zEnterprise –
The Ideal Platform For Smarter Computing

A Closer Look At The Value Of zEnterprise
zEnterprise Value

- zEnterprise z196 is STILL best for handling core business workloads
- zEnterprise is more than a mainframe – it’s a complete multi-architecture platform
- zEnterprise continues a tradition of unmatched reliability and superior qualities of service
zEnterprise Value

- zEnterprise z196 is STILL best for handling core business workloads
- zEnterprise is more than a mainframe – it’s a complete multi-architecture platform
- zEnterprise continues a tradition of unmatched reliability and superior qualities of service
z196 Is Ideal For High Transaction Workloads And Databases

**Kookmin Bank**
- IBM System z9 and DB2
- TCS BaNCS
- 15,353 Transactions/second
- 50 Million Accounts
- IBM benchmark for customer
- DB2 V9, CICS 3.1, z/OS V1.8

**Bank of China**
- IBM System z9 and DB2
- TCS BaNCS
- 9,445 Transactions/second
- 380 Million Accounts
- IBM benchmark for customer

---

Batch And OLTP Are Prime Workloads For z196

Incidence of workload on the Mainframe vs. allocation on the Mainframe

**Primary Strength Quadrant**

**Secondary Strength Quadrant**

**Niche Quadrant**

**Feeder Quadrant**

High incidence plus high allocation means OLTP and Batch are core mainframe workloads

Source: IBM Market Intelligence Customer Survey
z196 Is Optimized For Batch Processing And Heavy I/O Workloads

**Power PS701 + DS8300**
- 8 processors
- 128 GB RAM

**zEnterprise + DS8300**
- 8 processors
- 128 GB RAM

**SORT**  
*Job: Sort a 3 GB transaction file – Repetitions: 300*

<table>
<thead>
<tr>
<th></th>
<th>Power PS701 + DS8300</th>
<th>zEnterprise + DS8300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sorting Total Elapsed</td>
<td>6,900 secs</td>
<td>1,229 secs</td>
</tr>
<tr>
<td>Concurrency</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Bytes Per Sec</td>
<td>280 MB</td>
<td>1,600 MB</td>
</tr>
</tbody>
</table>

**MERGE**  
*Job: Merge 30 sorted files into a 90 GB master file – Repetitions: 10*

<table>
<thead>
<tr>
<th></th>
<th>Power PS701 + DS8300</th>
<th>zEnterprise + DS8300</th>
</tr>
</thead>
<tbody>
<tr>
<td>Merging Total Elapsed</td>
<td>7,920 secs</td>
<td>1,422 secs</td>
</tr>
<tr>
<td>Concurrency</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>Bytes Per Sec</td>
<td>244 MB</td>
<td>1,350 MB</td>
</tr>
</tbody>
</table>

**Batch window reduced by 83% on zEnterprise**

Source: IBM Internal Study. Results may vary based on customer workload profiles(characteristics.)
z196 Platform Easily Handles Workload Peaks

Example: Core banking workloads running simultaneously with high utilization
z196 Capacity On Demand Provides Elasticity To Handle Unexpected Peaks

- **On/Off Capacity on Demand (On/Off CoD)**
  - Flexible, easy, non-disruptive temporary additional capacity
  - Self-managed
  - Total flexibility within number of books installed

- **Can be automated**

![One Book with 6 Processing Units](image)

- Active processors – pay full price
- Inactive processors (On/Off CoD) – pay only 2% of full price
- Dark processors (unused) – no charge
Customer Data Shows Most Mainframe Workloads Are Already Best Fit

- IBM Eagle Team performs total cost of ownership (TCO) studies for customers
- With over 200 customers evaluated, Eagle Team has shown System z offers better TCO than a distributed alternative… with very few exceptions
- Contact Craig Bender (csbender@us.ibm.com)
Data Shows Mainframe-Biased Businesses Have Reduced Costs

IT cost of goods per industry:

