory</td>
</tr>
<tr>
<td>Fixed HSA as standard</td>
</tr>
<tr>
<td>Large Page Support (1 MB)</td>
</tr>
<tr>
<td>HiperDispatch</td>
</tr>
<tr>
<td>Enhanced CPACF SHA 512, AES 192 and 256-bit keys</td>
</tr>
<tr>
<td>Hardware Decimal Floating Point</td>
</tr>
<tr>
<td>New Capacity on Demand architecture and enhancements</td>
</tr>
<tr>
<td>6.0 GBps InfiniBand HCA to I/O interconnect</td>
</tr>
<tr>
<td>FCP Performance Improvement</td>
</tr>
<tr>
<td>SCSI IPL included in Base LIC</td>
</tr>
<tr>
<td>OSA-Express3 10 GbE (2Q08)*</td>
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<tr>
<td>HiperSockets Multi Write Facility enhancements</td>
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<tr>
<td>InfiniBand Coupling Links (2Q08)*</td>
</tr>
<tr>
<td>STP using InfiniBand (2Q08)*</td>
</tr>
<tr>
<td>Capacity Provisioning Support</td>
</tr>
<tr>
<td>Scheduled Outage Reduction</td>
</tr>
<tr>
<td>Improved RAS</td>
</tr>
<tr>
<td>FICON LX Fiber Quick Connect</td>
</tr>
<tr>
<td>Power Monitoring support</td>
</tr>
</tbody>
</table>

* SOD: InfiniBand Coupling Links for z9 EC & BC for non-dedicated CF Models*

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No support for Japanese Compatibility Mode (JCM)
No support for MVS™ Assist instructions

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*z10TLLB_06*
z10 EC – Under the covers (Model E56 or E64)

Internal Batteries (optional)
Power Supplies
2 x Support Elements
3x I/O cages
Fiber Quick Connect (FQC) Feature (optional)

Processor Books, Memory, MBA and HCA cards
Ethernet cables for internal System LAN connecting Flexible Service Processor (FSP) cage controller cards
InfiniBand I/O Interconnects
2 x Cooling Units
FICON & ESCON FQC
IBM System z10 EC Processor and Memory Structure
z10 EC Chip Relationship to POWER6™

- **New Enterprise Quad Core z10 EC processor chip**
- **Siblings, not identical twins**
- **Share lots of DNA**
  - IBM 65nm Silicon-On-Insulator (SOI) technology
  - Design building blocks:
    - Latches, SRAMs, regfiles, dataflow elements
  - Large portions of Fixed Point Unit (FXU), Binary Floating-point Unit (BFU), Hardware Decimal Floating-point Unit (HDFU), Memory Controller (MC), I/O Bus Controller (GX)
  - Core pipeline design style
    - High-frequency, low-latency, mostly-in-order
  - Many System z and System p designers and engineers working together

- **Different personalities**
  - Very different Instruction Set Architectures (ISAs)
    - very different cores
  - Cache hierarchy and coherency model
  - SMP topology and protocol
  - Chip organization
  - IBM z10 EC Chip optimized for Enterprise Data Serving Hub
**z10 EC Architecture**

- Continues line of upward-compatible mainframe processors
- **Rich CISC Instruction Set Architecture (ISA)**
  - 894 instructions (668 implemented entirely in hardware)
  - 24, 31, and 64-bit addressing modes
  - Multiple address spaces robust inter-process security
  - Multiple arithmetic formats
  - Industry-leading virtualization support
    - High-performance logical partitioning via PR/SM
    - Fine-grained virtualization via z/VM scales to 1000’s of images
  - Precise, model-independent definition of hardware/software interface
- **Architectural extensions for IBM z10 EC**
  - 50+ instructions added to improve compiled code efficiency
  - Enablement for software/hardware cache optimization
  - Support for 1MB page frames
  - Full hardware support for Hardware Decimal Floating-point Unit (HDFU)
z10 EC – Enterprise Quad Core z10 PU Chip

- **Up to Four cores per PU**
  - 4.4 GHz
  - L1 cache/PU core
    - 64 KB I-cache
    - 128 KB D-cache
  - 3MB L1.5 cache/PU core
  - Each core with its own Hardware Decimal Floating Point Unit (HDFU)

- **Two Co-processors (COP)**
  - Accelerator engines
    - Data compression
    - Cryptographic functions
  - Includes 16KB cache
  - Shared by two cores

- **L2 Cache interface**
  - Shared by all four cores
  - Even/odd line (256B) split

- **I/O Bus Controller (GX)**
  - Interface to Host Channel Adapter (HCA)
  - Compatible with System z9 MBA

- **Memory Controller (MC)**
  - Interface to controller on memory DIMMs
z10 EC Compression and Cryptography Accelerator

- **Data compression engine**
  - Static dictionary compression and expansion
  - Dictionary size up to 64KB (8K entries)
    - Local 16KB caches for dictionary data

- **CP Assist for Cryptographic Function (CPACF)**
  - DES (DEA, TDEA2, TDEA3)
  - SHA-1 (160 bit)
  - SHA-2 (224, 256, 384, 512 bit)
  - AES (128, 192, 256 bit)
  - PRNG

