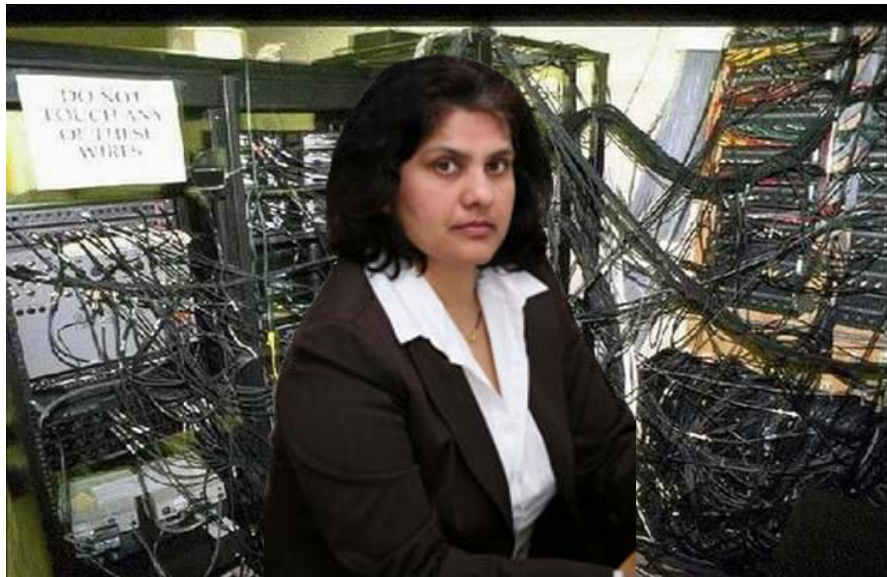# zEnterprise –
The Ideal Platform For Smarter Computing

Simplify And Compress Your Hardware Footprint With zEnterprise

Simplifying Hardware Infrastructure Dramatically Reduces The Cost Per Workload

Our front end infrastructure is too complex…

You can simplify by consolidating everything on a single platform!

CIO

IBM

Different Workloads Have Different Characteristics

Workloads

Workloads

Workloads

- High volume OLTP workload
- High I/O bandwidth
- High quality of service requirements

- High processing intensity
- Integer or floating point

- Light to moderate processing
- Modest quality of service requirements

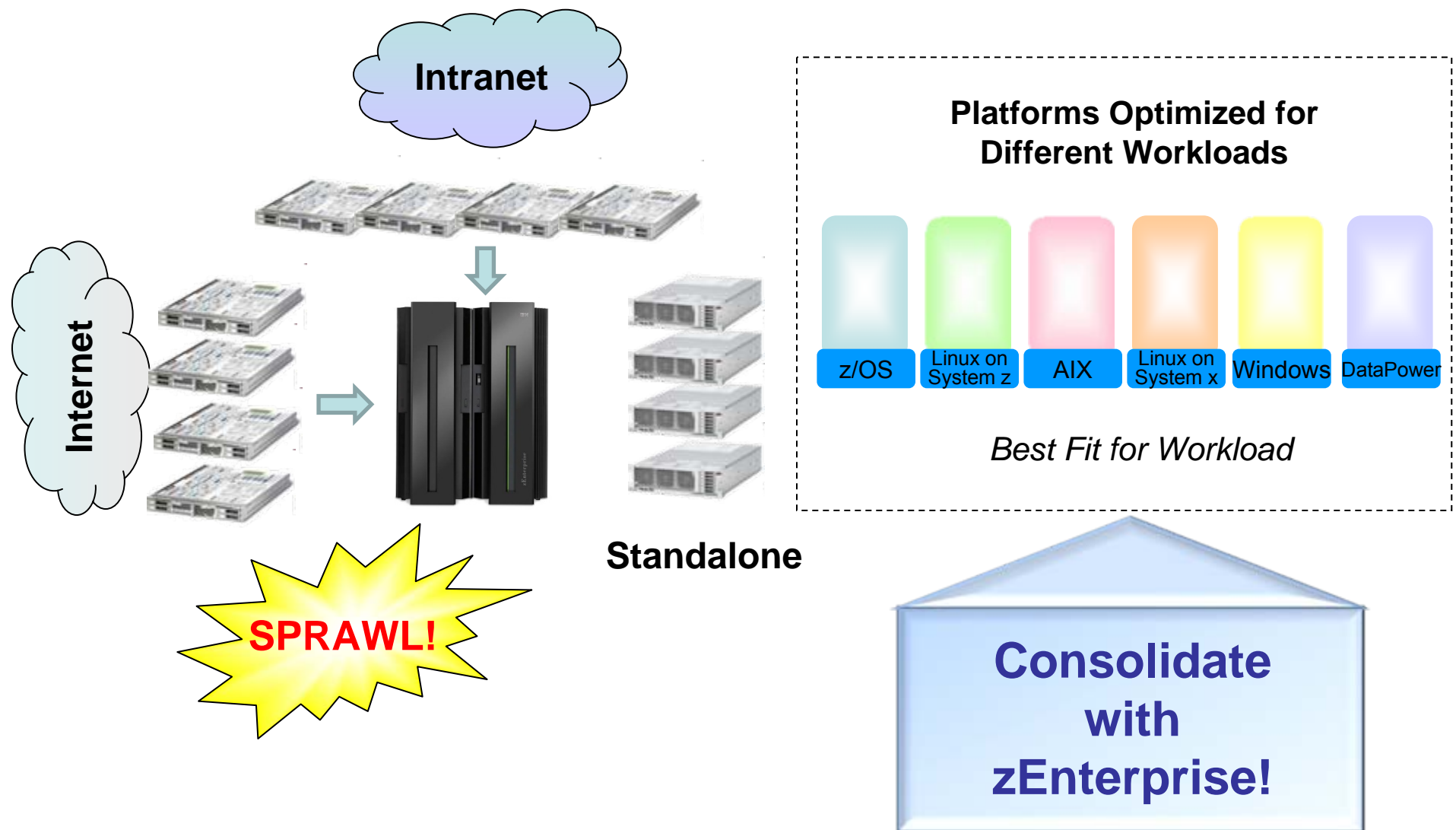*zEnterprise Environments Are Optimized For Different Workload Types*

Assign Workloads By Their Characteristics

- Front End Workloads
  - ▶ Consolidate to zBX blades

- Standalone Workloads
  - ▶ Consolidate to zBX blades and Linux on z

- OLTP and Batch Workloads
  - ▶ Consolidate to mainframe

zEnterprise

Eliminate Sprawl With zEnterprise Multi-Architecture Environment

Intranet

Internet

SPRAWL!

Standalone

Platforms Optimized for Different Workloads

| z/OS | Linux on System z | AIX | Linux on System x | Windows | DataPower |

Best Fit for Workload

Consolidate with zEnterprise!

zBX Inherits BladeCenter Advantages

- **BladeCenters offer significant advantages**
  - ▶ Denser packing reduces space requirements
  - ▶ Built in backplane switching provides redundant connectivity, reduces wiring and increases resiliency
    - − Ethernet, Fiber channel
    - − I/O and networking virtualization
  - ▶ Shared power supplies reduce power consumption and increase resiliency
 - ▶ Hot swapping and failure prediction improves serviceability

zBX Provides Additional Significant Advantages Over Other Blade Systems

- **Multiple server architectures support best fit workload assignments**
  - ▶ zBX supports power blades, x86 blades, and special purpose optimizers
  - ▶ Competition is typically limited to a single architecture

- **Dual power domains and dual DC supply lines**
  - ▶ zBX offers higher levels of availability
  - ▶ Competition typically provides single power and DC supply

- **Performance management dynamically adjusts resources as needed**

- **Automated zManager facilities reduce labor**
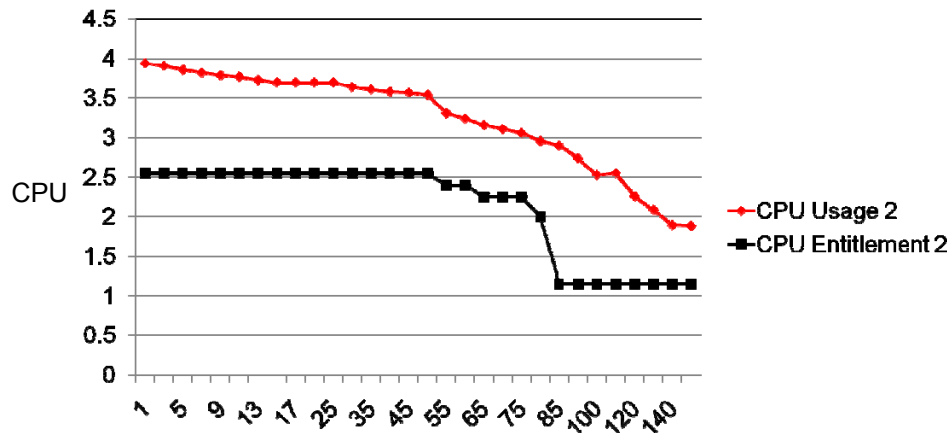
zManager Workload Management

- Enables definition of workload performance goals
- Tracks transaction performance end-to-end and isolates bottlenecks
- Can dynamically adjust virtual server entitlements on a particular hypervisor to achieve performance goals

