IBM zEnterprise Technology Update

IBM zEnterprise – Freedom Through Design
IBM zEnterprise – Freedom Through Design

Innovation, integration and optimization at every level

Focused, collaborative innovation
A “complete systems” approach
Intelligent performance
Year-to-year IBM mainframe growth

**Total Installed Mainframe Capacity**

- **Std**
- **IFL**
- **zAAP**
- **zIIP**

**Installed Capacity**

- **z990** 2Q03
- **z890** 3Q05
- **z9 EC** 2Q06
- **z9 BC** 1Q08
- **z10 EC** 4Q08
- **z10 BC** 4Q08
- **z196** 3Q10

**Growth**

- 16% growth
- 27% growth
- 18% growth
- 11% growth
- 23% growth
- 10% growth
- 18% growth
- 19% growth

*19% Growth is 2Q10 vs 2Q11*
# Today’s mainframe workload deployment patterns

<table>
<thead>
<tr>
<th>Core Applications</th>
<th>Multi-Tier Web Serving</th>
<th>Data Warehouse and Analytics</th>
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<tr>
<td><strong>Database (z)</strong></td>
<td><strong>Database (z)</strong></td>
<td><strong>Master Data Management</strong></td>
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<tr>
<td>▪ DB2 for z/OS</td>
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<td><strong>Database (z)</strong></td>
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<tr>
<td>▪ Application (z)</td>
<td>▪ Oracle for Linux for System z</td>
<td>▪ DB2 for z/OS</td>
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<tr>
<td>▪ CICS</td>
<td>▪ Application (z)</td>
<td>▪ Application (POWER / UNIX)</td>
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<tr>
<td>▪ COBOL</td>
<td>▪ WebSphere</td>
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<tr>
<td>▪ WebSphere</td>
<td>▪ Application (x86)</td>
<td>▪ JBoss</td>
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<td>▪ Apache / Tomcat</td>
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<th>SAP</th>
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<td><strong>Database (z)</strong></td>
<td><strong>Database (z)</strong></td>
<td><strong>Analytics</strong></td>
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<tr>
<td>▪ DB2 for z/OS, IMS</td>
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<td>▪ z/OS</td>
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<tr>
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<td>▪ Application (POWER / UNIX)</td>
<td>▪ DB2 for z/OS</td>
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<tr>
<td>▪ Linux on System z</td>
<td>▪ WebSphere</td>
<td>▪ Cognos</td>
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<td>▪ JBoss</td>
<td>▪ SAS</td>
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<td>▪ WebLogic Presentation (x86)</td>
<td>▪ Linux on System z</td>
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<td>▪ WebSphere</td>
<td>▪ SPSS</td>
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<td></td>
<td>▪ Windows</td>
<td>▪ InfoSphere Warehouse</td>
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<tr>
<th>Heterogeneous hardware infrastructure and software components</th>
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System z investment areas

1. Innovate to address the IT infrastructure challenges of today and the future
   – Further simplify, consolidate and reduce the costs of an IT infrastructure
   – Integrate, virtualize and coherently manage the multiple and varied elements of business applications
   – Scale up and leverage System z strengths in data serving

2. Extend strengths of System z
   – Invest for continued leadership in System z: performance, virtualization, enterprise security, enterprise business continuity
   – Extend System z best of breed capabilities to a broader set of workloads
   – Deploy optimized technologies for specific applications or components

3. Expand the ecosystem and support core applications that our clients want
   – Recruit new solutions and solution providers and integrators
   – Expand skills and capabilities across the globe
System z10 lifecycle

- System z10 upgrades requiring hardware additions/changes are withdrawn from marketing effective June 30, 2012
- System z10 microcode-only upgrades are withdrawn from marketing effective June 30, 2013 – some examples are:
  - Model changes, not requiring addition of a processor book
  - Addition of specialty engines, not requiring addition of a processor book
  - Addition of memory, when sufficient pre-planned memory is already installed
  - On/Off Capacity on Demand
- System z10 end of support will be no less than 5 years after withdrawal from marketing
Information technology today is limited by the technology and architecture configurations available