- **Accelerator unit shared by 2 cores**
  - Independent compression engines
  - Shared cryptography engines
z10 EC Hardware Decimal Floating Point Accelerator

- Meets requirements of business and human-centric applications
  - Performance, Precision, Function
  - Avoids rounding and other problems with binary/decimal conversions
  - Improved numeric functionality over legacy Binary Coded Decimal (BCD) operations
  - Much of commercial computing is dominated by decimal data and decimal operations

- IBM z10 EC Hardware Decimal Floating Point Unit co-developed (HDFU) with POWER6
  - Common architecture operations and semantics
  - Common dataflow elements
  - Mainframe legacy Binary Coded Decimal (BCD) operations mapped onto HDFU in z10 EC

- Growing industry support for DFP standardization
  - Java BigDecimal, C#, XML, XL C/C++, GCC, DB2 9, Enterprise PL/1, Assembler
  - Endorsed by key software vendors including Microsoft® and SAP
  - Open standard definition led by IBM
Evolution of System z Specialty Engines

Building on a strong track record of technology innovation with specialty engines – DB Compression, SORT, Encryption, Vector Facility

Eligible for zIIP:
- DB2 remote access and BI/DW
- ISVs
- New! IPSec encryption
- z/OS XML
- z/OS Global Mirror*

Eligible for zAAP:
- Java execution environment
- z/OS XML

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* SOD: IBM plans to enhance z/VM in a future release to support the new System z10 EC capability to allow any combination of CP, zIIP, zAAP, IFL, and ICF processor-types to reside in the same z/VM LPAR
zIIP Assisted z/OS Global Mirror (zGM): a cost effective mirroring solution

- z/OS Global Mirror (formally Extended Remote Copy, XRC) is enabled for the zIIP
  - z/OS DFSMS allows System Data Mover (SDM) processing to be eligible for the zIIPs
  - Most SDM processing associated with zGM/XRC is made eligible to run on the zIIP
- zIIP assisted z/OS Global Mirror function, can help provide better price performance and improved utilization of resources at the mirrored site.
  - DFSMS SDM processing is redirected to a zIIP processor which can lower system utilization at the mirrored site.

- Available with:
  - z/OS V1.10 (when available), or z/OS V1.9 and V1.8 with PTF for APAR #OA23174 (March, 2008)
  - IBM System Storage DS8000, or any storage controller supporting DFSMS SDM

Planned** GA March 2008

* For illustrative purposes only, your results will vary.

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z10 EC Book Layout – Under the covers

Note: Chart shows an example of how and where different fanouts are installed. The quantities installed will depend on the actual I/O configuration.
z9 EC vs z10 EC CEC Structure

<table>
<thead>
<tr>
<th></th>
<th>z9 EC</th>
<th>z10 EC</th>
</tr>
</thead>
<tbody>
<tr>
<td>SMP Configuration</td>
<td>4 books, 64 PU cores</td>
<td>4 books, 77 PU cores</td>
</tr>
<tr>
<td>Topology</td>
<td>Dual Ring</td>
<td>Fully Connected</td>
</tr>
<tr>
<td>Jumper Books</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Max Memory</td>
<td>512GB</td>
<td>1.5TB</td>
</tr>
<tr>
<td>Cache Levels</td>
<td>L1, L2</td>
<td>L1, L1.5, L2</td>
</tr>
</tbody>
</table>

64 PU core System

77 PU core System

SMP Configuration: 4 books, 64 PU cores; 4 books, 77 PU cores
Topology: Dual Ring vs Fully Connected
Jumper Books: Yes vs No
Max Memory: 512GB vs 1.5TB
Cache Levels: L1, L2 vs L1, L1.5, L2

Fully Connected Dual Ring Topology

Off-Book Interconnect
z10 EC – HSA considerations

- HSA of 16GB provided as standard
- The HSA has been designed to eliminate planning for HSA. Preplanning for HSA expansion for configurations will be eliminated as HCD/IOCP will, via the IOCDS process, always reserve:
  - 4 CSS’s
  - 15 LPs in each CSS (total of 60 LPs)
  - Subchannel set-0 with 63.75k devices in each CSS
  - Subchannel set-1 with 64k devices in each CSS
  - All the above are designed to be activated and used with dynamic I/O changes
Large Page Support

- **Issue:** Translation Lookaside Buffer (TLB) Coverage shrinking as % of memory size
  - Over the past few years application memory sizes have dramatically increased due to support for 64-bit addressing in both physical and virtual memory
  - TLB sizes have remained relatively small due to low access time requirements and hardware space limitations
  - TLB coverage today represents a much smaller fraction of an application’s working set size leading to a larger number of TLB misses
  - Applications can suffer a significant performance penalty resulting from an increased number of TLB misses as well as the increased cost of each TLB miss

- **Solution:** Increase TLB coverage without proportionally enlarging the TLB size by using large pages
  - Large Pages allow for a single TLB entry to fulfill many more address translations
  - Large Pages will provide exploiters with better TLB coverage

- **Benefit:**
  - Designed for better performance by decreasing the number of TLB misses that an application incurs
IBM System z10 EC Capacity and Performance
z10 EC LSPR Measurements