A "workload" is a grouping of virtual servers supporting a business application
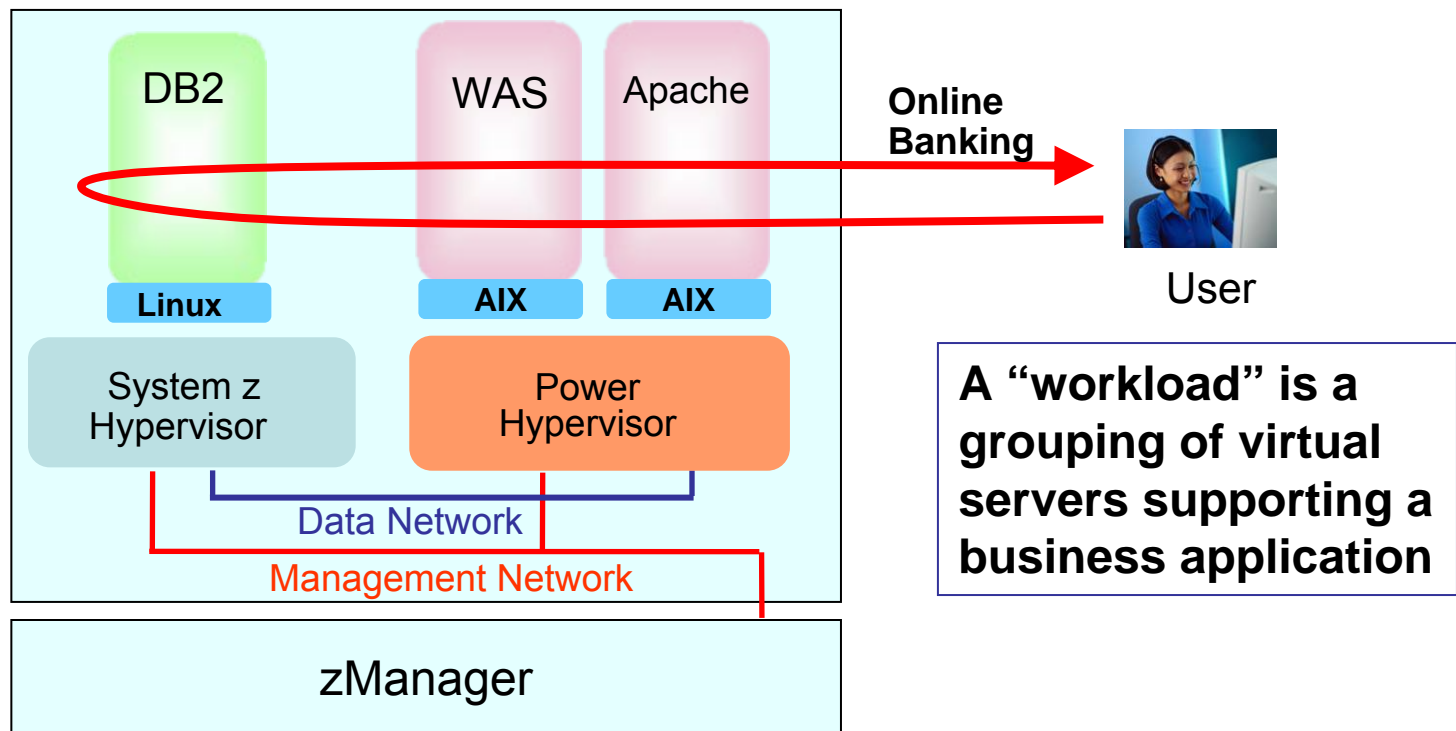
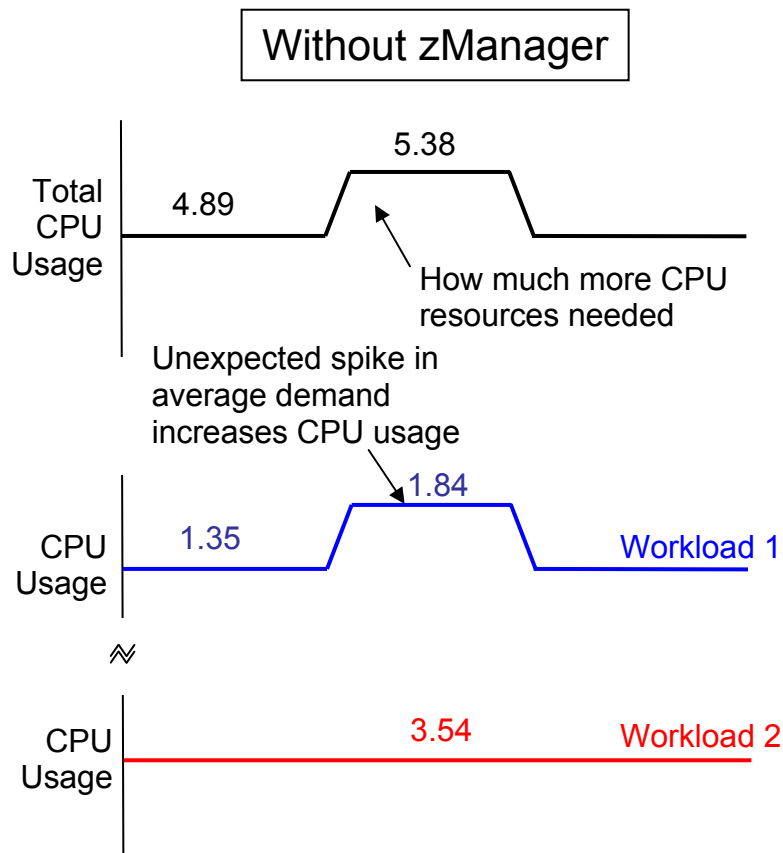# Performance Manager Lab Test – Automatic Allocation Of CPU Resource
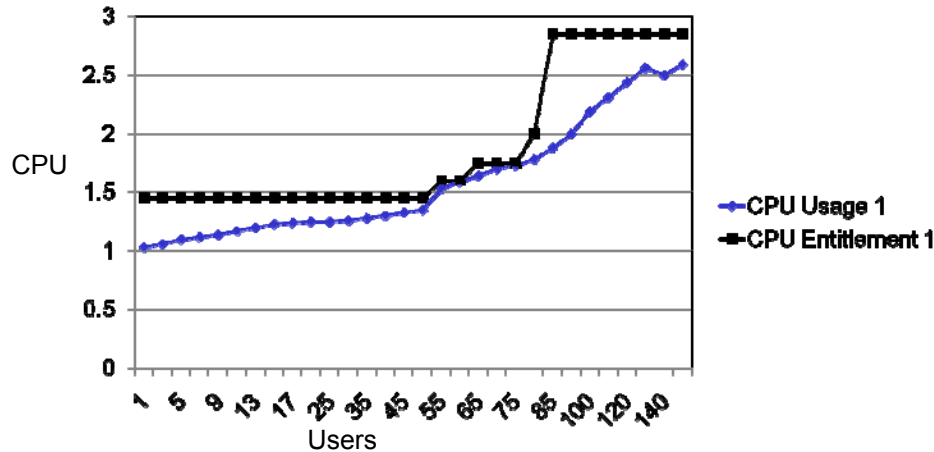
- zManager monitors virtual machine performance

- Automatically adjusts CPU resources as needed

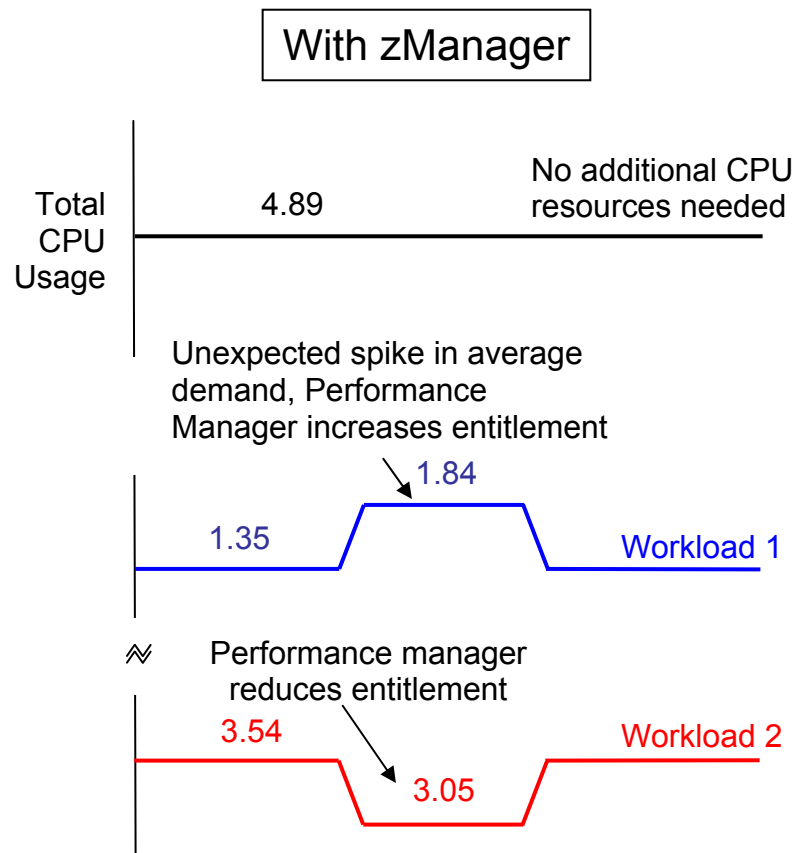- Considers priority and performance relative

Result: Reduces the need to over-provision CPU resources

Power Blade Example

zManager Performance Management Reduces Need To Overprovision CPU Resource

Without zManager

Total CPU Usage

4.89

5.38

How much more CPU resources needed

Unexpected spike in average demand increases CPU usage

CPU Usage

1.35

1.84

Workload 1

CPU Usage

3.54 Workload 2

Must over provision CPU resource by 10% to handle unexpected 64% spike in demand from workload 1

With zManager

Total CPU Usage

4.89

No additional CPU resources needed

Unexpected spike in average demand, Performance Manager increases entitlement

1.35

1.84

Workload 1

Performance manager reduces entitlement

3.54

3.05

Workload 2

Performance manager enables trading off resource from lower priority workload 2 avoiding the need to overprovision

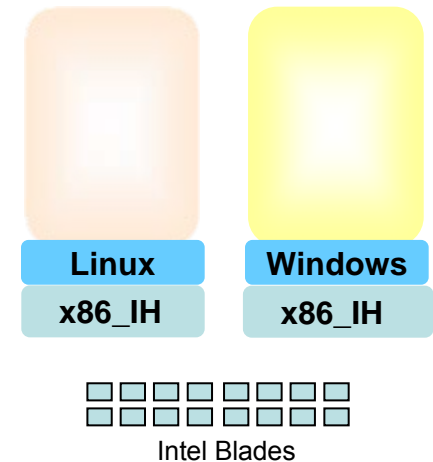# A Closer Look At Fit-For-Purpose Workload Assignment

Linux	
z/OS	z/VM

PR/SM

I/O Sub-system

AIX
PowerVM

Power Blades

Linux	Windows
x86_IH	x86_IH

Intel Blades
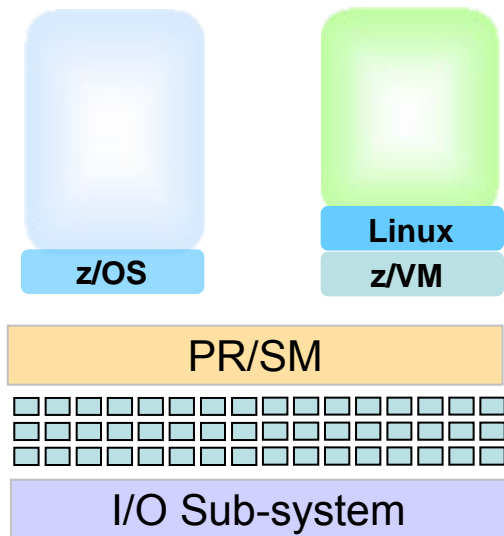
- Scale up to 80 cores in a frame (z/OS clusters with sysplex)
- Dedicated I/O sub-system
- Superior qualities of service
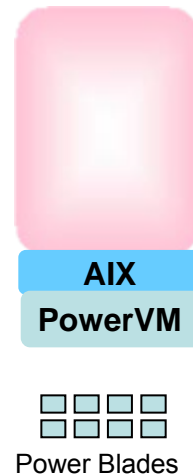
- Scales to 8 cores per blade
- 4 fast processing threads per core
- Floating point accelerators

- Scales to 16 cores per blade
- 2 fast processing threads per core
- Commodity I/O
- Modest qualities of service

Assigning Standalone Workloads With Heavy CPU Requirements

Benchmark to determine which platform provides the lowest TCA over 3 years

Heavy CPU workloads

- **IBM WebSphere ND**
- **Monitoring software**
- **On 8 core Nehalem servers**

Online banking workloads, each driving **460** transactions per second with light I/O

2 workloads per Intel blade

Scale to 16 cores

Virtualized on Intel 16 core HX5 Blade

$190,023 per workload

Best Fit

1 workload per POWER7 blade

PowerVM on PS701 8 core POWER7 Blade

$204,036 per workload

10 workloads per 32-way z/VM

z/VM on z196 CPC 32 IFLs

$339,939 per workload

Consolidation ratios derived from IBM internal studies. HX5 2.13GHz 2ch/16co performance projected from x3550 2.66GHz 2ch/12co measurements. zBX with x blades is a statement of direction only. Results may vary based on customer workload profiles/characteristics. Prices will vary by country.
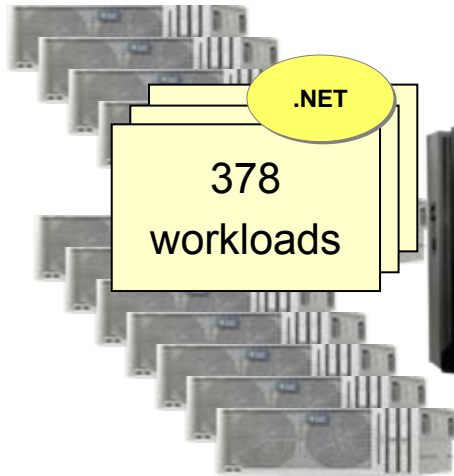
Run .NET Applications On zEnterprise With Centralized Management

Native .NET 22 tps applications on older Nehalem servers

10 Sun Fire X4170
2.26GHz Xeon L5640
120 cores total

$883
per workload
3yr TCA
HW+SW

.NET

378 workloads

Consolidate on Sun Fire X4170 Servers

6 HX5 Blades in zBX
2.13GHz Xeon E7-2830
96 cores total

$719
per workload
3yr TCA
HW+SW

Consolidate on zEnterprise zBX

19% less

Consolidation ratios derived from IBM internal studies. Sun X4170 2.26GHz 2ch/12co performance projected from HX5 2.13GHz 2ch/16co measurements. Lack of zManager Performance Management in Sun X4170 adds 11% extra capacity. zBX with x blades running Windows is a statement of direction only. Results may vary based on customer workload profiles/characteristics. Prices will vary by country.

