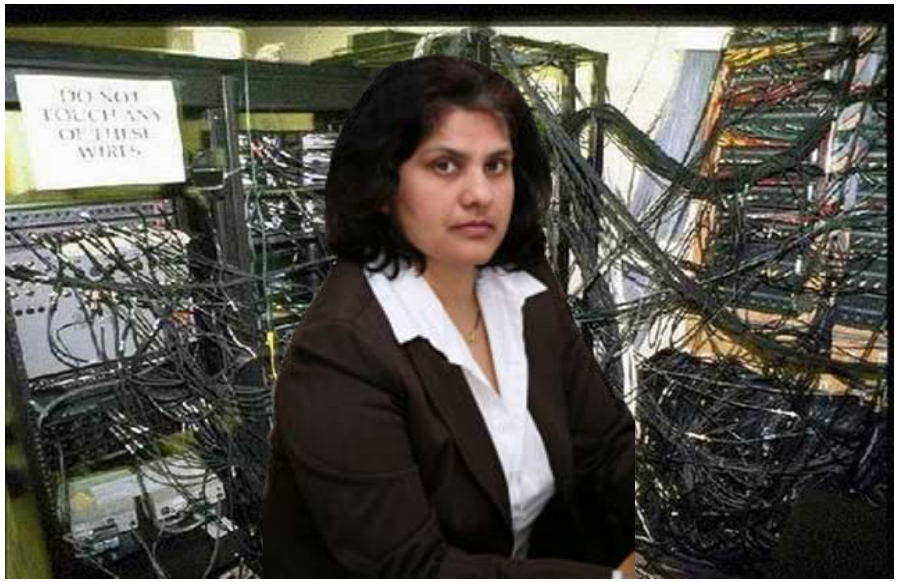
zEnterprise – The Ideal Platform For Smarter Computing

Consolidating Server Infrastructure

Simplifying Hardware Infrastructure Dramatically Reduces The Cost Per Workload

Our front end infrastructure is too complex…

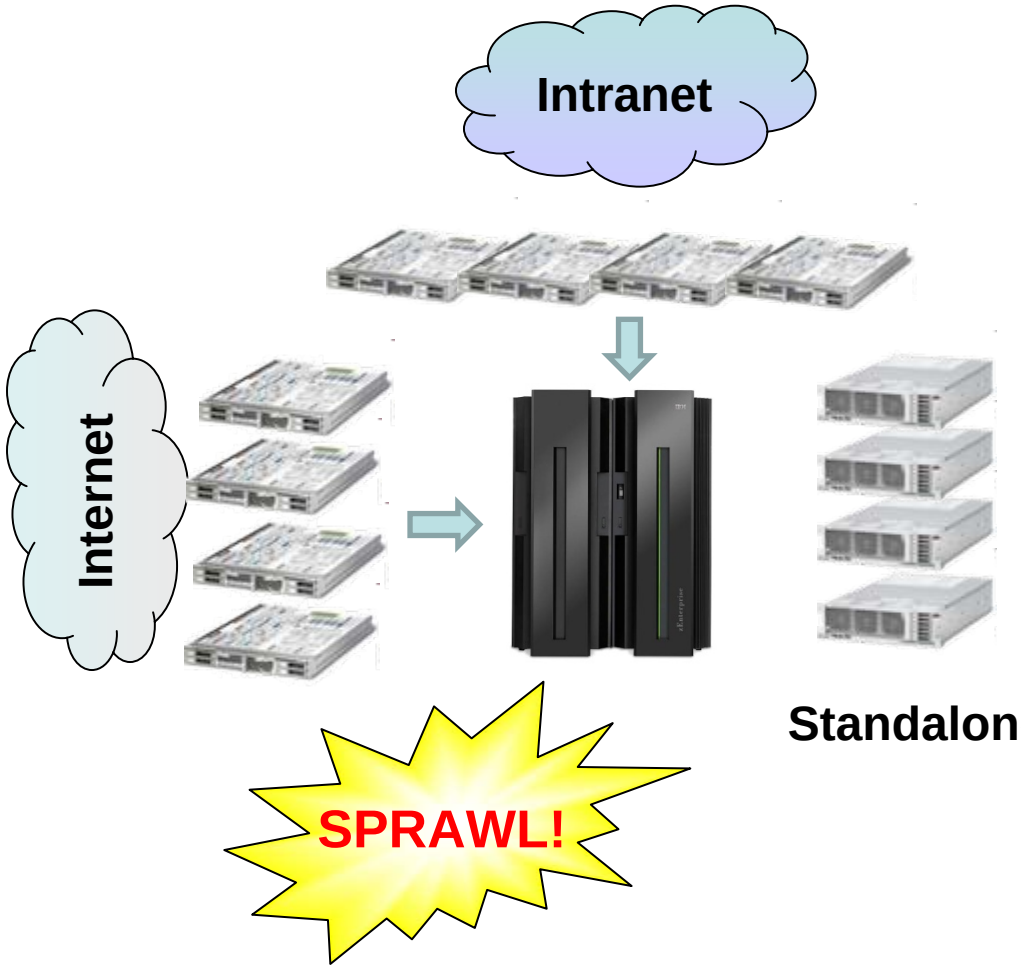


CIO

You can simplify by consolidating everything on a single platform!