- **5 Workloads included in Mixed Workload Average**
  - CB-L: Commercial Batch
  - ODE-B*: Java Batch
  - OLTP-T: Traditional Online Transaction Processing
  - OLTP-W: Web fronted Online Transaction Processing
  - WASDB: WebSphere Database

- **Software Levels**
  - z/OS 1.8
  - WAS 6.1 and WAS 5.1
  - JDK 1.5
  - DB2 V9 and DB2 V8
  - CICS 3.1
  - IMS V9
  - COBOL 3.4
  - * New – replaces CB-J
z10 EC LSPR Performance – continued

- LSPR Mixed Workload Average with Multiple Images
- LSPR Workload Descriptions
- HiperDispatch (DA/VCM)
  - Only available on z10 EC
  - Combination of z/OS software and firmware
    - Minimum z/OS R1.7 + IBM zIIP Web Deliverable Support for z/OS V1.7 to enable HiperDispatch
    - z10 EC Driver level 73G
  - Included in LSPR numbers
    - White paper to be available concurrent with the announcement
  - Customer will need to turn this on to get the rated performance
    - Dynamic on/off
    - Could require reset of WLM goals
    - With HIPERDISPATCH=YES, IRD management of LPs is turned OFF
z10 EC Base and Sub-Capacity Offerings

- The z10 EC has 36 additional capacity settings at the low end
- Available on ANY H/W Model for 1 to 12 CPs. Models with 13 CPs have to be full capacity
- All CPs must be the same capacity within the z10 EC
- All specialty engines run at full capacity. The one for one entitlement to purchase one zAAP or one zIIP for each CP purchased is the same for CPs of any capacity.
- Only 12 CPs can have granular capacity, other PU cores must be CBU or characterized as specialty engines

CP Capacity Relative to Full Speed
7xx = 100%
6xx = 69.35%
5xx = 51.20%
4xx = 23.69%
xx = 01 Through 12

Sub Capacity Models
### z10 EC Capacity/Performance compared to z9 EC

<table>
<thead>
<tr>
<th>LSPR Mixed workload average, multi-image for z/OS 1.8 with HiperDispatch active on z10 EC!</th>
<th>z10 EC to z9 EC Ratios</th>
<th>z10 EC MIP Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uni-processor</td>
<td>1.62</td>
<td>920</td>
</tr>
<tr>
<td>16-way z10 EC to 16-way z9 EC</td>
<td>1.49</td>
<td>10,321</td>
</tr>
<tr>
<td>32-way z10 EC to 32-way z9 EC</td>
<td>1.49</td>
<td>17,931</td>
</tr>
<tr>
<td>56-way z10 EC to 54-way z9 EC</td>
<td>1.54</td>
<td>27,800</td>
</tr>
<tr>
<td>64-way z10 EC to 54-way z9 EC</td>
<td>1.70</td>
<td>30,657</td>
</tr>
</tbody>
</table>
IBM System z10 EC HiperDispatch
z10 EC HiperDispatch

- **HiperDispatch – z10 EC unique function**
  - Dispatcher Affinity (DA) - New z/OS Dispatcher
  - Vertical CPU Management (VCM) - New PR/SM Support

- **Mitigate impact of scaling differences between processor and memory**
  - Access to memory and remote caches not scaling with processor speed
  - Increased performance sensitivity to cache misses in multi-processor system

- **Optimize performance by redispersing units of work to same processor group**
  - Keep processes running near their cached instructions and data
  - Minimize transfers of data ownership among processors / books

- **Tight collaboration across entire z10 EC hardware/firmware/OS stack**
  - Concentrate logical processors around shared L2 caches
  - Communicate effective cache topology for partition to OS
  - Dynamically optimize allocation of logical processors and units of work
IBM System z10 EC I/O Structure
InfiniBand architecture

- [http://www.infinibandta.org/home](http://www.infinibandta.org/home)
- Key requirements: high-bandwidth and low latency
- InfiniBand Trade Association (IBTA) founded in 1999
- Steering committee members
  - IBM, Intel, Mellanox, QLOGIC, Sun, Cisco and Voltaire

- z10 Implementation uses the IBTA defined Link and Physical layers only for:
  - InfiniBand (IFB) for host bus (CEC to I/O domain)
  - Parallel Sysplex over InfiniBand (PSIFB)*

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z10 EC System z I/O Interface Evolution

**z9**

- Extended Link (CEC to IO Cage)
- eSTI (IBM)
- InfiniBand (IFB) (Based on Standards)

**z10 EC**

- IO Cage Backplane
- mSTI (IBM)
- mSTI (IBM)

- Coupling Link
- ICB-4/ISC-3 (IBM)
- InfiniBand Coupling Links (PSIFB) (Based on Standards)
I/O Subsystem host bus interconnect speeds in GBps

- **InfiniBand I/O Bus**
  - **z10 EC**
  - **2008**
  - Speed: 6 GBps

- **STI**
  - **z9 EC**
  - **2005**
  - Speed: 2.7 GBps

- **STI**
  - **z990**
  - **2003**
  - Speed: 2 GBps

**STI**: Self-Timed Interconnect

InfiniBand refers to: 12x IB-DDR for z10 EC and 12x IB-SDR for System z9
IBM System z

z10 EC I/O Infrastructure

1st level Copper Cables

2nd level Embedded

HCA-O or HCA-C fanout or MBA fanout for ICB-4

Note: 28 I/O cards per cage
IBM System z10 EC I/O Connectivity
FICON, OSA, ESCON and Coupling Links
z10 EC Channel Type and Crypto Overview