Assigning Standalone Workloads With Light CPU Requirements

Benchmark to determine which platform provides the lowest TCA over 3 years
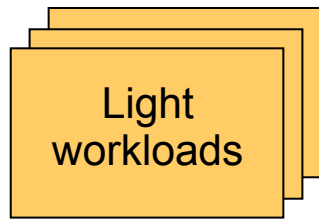
47 workloads per Intel blade

Virtualized on Intel
16 core HX5 Blade
$8,086 per workload

Light workloads

- **IBM WebSphere ND**
- **Monitoring software**
- **On 4 core "older" Intel**

28 workload per POWER7 blade

Fast low cost threads

PowerVM on PS701
8 core POWER7 Blade
$7,287 per workload

Best Fit

Online banking workloads, each driving **22** transactions per second with light I/O

155 workloads per 32-way z/VM

z/VM on z196 CPC
32 IFLs

$21,932 per workload

Consolidation ratios derived from IBM internal studies. HX5 2.13GHz 2ch/16co performance projected from x3550 2.66GHz 2ch/12co measurements. zBX with x blades is a statement of direction only. Results may vary based on customer workload profiles/characteristics. Prices will vary by country.

Run Web Front End Workloads On zEnterprise Platform

Web facing front-end

Message hub

CICS/DB2 core system

WAS

AIX

DataPower XI50z

DB2 CICS

z/OS
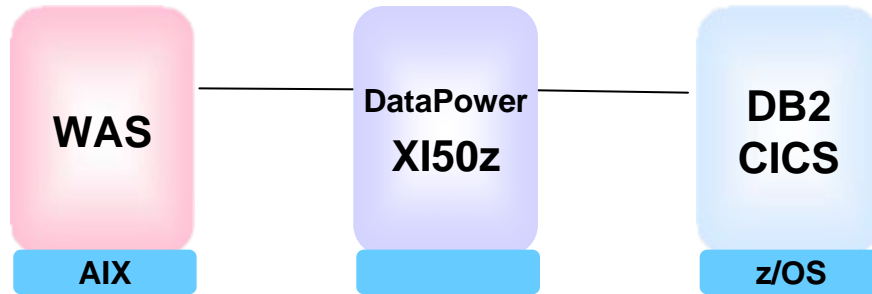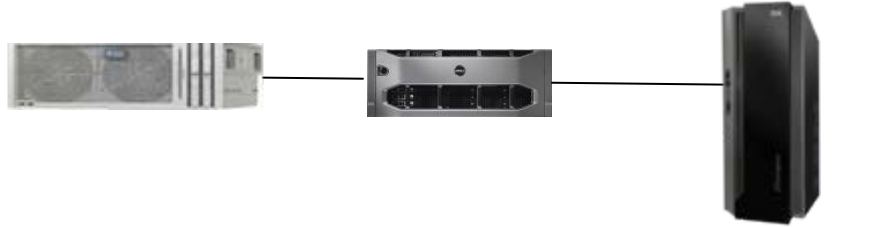
zEnterprise BladeCenter Extension (zBX)

zEnterprise z114 / z196

- Extends mission critical quality of service to hybrid environments

- Virtualization for workload isolation

- Run as ensemble of virtual servers

- Unified management of virtual machines

- Manage ensemble as a single workload with service goals

- Assign best fit to Power blade and XI50z for lowest cost per workload

- Embedded pre-configured data network

DataPower XI50z – Built For Purpose Appliance

Enterprise Service Bus benchmark comparison

BizTalk Server

Windows

messages → **ESB** **Linux** → messages
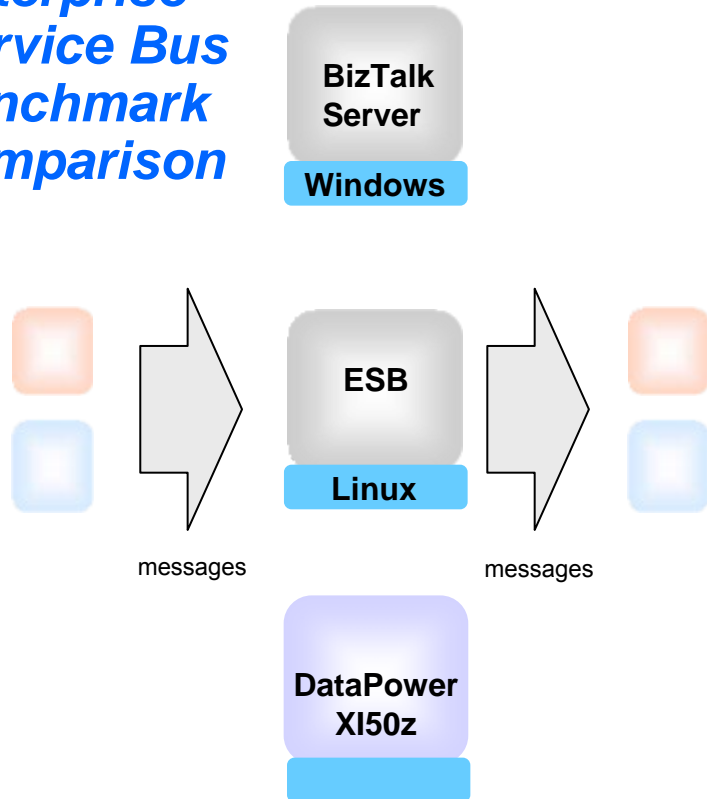
DataPower XI50z

Microsoft BizTalk Server
Windows on Intel Server

4 sockets, 32 cores

128 GB

492 messages per sec
$764 per mps

Competitive Service Bus
Oracle Linux on HP DL380

2 sockets, 12 cores

128 GB

5,839 messages per sec
$120 per mps

DataPower
XI50z in zBX

HS 22, 8 cores

5,117 messages per sec

$33 per mps

Source: IBM internal benchmarks. Tests consists of measuring maximum throughput of ESB while performing a variety of message mediation workloads: pass-through, routing, transformation, and schema validation. 3 yr. TCA includes hardware acquisition, maintenance, software acquisition and S&S. US list prices used. Prices may vary by country.

Web Front Ends Cost 59% Less On zEnterprise

Web front-end workloads

Web Facing

Message Driven
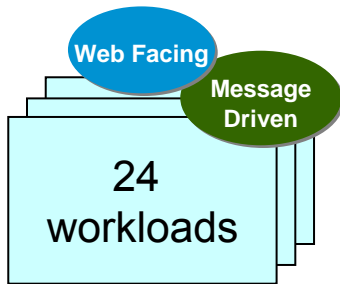
24 workloads

Each workload driving 3080 tps

High availability Workload isolation
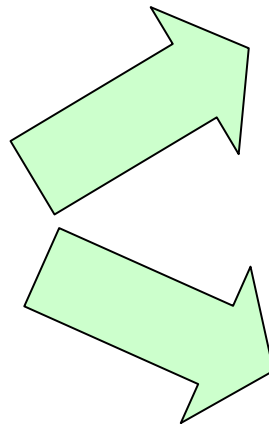
Competitive Packaged System

24 Sun Fire X4170 M2 12-core Xeon servers in ¾ rack
2 HP DL380 servers (for ESB)
312 cores total

Competitor's system relies on physical workload isolation

Deploy on Sun hardware

$433K
per workload
3yr TCA
Front end HW+SW

WebSphere App Server

24 POWER7 8-core blades
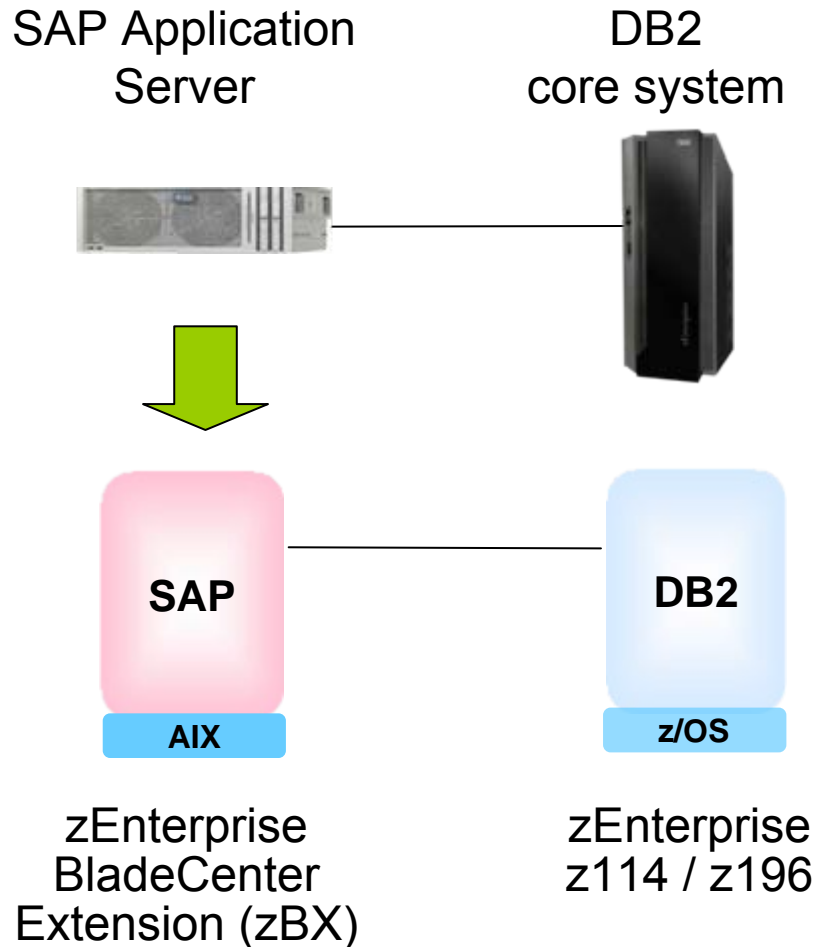**2 DataPower** XI50z
in zBX
192 cores total

Power blades in zBX

$177K
per workload
3yr TCA
Front end HW+SW

Source: IBM Internal benchmarks. Competitive Packaged System includes Competitive Application Server and Sun Fire X4170 M2 servers. 3 yr. TCA calculation includes hardware acquisition, maintenance, software acquisition and S&S. US list prices. Prices may vary by country.