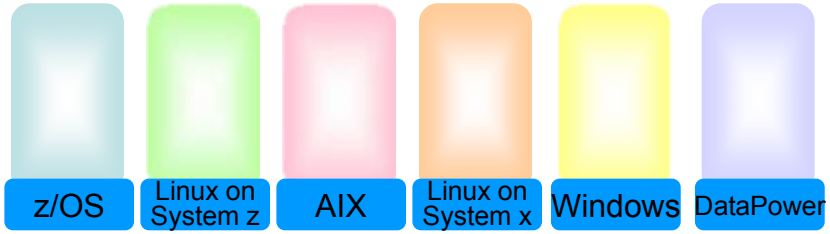
IBM

Eliminate Sprawl With zEnterprise Multi-Architecture Environment



Standalone

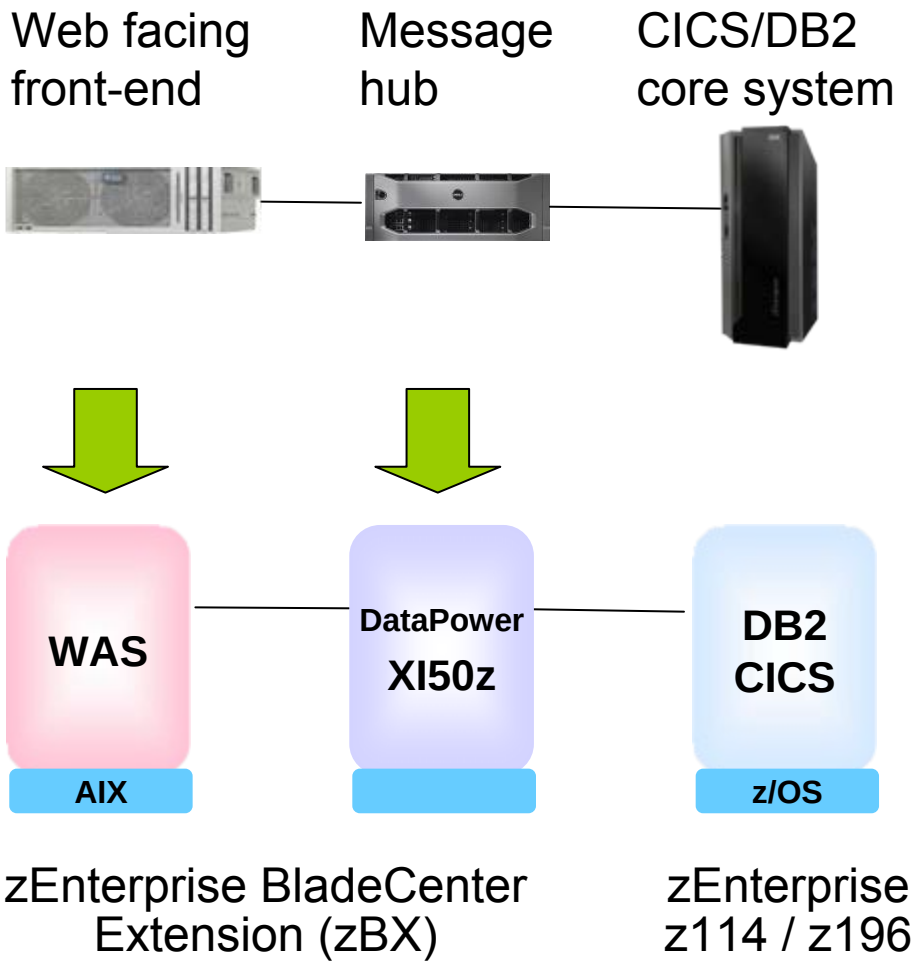
Platforms Optimized for Different Workloads



Best Fit for Workload

Consolidate with zEnterprise!