- **FICON/FCP**
  - FICON Express4
  - FICON Express2 *(carry forward on upgrade)*
  - FICON Express *(carry forward on upgrade for FCV)*

- **Networking**
  - OSA-Express3
    - 10 Gigabit Ethernet LR
  - OSA-Express2
    - 1000BASE-T Ethernet
    - Gigabit Ethernet LX and SX
    - 10 Gigabit Ethernet LR
  - HiperSockets *(Define only)*

- **ESCON**
- **STP**

- **Coupling Links**
  - InfiniBand Coupling Links *
  - ISC-3 *(Peer mode only)*
  - ICB-4 *(Not available on Model E64)*
  - IC *(Define only)*

- **Crypto**
  - Crypto Express2
    - Configurable Coprocessor or Accelerator

- **Channel types not supported:**
  - FICON *(pre-FICON Express)*
  - OSA-Express
  - ICB-2
  - ICB-3
  - ISC-3 Links in Compatibility Mode
  - PCIXCC and PCICA
  - Parallel *(use ESCON Converter)*

Note: ICB-4 cables are available as features.
All other cables are sourced separately.

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z10 EC FICON Express4

- **FICON Enhancements**
  - Improved performance at extended distance for FICON Express4 (and FICON Express2) features
- **1, 2, 4 Gbps auto-negotiated**
- **Up to 336 channels**
- **LX 10 km, LX 4 km, SX**
- **Concurrent repair of optics**
- **Personalize as:**
  - FC
    - Native FICON
    - Channel-To-Channel (CTC)
      - z/OS, z/VM, z/VSE, z/TPF, TPF, Linux on System z
  - FCP (Fibre Channel Protocol)
    - Support of SCSI devices
      - z/VM, z/VSE, Linux on System z
z10 EC FICON/FCP Enhancements

- **Extended Distance FICON (CHPID type FC) performance enhancements**
  - Enhancement to the industry standard FICON architecture (FC-SB-3)
    - Implements a new protocol for ‘persistent’ Information Unit (IU) pacing that can help to optimize link utilization
    - Requires supporting Control Unit(s) (e.g. DS8000 at new level)
  - Designed to improve performance at extended distance
    - May benefit z/OS Global Mirror (previously called XRC)
    - May simplify requirements for channel extension equipment
  - Transparent to operating systems
  - Applies to FICON Express4 and Express2 channels

- **Enhancements for Fibre Channel Protocol (FCP) performance**
  - Designed to support up to 80% more I/O operations per second for 4K block sizes with FICON Express4, compared to System z9
  - Transparent to operating systems
  - Applies to all FICON Express4 and Express2 channels (CHPID type FCP) communicating to SCSI devices
z/OS Global Mirror with DS8000 Extended Distance FICON

**DS8000 Extended Distance FICON**
- IBM System z10 and DS8000 now optimize the FICON pacing to increase the number of commands in flight
- Enables communication over greater distances without substantial reduction to effective data rate
- Supports increased link utilization
- Can significantly reduce the cost of remote mirroring over FICON for z/OS Global Mirror (XRC) solution
  - Eliminates need for more expensive 3rd party protocol-specific channel extender boxes

*Planned GA March 2008*

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OSA-Express3 – 10 GbE

- Double the port density
- Improved throughput
- 10 Gigabit Ethernet LR (Long Reach)
  - Two ports per feature
  - Small form factor connector (LC Duplex)
  - CHPID type OSD (QDIO)
  - Designed to Improve Performance for standard and jumbo frames
z10 EC HiperSockets Performance Enhancements

- **HiperSockets Multiple Write Facility**
  - Performance improvements
    - For the streaming of bulk data over a HiperSockets link between LPARs
    - Allows receiving LPARs to process a much larger amount of data per I/O interrupt
      - z/OS V1.10*
    - Transparent to software in receiving LPARs

- **HiperSockets Layer 2 support**
  - Hosting of new workloads
  - Host non-IP protocols (IPX, NetBIOS, SNA)
  - Bridge from and into distributed switched fabrics
  - Supports broadcast, unicast, or multicast
  - VLANs: In Layer 2 the same rules apply as for Layer 3 VLAN handling
    - Linux on System z
  - Layer 3 applications cannot communicate with Layer 2 applications
  - z/VM 5.2 or higher – Guest support

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z10 EC Coupling Link Options

- **PSIFB** - 12x IB-DDR for high speed communication at medium distance
  - New CHPID – CIB (Coupling using InfiniBand)
  - New 50 micron OM3 (2000 MHz-km) multimode fiber with MPO connectors
  - Up to 150m at 6 GBps

- **ICB-4 for short distances over copper cabling**
  - New ICB-4 cables are required
    - z10 EC to z10 EC and z10 EC to System z9/z990/z890
  - 10 meter distance remains

- **ISC-3 for extended distance over fiber optic cabling**
  - No change to current cabling

- **Internal Coupling channels (IC)**

*All statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.*
z10 EC Parallel Sysplex coexistence and coupling connectivity