<table>
<thead>
<tr>
<th>Industry</th>
<th>Measure</th>
<th>Avg IT Cost of Goods</th>
<th>MF Biased</th>
<th>Server Biased</th>
<th>%Improve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Airlines</td>
<td>Per Passenger Mile</td>
<td>$0.007</td>
<td>$0.0061</td>
<td>$0.0076</td>
<td>-20%</td>
</tr>
<tr>
<td>Automotive</td>
<td>Per Vehicle</td>
<td>$333</td>
<td>$275</td>
<td>$370</td>
<td>-26%</td>
</tr>
<tr>
<td>Chemicals</td>
<td>Per Patent</td>
<td>$57,717</td>
<td>$55,800</td>
<td>$59,552</td>
<td>-6%</td>
</tr>
<tr>
<td>Consulting</td>
<td>Per Consultant</td>
<td>$53,060</td>
<td>$48,900</td>
<td>$62,344</td>
<td>-22%</td>
</tr>
<tr>
<td>Hospitals</td>
<td>Per Bed per Day</td>
<td>$64.30</td>
<td>$54.4000</td>
<td>$71.7000</td>
<td>-24%</td>
</tr>
<tr>
<td>Railroads</td>
<td>Per Ton Mile</td>
<td>$0.0014</td>
<td>$0.0012</td>
<td>$0.0018</td>
<td>-29%</td>
</tr>
<tr>
<td>Retail</td>
<td>Per Store (Door)</td>
<td>$494,818</td>
<td>$421,346</td>
<td>$560,300</td>
<td>-25%</td>
</tr>
<tr>
<td>Web Sites</td>
<td>Per Search</td>
<td>$0.042</td>
<td>$0.046</td>
<td>$0.041</td>
<td>12%</td>
</tr>
<tr>
<td>Trucking</td>
<td>Per Road Mile</td>
<td>$0.177</td>
<td>$0.1550</td>
<td>$0.1940</td>
<td>-20%</td>
</tr>
<tr>
<td>Armed Service</td>
<td>Per Person</td>
<td>$8,036.00</td>
<td>$6,871.00</td>
<td>$9,839</td>
<td>-30%</td>
</tr>
<tr>
<td>Utilities</td>
<td>Per MegaWatt Hour</td>
<td>$2.63</td>
<td>$2.21</td>
<td>$2.94</td>
<td>-25%</td>
</tr>
<tr>
<td>Oil &amp; Gas</td>
<td>Per Barrel of Oil</td>
<td>$2.10</td>
<td>$1.78</td>
<td>$2.32</td>
<td>-23%</td>
</tr>
</tbody>
</table>

From Rubin Worldwide analysis of Gartner Research customer data and costs

Compared to average platform costs for all industries, mainframe-biased businesses spent 14% less, and distributed-biased businesses spent 33% more
Now With zEnterprise z196, System z Is Better Than Ever

zEnterprise z196 continues a tradition of mainframe innovation

Faster clock speed!

More processors per MCM!

More total processors!

More memory!

More performance!**

More capacity!*

Same power!

4.4 GHz

5

77 (64 configurable)

Up to 1.5 TB

920 MIPS

>30,000 MIPS

1800 W per MCM

5.2 GHz

6

96 (80 configurable)

Up to 3TB

1,202 MIPS

>50,000 MIPS

1800 W per MCM

• Based on LSPR ratings for fully configured system

** Single process performance

MCM = Multi-chip module
z196 Also Has Almost 8x More On-Chip Cache As z10 EC

One z10 EC MCM

- **L1**: Private per core
  - 64K I + 128K D
- **L1.5**: Private per core
  - 3MB I+D
- **L2**: On SC chips (2)
  - Shared by all PUs on MCM
  - 24MB per SC chip
  - 48MB per MCM

One z196 MCM

- **L1**: Private, in core
  - 64K I + 128K D
- **L2**: Private, adjacent to core
  - 1.5MB I+D
- **L3**: Shared by all four cores
  - 24MB eDRAM
- **L4**: On SC chip (2)
  - Shared by all PUs on MCM
  - 96MB eDRAM per SC chip
  - 192MB eDRAM per MCM

More cache leads to reduced latency times
z196 Adds Out-Of-Order Processing To Its Superscalar Architecture

- Superscalar enhancements to z196:
  - Decodes up to 3 instructions per cycle (up from 2 on z10)
  - Executes up to 5 instructions per cycle (up from 2 on z10)

- >100 new instructions added
  - In particular, Instruction Cracking and Register Renaming which enable Out-of-Order (OOO) instruction execution

- Reduces instruction wait times, and benefits compute-intensive apps
How Does This Add Up? z196 Significantly Outperforms z10 EC

