A “System of Systems” for Predictable Service Delivery

**IBM zEnterprise™ 196 (z196) or IBM zEnterprise 114 (z114) or zEC12**
- Optimized to host transaction, and mission-critical applications
- The most efficient platform for large-scale Linux® consolidation
- Massive scale-up

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

**zEnterprise BladeCenter® Extension (zBX)**
- Selected IBM POWER7® blades and IBM System x® blades for deploying applications in a multi-tier architecture
- High-performance optimizers and appliances to accelerate time to insight and reduce cost
- Dedicated high-performance private network
History of Blades…..

- 1999
  - Data center inefficiency
History of Blades.....

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  - Data center inefficiency
  - Easier way to deploy large numbers of rack mount web servers in data centers
  - A new server form factor...lower power consumption without sacrificing performance
History of Blades.....

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• 2001
  – RLX Technologies
  – New term..."server blade"
  – First generation target market – large internet data centers

History of Blades.....

• 2002 – 2003
  – As service provider market collapsed, blade manufacturers attempted to take products to broader enterprise data center market
  – HP, Compaq, Dell, IBM, Sun

• 2006 - 2007
  – New blade designs further address needs of data centers...better I/O management and thermal management
What is a Blade Server?

- Blade servers offer a standardized method of deploying multiple processors, memory and I/O resources by placing those resources on plug-in boards that slide into a standard chassis.

### IBM BladeCenter Family

<table>
<thead>
<tr>
<th>IBM BladeCenter E</th>
<th>IBM BladeCenter T</th>
<th>IBM BladeCenter H</th>
<th>IBM BladeCenter HT</th>
<th>IBM BladeCenter S</th>
</tr>
</thead>
<tbody>
<tr>
<td>High density, power efficient</td>
<td>Highly rugged, Telco, AC/DC, N+1, air filtration</td>
<td>Ultra high performance, and I/O flexibility</td>
<td>Highly rugged, Telco, AC/DC, N+1, air filtration</td>
<td>Integrated disk, 110-344kW power, BladeCenter outside the datacenter</td>
</tr>
</tbody>
</table>

- 7U design
- Up to 14 blade bays
- Up to 8 switch fabrics
- AC or DC models
- N+1 compliant
- Rugged
- Support 10 Gb uplinks
- Support 6 Gb FC
- SAS Connectivity Module

- 8U design
- Up to 8 blade bays
- Up to 4 switch fabrics
- AC or DC models
- N+1 compliant
- Rugged
- Support 10 Gb uplinks
- Support 6 Gb FC
- Telco, military, dirty floor
- SAS Connectivity Module

- 9U design
- Up to 14 blade bays
- Up to 10 Gb Ethemet
- I/O flexibility up to 8 switch bays
- Support 30 mm blades with up to 8 ports
- Support 10 Gb Ethernet
- Support 6 Gb FC
- InfiniBand
- SAS Connectivity Module

- 12U design
- Up to 12 blade bays
- AC or DC models
- I/O flexibility up to 8 switch bays
- N+1 compliant
- Rugged
- Up to 10 Gb Ethemet
- Support 10 Gb Ethernet
- Support 6 Gb FC
- SATA Connectivity Module
- Telco, military, dirty floor
- SAS RAID and Connectivity Modules

Common blades, common switches, common management
Power and Signal Paths

Blade server to midplane connections
- Redundant power
- Signaling

Advanced Management Module

Center point for IBM BladeCenter infrastructure intelligence

- Hot-swappable module
- Powerful and robust systems management
- Proxy for expansion modules
- Controls all aspects of power, connectivity and communication
- Reliability, availability, and serviceability (RAS)
The POWER7 Product Family

**Power 770**
- 12 or 16 Cores / Node
- 4-48 Cores at 3.5 GHz
- Up to 2 TB memory
- Capacity on Demand

**Power 780**
- 8 or 16 Cores / Node
- TurboCore Mode
- 4-64 Cores at 3.8 GHz
- Up to 2 TB memory

**Power 795**
- Up to 128 @ 4.25 GHz (4)
- Up to 192 @ 3.72 GHz (6)
- Up to 256 @ 4.00 GHz (8)
- Capacity on Demand

**Power 795**
- Up to 128 @ 4.25 GHz (4)
- 4-64 Cores at 3.8 GHz
- 4-32 Cores at 4.1 GHz
- TurboCore Mode
- PowerCare Service
- Capacity on Demand