Run SAP Front End Applications On zEnterprise Platform

SAP Application Server

DB2 core system

SAP

AIX

zEnterprise BladeCenter Extension (zBX)

DB2

z/OS

zEnterprise z114 / z196

- Run as ensemble of virtual servers

- Unified management of virtual machines

- Manage ensemble as a single workload with service goals

- Assign best fit to Power blade for lowest cost per workload

- Embedded pre-configured data network

SAP Applications Cost 18% Less On zEnterprise

SAP applications on older SPARC T2+ servers

Data Processing

20 workloads

38 Sun T3-1B blades in Sun rack
608 cores total

Upgrade to new SPARC T3 hardware

$60K
per workload
3yr TCA
Front end HW+SW

23 POWER7 blades in zBX
184 cores total

1010010010100
101001001010010
101001010101001
101001010101001
101001001010101001

Consolidate on zEnterprise

$49K
per workload
3yr TCA
Front end HW+SW

Source: IBM Internal sizing benchmarks for SAP. 3 yr. TCA calculation includes hardware acquisition, maintenance, software acquisition and S&S. US list prices. Prices may vary by country.
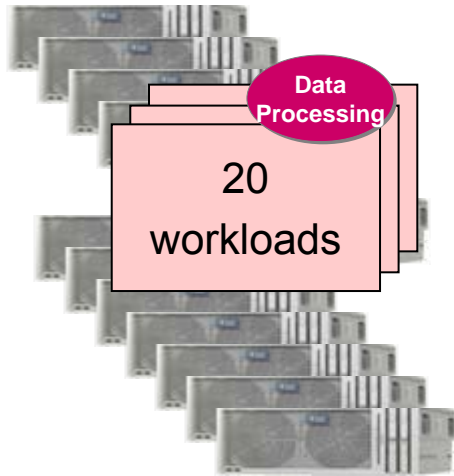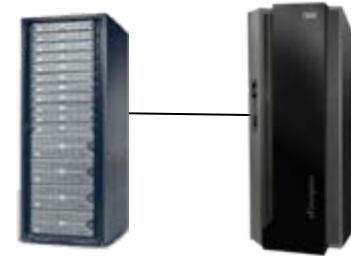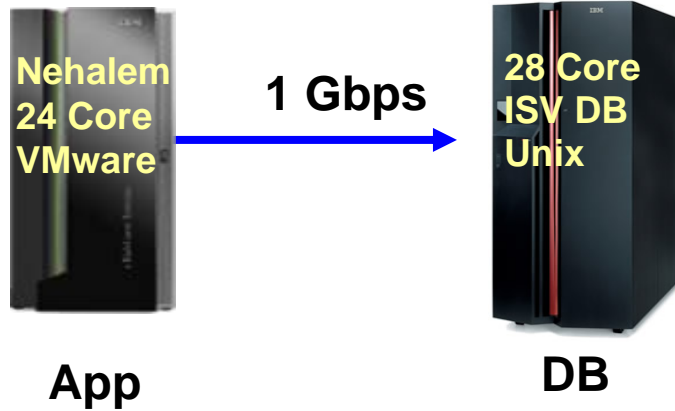
European Utility Company SAP Experience Shows zEnterprise Is 71% More Cost Effective

x Blades / ISV DB on Unix

Nehalem 24 Core VMware → 1 Gbps → **28 Core ISV DB Unix**

App   DB

Unit Cost (3yr TCA)   **$16.15/BPH**

Hardware	$1,537,822
Software	$1,689,348
Bills/Hour (BPH)	200K

zEnterprise

zBX 4 PS701 32 Core — 10 Gbps — 1010010010100 10100100101001 10100100101001 10100100101001 → **z196-707 4GP+ 3zIIP DB2 V10 z/OS 1.11**

App   DB
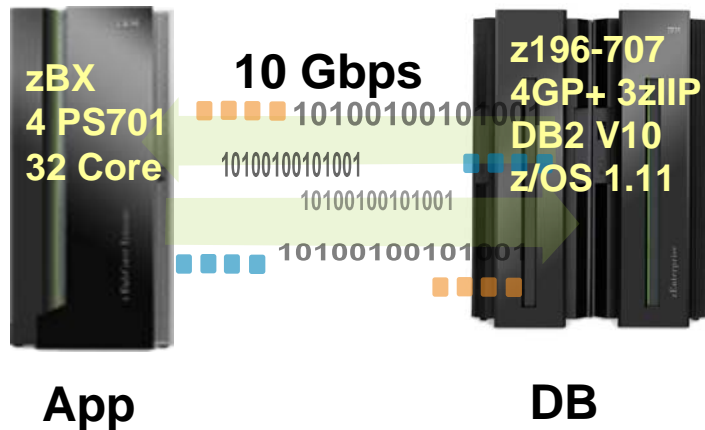
71% less

Unit Cost (3yr TCA)   **$4.59/BPH**

Hardware	$844,432
Software	$352,536
Bills/Hour (BPH)	261K

Based on customer data. 3Yr TCA calculation includes hardware acquisition, maintenance, application and database software acquisition and S&S. U.S. list prices prices, prices will vary by country. Cost of packaged application (SAP) not included.

Assigning Standalone Workloads With Heavy I/O Requirements

Benchmark to determine which platform provides the lowest TCA over 3 years

Heavy I/O workloads
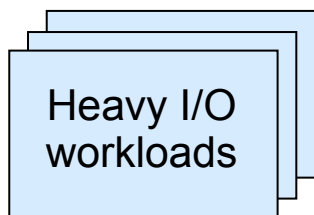
- **IBM WebSphere ND**
- **Monitoring software**
- **On 4 core "Older" Intel**

Online banking workloads, each driving **22** transactions per second, with **1 MB I/O per transaction**

1 workload per Intel blade

Virtualized on Intel 16 core HX5 Blade **$380,046** per workload

1 workload per POWER7 blade

PowerVM on PS701 8 core POWER7 Blade **$204,036** per workload

40 workloads per 32-way z/VM

I/O bandwidth large scale pool

z/VM on z196 CPC 32 IFLs **$84,985** per workload **Best Fit**

Consolidation ratios derived from IBM internal studies. HX5 2.13GHz 2ch/16co performance projected from x3550 2.66GHz 2ch/12co measurements. zBX with x blades is a statement of direction only. Results may vary based on customer workload profiles/characteristics. Prices will vary by country.

Linux On z/VM Is Designed For Efficient Virtualization And Consolidation

Logical Partitions Share Processors, Common Cache Structures, and I/O

I/O Sub-system offloads I/O processing

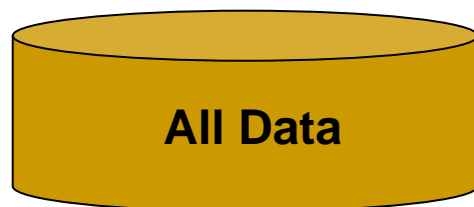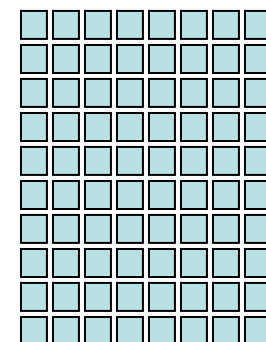| z/OS	z/OS	Linux	Linux	Linux
		z/VM	z/VM	z/VM
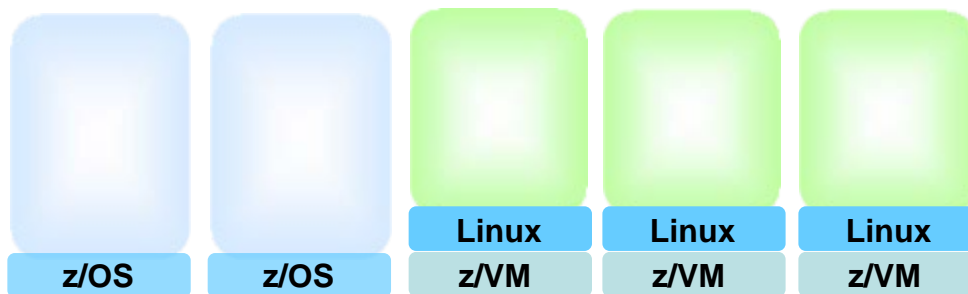
Internal networking via secure high speed HiperSockets

Intelligent Resource Director dynamically allocates processors to partitions

Shared access to all disk data and to external networks

All Data

z/VM supports 1,000s of virtualized images

Linux on z/VM can run on up to 32 IFL Processors per LPAR

Linux On z/VM Benefits From High I/O Bandwidth Provided By z196

GPs

SAPs

FICON Express8 card

- - - -

RISC processors – 1/channel
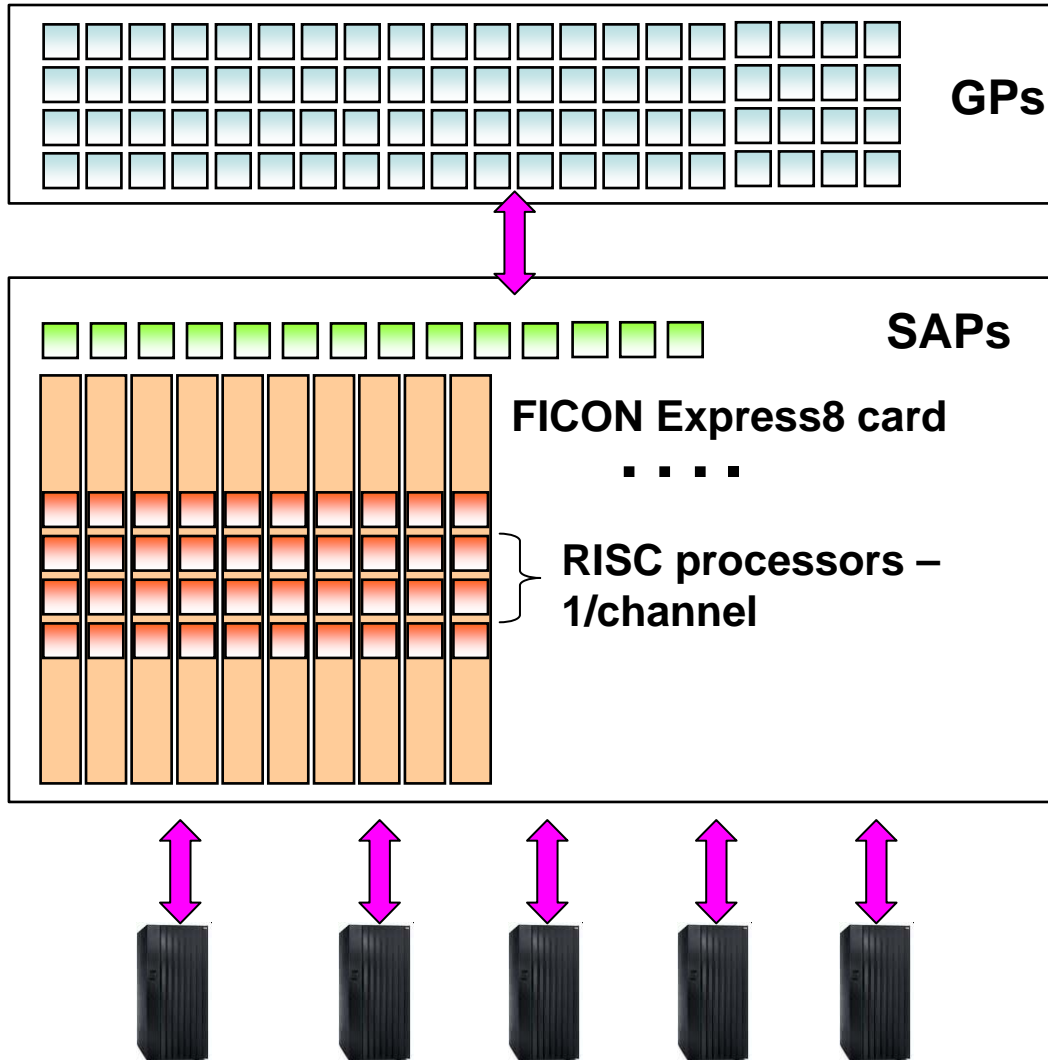
- Up to 80 General Purpose (GP) or Specialty Engine processors
  - Execute business logic