- Business processes and the applications that support them are becoming more service oriented, modular in their construction, and integrated.
- The components of these services are implemented on a variety of architectures and hosted on heterogeneous IT infrastructures.
- Approaches to managing these infrastructures along the lines of platform architecture boundaries cannot optimize: alignment of IT with business objectives; responsiveness to change; resource utilization; business resiliency; or overall cost of ownership.
- Customers need better approach: The ability to manage the IT infrastructure and business applications as an integrated whole.
IBM zEnterprise System – Best-in-class technologies
A “System of Systems” that unifies IT for predictable service delivery

- Optimized to host large-scale database, transaction, and mission-critical applications
- The most efficient platform for large-scale Linux® consolidation
- Capable of massive scale-up

IBM zEnterprise 196™ (z196)

- Unifies management of resources, extending IBM System z® qualities of service end-to-end across workloads
- Provides platform, hardware and workload management

zEnterprise Unified Resource Manager

- Selected IBM POWER7® blades and IBM System x® blades for deploying applications in a multi-tier architecture
- High-performance appliances
- Dedicated high-performance private network

zEnterprise BladeCenter Extension (zBX)
IBM zEnterprise 196 – The heart of the new machine
The industry’s fastest and most scalable enterprise system

<table>
<thead>
<tr>
<th>Feature</th>
<th>Description</th>
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<tbody>
<tr>
<td>5.2 GHz superscalar processor</td>
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<tr>
<td>Up to 96 Cores, 1 to 80 configurable for client use</td>
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<tr>
<td>45 sub-capacity settings</td>
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<tr>
<td>Up to 3 TB RAIM memory</td>
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<tr>
<td>Over 100 new instructions</td>
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<tr>
<td>192 KB L1 cache per core, 1.5MB L2 Cache per core, 24MB L3 Cache per chip, 192MB L4 Cache per book</td>
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<tr>
<td>Cryptographic enhancements</td>
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<tr>
<td>Optional water cooling</td>
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<td>Option DC power</td>
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Dramatic improvement over IBM System z10 EC

For Linux
- Improvement in performance: Up to 60% for up to 35%

For z/OS
- Improvement in performance: Up to 40%
- More capacity with 60%
- Less cost
  - With no increase in energy consumption
  - And even better performance with new software
IBM zEnterprise – Freedom Through Design

z196 – IBM leadership technology at the core

- **5.2 GHz Quad Core Processor Chip boosts hardware price/performance**
  - Over 100 new instructions – improvements for CPU intensive, Java™, and C++ applications
  - Over twice as much on-chip cache as System z10 to help optimize data serving environment
  - Out-of-order execution sequence gives significant performance boost for compute intensive applications
  - Significant improvement for floating point workloads

- **Performance improvement for systems with large number of cores – improves MP ratio**

- **Data compression and cryptographic processors right on the chip**
What’s new: Delivering innovation and value at all levels

- IBM zEnterprise 114 (z114) for mid-sized businesses
- New I/O subsystem for improved system connectivity
- Security enhancements
- Clustering improvements

Central Processing Complex

- Delivering APIs to enable management of Unified Resource Manager from external tools

zEnterprise Unified Resource Manager

- Introduction of select System x blades into zBX
- Support for Linux and Windows to broaden application support and integration.

zEnterprise BladeCenter Extension (zBX)
**IBM zEnterprise – Freedom Through Design**

*zEnterprise technology designed for small and mid-sized businesses*

*The value begins at the heart with the z114*

- **New technology in a new package**
  - Modular 2 drawer design for lower cost of entry
  - Granularity for right-sizing your system
  - Additional scale for consolidation and growth
  - Improved data center efficiency
  - Same qualities of service as the z196
  - Hybrid enabled to drive workload expansion and integration

- **Improved platform economics**
  - New software curve
  - Lower hardware maintenance
  - Lower specialty engine and memory prices
  - Upgradeability for investment protection

- **Up to 18% improvement for traditional z/OS workloads**
- **Up to an additional 25% improvement in CPU intensive workloads via compiler enhancements**
- **Up to 12% total capacity improvement**
- **Scales from 26 – 3100 MIPS**
- **Up to 130 available capacity settings**
- **From 1 – 10 configurable cores for client use as CPs, IFLs, zIIPs, zAAPs and ICFs**
- **From 0 – 2 IBM provided spare cores**
- **Up to 256 GB RAIM memory**
- **Fully upgradeable from the IBM z9 BC and IBM z10 BC**
- **Fully upgradeable to the IBM z196 M15**