**Power 755**
- Up to 192 @ 3.72 GHz (6)
- 4-64 Cores at 3.1 GHz
- 4-48 Cores at 3.5 GHz
- Up to 2 TB memory
- PowerCare Service
- Capacity on Demand

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**POWER Blades**
- PS701 – 4 core / 64 GB max
- PS702 – 8 cores / 128 GB max
- PS702 – 16 cores / 256 GB max

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**zBX**
- Dedicated physical processor cores
- Virtual processors (vp)
- Micro-partitions or virtual servers
- Pool of shared physical processor cores
- Processing units (pu)
System x – HX5 Blade Server

- The HX5 Blade Server implements the IBM eX5 architecture
- Processor support for up to four Intel Xeon 7500 processors
  - Four-core, six-core or eight-core configurations
    - Hyper-threading
    - Turbo boost
    - Quick path interconnect (QPI)

System x Hypervisor

- Integrated KVM based Hypervisor supplied by Unified Resource Manager (xHyp)
- KVM: Kernel-based Virtual Machine
  - Open source virtualization solution for Linux on x86 hardware

- For System x blade on zBX, loaded as firmware
  - Linux Kernel + KVM + zManager components
IBM zEnterprise BladeCenter Extension
A Uniquely Configured Extension

Looks like a rack with BladeCenters but much more...

- zBX assembled and built at IBM plant
  - All parts and microcode - tested and shipped as complete package
- zBX hardware redundancy provides improved availability
  - Redundant switches provide guaranteed connection between z196/z114/zEC12 and zBX
  - Redundant Power Distribution Units improve availability
  - Extra blowers manage heat dispersion/removal
- zBX provides isolated and secure network
  - Four top-of-rack switches for connection to controlling z196/z114/zEC12
  - Traffic on user networks not affected
  - Provides foundation for the Unified Resource Manager

IBM zEnterprise BladeCenter Extension (zBX)
Machine Type: 2458 Model 003

- zBX is built with integrated IBM certified components
  - Standard parts – TOR switch, BladeCenter Chassis, Power Distribution Units, Optional Acoustic Panels
  - Optional optimizer - DataPower (XI50z) ordered as a feature of zBX
- Up to 112 blades are supported on zBX
  - System x and POWER7 blades are acquired through existing channels
    - IBM System x Blades – up to 56 entitlements
      - IBM BladeCenter HX5 (7873) dual-socket 16-core blades
        - Four supported memory configurations in zBX – 64 GB, 128 GB, 192 GB, 256 GB
    - IBM POWER7 Blades – up to 112 entitlements
      - IBM BladeCenter PS701 Express - 8-core processor 3.0GHz,
        - Three supported memory configurations in zBX - 32 GB, 64 GB, 128 GB
  - Up to 28 DataPower XI50z blades (double wide)
  - Mix and match blades in the same chassis
- Model 002 is managed only by z196 and Model 003 is managed by zEC12
Operating System Environments extend application flexibility

- Support for Linux and Windows environments on System x blades in zBX
  - 64-bit version support only
  - Linux: RHEL 5.5, 5.6, 6.0 & Novell SUSE SLES 10 (SP4) and SLES 11 SP1
  - Microsoft® Windows® Server 2008 R2 and Microsoft Windows Server 2008 (SP2) (for either we recommend Datacenter Edition)
  - The zBX web page will host the most current blade ordering information:

- Support of AIX environments on POWER7 blades in zBX
  - AIX®: AIX 5.3 Technology Level 12 or higher, AIX 6.1 Technology Level 5 or higher, AIX 7.1
  - For the most current POWER7 blade ordering information:

- Certifications inherited from blades
  - SAP support for Linux and Windows on x86 blades in the zBX
  - Operating Systems are customer acquired and installed

What's different about installing DataPower into the zBX?