- Up to 14 System Assist Processors (SAP) to manage I/O requests
  - Logical Channel Sub-systems virtualize I/O
  - Can sustain up to **2.2M IOPS**[*]
- Up to 84 physical FICON cards for I/O transfers
  - Up to **336 RISC channel I/O processors**
  - High Performance FICON connections (zHPF)

- IBM DS8800 Storage System
  - Up to **440K IOPS capability** with zHPF
- Benefits both z/OS and z/VM workloads

* Recommend 70% max utilization – 1.5M IOPS

Linux On z/VM Benefits From Virtualized Logical Channel Sub System – Sharing And Failover

z196

Logical Channel Sub-system 1

Logical Channel Sub-system 2

Logical Channel Sub-system 3

Logical Channel Sub-system 4

System z Physical Channel Sub-system

Physical hardware virtualized and shared via logical channel architecture

FICON Channel Path Transparently Shared by All Logical Partitions

OSA Transparently Shared By Logical Partitions Configured to Logical Channel Sub-system 4

FICON Switch, CU, Devices, etc

Switches, Network Links, etc.

# Linux On z/VM Workloads Inherit System z Qualities Of Service

- Reliability, availability, serviceability characteristics of System z

- Site failover for disaster recovery

- Capacity on demand upgrades

- Add physical processors to Linux environment without disruption

DEMO: Dynamically Add New Processor To z/VM LPAR To Handle Increased Workload

1. A customer has in-house Risk Analysis program running on Linux on System z

2. Increased workload to all 4 Linux guests is causing z/VM LPAR utilization of 90%+

3. Customer determines this is a long term trend - additional physical capacity needed

4. New capacity made available to LPAR as new Logical CPU, available for work

   ▶ Without disruption in service
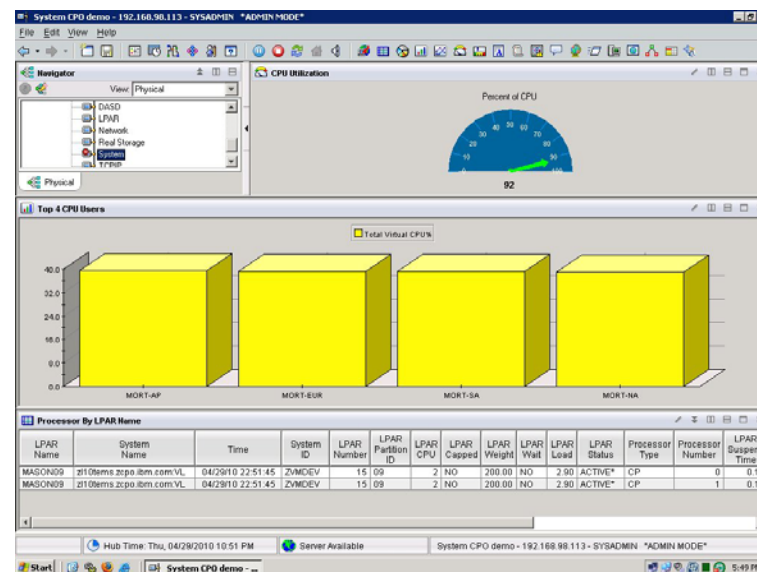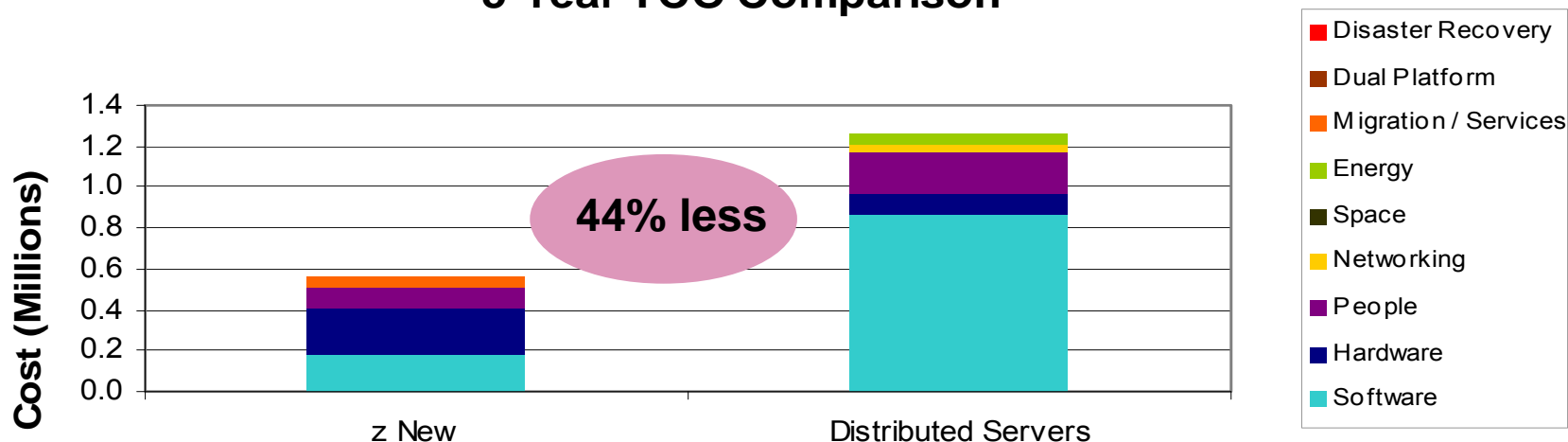

VMware can't recognize and take advantage of additional physical processors without bringing down and rebooting the system

Note: Assumes available processors on installed books

Large Technology Company Assigns Manufacturing Application To Linux On z/VM

■ z/VM offers 7 to 1* footprint reduction over x86 Virtualization

▶ 100 Low CPU, High I/O mission critical workloads

▶ Continuous operation required

▶ Once-a-year scheduled maintenance

    − Any downtime very painful

▶ Consolidate to 2 IFLs or 56 Nehalem cores

▶ Distributed hypervisor costs exceed entire System z incremental costs

5-Year TCO Comparison

Legend:
- Disaster Recovery
- Dual Platform
- Migration / Services
- Energy
- Space
- Networking
- People
- Hardware
- Software

Y-axis: Cost (Millions) — 0.0, 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4

X-axis categories: z New, Distributed Servers

44% less

*IFLs added to existing z footprint.

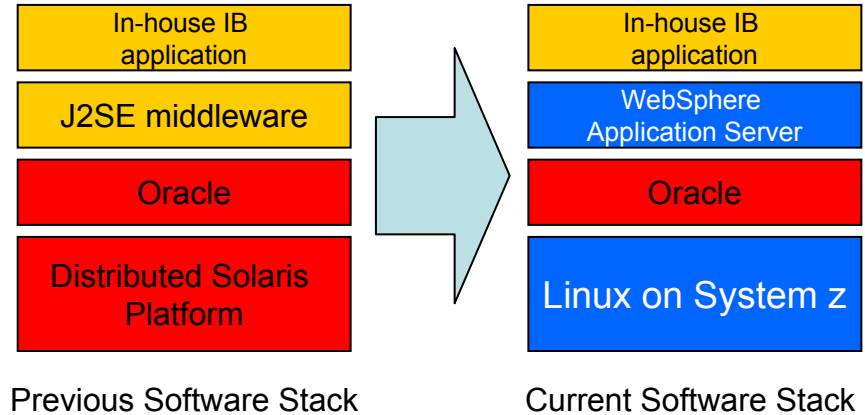# BNZ Replaced Solaris With Linux On System z – Reduced HW And Achieved Systematic DR Plan

bnz Bank of New Zealand

Transformed their Internet Banking (IB) front end application from a distributed Solaris platform to Linux on System z

Result
- *Physical x86 servers reduced by 75%*
- *Linux on System z yielded lowest costs for software priced per core*

Previous Software Stack
In-house IB application
J2SE middleware
Oracle
Distributed Solaris Platform

Current Software Stack
In-house IB application
WebSphere Application Server
Oracle
Linux on System z

Implemented a second z10 EC mainframe at a separate site to support DR / Dev / Test

Result
- *"Simple, consistent and reliable DR" plan in place protecting data and workloads*

2007
Wellington

Production/DEV
z9-EC
4 IFLs
1 CBU (z/OS)
128 GB Memory

2011
Auckland - NDC

Production
z10-EC
26 IFLs
288 GB Memory

Auckland – BNC Quay Pk

DR/DEV/Test
z10-EC
22 IFLs
10 IFL CBUs
560 GB Memory
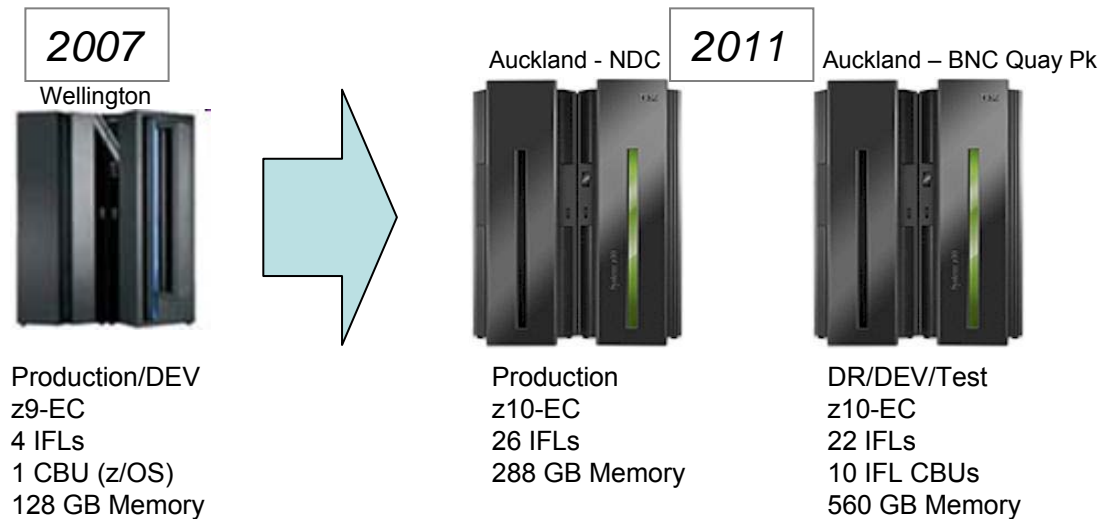
Blue Cross Blue Shield Of Minnesota Saves Up To 50% By Reducing Their Hardware Footprint