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1. Relative capacity and performance compares at equal software levels as measured by IBM Large System Performance Reference (LSPR) workloads using z/OS® 1.11, Results may vary
2. The z114 will exhibit up to 25% increase for CPU intensive workload as provided by multiple C/C++ compiler level improvements when going from z/OS 1.09 to z/OS 1.12
Connectivity enhancements
New features with big performance boost

- **HMC**
  - Location to run Unified Resource Manager – including monitoring CPU, energy, workload performance
  - Host of the ensemble – controlling all functions of the ensemble
  - Primary with Alternate needed for DR

- **For Clustering**
  - HCA-3 InfiniBand® Coupling Links
    - 12x InfiniBand (improved performance with 12x IFB3 protocol)
    - 1x InfiniBand (4 ports)
  - ISC-3 (peer mode only)
  - IC (define only)
  - STP
    - Improved time coordination for zBX components

- **Within z196/z114 and to zBX**
  - PCIe I/O Infrastructure
  - I/O Drawer and I/O Cage
    - Intraensemble data network (IEDN)
    - Intranode management network (INMN)

- **To the Network**
  - OSA-Express4S (PCIe-based)
    - 10 Gigabit Ethernet LR and SR
    - 1 Gigabit Ethernet SX and LX
  - OSA-Express3
    - 1000BASE-T Ethernet

- **To the Data**
  - FICON Express8S (PCIe-based)
  - ESCON (up to 240 maximum)

* I/O cage for z196 only
PCIe Internal I/O Infrastructure

- **System z continues the I/O evolution with a new internal I/O infrastructure change on the platform to continue to support the industry direction for new, high performance I/O**
  - Increase the internal bandwidth of I/O infrastructure backbone from InfiniBand (6 GBps) to PCIe (8 GBps)
  - Allow for future I/O performance growth requirements
  - Provides future power management capability to reduce overall power consumption
  - Adopt industry standard technology (PCIe)
    - System z strategic direction to utilize industry standards without compromising robustness and System z qualities of service.
    - Enables improved I/O capability and flexibility by leveraging the technology investments of the industry
  - Allows for the future possibility of integration of industry standard, native PCIe adapters and accelerators
New 32 slot PCIe I/O drawer for z114 and z196

Front

- Supports only the new PCIe I/O cards introduced with z114 and z196 GA2.
- Supports 32 PCIe I/O cards, 16 front and 16 rear, vertical orientation, in four 8-card domains (shown as 0 to 3).
- Requires four PCIe switch cards (●), each connected to an 8 MBps PCIe I/O interconnect to activate all four domains.
- To support Redundant I/O Interconnect (RII) between front to back domain pairs 0-1 and 2-3 the two interconnects to each pair must be from 2 different PCIe fanouts. (All four domains in one of these cages can be activated with two fanouts.)
- Concurrent field install and repair.
- Requires 7 EIA Units of space (12.25 inches ≈ 311 mm)

Rear

Domain 0

Domain 2

Domain 3

Domain 1

7U
FICON Express8S – SX and 10KM LX in the PCIe I/O drawer

- For FICON, zHPF, and FCP environments
  - CHPID types: FC and FCP
    - 2 PCHIDs/CHPIDs
- Auto-negotiates to 2, 4, or 8 Gbps
- Increased performance compared to FICON Express8

- 10KM LX - 9 micron single mode fiber
  - Unrepeated distance – 10 kilometers (6.2 miles)
  - Receiving device must also be LX
- SX - 50 or 62.5 micron multimode fiber
  - Distance variable with link data rate and fiber type
  - Receiving device must also be SX
- 2 channels of LX or SX (no mix)
- Small form factor pluggable (SFP) optics
  - Concurrent repair/replace action for each SFP
IBM zEnterprise – Freedom Through Design

FICON performance on System z

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

I/O driver benchmark
MegaBytes per second
Full-duplex
Large sequential read/write mix

77% increase

108% increase
OSA-Express4S GbE and 10 GbE fiber for the PCIe I/O drawer

- **10 Gigabit Ethernet (10 GbE)**
  - CHPID types: OSD, OSX
  - Single mode (LR) or multimode (SR) fiber
  - One port of LR or one port of SR
    - 1 PCHID/CHPID

- **Gigabit Ethernet (GbE)**
  - CHPID types: OSD (CHPID OSN not supported)
  - Single mode (LX) or multimode (SX) fiber
  - Two ports of LX or two ports of SX
    - 1 PCHID/CHPID