- Security: VLAN support provides enforced isolation of network traffic with secure private networks.
- Improved support: Monitoring of hardware with “call home” for current/expected problems and support by System z Service Support Representative.
- System z packaging: Increased quality with pre-testing of blade and zBX. Upgrade history available to ease growth.
- Operational controls: Monitoring rolled into System z environment from single console. Consistent change management with Unified Resource Manager.
- Cloud: WebSphere DataPower enhancements can provide a secure, managed connection from the enterprise applications or enterprise users to public cloud applications.
zEnterprise Unified Resource Manager
Transforming the way resources are managed and deployed

How is it different?
- **Heterogeneous management**: Total systems management across heterogeneous resources. APIs facilitate enterprise-wide management.
- **Integration**: Single point of control, common skills for resources, reduced complexity of day-to-day operations.
- **Monitoring**: New dashboard for CPU resources and energy management.
- **Simplified installation**: Auto discovery and configuration of resources and workloads with single interface.
- **Secure**: Improved network security with lower latency, less hops, and less complexity. Improved control of access due to management of hypervisors as firmware.
- **Service and support management**: Virtual machines and blades able to perform hardware problem detection, reporting, and call home.

What is it?
Unified Resource Manager provides infrastructure awareness to optimize the system resources in accordance with understanding the policies assigned to that particular workload.

Functions are grouped into suites of tiered functionality that enable different levels of capability – Manage, Advanced Management, and Automate.
Unified Resource Manager
Manage Firmware Suite

- **Manage (DataPower XI50z, select POWER7 and System x blades)**
  - Monitor and trend reporting of CPU energy efficiency.
  - New dashboard interface enabling a broader view of system resource consumption.
  - Integrated hardware / asset management across all elements of the system.
  - Private and physically isolated connections for secure support and data sharing.
  - Management of network resources to assist with problem determination.
  - Administrative simplification (wizard) for virtual server provisioning and enablement of integrated storage and network across hypervisors.
  - Sharing of resource information and metrics via APIs.

Unified Resource Manager
Advanced Management / Automate Firmware Suites

- **Advanced Management (Select System x blades)**
  - Additional wizard function to set up resources associated with a workload and the capability to associate those resources with a named business process.
  - Ability to monitor and report performance.
  - Load balancing to ensure that network traffic flows correctly.
  - Energy management capabilities.

- **Automate (Select POWER7 blades and DataPower XI50z)**
  - Energy management capabilities.

- **Automate (Select POWER7 blades only)**
  - Additional wizard function to set up resources associated with a workload and the capability to associate those resources with a named business process.
  - Ability to manage to a user defined performance service level policy and enable performance monitoring, reporting and resource optimization.
  - Load balancing to ensure that network traffic flows correctly.
  - Static power savings.
Defining an Ensemble Enables Improved Management and Scale

- An ensemble is a collection of up to eight zEnterprise nodes that are managed collectively by the Unified Resource Manager as a single logical virtualized system.
- A zEnterprise node is a z196, z114 or zEC12 with 0 or 1 zBX. The zBX may contain from 1 to 4 racks each containing up to two BladeCenters. zEnterprise nodes are deployed within a single site.
- Automated failover to ensemble back up HMC.

An ensemble allows you to have a single pool of resources—integrating system and workload management across the multi-system, multi-tier, multi-architecture environment.

Ensemble Management

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Hypervisor Report

zEnterprise Unified Resource Manager

Hardware Management

Hypervisor Management
- Integrated deployment and configuration of hypervisors
- Hypervisors (except z/VM) shipped and serviced as firmware
- Management of ISO images
- Creation of virtual networks

Operational Controls
- Auto-discovery and configuration support for new resources (including storage)
- Cross platform hardware problem detection, reporting and call home
- Physical hardware configuration, backup and restore
- Delivery of system activity using new user interface

Network Management
- Monitoring and collecting metrics of networking resources
- Management of virtual networks including access control

Energy Management
- Monitoring and trend reporting of CPU energy efficiency
**zEnterprise Unified Resource Manager**

