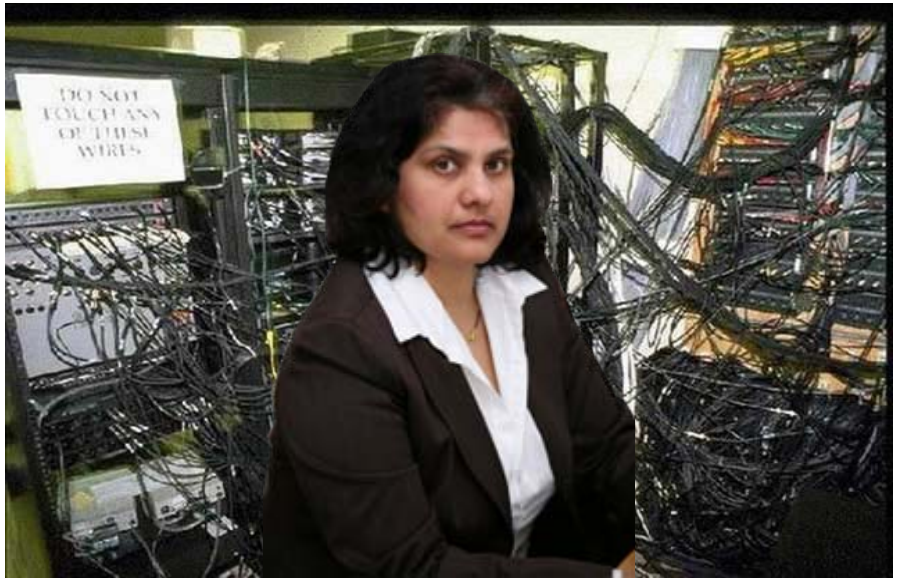
zEnterprise – An Ideal Basis For Smarter Computing

Simplify And Compress Your Hardware Footprint With zEnterprise

Simplifying Hardware Infrastructure Dramatically Reduces The Cost Per Workload

Our surrounding infrastructure is too complex…



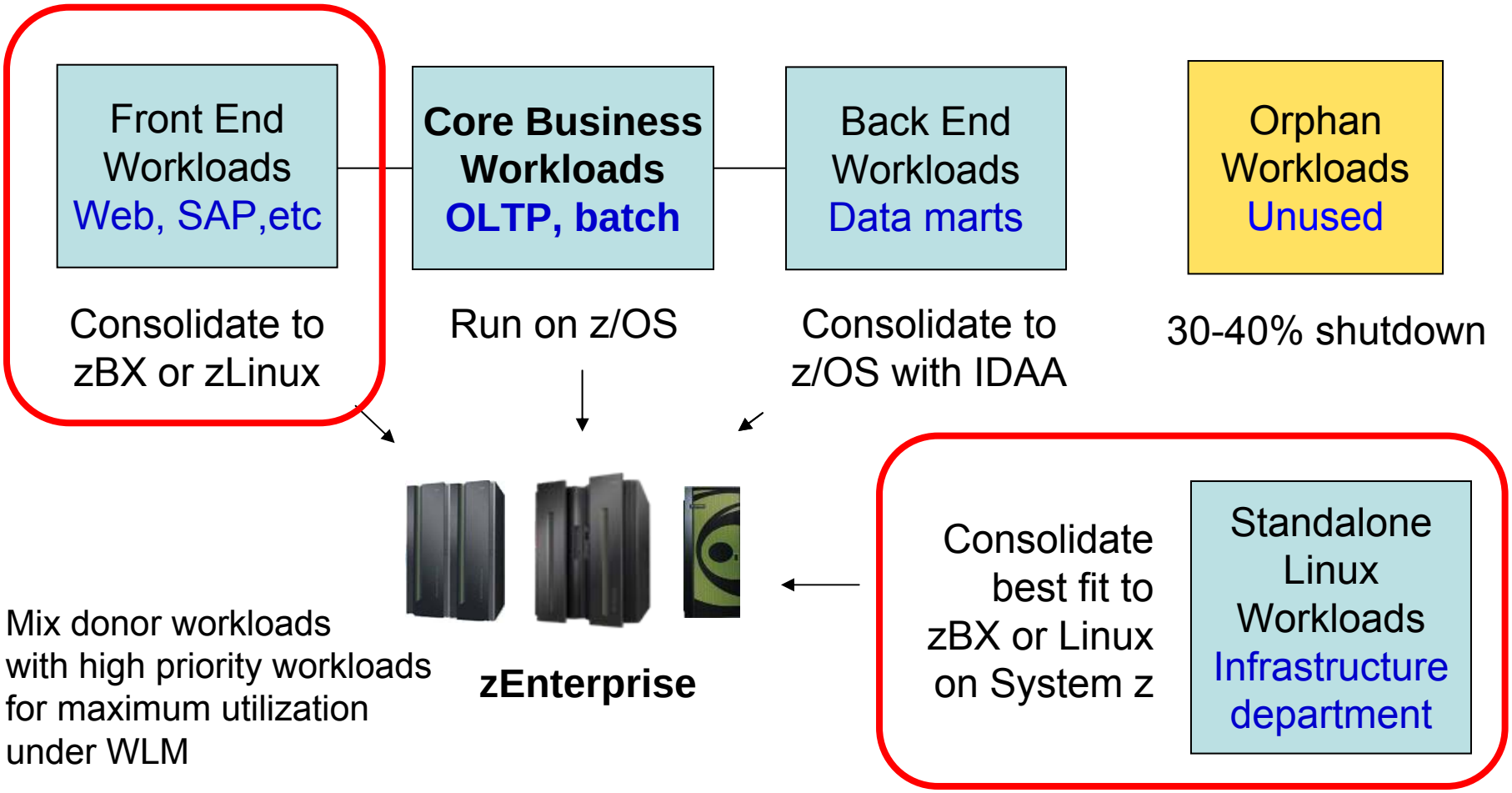
CIO

We've already seen that z196 is the best place to run your core business workloads.
Now let's see how zEnterprise can simplify the surrounding infrastructure

IBM

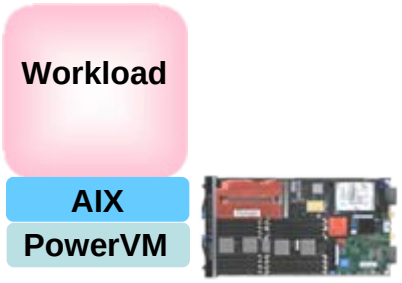
How To Make The Best Use Of System z To Reduce Costs

- Survey workloads for best assignments



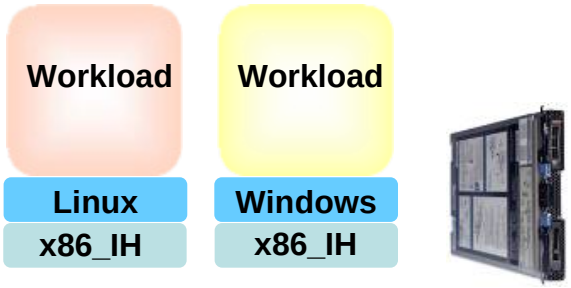
zBX Supports POWER, System x And DataPower Optimizer Blades

POWER7 Blades



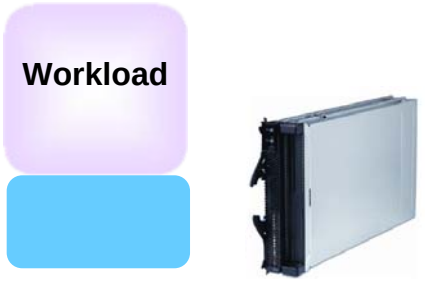
- POWER7 PS701 Express
  - Single-width, **8 cores**, 3.0 GHz
    - Up to 4 threads per core
  - AIX 5.3+
  - PowerVM hypervisor

System x Blades



- System x HX5
  - Single-width, **16 cores**, 2.13 GHz
    - Up to 2 threads per core
  - Windows and Linux
  - KVM-based integrated hypervisor