- **Small form factor optics – LC Duplex**
Putting zEnterprise System to the task

Use the smarter solution to improve your application design
New blades provide added flexibility for workload deployment and integration

- **Introducing System x Blades in the zBX**
  - Select IBM BladeCenter HX5 7873 dual-socket 16-core blades
  - Ordered and fulfilled through System x providers and installed into the zBX by the customer
  - Blades assume System z warranty and maintenance when installed in the zBX

- **Unified Resource Manager will install an integrated hypervisor on blades in the zBX**
  - KVM-based with IBM service and support

- **Up to 112 Blades supported on zBX**
  - Ability to mix and match DataPower XI50z, POWER7 and System x blades in the same chassis for better zBX utilization
  - Number of blades supported varies by type

... managed by the zEnterprise Unified Resource Manager
IBM zEnterprise – Freedom Through Design

zEnterprise extends Service Management for improved governance

Focused, collaborative innovation – A “complete systems” approach
Continuing value using the Unified Resource Manager

- Simplified installation of hypervisors
- Gain significant time to market with improved speed of deployment

- Save time, cost and simplify asset management
- Decrease problem determination and resolution time for cross-platform resources
- Improve and simplify cross-platform availability procedures
- Enable broader and more granular view of resource consumption

- Factory installed and configured network
- Improved network security with lower latency, less complexity, no encryption/decryption

- Simplified energy management
- Energy cost savings

- Allow critical workloads to receive resources and priority based on goal-oriented policies established by business requirements
- Smart business adjustments based on workload insight
- Provide deep insight into how IT resources are being used

- Gain flexibility, consistency and uniformity of virtualization
- Provide the business with faster time to market
- Simplified network management for applications
Extending support to new operating system environments

- **Power Systems blades**
  - AIX 5, 6, 7

- **System x blades**
  - Support for Linux and Windows environments
    - 64-bit version support only
  - Red Hat RHEL 5 and 6
  - SUSE Labs SLES 10 and 11
  - Microsoft® Windows® Server 2008
    - Datacenter Edition recommended
  - Certifications inherited from System x

- **Operating Systems are customer acquired and installed**

- **Delivering APIs to enable management of Unified Resource Manager from external tools**
  - Providing API access to Unified Resource Manager functions

Manage your mainframe and distributed environment with the same tools, same techniques, same practices.
The IBM DB2 Analytics Accelerator V2
Capitalizing on the best of both worlds – System z and Netezza

The IBM DB2 Analytics Accelerator is a blending of System z and Netezza technologies that delivers unparalleled mixed workload performance for addressing complex analytic business needs.

- Performance, availability and scalability
- Extreme performance for complex analytics
- Breakthrough technologies – hardware acceleration
- Transparent to DB2 applications
Deep DB2 integration within zEnterprise

Applications
- Application Interfaces (standard SQL dialects)
- DBA Tools, z/OS Console, ...
- Operational Interfaces (e.g. DB2 Commands)

DB2 for z/OS
- Data Manager
- Buffer Manager
- IRLM
- Log Manager

Superior availability, reliability, security, workload management

z/OS on System z

IBM DB2 Analytics Accelerator

Netezza

Superior performance on analytic queries

Operational Interfaces (e.g. DB2 Commands)

Application Interfaces (standard SQL dialects)
A zEnterprise for everyone: Freedom to choose the “right sized” mainframe to fit your needs

- **If you ...**
  - ... want the flexibility to manage across heterogeneous platform – including z/OS, AIX, Linux on System x, Windows on System x
  - ... are looking for an entry level mainframe with options for traditional capacity settings
  - ... need a smaller mix of special engines (zAAP on zIIP great option here!)
  - ... have smaller Coupling and/or I/O attachment requirements
  - ... need the lowest cost application development environment.

- **If you ...**
  - ... want the flexibility to manage across a heterogeneous platform
  - ... want to replace your server with one that has the same number of engines – but would like more IFLs, zAAPs or zIIPs
  - ... want to replace your standalone coupling facility or Linux only server with a machine that provides engine, memory and I/O scale out capabilities
  - ... have future growth needs, but prefer grow in smaller increments and want to avoid disruptive outage during upgrade

- **If you ...**
  - ... want the flexibility to manage across a heterogeneous platform
  - ... have a large mainframe capacity requirement or desire for massive consolidation – scale to over 52,000 MIPS in one footprint
  - ... have a large disk installment so in turn have large I/O requirements
  - ... need new ways to address your ‘green’ requirements – like water cooling and static power save mode
  - ... have a large CBU requirement – and like the control of having your disaster recovery site right in your own shop.