BlueCross BlueShield of Minnesota

- Lead time for server provisioning reduced to 99%

- IT deploys new Linux Virtual Servers for test and dev within 20 mins

- Not a single incidence of unplanned downtime or underperformance

**140 Windows Servers
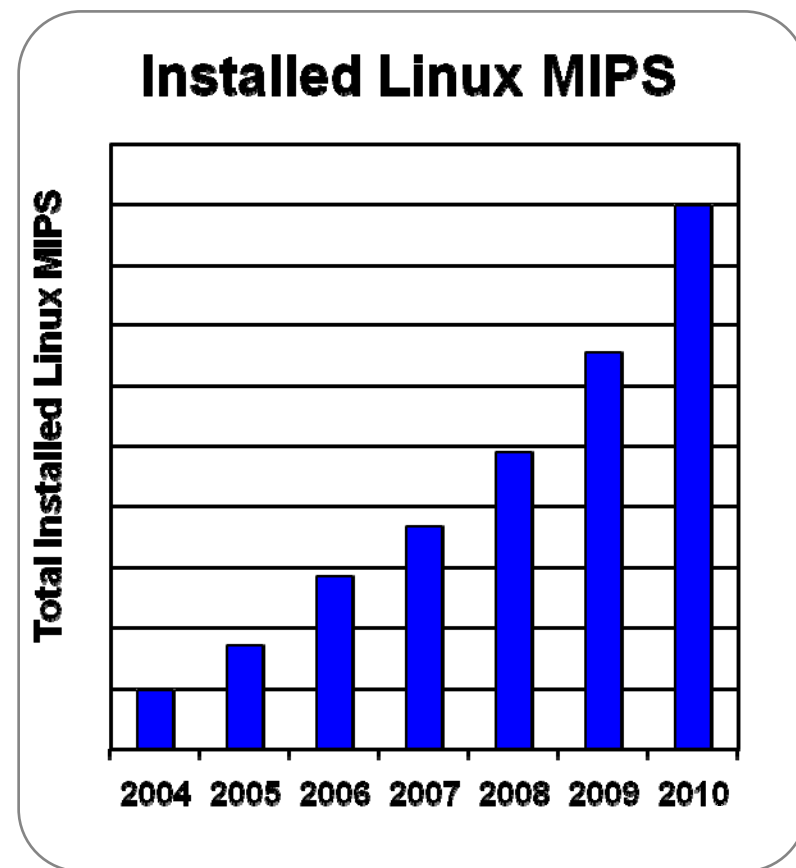Inflexible and costly to maintain
Business Problem:**

**6 IFL processors for
SUSE applications
DB2 for z/OS**

"We found that running a virtualized Linux environment on System z would be somewhere between 30 and 50 percent less expensive than a distributed architecture."

— *Ted Mansk, Director of Infrastructure Engineering and Databases at BCBSM*

Installed MIPS For Linux On z/VM Are Growing At 45% CAGR

- The momentum continues:

  - **Shipped IFL MIPS increased 84% from YE08 to YE10**

- Linux is 18% of the System z customer install base (MIPS)

- Over 80% of the top 100 System z clients are running Linux on the mainframe

- More than 3,100 applications available for Linux on System z

Installed Linux MIPS

Total Installed Linux MIPS

2004 2005 2006 2007 2008 2009 2010

zEnterprise Best Fit Workload Assignments

Easiest architectural fit

workloads workloads workloads

| z/OS | Linux z/VM | AIX PowerVM | Linux x86_IH | Windows x86_IH |

PR/SM

I/O Sub-system

Power Blades

Intel Blades

Heavy I/O
Qualities of service

Light CPU
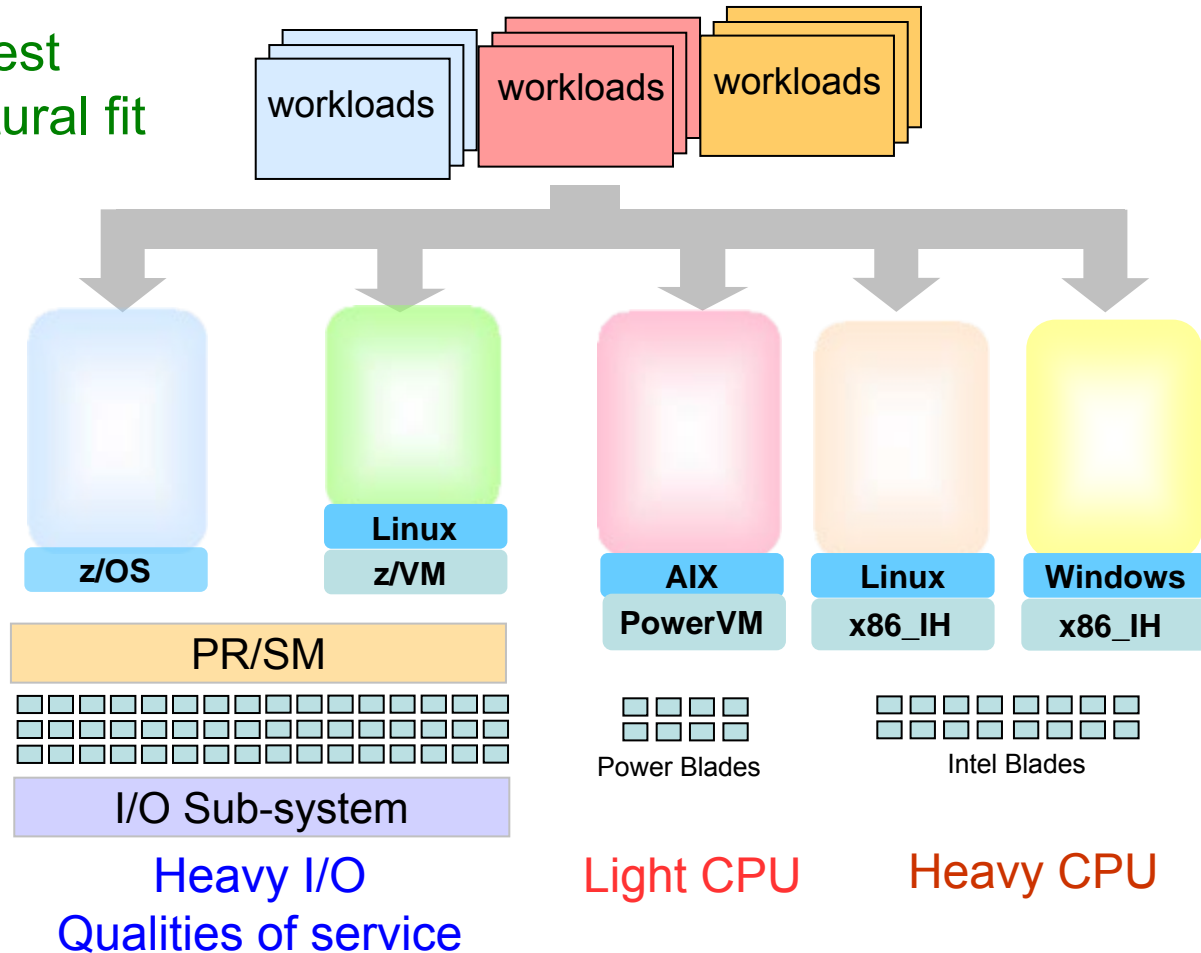
Heavy CPU

Deploy or consolidate workloads on the environment best suited
for each workload to yield lowest cost

Case Study – Consolidate 880 Standalone Workloads On zEnterprise

- Distributed workload profile is a mix of
    - **784 light**
    - **56 heavy CPU**
    - **40 heavy I/O**

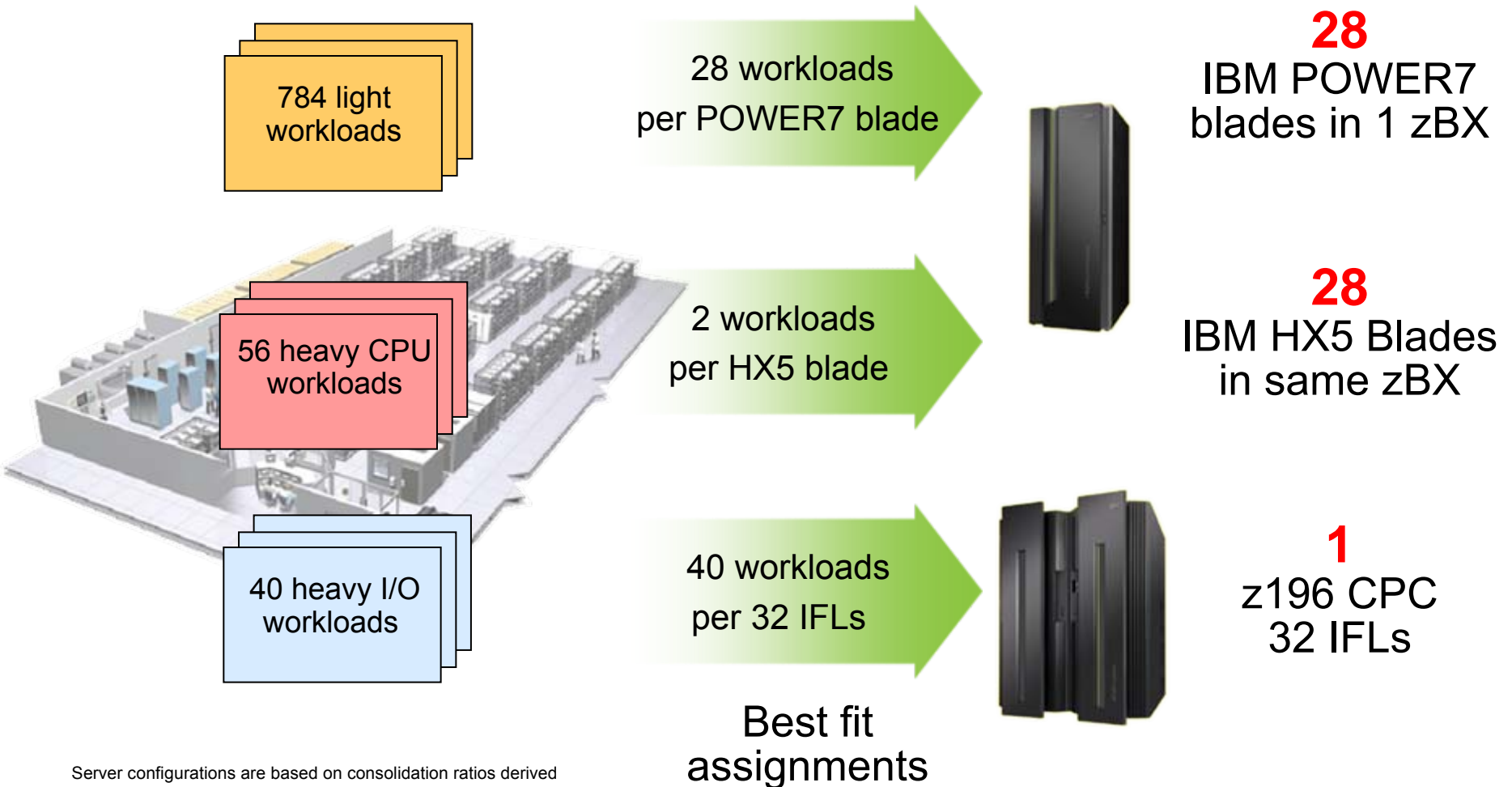- What is the most cost effective way to consolidate/deploy all these workloads?
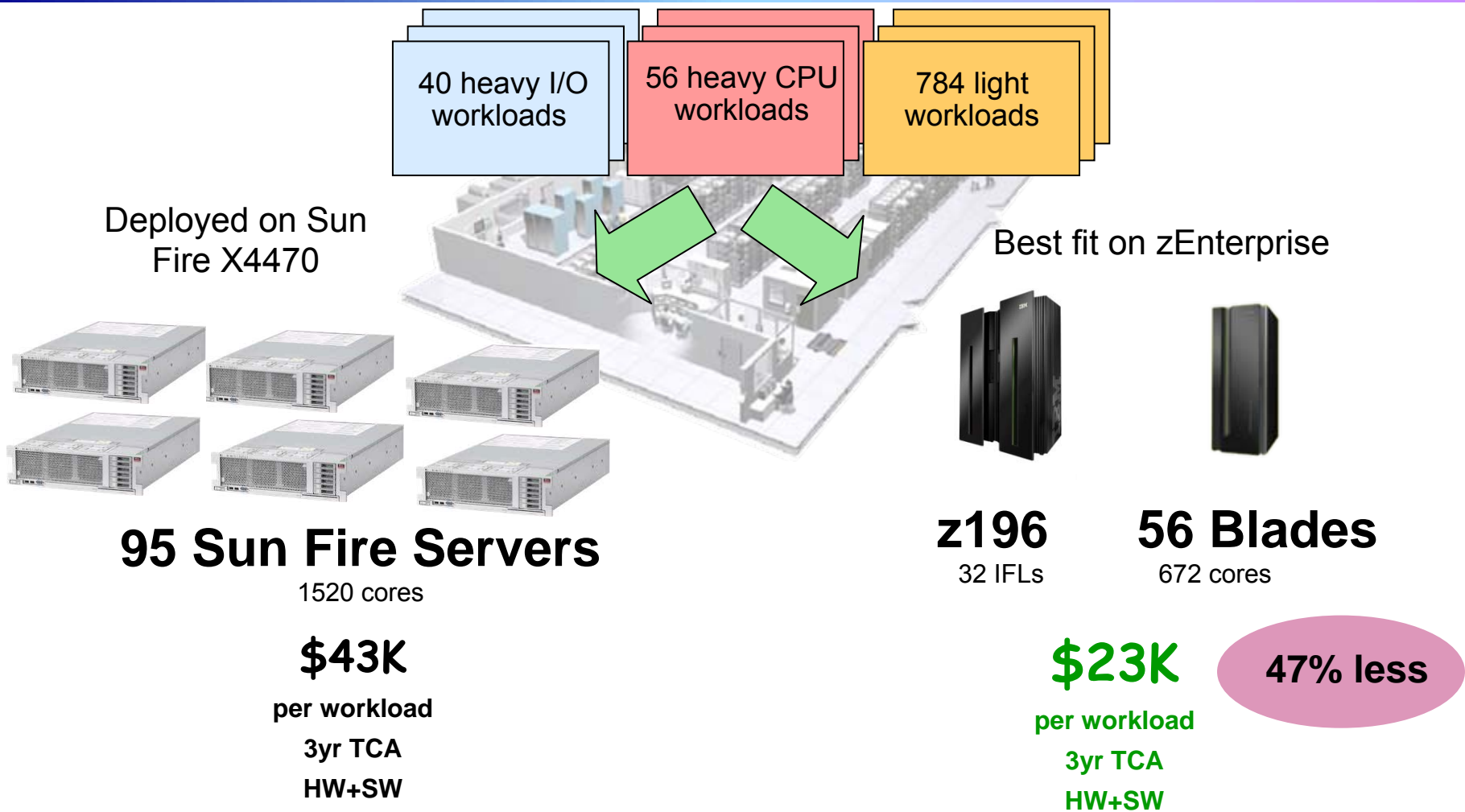
Sun Fire X4470