DataPower XI50z

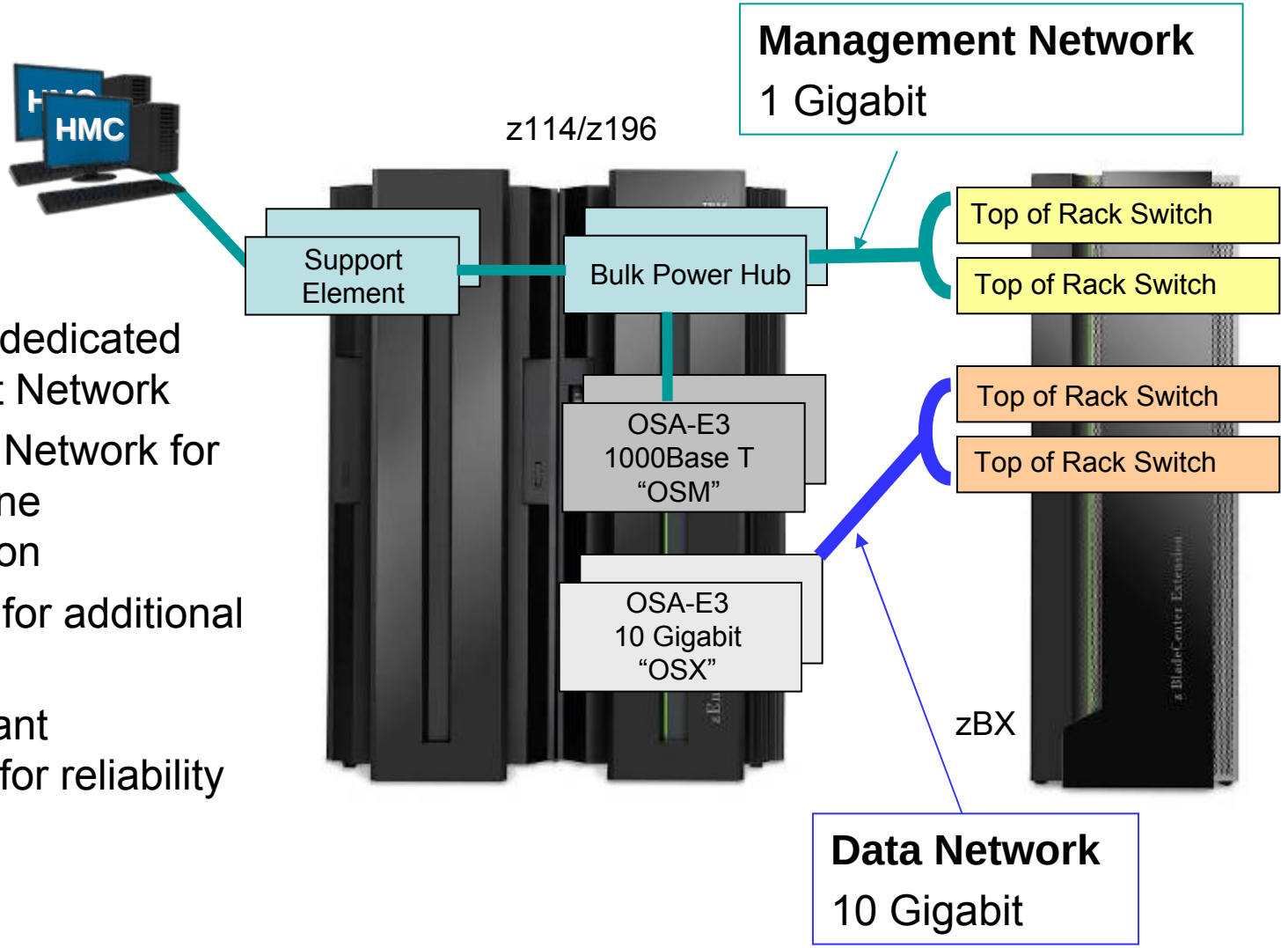


- Blade appliance designed for integration with and management by zEnterprise
- Optimized for specific message processing functions
  - Pre-packaged including hardware, software, memory

Blades run distributed software purchased through Passport Advantage

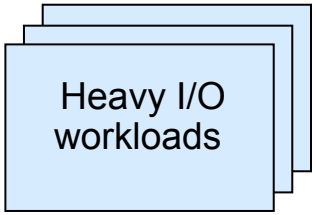
zEnterprise Is Connected Via Secure Networks

- Isolated and dedicated Management Network
- Secure Data Network for virtual machine communication
  - No need for additional firewalls
- Fully redundant components for reliability

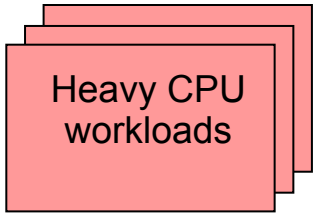


Network cables max of 26m from z114 / z196 to Top of Rack switch. Up to 10km to another zBX.

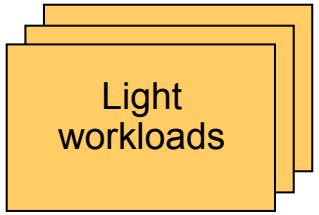
Different Workloads Have Different Characteristics



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

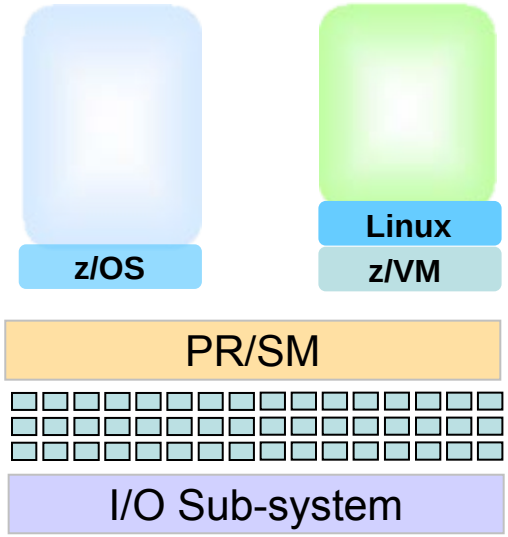


- High processing intensity
- Integer or floating point



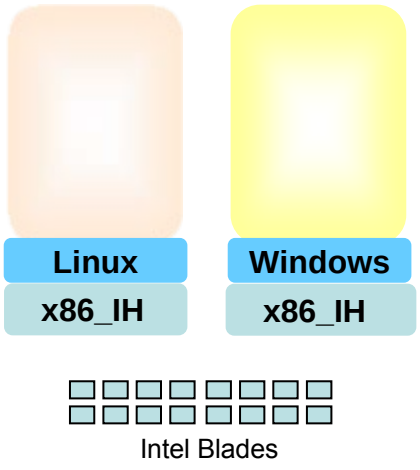
- Light to moderate processing
- Modest quality of service requirements

zEnterprise Environments Are Optimized For Different Workload Requirements



- Scale up to 96 cores in a frame
- Dedicated I/O sub-system
- Superior qualities of service

- Scales to 8 cores per blade
- 4 fast processing threads per core
- Floating point accelerators