*Platform Management*

**Hypervisor Management**
- Manage and control communication between virtual server operating systems and the hypervisor

**Energy Management**
- Static power savings
- Ability to query maximum potential power

**Resource Workload Awareness and Platform Performance Management**
- HMC provides a single consolidated and consistent view of resources
- Wizard-driven set up of resources in accordance with specified business process
- Ability to monitor and report performance
- Load balance recommendations
- Manage to a performance policy

**Virtual Server Lifecycle Management**
- Single view of virtualization across platforms
- Ability to deploy multiple, cross-platform virtual servers within minutes
- Management of virtual networks including access control
- Integration of HiperSockets network with IEDN

**Operations**
- Monitor status and general health of network systems and the hypervisor
- Less complexity, no encryption/decryption
- Improved network security with lower latency, less complexity, and improved performance
- Monitor status and general health of network resources

**Networks**
- Simplified network management for applications
- Bridging of internal HiperSockets network to the external 16G network

**Virtual Servers**
- Gain flexibility, consistency and uniformity of virtualization
- Allow critical workloads to receive resources and priority based on goal-oriented policies established by business requirements
- Provide deep insight into how IT resources are being used
- Simplified energy management
- Energy cost savings
- Load balancing to manage traffic flow
- Provide the business with faster time to market
- Simplified network management for applications
- Bridging of internal HiperSockets network to the entire ensemble

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**Value Made Possible By the Unified Resource Manager**

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

**Energy Management**
*Energy cost savings*

**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*

**Monitor status and general health of network resources**
Extending zEnterprise Unified Resource Manager
Continuing to add function and management

- Operational Controls enhanced with auto-discovery and configuration support for new resources
  - Dynamic discovery and configuration of storage resources by Unified Resource Manager

- Extending management functions of Unified Resource Manager with programmatic access
  - New Unified Resource Manager APIs enable discovery, monitoring and management of ensemble resources using external tools
    - Open documented interface available for clients
    - Access using common scripting languages like Perl and Python
    - IBM Tivoli® will be taking advantage of the APIs:
    - CA Technologies, Dovetailed Technologies, CSL International and other ISVs are interested in taking advantage of the APIs

zEnterprise Unified Resource Manager
Management of zEnterprise from external tools

Application Programming Interface (API) is a new implementation in the HMC
- Build on existing SNMP/CIM function plus new Unified Resource manager capabilities
- TCP/IP Sockets/HTTP is underlying network support with SSL for connection security
- Supports modern scripting languages (e.g., Perl, Python) that have HTTP supporting libraries
- Fully documented and supported for customer and third-party use
- HMC UI remains in place, supported and will continue to be extended as Unified Resource Manager evolves
- APIs are governed by the functions they involve such as 'Manage' or 'Automate'

API allows programmatic access to the same functions exploited by the HMC UI. Corresponding to views and tasks in the UI such as:
- List and get properties for core (traditional) entities, ensemble, workloads, virtual networks, virtual hosts, virtual servers, storage, zBX infrastructure (as well as provide start/stop/restart for many of these also)
- Can provide service oriented functions like metrics retrieval and inventory
- Manage energy management modes
- Help on recover actions of virtual actions
- And more ...
zManager APIs for Integrated Service Management

Monitoring
ITM 6.2.3
zEnterprise Monitoring Agent and Enterprise Common Collector

Availability
SA zOS V3.4
SA Application Manager V3.2.2

Discovery
TADDM (in Beta)* and Enterprise Common Collector

IBM Tivoli Service Management
Integrates zEnterprise monitoring into the IBM Tivoli Monitoring Infrastructure to provide real-time and historical reporting data

Provides zEnterprise resource automation policies and commands in the same standard fashion as existing resources

Discovery of zEnterprise resources for use in mapping application resources and dependencies

Component Architecture

Enterprise Common Collector (ECC)
- Captures data from Unified Resource Manager via the zManager APIs
- Provides a ReST API to other Tivoli products for access its collected data
- Can connect to multiple zHMCs to consolidate monitoring

IBM Tivoli zEnterprise Monitoring Agent
- Displays captured data in the Tivoli Enterprise Portal
- Records data into the Tivoli Data Warehouse for reporting/trending/usage
- Situations to TEP and/or EEM events to Netcool/OMNibus/TBSM, NetView on z/OS, etc.