**z9 EC**
- ISC-3, ICB-4
- Dedicated CF
- PSIFB, ISC-3, ICB-4

**z9 BC**
- ISC-3, ICB-4
- Dedicated CF
- PSIFB, ISC-3, ICB-4

**z9 EC**
- ISC-3, ICB-4
- ICB-4 2 GBps
- 12x IB-SDR 3 GBps
- Current
- PSIFB*

**z9 BC**
- ISC-3, ICB-4
- ICB-4 2 GBps
- 12x IB-SDR 3 GBps

**z10 EC**
- E64 no ICB-4
- ICB-4 2 GBps
- 12x IB-DDR 6 GBps
- 12x IB-SDR 3 GBps

**z890**
- ISC-3, ICB-4

**z990**
- ISC-3, ICB-4

**z800, z900**
- Not supported!

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z10 EC External Time Reference feature

- Connectivity to Sysplex Timer®
- Standard on z10 EC
- Resides in CEC cage
- Redundant features - 1 port each
- Uses MT-RJ connector
IBM System z10 EC Cryptography
z10 EC CP Assist for Cryptographic Functions (CPACF)

**Integrated Cryptographic Service Facility (ICSF)**

**Crypto Express2**

CP Assist for Cryptographic Function

**High performance clear key symmetric encryption/decryption**
z10 EC Cryptographic Support

- **CP Assist for Cryptographic Function (CPACF)**
  - Standard on every CP and IFL
  - Supports DES, TDES and SHA-1
  - Pseudo Random Number Generation (PRNG)
  - New to z10 EC
    - Advanced Encryption Standard (AES) - 192, 256
    - Secure Hash Algorithm (SHA) – 384 and 512

- **Crypto Express2**
  - Two configuration modes
    - Coprocessor (default)
      - Federal Information Processing Standard (FIPS) 140-2 Level 4 certified
    - Accelerator (configured from the HMC)
  - Three configuration options
    - Default set to Coprocessor
  - Concurrent Patch

- **Dynamic Add Crypto to LPAR**
  - No recycling of LPAR
  - No POR required

- **TKE workstation with 5.2 level of LIC**
  - Diskette read only ability - no writing to diskette
Certifications on System z

The Common Criteria program developed by NIST and NSA establishes an organizational and technical framework to evaluate the trustworthiness of IT Products and protection profiles.

**z/OS**
- Common Criteria EAL4+
  - with CAPP and LSPP
  - z/OS 1.7 + RACF
  - z/OS 1.8 + RACF
  - z/OS 1.9 + RACF, under evaluation

- **IdenTrust™ certification** for z/OS as a Digital Certificate Authority (PKI Services)

**z/VM**
- Common Criteria
  - z/VM 5.1 + RACF
  - EAL3+ with CAPP and LSPP
  - z/VM 5.3 + RACF with CAPP in evaluation for EAL4+

**Linux on System z**
- Common Criteria
  - SUSE LES9 and 10 certified at EAL4+ with CAPP
  - Red Hat EL4 EAL4+ with CAPP
  - Red Hat EL5 EAL4+ with CAPP and LSPP

Virtualization with partitions
- System z9 EC and z9 BC and other System z servers, z10 EC pending

- **Common Criteria** EAL5 for Logical partitions
- **FIPS 140-2 level 4** for Crypto Express 2

IBM System z10 EC Availability
System z – RAS Design Focus

- High Availability (HA)
  - The attribute of a system designed to provide service during defined periods, at acceptable or agreed upon levels and masks UNPLANNED OUTAGES from end-users. It employs Fault Tolerance; Automated Failure Detection, Recovery, Bypass Reconfiguration, Testing, Problem and Change Management

- Continuous Operations (CO)
  - Attribute of a system designed to continuously operate and mask PLANNED OUTAGES from end-users. It employs non-disruptive hardware and software changes, non-disruptive configuration, software coexistence

- Continuous Availability (CA)
  - Attribute of a system designed to deliver non-disruptive service to the end user 7 days a week, 24 HOURS A DAY (there are no planned or unplanned outages). It includes the ability to recover from a site disaster by switching computing to a second site
z10 EC – Hardware RAS Improvements for Outage Avoidance

Sources of Outages - Pre z9 -Hrs/Year/Syst-

Impact of Outage

Increased Focus over time

<table>
<thead>
<tr>
<th></th>
<th>Prior Servers</th>
<th>z9 EC</th>
<th>z10 EC</th>
</tr>
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<tbody>
<tr>
<td>Unscheduled Outages</td>
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<td>✓</td>
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<tr>
<td>Scheduled Outages</td>
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<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Planned Outages</td>
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<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Preplanning requirements</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>
z10 EC Enhancements designed to avoid Outages

- Continued Focus on Firmware Quality
- Reduced Chip Count on MCM
- Memory Subsystem Improvements

- DIMM FRU indicators
- Single Processor Core Checkstop
- Single Processor Core Sparing
- Point to Point SMP Fabric (not a ring)
- Rebalance PSIFB and I/O Fanouts
- Redundant 100Mb Ethernet service network w/ VLAN

- CoD – Flexible Activation/Deactivation
- Elimination of unnecessary CBU passwords
- Enhanced Driver Maintenance (EDM) Upgrades
  - Multiple “from” sync point support
  - Improved control of channel LIC levels