*The z114 M05 may be the perfect option.*

*The z114 M10 is just what you need.*

*The enhanced z196 is right for you.*
Evolution of specialty engines

Building on a strong track record of technology innovation

- **1997** Internal Coupling Facility for Linux (ICF)
- **2001** Integrated Facility for Linux (IFL)
- **2004** System z Application Assist Processor (zAAP)
  - Eligible workloads: Java and XML
- **2006** System z Integrated Information Processor (zIIP)
  - Eligible workloads: IPSec encryption, HiperSockets™, XML, ISV, some DB2, z/OS Global Mirror, Java (when using zAAP on zIIP)
- **2010** Optimizers, Accelerators, Hybrid processing
System z specialty engines – Basics

- Enable new workloads on System z
- Have no impact on z/OS software stack cost
- Sold at lower price than standard GCP engines
- Leverage incremental capacity on existing systems
  - Exception: Enterprise Linux Server
- Use standard CP engines (with different microcode)
- Inherit same hardware RAS as GCP engines
- Run always at “full speed” (even on sub-capacity systems)
- Grouped into three basic “types”:
  - ICF: Coupling facility engine on same system as “regular” workload
  - IFL: Enable Linux workloads on System z leveraging strength of z/VM hypervisor
  - zAAP and zIIP: Enable low cost offload of selected z/OS workloads
- Enable cost effective collocation benefits with z/OS applications and data
zAAPs and zIIPs

*Designed to help implement, integrate, optimize new technologies*

- **Java** – for WebSphere® Application Server and Java technology-based applications
- **Centralized data serving eligible for zIIP** – Portions of BI, ERP, and CRM remote connectivity to DB2, as well as portions of long running parallel queries and select utilities
- **Network encryption on zIIP** – IPSec network encryption/decryption
- **XML parsing** – z/OS XML System Services eligible on zAAP or zIIP
- **Remote mirror** – zIIP assisted z/OS Global Mirror function
- **HiperSockets** – HiperSockets Multiple Write operation for outbound large messages
- **Business Intelligence** – IBM Scalable Architecture for Financial Reporting provides a high-volume, high performance reporting – can be eligible for zIIP
- **Intra-server communications** – z/OS CIM Server processing eligible for zIIP
- **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
Linux on System z – take back control of your IT

* A data center in a box – not a server farm

- Potentially lower cost of operations
  - Less servers
  - Fewer software licenses
  - Fewer resources to manage
  - Less energy, cooling and space

- Central point of management
- Increased resource utilization
- Fewer intrusion points
  - Tighter security
- Fewer points of failure
  - Greater availability

*It’s simple*

System z® and Linux provide a better, faster solution to IT complexity
Linux on IBM System z

Linux + Virtualization + System z = SYNERGY

- **The legendary IBM mainframe – IBM System z**
  - Legendary dependability
  - Extremely security-rich, highly scalable
  - Designed for multiple diverse workloads executing concurrently
  - Proven high volume data acquisition and management

- **The IBM mainframe virtualization capabilities – z/VM**
  - Support for large real memory and 32 processors in a single partition
  - Clustered z/VM images for availability, performance and simplified management
  - Enhanced security and LDAP server/client
  - Enhanced memory management for Linux guests
  - Enhanced management functions for Linux

- **Open standards operating system – Linux for System z**
  - Reliable, stable, security-rich
  - Available from multiple distributors
  - Plentiful availability of skills administrators and developers
  - Large selection of applications middleware and tooling
Linux on System z

Client adoption continues to drive success

- The momentum continues:
  - Shipped IFL engine volumes increased 34% from YTD 4Q09 to YTD 4Q10
  - Installed IFL MIPS increased 6% from 3Q10 to 4Q10
  - Installed IFL MIPS increased 35% from 4Q09 to 4Q10
- 32% of System z customers have IFLs installed
- Linux represents 19% of the System z install base capacity (MIPS)
- 64 of the top 100 System z clients are running Linux on the mainframe
- > 3,000 applications are available for Linux on System z
Thanks!

J. L. (Jim) Elliott
Consulting Sales Specialist – System z
zChampion & Linux Champion
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