zEnterprise

A Best Fit Assignment Of 880 Standalone Workloads On zEnterprise

784 light workloads

56 heavy CPU workloads

40 heavy I/O workloads

28 workloads per POWER7 blade

2 workloads per HX5 blade

40 workloads per 32 IFLs

Best fit assignments

28 IBM POWER7 blades in 1 zBX

28 IBM HX5 Blades in same zBX

1 z196 CPC 32 IFLs

Server configurations are based on consolidation ratios derived from IBM internal studies. Projected Sun Fire X4470 2.0GHz 2ch/16co from x3550 2.66GHz 2ch/12co measurements. Prices are in US currency, prices will vary by country

Standalone Workloads Cost 47% Less On zEnterprise

40 heavy I/O workloads	56 heavy CPU workloads	784 light workloads

Deployed on Sun Fire X4470

Best fit on zEnterprise

95 Sun Fire Servers
1520 cores

z196
32 IFLs

56 Blades
672 cores

$43K

per workload

3yr TCA

HW+SW

$23K

per workload
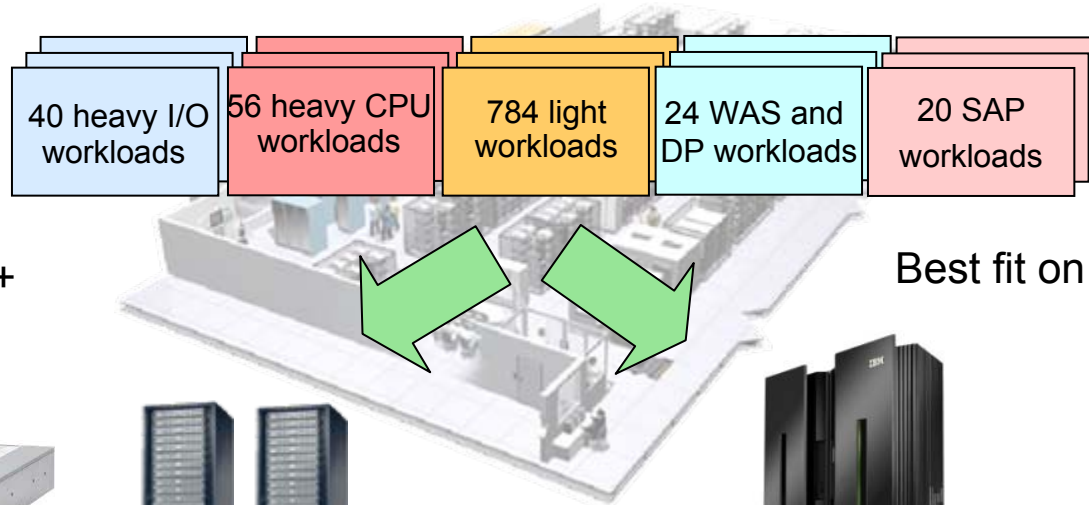
3yr TCA

HW+SW

47% less

Server configurations are based on consolidation ratios derived from IBM internal studies. Projected Sun Fire X4470 2.0GHz 2ch/16co from x3550 2.66GHz 2ch/12co measurements. Prices are in US currency, prices will vary by country

Compare Server Hardware And Software Cost Of Acquisition

40 heavy I/O workloads

56 heavy CPU workloads

784 light workloads

24 WAS and DP workloads

20 SAP workloads

Deployed on Sun + HP servers

Best fit on zEnterprise

95 Sun Fire X4470
1,520 cores

24 Sun Fire X4170
38 Sun T3-1B
896 cores

z196
32 IFLs

105 Blades
1,064 cores

159 servers
2,440 cores

2 DL380
24 cores

106 servers
1,096 cores

49% less

$49.4M Total
3yr TCA HW+SW

$25.0M Total
3yr TCA HW+SW
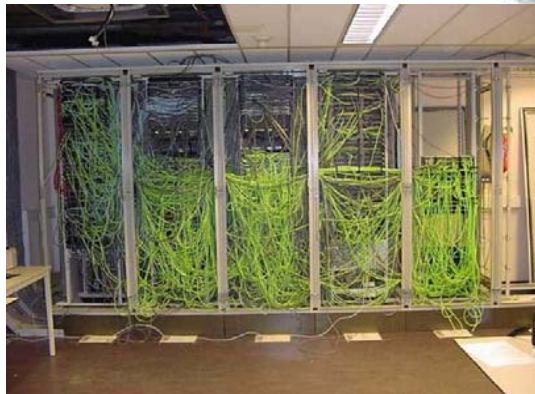
Server configurations are based on consolidation ratios derived from IBM internal studies. Prices are in US currency, prices will vary by country

Compare Network Cost Of Acquisition

40 heavy I/O workloads

56 heavy CPU workloads

784 light workloads

24 WAS and DP workloads

20 SAP workloads

Deployed on Sun + HP servers

Best fit on zEnterprise

Additional network parts
22 switches
480 cables
380 adapters

882 total network parts

$0.32M Total

Additional network parts
1 switch
10 cables
10 adapters

21 total network parts

$0.03M Total

91% less

Network configuration is based on IBM internal studies.
Prices are in US currency, prices will vary by country

Compare Power Consumption

40 heavy I/O workloads

56 heavy CPU workloads

784 light workloads

24 WAS and DP workloads

20 SAP workloads

Deployed on Sun + HP servers

Best fit on zEnterprise

159 servers
115.3 kW

106 servers
47.1 kW

$0.46M Total
3 years
@ $0.10 per kWh

$0.21M Total
3 years
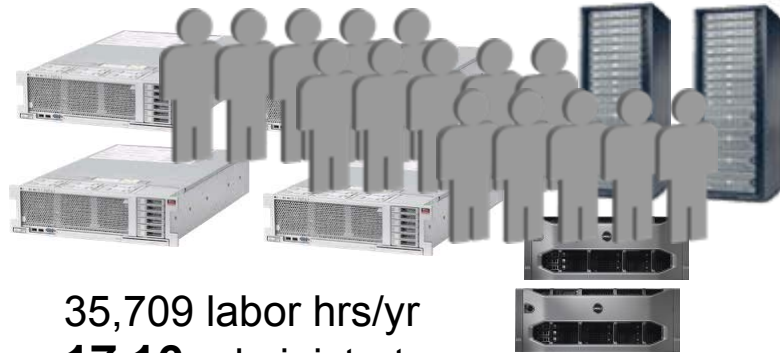@ $0.10 per kWh

54% less

Server configurations are based on consolidation ratios derived from IBM internal studies. Prices are in US currency, prices will vary by country

Compare Server Infrastructure Labor Costs

40 heavy I/O workloads

56 heavy CPU workloads

784 light workloads

24 WAS and DP workloads

20 SAP workloads

Deployed on Sun + HP servers

Best fit on zEnterprise

35,709 labor hrs/yr
17.16 administrators

26,441 labor hrs/yr
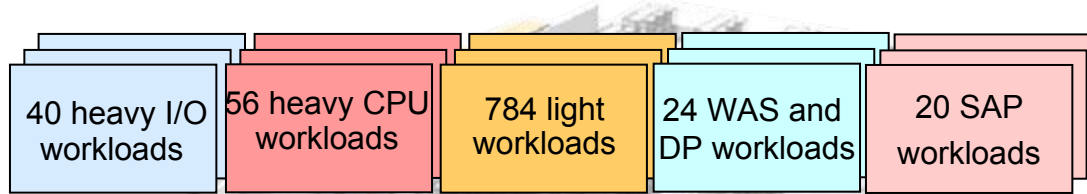**12.71** administrators

$8.22M Total
3 years
@ $159,600/yr

$6.09M Total
3 years
@ $159,600/yr

26% less

Server configurations are based on consolidation ratios
derived from IBM internal studies. Prices are in US
currency, prices will vary by country

Compare Total Cost Of Ownership

40 heavy I/O workloads	56 heavy CPU workloads	784 light workloads	24 WAS and DP workloads	20 SAP workloads