- Reduce Pre-planning to Avoid POR
  - 16 GB for HSA
  - Dynamic I/O Enabled by Default
  - Add Logical Channel Subsystem (LCSS)
  - Change LCSS Subchannel Sets
  - Add/Delete Logical Partitions

- Reduce Pre-Planning to Avoid LPAR Deactivate
  - Change Partition Logical Processor Config
  - Change Partition Crypto Coprocessor Config
z10 EC Service Enhancements designed to avoid Scheduled Outages

- **Concurrent firmware fixes**
  - MCLs

- **Concurrent Driver Upgrades**
  - Enhanced Driver Maintenance

- **Concurrent parts replacement**
  - N + 1, Fanouts, Power supplies, MRU etc.

- **Concurrent Hardware Upgrades**
  - Book adds, microcode upgrades, I/O cards etc.
z10 EC Preplanning Improvements designed to avoid Planned Outages

- Capacity on Demand (CoD) – Flexible Customer initiated Upgrades
- Designed for Elimination of unnecessary CBU passwords
- Enhanced Driver Maintenance
  - Multiple ‘from’ sync points supports for Enhanced Driver Maintenance
- Designed to eliminate a logical partition deactivate/activate/IPL
  - Dynamic Change to the Logical Processor Definition and Logical Crypto – z/VM 5.3
  - Dynamic Change to the Logical Cryptographic Coprocessor Definition – z/OS ICSF
IBM System z10 EC Capacity on Demand (CoD)
z10 EC CoD – The Basics

- **Capacity Backup (CBU)**
  - Predefined capacity for disasters on a other “lost” server(s)
  - Concurrently add CPs, IFLs, ICFs, zAAPs, zIIPs, SAPs
  - Pre-paid

- **Capacity for Planned Events (CPE)**
  - CBU-like offering, when a disaster is not declared
    - Example: Scheduled Data Center maintenance
  - Predefined capacity for a fixed period of time (3 days)
  - Pre-paid

- **On/Off Capacity on Demand (On/Off CoD)**
  - Satisfy periods of peek demand for computing resources
  - Concurrent 24 hour rental of CPs, IFLs, ICFs, zAAPs, zIIPs, SAPs
  - Optionally Supported with Capacity Provisioning Manager (CPM)
  - Post-paid
z10 EC CoD – Key Enhancements

- **All offering records are resident on machine**
  - No connection or passwords required at time of activation
  - Records are changed only when customer places order for new / updated offering

- **Multiple records can be simultaneously active**
  - Each has independent controls and policy
  - Each can be activated / deactivated in any sequence

- **Individual record can be used to temporarily reach multiple configurations**
  - Customer determines level of resources activation real time based on circumstances (i.e. multiple use for a single On/Off CoD record, even during a permanent upgrade)
  - All movement between configurations is concurrent

- **More flexibility to configure offering limits**

- **Ability to perform upgrades while temporary resources are active**
  - Modification of record entitlement performed dynamically and concurrently

- “Capacity Provisioning Manager” provides policy based advice and automation
IBM System z NTP Client Support for Server Time Protocol
Network Time Protocol (NTP) client support for STP

- Purpose of this function is to allow the same accurate time across an enterprise comprised of heterogeneous platforms
- Simple Network Time Protocol (SNTP) client support added to Support Element (SE) code of System z9 and System z10 servers to enable interfacing with Network Time Protocol (NTP) servers
  - SNTP client support not available on z990 and z890 servers
  - z990 or z890 server can still be configured in an STP-only CTN
    - Cannot be assigned role of CTS
- NTP server becomes the single time source (External Time Source (ETS)) for STP, as well as other non-System z servers (UNIX, Windows NT®, other) that have NTP clients
- NTP servers can be
  - NTP server at NTP v3 or v4 or SNTP with IPv4 or IPv6 support
- Time reference for NTP server can be GPS, dial-out, DCF-77 etc.
IBM System z10 EC Energy Management and Environmentals
System Activity Display with Power Monitoring

Total System power consumption: 4.7 kW (KVA), 16037 BTU/hr
Air input temperature: 66.2 °C, 79.2 °F

<table>
<thead>
<tr>
<th>List</th>
<th>HIGH USE</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPALL</td>
<td>(50%) (50%)</td>
</tr>
<tr>
<td>SAPALL</td>
<td>(50%)</td>
</tr>
<tr>
<td>IFL 0</td>
<td>(50%) (50%)</td>
</tr>
<tr>
<td>IFL 1</td>
<td>(50%) (50%)</td>
</tr>
<tr>
<td>IFL 2</td>
<td>(50%) (50%)</td>
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<tr>
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<td>(50%) (50%)</td>
</tr>
<tr>
<td>IFL 4</td>
<td>(50%) (50%)</td>
</tr>
<tr>
<td>IFL 5</td>
<td>(50%) (50%)</td>
</tr>
<tr>
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<td>(50%) (50%)</td>
</tr>
<tr>
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<tr>
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<td>(50%) (50%)</td>
</tr>
<tr>
<td>IFL 9</td>
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<tr>
<td>SAP 0</td>
<td>(61%)</td>
</tr>
<tr>
<td>SAP 1</td>
<td>(68%)</td>
</tr>
<tr>
<td>SAP 7</td>
<td>(92%)</td>
</tr>
<tr>
<td>SAP B</td>
<td>(53%)</td>
</tr>
</tbody>
</table>
IBM Systems Director Active Energy Manager