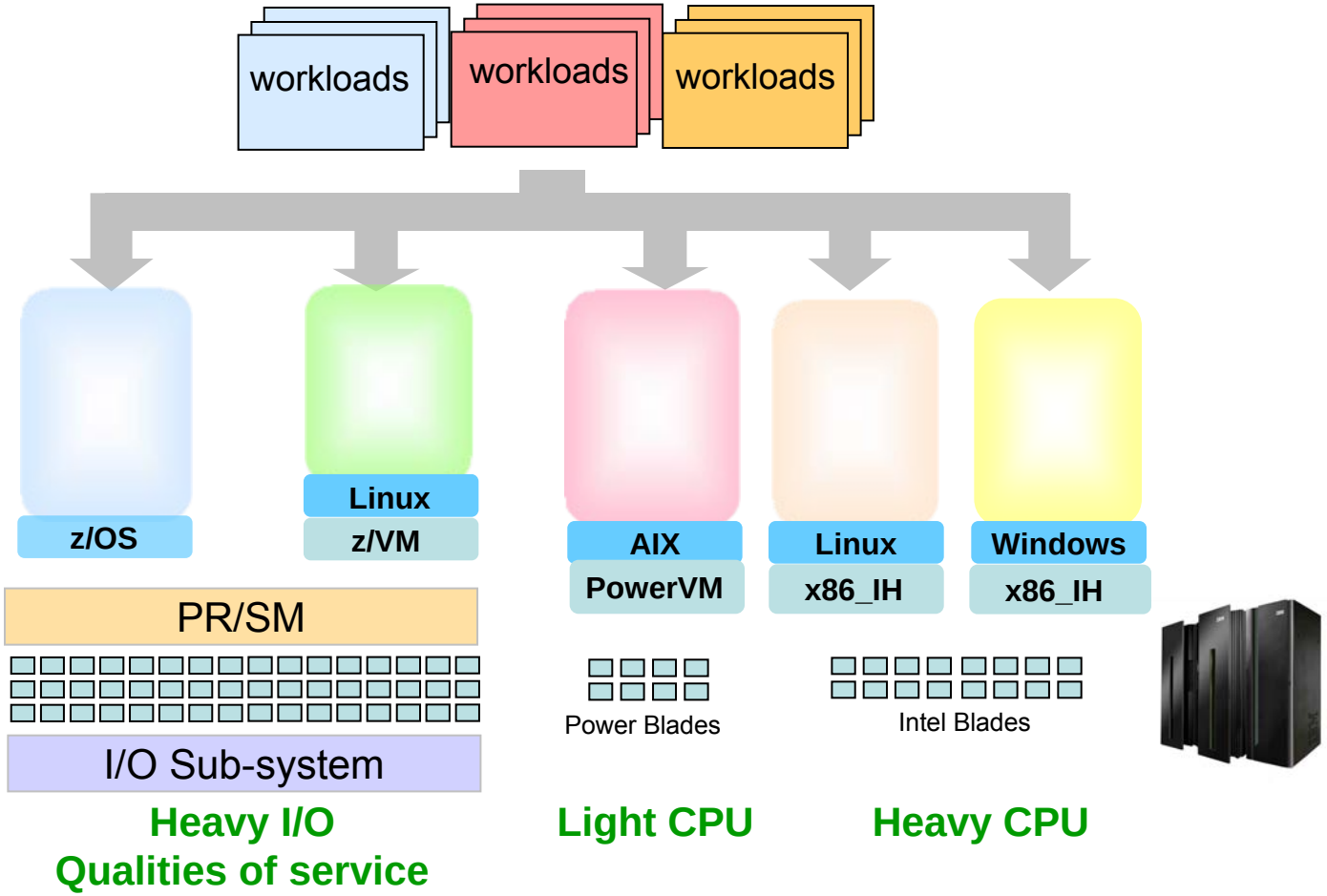


- Scales to 16 cores per blade
- 2 fast processing threads per core
- Commodity I/O
- Modest qualities of service

zEnterprise Best Fit Workload Assignments

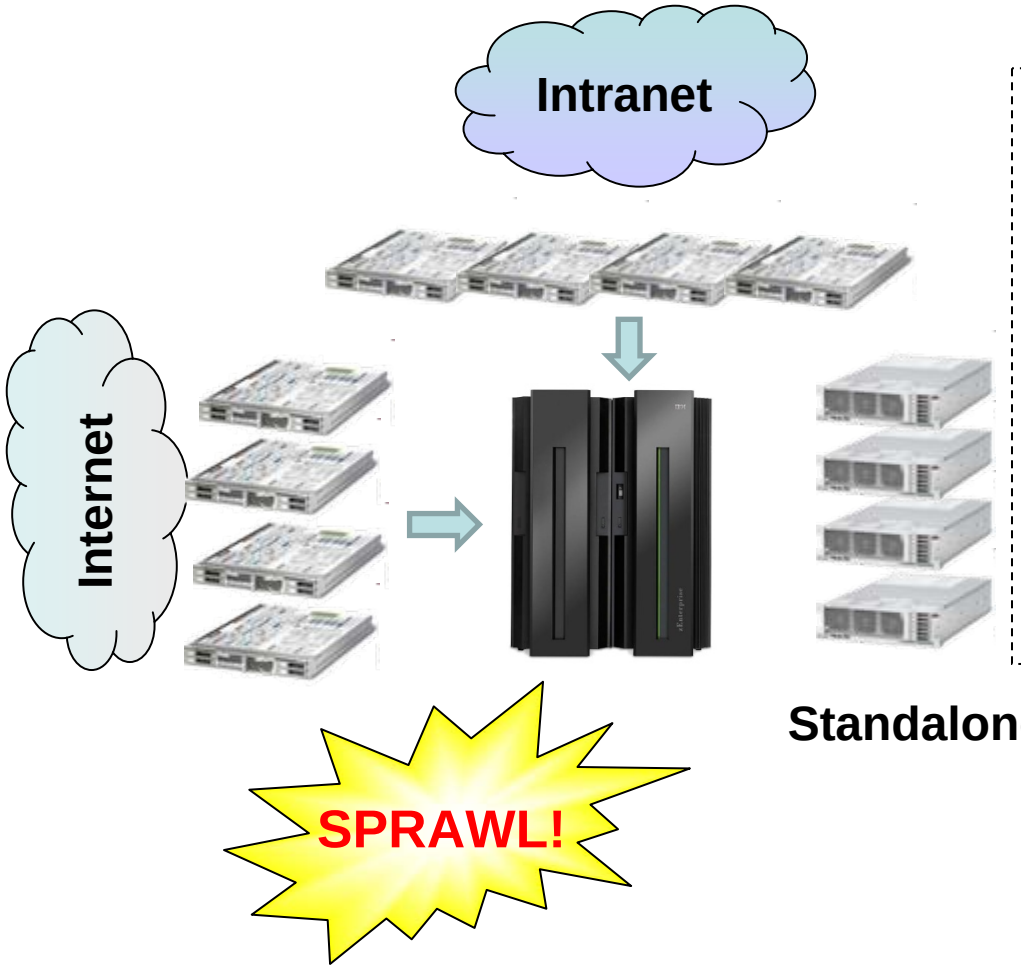
Easiest architectural fit

Lowest cost match to requirements

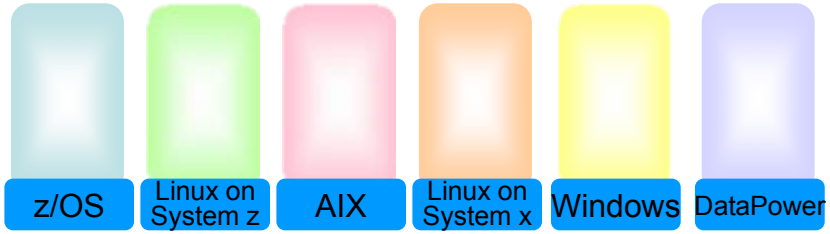


Deploy or consolidate workloads on the environment best suited for each workload to yield lowest cost

Eliminate Sprawl With zEnterprise Multi-Architecture Environment



Platforms Optimized for Different Workloads



Best Fit for Workload

Consolidate with zEnterprise!

zBX Inherits BladeCenter Advantages

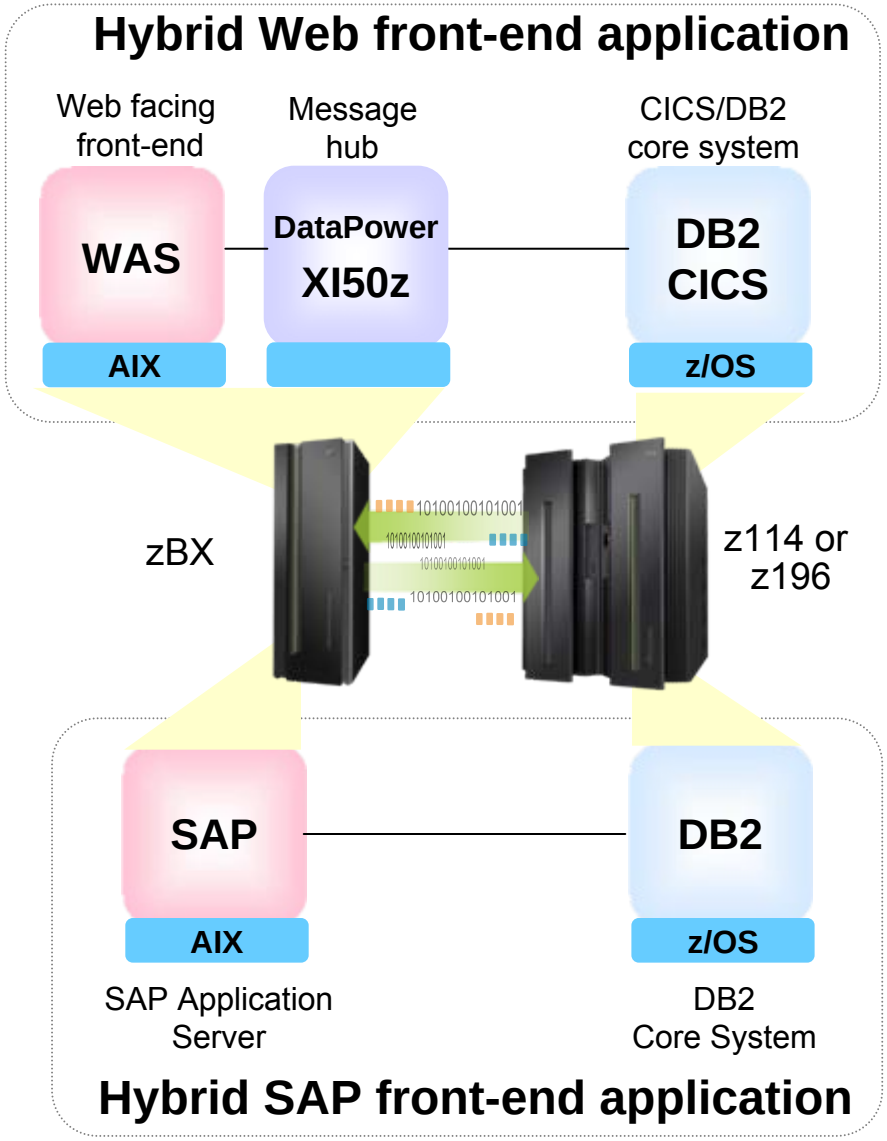
- BladeCenters offer significant advantages
  - Denser packing reduces space requirements
  - Built in backplane switching provides redundant connectivity, reduces wiring and increases resiliency
    - Ethernet, Fiber channel
    - I/O and networking virtualization
  - Shared power supplies reduce power 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