<table>
<thead>
<tr>
<th>Benchmark</th>
<th>Performance Ratio (z196 : z10 EC)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>LSPR with z/OS V1R11</strong></td>
<td></td>
</tr>
<tr>
<td>z196 708 and z10 708*</td>
<td>1.37</td>
</tr>
<tr>
<td>z196 780 and z10 764**</td>
<td>1.64</td>
</tr>
<tr>
<td><strong>CPO Banking Benchmark</strong></td>
<td></td>
</tr>
<tr>
<td>CICS – 3270 version</td>
<td>1.37</td>
</tr>
<tr>
<td>WAS on z/OS</td>
<td>1.32</td>
</tr>
<tr>
<td>WAS on Linux on System z</td>
<td>1.47</td>
</tr>
<tr>
<td><strong>CPO COBOL Benchmark</strong></td>
<td></td>
</tr>
<tr>
<td>z/OS V1R11 Enterprise COBOL 4.1</td>
<td>1.41</td>
</tr>
</tbody>
</table>

* Customer average for z10 EC CEC is 9 GP processors
** Each as fully-configured systems
CICS/DB2 Optimizations For z/OS – From Then To Now

Continued investment to optimize key software for z/OS environment

- Upgrade CICS/DB2 stack produces 1.49 times performance improvement on same z10 hardware
- Move to zEnterprise hardware produces 1.35 times performance improvement
- From then to now – 2.01 times performance improvement

Results may vary
WebSphere Optimizations For z/OS – From Then To Now

Continued investment to optimize WebSphere software for z/OS environment

- 1.35 times performance improvement for JPA 2.0 applications that exploit the OpenJPA caching facilities available in the WebSphere Version 7 JPA Feature Pack.
- Up level to zEnterprise hardware produces 1.43 times performance improvement
- From then to now – 1.93 times performance improvement

Results may vary
WebSphere Optimizations For Linux

Similar results are achieved for WebSphere software in a Linux for System z environment

- 1.32 times performance improvement for JPA 2.0 applications that exploit the OpenJPA Caching facilities available in the WebSphere Version 7 JPA Feature Pack.
- Move to zEnterprise hardware produces 1.37 times performance improvement
- Combined hardware and software - 1.81 times performance improvement

Results may vary
zEnterprise Value

- zEnterprise z196 is STILL best for handling core business workloads

- zEnterprise is more than a mainframe – it’s a complete multi-architecture platform

- zEnterprise continues a tradition of unmatched reliability and superior qualities of service
zEnterprise Has Different Environments For Different Workload Requirements

z/OS Workload
Linux on System z

Linux on System x Blades

z/VM Workload
PowerVM Optimizers

AIX on System x Blades*

Linux on System x Blades*

zBX integrated Hypervisor for IBM System x Blades

Windows on System x Blades*

zEnterprise z196

zEnterprise BladeCenter Extension (zBX)

Fit-For-Purpose Strategy

- Multiple architecture environments to support a broader range of existing workloads
- When there is a choice, workloads can be assigned to platform with lowest cost per workload

*All statements regarding IBM future direction and intent are subject to change or withdrawal without notice, and represents goals and objectives only.
zEnterprise BladeCenter Extension (zBX) Adds New Platforms To System z

- zBX ordered and installed as one fully built and tested System z “part”
  - Includes all necessary components – switches, chassis, power, and cabling
  - Blades and optimizers purchased separately
- Built from standard IBM Certified Components
- Full redundancy insures highest reliability
- System z product support for problem reporting, hardware and firmware updates

One zBX rack:
- Up to 14 blades per chassis
- Up to 2 chassis per rack

One fully loaded zBX is:
- 4 racks
- 112 blades

Selected IBM blades supported:
- IBM POWER7 blades
- IBM System x blades*
- Specialty Optimizers
- Most can be mixed

* All statements regarding IBM future direction and intent are subject to change or withdrawal without notice, and represents goals and objectives only.
Blades Run Distributed Software Available Through Passport Advantage

- No MIPS or MSU rating for zBX software

---

**WebSphere** software
- Application Workload Modeler
- Communications Server Decision Server
- MQSeries
- Process Integration Server Application Server
- BI Server
- Business Integration Commerce
- ESB
- Lombardi
- Portal
- Portlet Factory
- Translation Server Voice Server

**Rational** software
- Team Concert
- Requirements Composer
- Asset Manager
- BuildForge
- ClearCase
- AppScan
- Quality Manager
- Functional Test
- Performance Test

**Lotus** software
- Connections
- Domino
- Forms
- ActiveInsight
- Quickr
- Web Content Manager
- Workflow
- Mashup Center
- Sametime

**Tivoli** software
- Directory Server
- Maximo
- Performance Analyzer
- Composite Application Manager
- Identity and Access Assurance
- Access manager
- Asset Manager
- Change and Configuration Manager
- Compliance Insight Manager
- Directory Integrator
- Federated Identity Manager
- Identity and Access Manager
- License Compliance Manager
- Monitoring
- Netcool
- OMEGAMON
- Provisioning
- Security Compliance Manager
- Service Automation Manager
- Systems Automation
- Workload Scheduler