Introduction

- IBM Systems Director Active Energy Manager (AEM) is an energy management solution building block that returns true control of energy costs to the customer

- AEM is a cornerstone of the IBM energy management framework and is leading edge in the Industry

- In tandem with chip vendors Intel and AMD and consortiums like the Green Grid, AEM supports the IBM initiative to deliver price performance per square foot

- AEM runs on Windows, Linux on IBM System x™, Linux on IBM System p™, and Linux on IBM System z. Refer to its documentation for more specific information.
IBM System z10 EC Operating System Support
## System z10 EC Operating System Support

<table>
<thead>
<tr>
<th>Operating System</th>
<th>ESA/390 (31-bit)</th>
<th>z/Architecture (64-bit)</th>
</tr>
</thead>
<tbody>
<tr>
<td>z/OS Version 1 Releases 7(^{(1)}), 8 and 9</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Linux on System z(^{(2)}), RHEL 4, 5 &amp; SLES 9, 10</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>z/VM Version 5 Release 2(^{(3)}) and 3(^{(3)})</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>z/VSE Version 3 Release 1(^{(2)})(^{(4)})</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>z/VSE Version 4 Release 1(^{(2)})(^{(5)})</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>z/TPF Version 1 Release 1</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>TPF Version 4 Release 1 (ESA mode only)</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

1. z/OS R1.7 + zIIP Web Deliverable required for z10 EC to enable HiperDispatch
2. Compatibility Support for listed releases. Compatibility support allows OS to IPL and operate on z10 EC
3. Requires Compatibility Support which allows z/VM to IPL and operate on the z10 EC providing System z9 functionality for the base OS and Guests.
4. z/VSE V3. 31-bit mode only. It does not implement z/Architecture, and specifically does not implement 64-bit mode capabilities. z/VSE is designed to exploit select features of IBM System z10, System z9, and zSeries hardware.
5. z/VSE V4 is designed to exploit 64-bit real memory addressing, but will not support 64-bit virtual memory addressing

Note: Refer to the z/OS, z/VM, z/VSE subsets of the 2097DEVICE Preventive Planning (PSP) bucket prior to installing a z10 EC
z/OS Release 1.9

**Scalability and Performance**
64-way support, 64-bit GRS, SMF to Logger, TSO/E support for large sequential data sets, Message Flooding Automation, XCF CDS Performance, heap pools, cache alignment, LAN idle, VSCR

**Improving Availability**
Improved latch contention detection, CF duplexing and Logger enhancements, SFM improvements, New RRS options …

**Self-Managing Capabilities**
WLM support for cross-system routing of zAAP workloads, WLM “Trickle” Support, Promotion of canceled jobs, Start servers in parallel, RMF reporting for CF structures…

**Enhancing Security**
IPSec offload to zIIP, Additional password phrase support, Kerberos AES & Enhanced CRL support, PKI Services & RACF extensions, z/OS UNIX System Services auditability, Java user and group SAF admin classes, Crypto, NAS AES …

**Improving Usability and Skills**
Health Checker improvements & checks, ISPF, DFSMSrmm™, Configuration and Management Usability for Communications Server, HCM, CF management…

**Integrating new Applications and Supporting Industry and Open Standards**
XML offload to zIIPs & zAAPs, System REXX™, SDSF REXX, Metal C, NFS V4 Server, pthread enhancements, Decimal Floating Point, porting enablement, Binder, PKCS#11…

**Extending the Network**
Policy-based TCP/IP Routing, Centralized Policy-Based Networking, Expanded use of AT-TLS, FTP Unicode support, new Network Management Interfaces

**Enterprise-Wide Roles**
CIM monitoring enhancements, Updated Pegasus server, DFSMSrmm CIM Update, IRMM, ARM 4.1 support
z/OS 1.9 Summary for z10*

- z/OS V1.9
  - 64-way support for a single z/OS image
  - HiperDispatch
  - Up to 4 TB Real Memory (Up to 1.5 TB per server and 1 TB per LPAR on z10 EC Models E56 and E64 servers)
  - Hardware Decimal Floating Point**
  - Capacity Provisioning
  - Large (1 MB) Page support
  - Parallel Sysplex support for InfiniBand Coupling links
  - System Data Mover (SDM) offload to zIIP
  - NTP support for STP
  - OSA-Express3 10 Gbps – CHPID OSD
  - HiperSockets Multi Write Facility
  - Crypto Exploitation
  - 4096-bit RSA support

* Additional features, service or Web downloads required
** Level of decimal floating-point exploitation will vary by z/OS release and PTF level.
  z/OS V1.7 with PTFs (for High level Assembler support).
  z/OS V1.9 with PTFs for full support, for C/C++.
z/OS 1.10 Preview*

Improving Usability and Skills
Configuration Assistant, Health Checker & checks, root migration to zFS, PSP processing, CEEPARM syntax checks, DFSMSrmmm and DFSMShsm, ISPF, ...