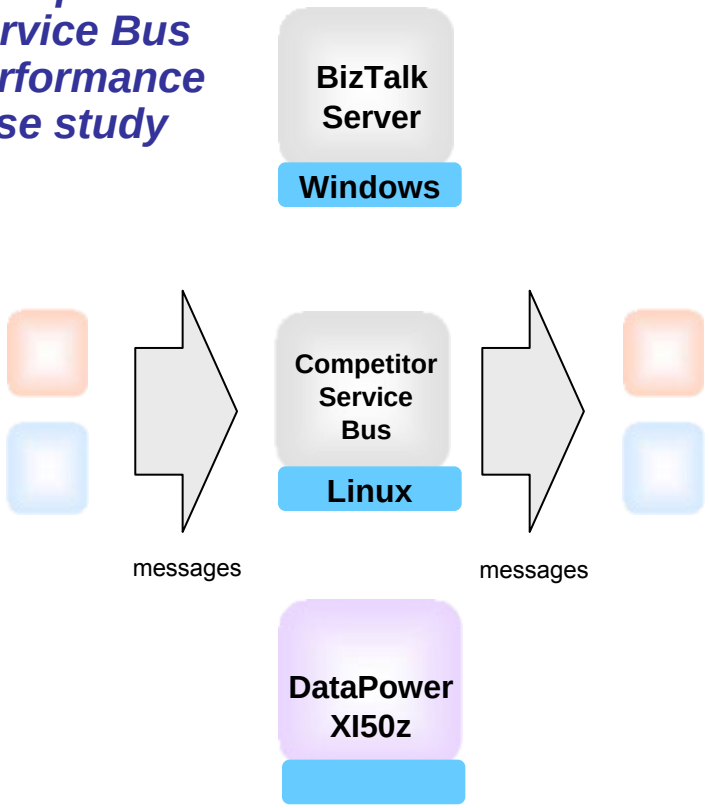
Consolidate Multi-tier Hybrid Workloads On zEnterprise Platform

- DB2 and CICS core systems are already best fit on z/OS
- Assign front end components to zBX blades and optimizers according to best fit strategy
  - Utilize virtualization for workload isolation
  - Manage as ensemble of virtual servers with service goals
  - Utilize embedded secure data network
- Mission critical qualities of service extended to hybrid environments



Purpose-Built DataPower XI50z Appliance Delivers Stunning Price/Performance

Enterprise Service Bus performance case study



Microsoft BizTalk Server
Windows on Intel Server
4 sockets, 32 cores
128 GB

492 messages per sec
$764 per mps

Competitor Service Bus
Linux on HP DL380
2 sockets, 12 cores
128 GB

5,839 messages per sec
$120 per mps

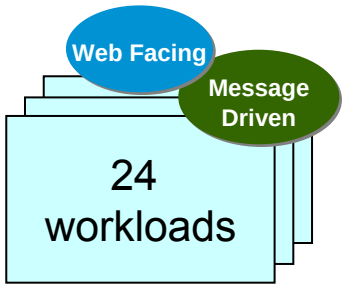
DataPower
XI50z in zBX

5,117 messages per sec
$52 per mps

Tests consists of measuring maximum throughput of ESB while performing a variety of message mediation workloads: pass-through, routing, transformation, and schema validation

Web Front Ends Cost Less On zBX

Web front-end 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

Deploy on Competitor's pre-integrated system

$693K
per workload
3yr TCA
Front end HW+SW

WebSphere App Server

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

Deploy on Power blades in zBX

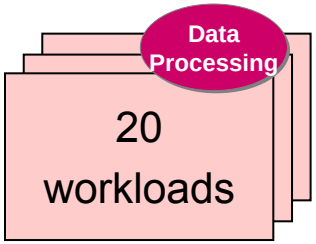
$193K
per workload
3yr TCA
Front end HW+SW

72% less

Source: IBM Internal comparisons. 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.

SAP Applications Cost Less On zBX

SAP applications on older SPARC T2+ servers



Upgrade to new SPARC T4 hardware

34 Sun T4-1 blades
in Sun rack
272 cores total

$58K
per workload
3yr TCA
Front end HW+SW

Consolidate on zEnterprise

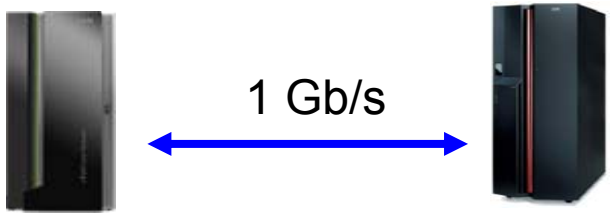
23 POWER7 blades
in zBX
184 cores total

$44K
per workload
3yr TCA
Front end HW+SW

Source: IBM Internal sizing comparisons 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 Comparisons Show zEnterprise Beats Intel

x Blades / Competitor DB on Unix



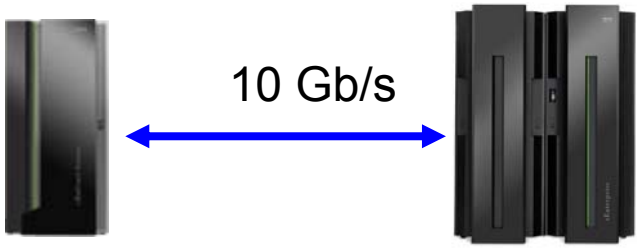
Nehalem
24 Core
VMware

28 Core
Comp DB
Unix

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

z196-707
4GP+ 3zIIP
DB2 V10
z/OS 1.11

71% less

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

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

SAP Applications **SAP Database**

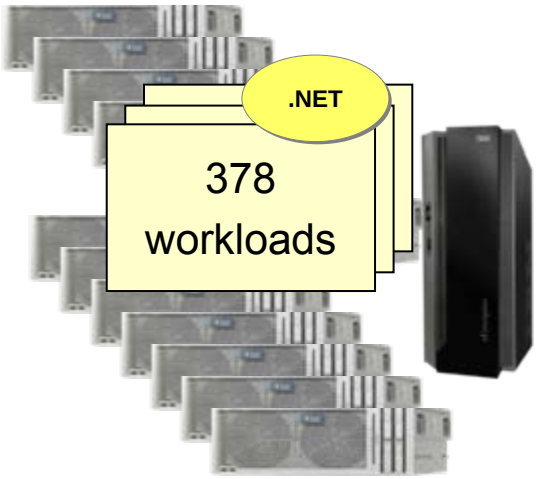
Based on customer data. 3Yr TCA calculation includes hardware acquisition, maintenance, application and database software acquisition and S&S. U.S. list prices prices, prices will vary by country. Cost of packaged application (SAP) not included.

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



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

19% less

Consolidate on zEnterprise zBX

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 Heavy CPU Requirements

Comparison 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
$200,055 per workload

Best Fit

1 workload per POWER7 blade

PowerVM on PS701
8 core POWER7 Blade
$216,658 per workload

10 workloads per 32-way z/VM

z/VM on z196 CPC
32 IFLs
$328,477 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.