Deployed on Sun + HP servers

Best fit on zEnterprise

159 servers
2,440 cores

106 servers
1096 cores

$58.4M Total
or **$63K** per workload
3yr TCO

$31.3M Total
or **$34K** per workload
3yr TCO

46% less

Server configurations are based on consolidation ratios
derived from IBM internal studies. Prices are in US
currency, prices will vary by country

# From Server Sprawl To Storage Sprawl, The New Era Of CIO Pain
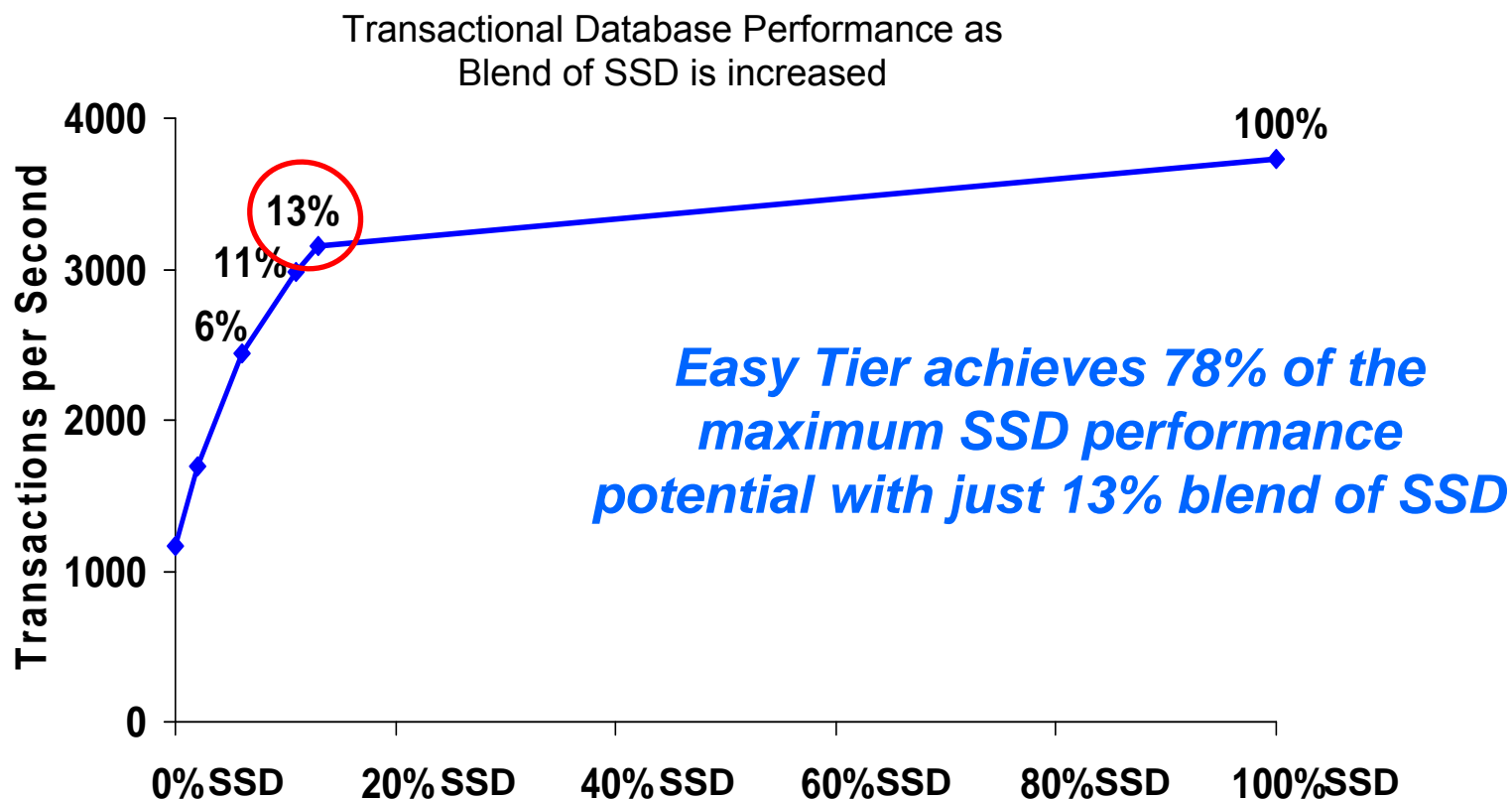

CIO

IBM

Easy Tier In DS8800 Optimizes Use Of SSD Across Shared Workloads

- Migrates data extents between SSD and HDD in the same pool
  - ▶ Automatic hotspot detection
  - ▶ Easy Tier automatic mode now supports migration between any two tiers
- Virtualized SSD is shared across all workloads using the pool
- More cost effective use of SSD vs. ad hoc dedicated assignment
  - ▶ Use less SSD to achieve the same overall performance benefits
- Transparent to applications, no code changes required

SSD Array

Cold data migrates down   Hot data migrates up

HDD Array
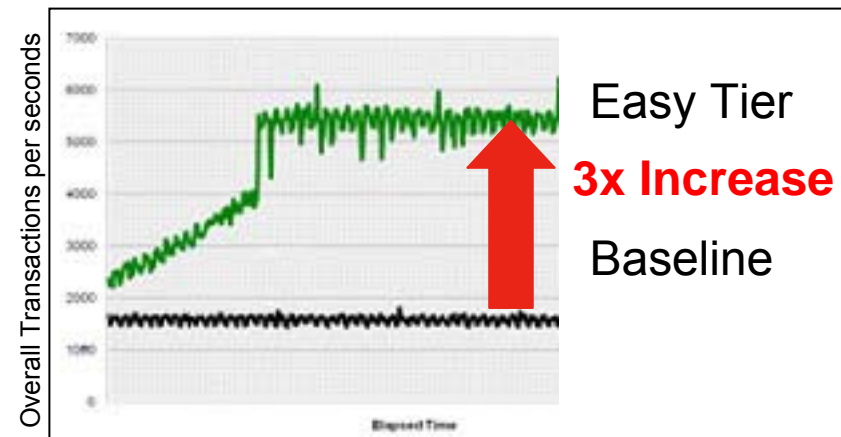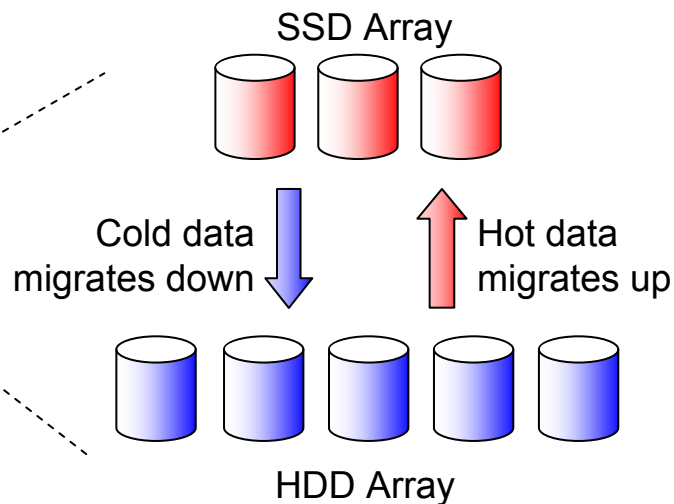
Example: Complex database transactional workload

Easy Tier

3x Increase

Baseline

Small Amounts Of Optimally Managed SSD Can Improve Storage Performance

Transactional Database Performance as
Blend of SSD is increased

Easy Tier achieves 78% of the maximum SSD performance potential with just 13% blend of SSD

Source: IBM Internal Study of Benchmark Factory transactional database workload performance as Easy Tier migrates data to SSD. The performance data contained herein was obtained in a controlled, isolated environment. Actual results that may be obtained in other operating environments may vary.

Messy Distributed Storage Vs. Clean Centralized Storage With DS8800
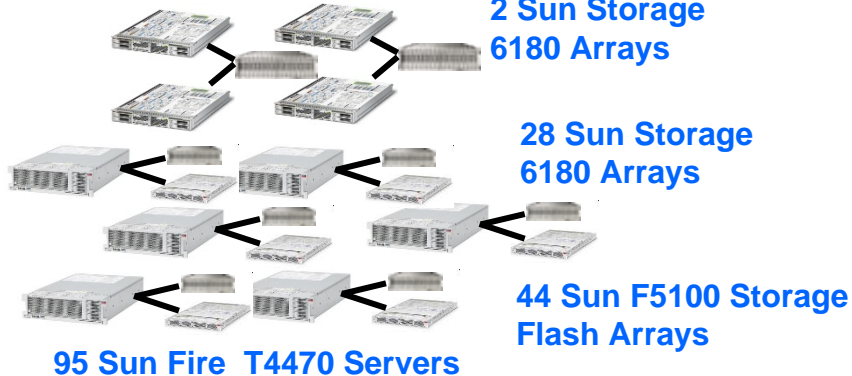
Deployed on Sun

24 Sun Fire X4170 Servers
38 Sun T3-1B Blades

2 Sun Storage 6180 Arrays

28 Sun Storage 6180 Arrays

44 Sun F5100 Storage Flash Arrays
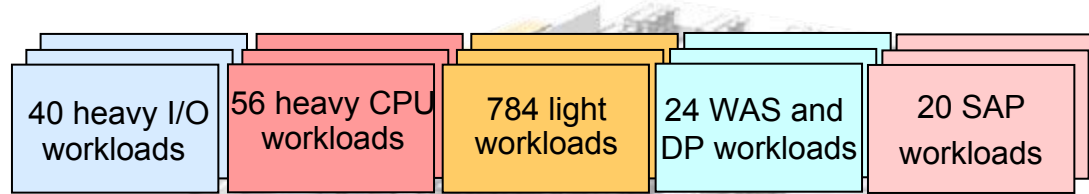
95 Sun Fire T4470 Servers

Best fit on zEnterprise

Incremental add on DS8800

- Storage added on a per server basis
- Fragmented Storage Capacity and Storage Cache
- Storage is shared rather than virtualized
- Flash/SSD is over-provisioned and not available to all hosts
- Allocating Flash/SSD is a manual process

- Enterprise class virtualization
- Storage utilized at 60%
- Use the same storage admin as your zEnterprise storage
- Storage Cache available to all connected hosts
- SSD can be provided to all/any hosts that would benefit

Dramatic Storage Cost Savings Through Consolidation In Smart Storage

40 heavy I/O workloads	56 heavy CPU workloads	784 light workloads	24 WAS and DP workloads	20 SAP workloads

Deployed on Sun

Best fit on zEnterprise

Sun Storage 6180 Array   Sun F5100 Storage Flash Array

Incremental add on DS8800

234.6TB embedded storage
36.31% utilization
74 points of admin

142.5TB embedded storage
59.73% utilization
1 point of admin

$7.8M
3yr TCA

$4.6M
3yr TCA

41% less

75GB/240GB active storage required per workload

Storage configuration is based on IBM internal studies.
Prices are in US currency, prices will vary by country

zEnterprise And IBM System Storage Synergy

- **System z and IBM System Storage have a unique relationship**
  - ▶ Collaborate
  - ▶ Comprehensive testing in zSeries lab
  - ▶ Share cross support by skilled resources

- **This helps IBM System Storage and System z development to:**
  - ▶ Better design products that work well together
  - ▶ Implement streamlined, efficient, integrated product offerings

- **This provides value to zEnterprise and IBM System Storage customers by helping to:**
  - ▶ Verify product reliability
  - ▶ Speed implementation
  - ▶ Reduce risk