**Other**
- Unica
- Systems Director
- Sterling

---
zBX Optimizers Are Built-For-Purpose

- Delivered as Blades for use in zBX
- Fully-integrated, fully-contained – each targeted for specific workload functions
  - Pre-packaged, self-contained units including hardware, software, memory, etc.
- Designed for integration with and management by zEnterprise
- Two zBX optimizers available today:
  - IBM Smart Analytics Optimizer
  - IBM WebSphere DataPower XI50 for zEnterprise
There’s more to this than meets the eye!

The Unified Resource Manager – also called zManager – is the “secret sauce”.

It provides extensive management of resources and workloads across all zEnterprise platforms!

But what is so unique about putting a BladeCenter next to a mainframe?
### zManager Provides Platform And Resource Management Across zEnterprise Environments

<table>
<thead>
<tr>
<th>Process</th>
<th>Typical Distributed Management Practices</th>
<th>zManager</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset Management</td>
<td>- Discover assets with ad hoc methods&lt;br&gt;- Manual entitlement management</td>
<td>- Automated discovery and management of entitlement assets</td>
</tr>
<tr>
<td>Deployment Management</td>
<td>- Manually configure hypervisor and build networks</td>
<td>- Automated deployment of hypervisor and attachment to integrated networks</td>
</tr>
<tr>
<td>Security Management</td>
<td>- Different ways to manage administrator access</td>
<td>- Centralized, fine-grained administrator access management</td>
</tr>
<tr>
<td>Change Management</td>
<td>- No visibility into impact of changes</td>
<td>- Track dependencies for change impact</td>
</tr>
<tr>
<td>Capacity and Performance Management</td>
<td>- No end-to-end transaction monitoring&lt;br&gt;- Manually adjust CPU resources to meet changing workload demands</td>
<td>- End-to-end transaction monitoring to isolate issues&lt;br&gt;- Automatic CPU resource adjustments to meet changing workload demands</td>
</tr>
</tbody>
</table>
z196 And zBX Are Connected Via Two Internal Networks

- Isolated and dedicated Management Network
- Secure Data Network for virtual machine communication
- Full redundancy for reliability
  - OSA adapters
  - Top of rack switches
  - Bulk power hubs
  - Support Elements and HMC

Management Network
- Cables 3.2m from OSM to BPH, and 26m from BPH to TOR

Data Network
- Cables max of 26m from z196 to TOR, and 300m short-reach or 10km long-reach to another zBX

z196
- OSA-E3 1000Base T “OSM”
- OSA-E3 10 Gigabit “OSX”

zBX
- Top of Rack Switch
- Bulk Power Hub
zEnterprise Network Simplification And Security

- “Network in a box” limits vulnerability to security breaches
  - Fully integrated concealed networks
    - No external switches or routers necessary – IBM-only equipment
    - Fully tested, pre-installed and pre-configured
  - Can reduce latency and the number of “hops”

- Security
  - Management Network:
    - Tightly restricted to zManager use only
  - Data Network:
    - Accessible only by authorized virtual machines
  - Logical security via virtualization
  - zManager includes strict “role-based” access control
  - No need for additional encryption or firewall
zManager Owns The Private Management Network For Hypervisor Communications

- Dynamically manages resources for better workload management
- Extends mainframe-quality problem detection and reporting across all platforms
- Monitors system-wide energy efficiency

*All statements regarding IBM future direction and intent are subject to change or withdrawal without notice, and represents goals and objectives only.
DEMO: Manage Resources And Workloads Using zManager

- zManager uses familiar HMC interface
- View and manage all zEnterprise platforms
# zManager Can Drive Down Labor Costs

<table>
<thead>
<tr>
<th>IT Process</th>
<th>zManager</th>
<th>Costs Reduced By*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asset Management</td>
<td>Automated discovery and management of entitlement</td>
<td>9%</td>
</tr>
<tr>
<td>Deployment Management</td>
<td>Automated deployment of hypervisors and virtual networks</td>
<td>33%</td>
</tr>
<tr>
<td>Capacity and Performance</td>
<td>Automatic resource adjustments to meet changing workload demands</td>
<td>52%</td>
</tr>
<tr>
<td>Management</td>
<td>Centralized, fine-grained administrator access</td>
<td>20%</td>
</tr>
<tr>
<td>Change Management</td>
<td>Dependency tracking across platform for change impact</td>
<td>41%</td>
</tr>
</tbody>
</table>