Assigning Standalone Workloads With Light CPU Requirements

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

Light workloads

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

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

47 workloads per Intel blade

Virtualized on Intel
16 core HX5 Blade
$8,165 per workload

28 workload per POWER7 blade

Fast low cost threads

PowerVM on PS701
8 core POWER7 Blade
$7,738 per workload

Best Fit

155 workloads per 32-way z/VM

z/VM on z196 CPC
32 IFLs

$21,192 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.

Assigning Standalone Workloads With Heavy I/O Requirements

Comparison 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**

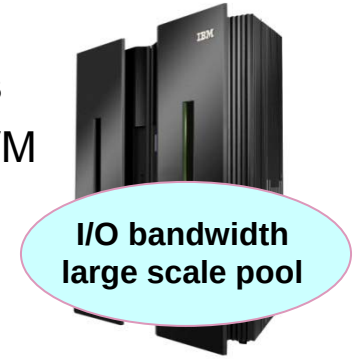
1 workload per Intel blade

Virtualized on Intel
16 core HX5 Blade
$400,109 per workload

1 workload per POWER7 blade

PowerVM on PS701
8 core POWER7 Blade
$216,658 per workload

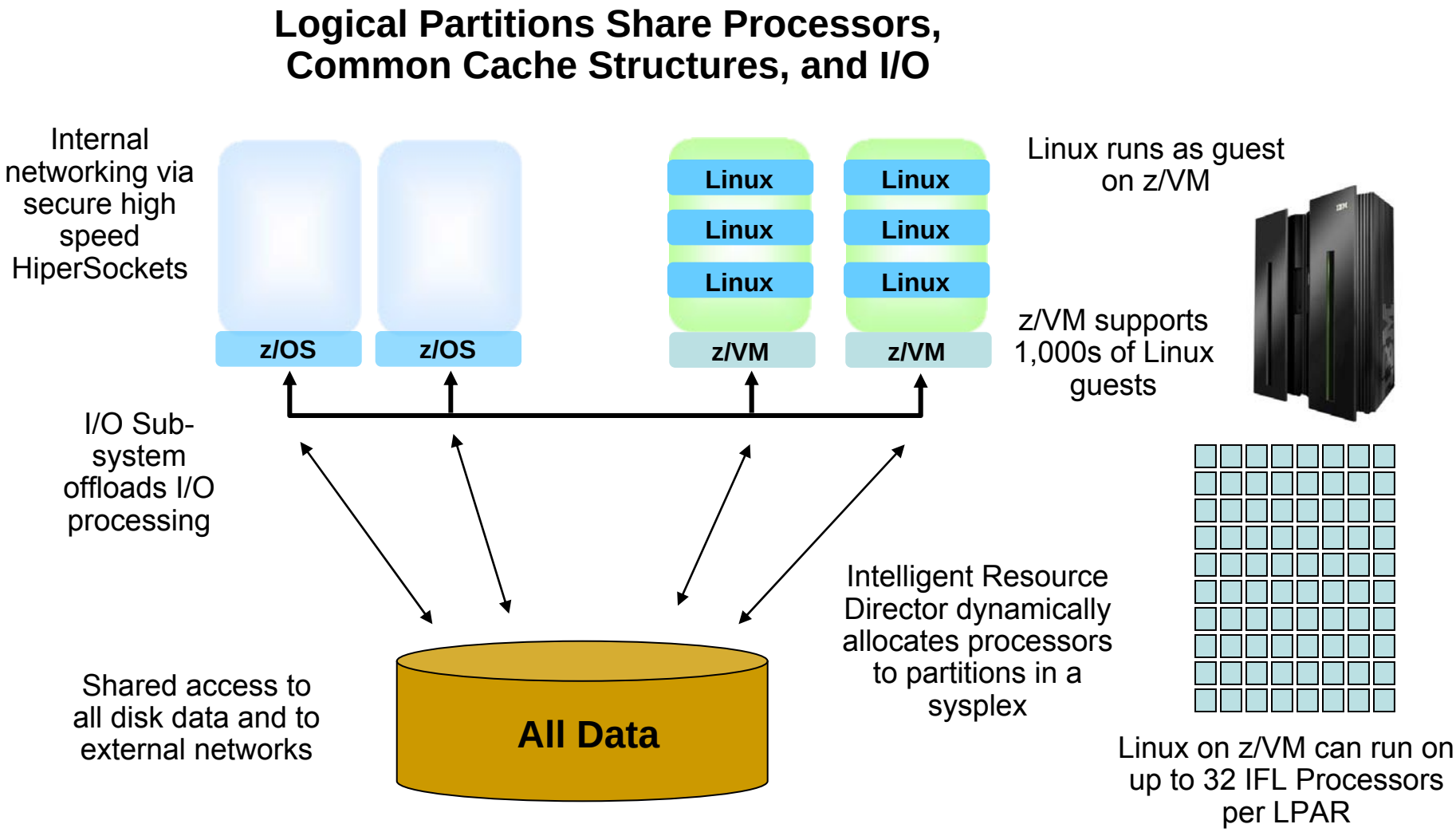
40 workloads per 32-way z/VM



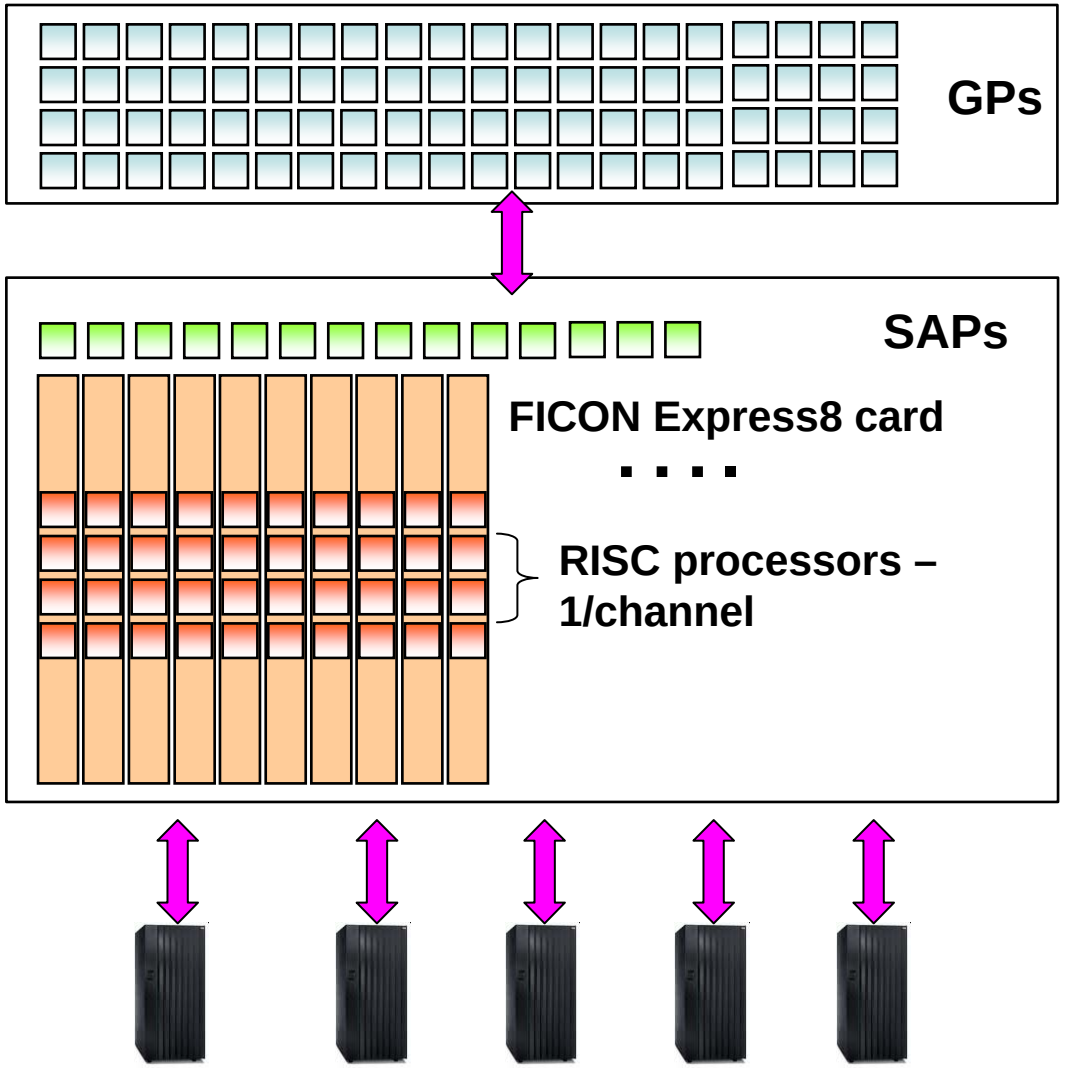
z/VM on z196 CPC
32 IFLs
$82,119 per workload
Best Fit

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.