Improving Availability
Auto-IPL and SADMP, Dynamic JES2 exits, JES2 NJE connection recovery, Basic HyperSwap support, Expanded ASID reuse, SDM offload to zIIP, RACF database integrity, Consoles 2B, DFSMSrmmm recovery ...

Integrating new Applications and Supporting Industry and Open Standards
HLASM source-level dbx debugging, submit from z/OS UNIX shell, XML offload & validating parser, CEEROPT for batch, NFS V4 enhancements, FTP from Java, Mixed addressing for METAL C, ...

Self Managing Capabilities
Policy-based capacity provisioning, Contention Mgt Phase 3, PB delays, DATACLAS JCL overrides, More DFSMSrmmm/IRMM integration, zIIP CPU Management ...

Scalability and Performance
64-way support, HiperDispatcher, Extended Address Volumes, InfiniBand Coupling, 64-bit Common, Improved XCF locking, Metro Mirror devices in Channel Set 1, ...

Extending the Network
Hipersockets Multiple Write, TCP/IP and SNA Performance, multiple VLAN support, Auditability enhancements, Load Balancing Subplex support ...

Enhancing Security
Password phrase exploitation in z/OS UNIX, rlogin, Language Environment, TSO/E, Kerberos, and LDAP; UTF8 CA support in PKI Services, System SSL and Crypto improvements, Custom Fields ...

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z/OS 1.10* Summary

- **z/OS V1.10**
  - z/OS V1.10
  - 64-way support for single z/OS image
  - HiperDispatch support
  - PS InfiniBand Coupling support
  - Large PAGE support
  - Capacity provisioning
  - System Data Mover (SDM) offload to zIIP

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Linux and z/VM on System z

Consolidation capabilities:
✓ Server, network, storage
✓ Staff and skills
✓ Applications and utilities

Security capabilities:
✓ Privacy
✓ Regulatory requirements
✓ Identify management
✓ zSeries qualities of service
✓ Common Criteria Certification
✓ Ethical hacking
✓ HiperSockets

Business resiliency capabilities:
✓ High availability
✓ Disaster recovery
✓ Serviceability
✓ Reliability
✓ HyperSwap
✓ XRC and PPRC

Operational simplification capabilities:
✓ Virtualization
✓ Simulation
✓ Single point of control
✓ Large single system image
✓ z/OS similarities and synergies
✓ Highly granular resource sharing

Proximity to data:
✓ Can increase transaction throughput
✓ Shared data access
✓ Integrated storage management
✓ HiperSockets

On demand infrastructure:
✓ Scale up and scale out
✓ Rapid server (de)commissioning
✓ Idle servers don't consume system resources
z/VM Version 5 Release 3 New Function Highlights

- **Processor and I/O support**
  - Single-image support for up to 32 CPUs
  - Guest support for specialty processors
  - Enhanced SCSI support
  - HyperPAV support for IBM DS8000
  - FlashCopy® I/O support enhancements

- **Virtualization support**
  - Additional z/VM support for large real memory configurations (256 GB)
  - Collaborative Memory Management Assist
  - OSA-Express2 and OSA-Express3 link aggregation
  - Virtual Switch SNMP agent support
  - Enhanced usability for z/VM Virtual Switch and Guest LAN support
  - Guest program-directed IPL support
  - Guest MIDAW support
  - Guest ASCII console support

- **Networking**
  - z/VM TCP/IP support enhancements
  - Enhanced IP failover
  - Currency support for SSL server
  - Dynamic SSL/TLS support

- **Systems management**
  - z/VM system management API enhancements
  - z/VM integrated systems management with the System z HMC
  - User Directory COMMAND support
  - Asynchronous CP command API
  - RACF support enhancements
  - Password phrase support
  - LDAP server and client support
  - Installation and service enhancements
  - Performance Toolkit support
# System z Linux Support

<table>
<thead>
<tr>
<th></th>
<th>z890 (WdfM)</th>
<th>z990** (WdfM)</th>
<th>z9 EC</th>
<th>z9 BC</th>
<th>z10 EC</th>
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<tbody>
<tr>
<td>SLES 9</td>
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<td>x</td>
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### Support Dates

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<th>Operating System</th>
<th>General support</th>
<th>Extended support</th>
<th>Self support</th>
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<tbody>
<tr>
<td>SLES 9 support*</td>
<td>07/30/2009</td>
<td>07/30/2011</td>
<td>07/30/2014</td>
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<tr>
<td>SLES 10 support*</td>
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<td>07/31/2013</td>
<td>07/31/2016</td>
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<table>
<thead>
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<th>Deployment support</th>
<th>Maintenance support</th>
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<tbody>
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<td>02/29/2008</td>
<td>02/29/2012</td>
</tr>
<tr>
<td>RHEL 5 support*</td>
<td>03/31/2010</td>
<td>09/30/2010</td>
<td>03/31/2014</td>
</tr>
</tbody>
</table>

* For latest information and details contact your Linux distributor

** Recommendation: use SLSE 10 or RHEL 5 for new z10 EC projects

* Support dates may be changed by Linux distributors

** WdfM for EMEA countries. Rest of the world June 30, 2008

---

SLES = SUSE Linux Enterprise Server
RHEL = Red Hat Enterprise Linux
End of Presentation