*Source: IBM Internal study of 92 hybrid workloads*
zEnterprise Value

- zEnterprise z196 is STILL best for handling core business workloads
- zEnterprise is more than a mainframe – it’s a complete multi-architecture platform
- zEnterprise continues a tradition of unmatched reliability and superior qualities of service
A Complex, Distributed-based Scale Out Strategy Has Its Risks

### Amazon public cloud platform suffered a 3+ day outage in April, 2011

- Distributed architecture designed “for durability and availability”
- Yet a complex *single point of failure* negated the advantage of rapid replacement of failed resources
- Numerous customers suffered significant and unrecoverable data loss

**Caveat Emptor!**

Source: http://status.aws.amazon.com
Availability Is Paramount – Downtime Is Extremely Expensive

- 1+ hour outage August 2009
- $2,000 lost per second
- $7.2M+ lost revenue

Financial Impact of Downtime Per Hour

<table>
<thead>
<tr>
<th>Industry/Sector</th>
<th>Revenue/Hour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy</td>
<td>$1,468,798</td>
</tr>
<tr>
<td>Telecommunications</td>
<td>$4,611,604</td>
</tr>
<tr>
<td>Financial</td>
<td>$8,213,470</td>
</tr>
<tr>
<td>Information Technology</td>
<td>$3,316,058</td>
</tr>
<tr>
<td>Insurance</td>
<td>$2,582,382</td>
</tr>
<tr>
<td>Pharmaceuticals</td>
<td>$2,058,710</td>
</tr>
<tr>
<td>Banking</td>
<td>$1,145,129</td>
</tr>
<tr>
<td>Consumer Products</td>
<td>$989,795</td>
</tr>
<tr>
<td>Chemicals</td>
<td>$1,071,404</td>
</tr>
<tr>
<td>Transportation</td>
<td>$1,463,128</td>
</tr>
</tbody>
</table>

Source: Robert Frances Group 2006

Average = $2.7M
Example of fault-tolerant design:

- Error prevention
  - Technology
  - Design
  - Test

- Error detection
  - Instantaneous
  - Error domain
  - Data capture

- Recovery
  - Fence
  - Reset
  - Fault tolerance

- Problem determination
  - Problem correlation
  - Problem isolation

- Change management
  - Hardware
  - Drivers

- Measurements & analysis
  - Product RAS
  - Failure analysis

- Corrective Maintenance
  - Maintenance
  - Service personnel
  - Parts
  - Problem management

- Reliable Operations

System z Has A History Of Continuous Improvements To Reliability And Serviceability

Example of fault-tolerant design:

System z Has A History Of Continuous Improvements To Reliability And Serviceability
z/OS Can Support Unprecedented Levels Of Availability

- Parallel Sysplex architecture designed for **99.999%** availability
  - Full redundancy yielding no single points of failure
    - All systems can have concurrent access to all critical applications and data
    - Automatic restart and recovery capabilities
  - Dynamic workload routing via z/OS Workload Manager and Sysplex Distributor
    - Work flow designed for best response times
Result: zOS Delivers The Highest Availability And The Lowest Downtime Cost

Source: IBM Internal Study

Downtime Hours Per Year

- z/OS: 5 minutes
- Windows 2000: 90 minutes
- Windows 2003: Same as promised by Amazon EC2
- Red Hat Linux: 8.8 hours
- Solaris: 90 minutes
- HP-UX
- SUSE Linux
- AIX

Downtime cost:
- z/OS: $4.05M per year
- Windows 2000: $225K per year

System z Parallel Sysplex with 99.999% availability
zEnterprise Continues The Strategy Of Constant Improvements In Availability

- **RAIM Memory**
  - Provides more redundancy to protect against additional failure modes
    - Protects DIMM level components such as ASIC, power regulators, clock, and board
    - Protects memory channel failures such as signal lines, control lines, and drivers/receivers on the MCM
    - More robust than ECC, and more cost effective than 100% memory mirroring
    - No performance penalty

- **Hot pluggable I/O drawer technology reduces planned down time**
  - Perform maintenance while the system keeps running
zEnterprise Value Is Unsurpassed!

- zEnterprise z196 is STILL best for handling core business workloads
- zEnterprise is more than a mainframe – it’s a complete multi-architecture platform
- zEnterprise continues a tradition of unmatched reliability and superior qualities of service