A Deeper Look At Linux On z/VM Qualities Of Service



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



- 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

Consolidate More Linux Workloads With Heavy I/O On zLinux

40 Linux heavy I/O workloads

Deployed on Sun Fire X4170 M2

40 Sun Fire Servers

480 cores

$285K per workload

3yr TCA HW+SW

Deployed on z/VM

Z196

32 IFL cores

$82K per workload

3yr TCA HW+SWI

Solution Edition for Enterprise Linux

71% 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

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."

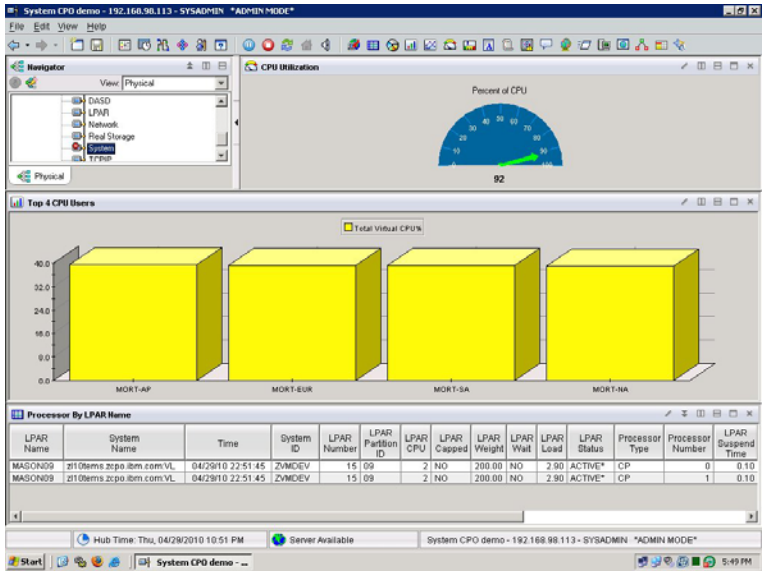
— Ted Mansk, Director of Infrastructure Engineering and Databases at BCBSM

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

- Reliability, availability, serviceability characteristics of System z
- Capacity on demand upgrades
- Add physical processors to Linux environment without disruption
- Site failover for disaster recovery

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

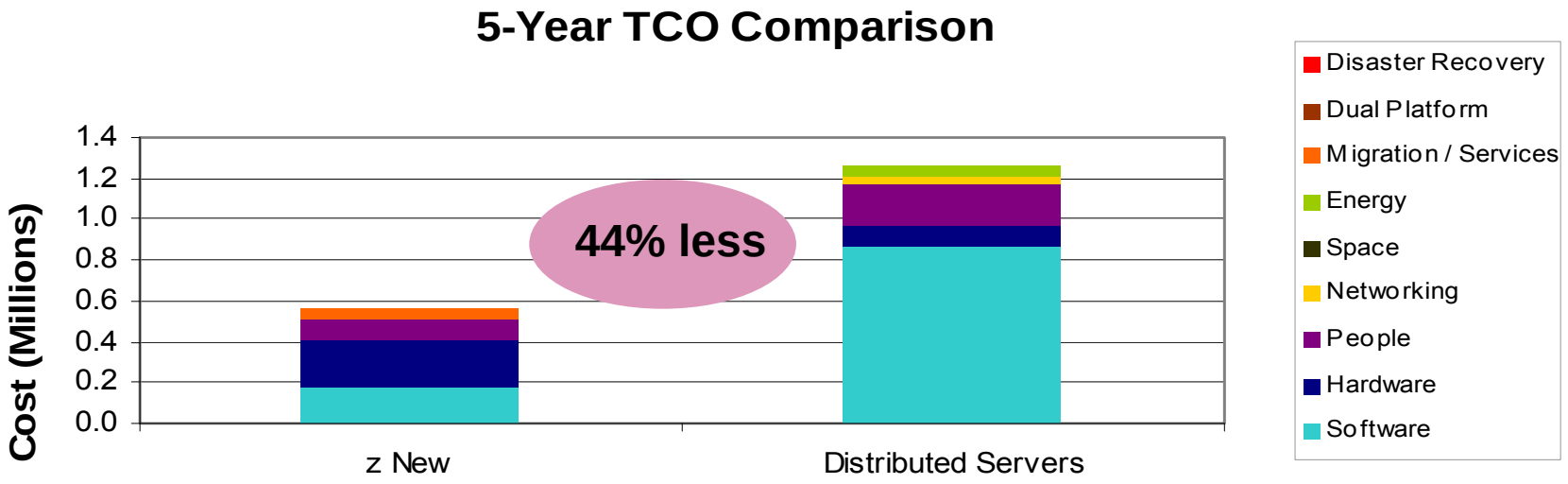


VMware can't recognize and take advantage of additional physical processors without bringing down and rebooting the system

Note: Assumes available processors on installed books

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

- z/VM offers 23 to 1 core reduction over x86 Virtualization
- Ideal Linux on System z workloads
  - 100 Low CPU, High I/O
  - High availability, continuous operation
  - Once-a-year scheduled maintenance
- Distributed hypervisor costs exceed entire System z incremental costs

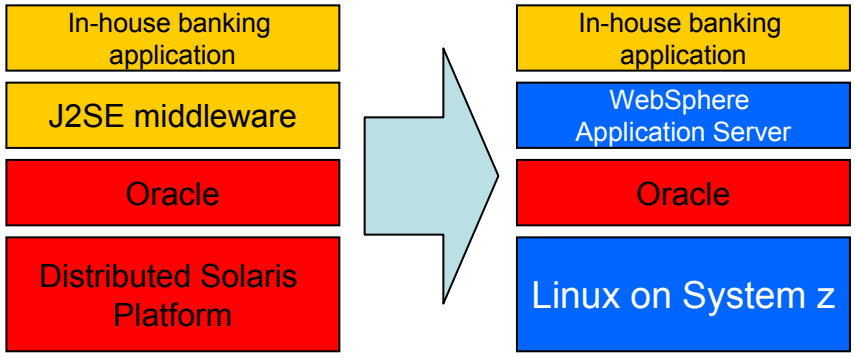


IFLs added to existing z footprint.

BNZ Replaced Solaris On Intel With Linux On System z

Bank of New Zealand

Moved front end banking application from distributed Solaris platform to Linux on System z



Previous Software Stack

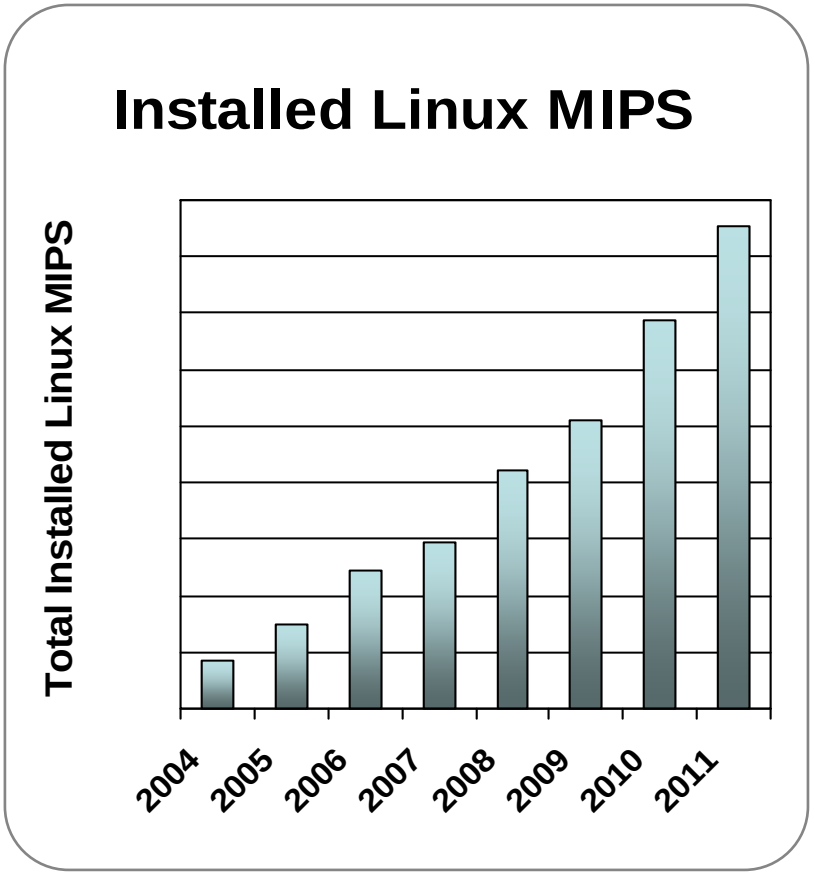
Current Software Stack

Result

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

Installed MIPS For Linux On z/VM Are Growing At 39% CAGR

- The momentum continues:
  - **Installed IFL MIPS increased 24% from 4Q10 to 4Q11**
- Linux is 20% of the System z customer install base (MIPS)
- 66 of the top 100 System z clients are running Linux on the mainframe
- More than 3,000 applications available for Linux on System z