ECC and zEnterprise agent can be located on the same or separate servers

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zEnterprise Monitoring Agent

- Provides visibility into the IBM zEnterprise hybrid infrastructure, including hardware resources, hypervisors, virtual servers, and workload resource groups.
- Automated discovery of resources within the monitoring environment.
- Integrates the information into IBM Tivoli Monitoring infrastructure to provide:
  - Information highlighting and alerting capabilities.
  - Integration with data from other agents in the ITM infrastructure.
  - Optional long term history collection and reporting/trending with the Tivoli Data Warehouse and Tivoli Common Reporting.
  - Optional event integration and Business Service Management with Netcool/OMNibus and Tivoli Business Service Manager (TBSM).

zEnterprise Lifecycle Management of Virtual Resources

- **Deployment**
  - Instantiate new workload.
  - Add virtual resources into workload.
  - Specify targets for goal oriented resource management according to business priorities.
- **Production**
  - Monitor virtual resources.
  - Manual or automatic adaption of resources in workload to achieve business goals.
- **Termination**
  - Destroy virtual resources and free up resources.

Definition of virtual resources:
- Definition of virtual servers, virtual storage, and virtual networks backed by physical resources.
- Define workloads.
Putting zEnterprise System to the Task

Operational Controls – POWER7

Putting zEnterprise System to the Task

Hypervisor Management and Virtual Server Management – POWER7
Putting zEnterprise System to the Task

Network Management

- z HW Resources
- z/OS
- z/VM
- Unified Resource Manager
- Private data network (IEDN)
- Customer Network
- Customer Network
- System z Host
- System z PR/SM
- z/TPF
- z/VSE
- Linux on System z
- Linux on System z
- Support Element
- System z Hardware Management Console (HMC) with Unified Resource Manager
- HMCHMC
- Select IBM Blades
- Blade HW Resources
- Optimizers
- DataPower XI50z
- Blade
- Virtualization
- Blade
- Virtualization
- Linux on System x
- Linux on System x
- or Windows
- zBX
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- Support Element
- System z Hardware Management Console (HMC) with Unified Resource Manager
- HMCHMC

Private High Speed Data Network IEDN

Private Management Network INMN

Private Management Network (information only)

Communication between blades and z196 is established over these networks.

Two networks established – one for data (IEDN) and one for service (INMN).

When the virtual server is defined, communication is set up between the blade and the other virtual servers - including those on the z196.

Set a performance policy for those resources.

If more resources are needed, more CPU can be added to the group to satisfy the business policy.

From the HMC you can define a group of resources together.
Putting zEnterprise System to the Task

Energy Management

System x Blade – New Virtual Server
System x Blade – New Virtual Server

System x Blade – New Virtual Server
System x Blade – New Virtual Server
System x Blade – Monitors Dashboard

zManager CPU Resource Mgmt Function

• z/VM and PowerVM Hypervisors
  – Virtual Server CPU Management provides the ability to manage CPU resources across virtual servers based on a goal-oriented performance policy.

• System x (KVM based) Hypervisor
  – Does not currently participate in dynamic resource management
  – Statement of Direction (8/28/12): IBM intends to deliver workload-aware optimization for IBM System x blades in the zBX, allowing virtual CPU capacity to be adjusted automatically across virtual servers within a hypervisor

• PR/SM Hypervisor
  – Does not make resource management adjustments based on PPM Policy. Only IRD dynamically influences the PR/SM hypervisor
CPU Management causes the hypervisor to move processing units (pu) from the donor to the receiver virtual server.
Putting zEnterprise System to the Task
Use the smarter solution to improve your application design

System z Host
- z/OS
- z/TPF
- z/VSE
- Linux on System z
- Linux on System z
- z/VSE
- z/VM
- System z PR/SM®

Support Element

Blade HW Resources

Select IBM Blades
- Linux on System x
- Windows on System x
- AIX on POWER7
- Blade Virtualization
- Blade Virtualization

Optimizers
- DataPower XI50z
- zBX

Private data network (IEDN)
Unified Resource Manager
Private Management Network (INMN)
Private High Speed Data Network (IEDN)

Customer Network

Please complete the evaluation for Session # 12948

Thank You
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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