[1] Based on YE 2004 to YE 2011

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 X4170 M2

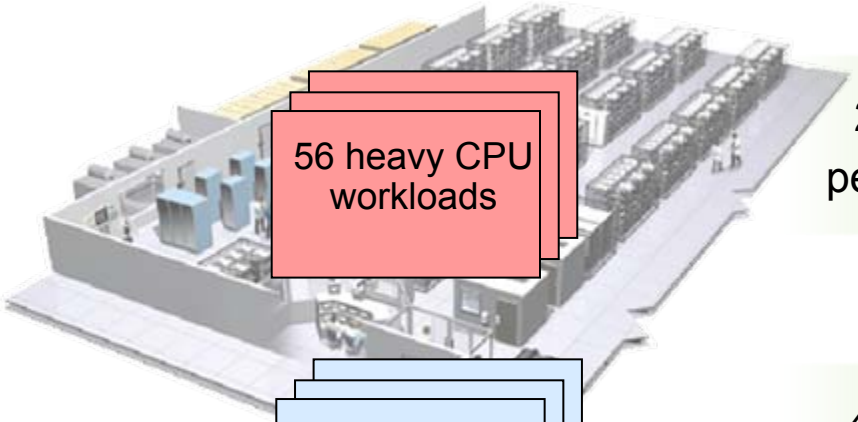
zEnterprise

A Best Fit Assignment Of 880 Standalone Workloads On zEnterprise

784 light workloads

28 workloads per POWER7 blade

28 IBM POWER7 blades in 1 zBX



56 heavy CPU workloads

2 workloads per HX5 blade

28 IBM HX5 Blades in same zBX

40 heavy I/O workloads

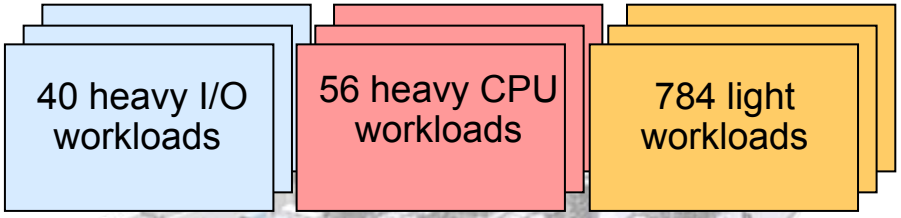
40 workloads per 32 IFLs

1 z196 CPC 32 IFLs

Best fit assignments

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 Less On zEnterprise



Deployed on Sun Fire X4170 M2

123 Sun Fire Servers

1476 cores

$40K

per workload

3yr TCA

HW+SW

Best fit on zEnterprise

z196

32 IFLs

56 Blades

672 cores

Best fit assignments result in 41% lower cost per workload

$23K

per workload

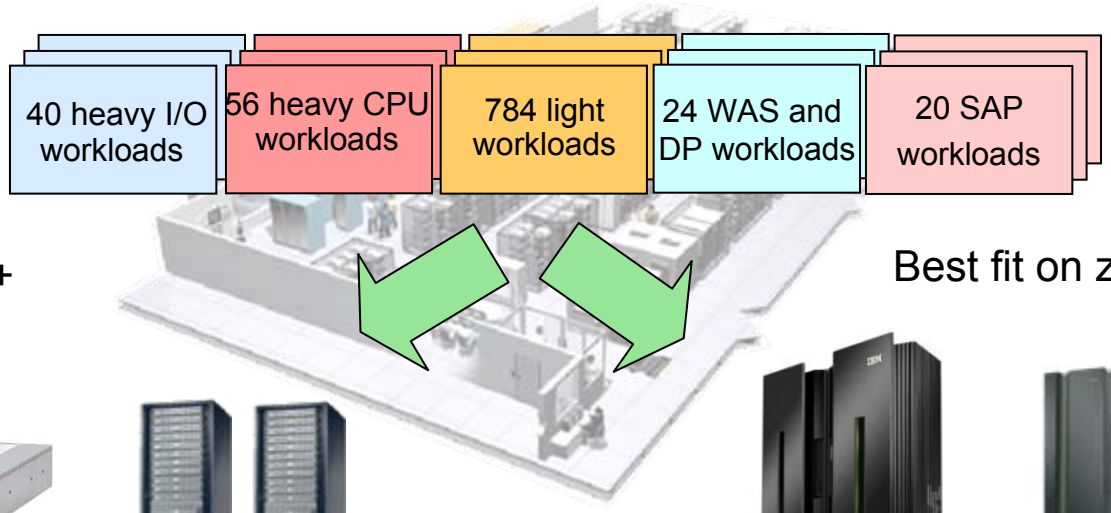
3yr TCA

HW+SW

Server configurations are based on consolidation ratios derived from IBM internal studies. Projected Sun Fire X4170 2.26GHz 2ch/12co from x3550 2.66GHz 2ch/12co measurements. Prices are in US currency, prices will vary by country

We've looked at 44 hybrid workloads and 880 standalone workloads. Let's put it all together to see how much money zEnterprise can save!

Compare Server Hardware And Software Cost Of Acquisition



Deployed on Sun + HP servers

123 Sun Fire X4170
1476 cores

183 servers
2,060 cores

$46.0M Total
3yr TCA HW+SW

24 Sun Fire X4170
34 Sun T4-1
560 cores

2 DL380
24 cores

Best fit on zEnterprise

z196
32 IFLs

105 Blades
1,048 cores

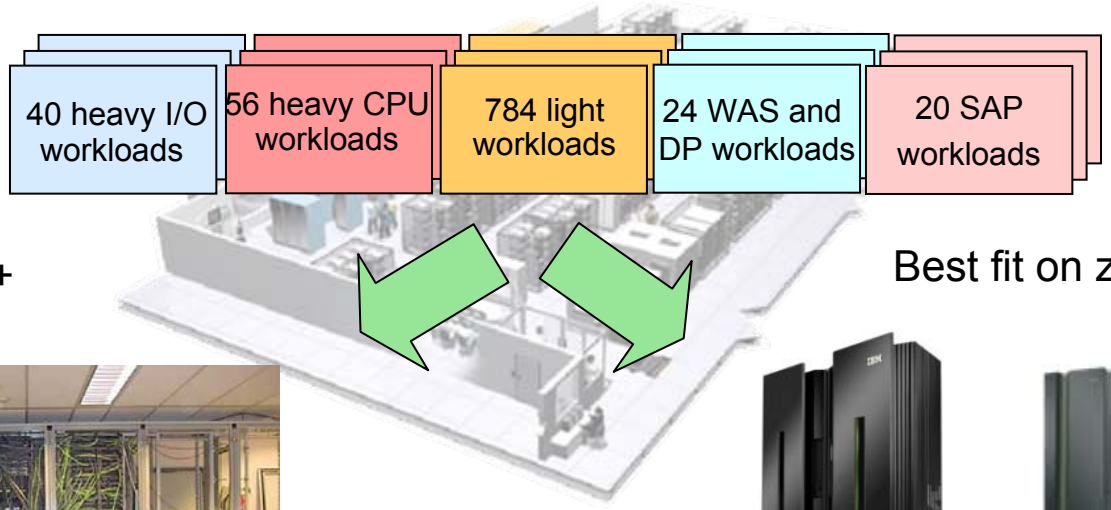
106 servers
1,080 cores

$26.1M Total
3yr TCA HW+SW

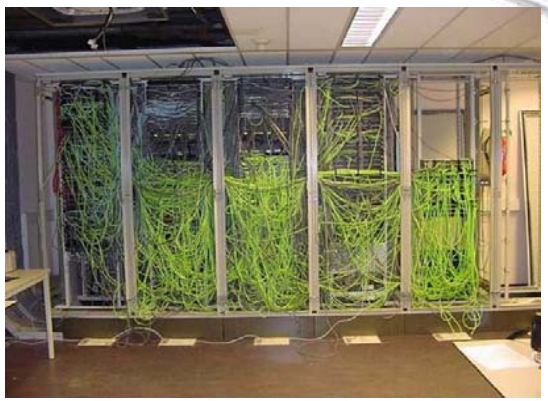
43% less

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



Deployed on Sun + HP servers



Additional network parts
37 switches
814 cables
740 adapters

1591 total network parts

$0.45M **Total**

Best fit on zEnterprise

Additional network parts
1 switch
10 cables
10 adapters

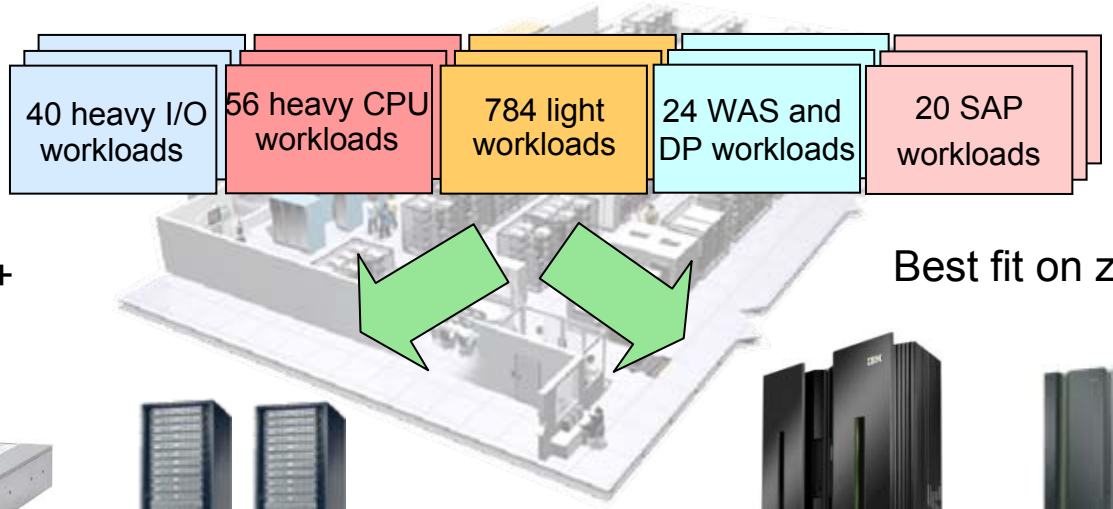
21 total network parts

$0.03M **Total**

94% less

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

Compare Power Consumption



Deployed on Sun + HP servers

183 servers
124.1 kW

$0.33M **Total**

3 years
@ $0.10 per kWh

Best fit on zEnterprise

106 servers
53.4 kW

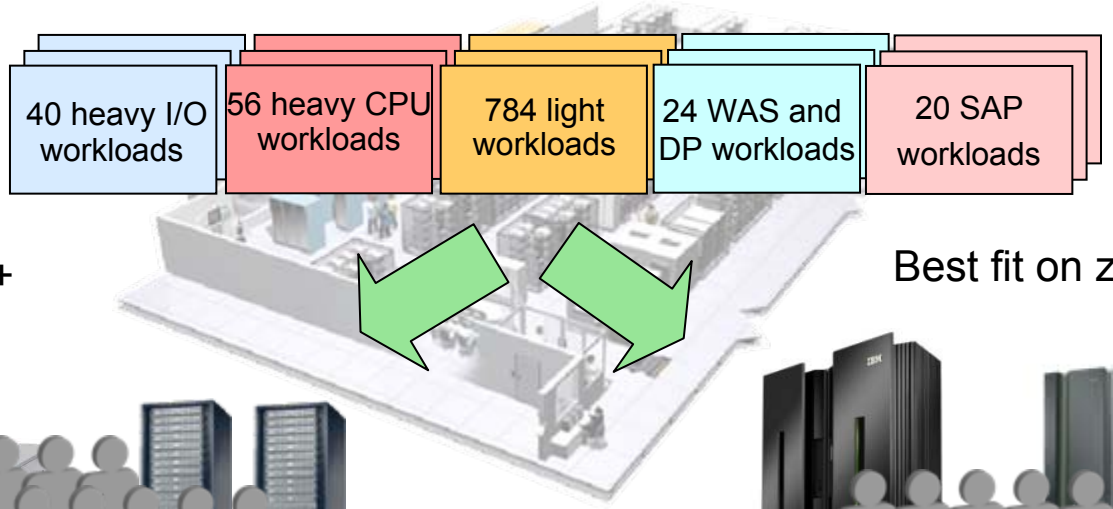
$0.14M **Total**

3 years
@ $0.10 per kWh

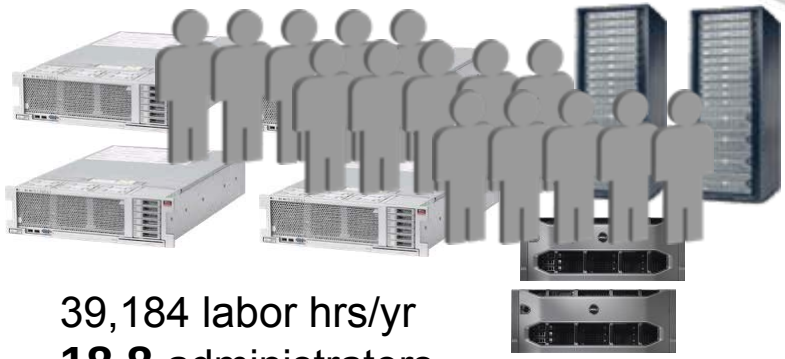
57% less

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



Deployed on Sun + HP servers



39,184 labor hrs/yr
18.8 administrators

$9.0M Total

3 years
@ $159,600/yr

Best fit on zEnterprise

26,441 labor hrs/yr
12.7 administrators

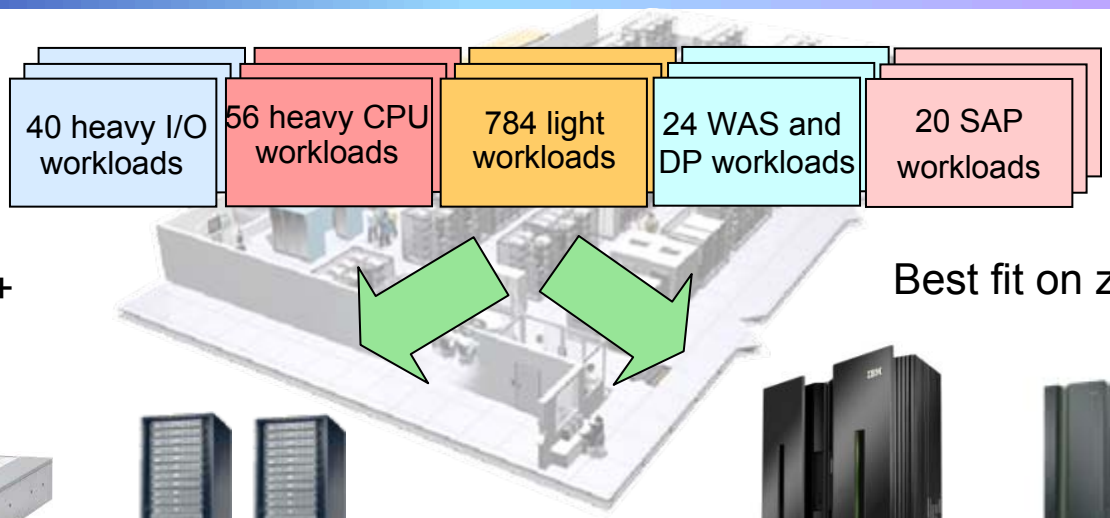
$6.1M Total

3 years
@ $159,600/yr

32% 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



Deployed on Sun + HP servers

183 servers
2,096 cores

$55.8M Total

or **$61K** per workload

3yr TCO

Best fit assignments result in 42% lower cost per workload

Best fit on zEnterprise

106 servers
1080 cores

$32.4M Total

or **$35K** per workload

3yr TCO

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