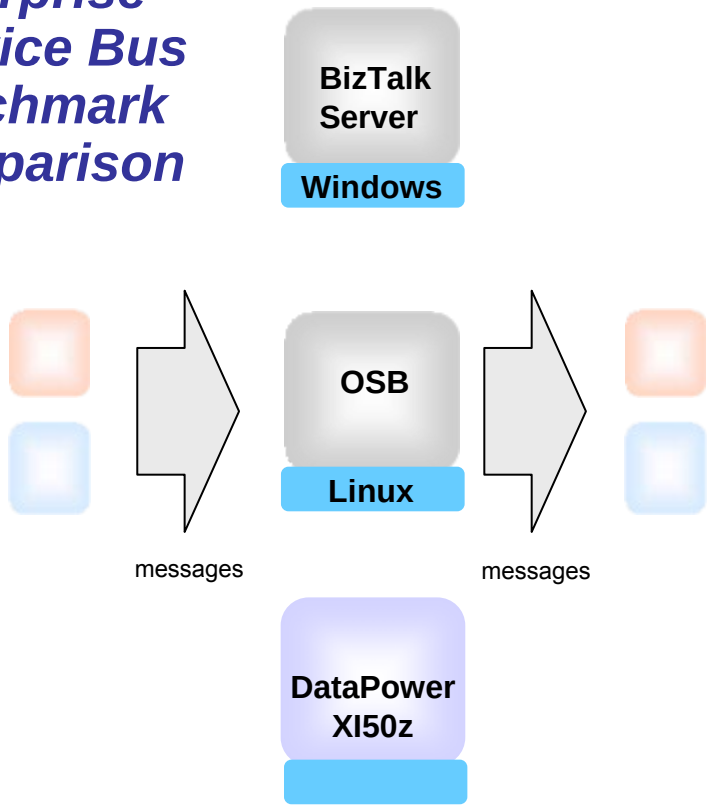
Run Web Front End Workloads On zEnterprise Platform



- 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



Microsoft BizTalk Server
Windows on Intel Server

4 sockets, 32 cores

128 GB

492 messages per sec

$764 per mps

Competitior 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

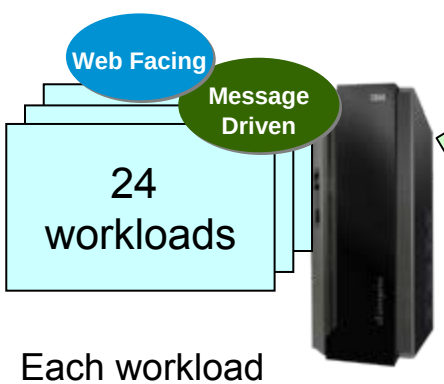
5,117 messages per sec

$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



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 Sun hardware

Competitor's system relies on physical workload isolation

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

WebSphere App Server

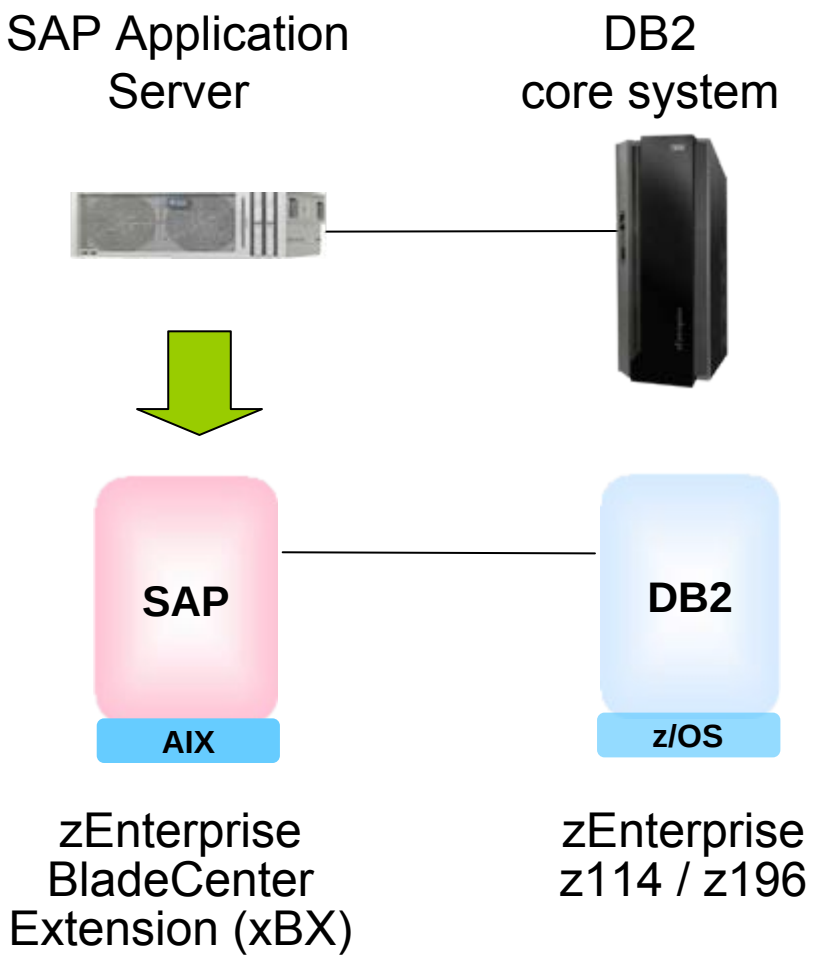
24 POWER7 8-core blades
2 DataPower XI50z in zBX
192 cores total

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



- 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

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

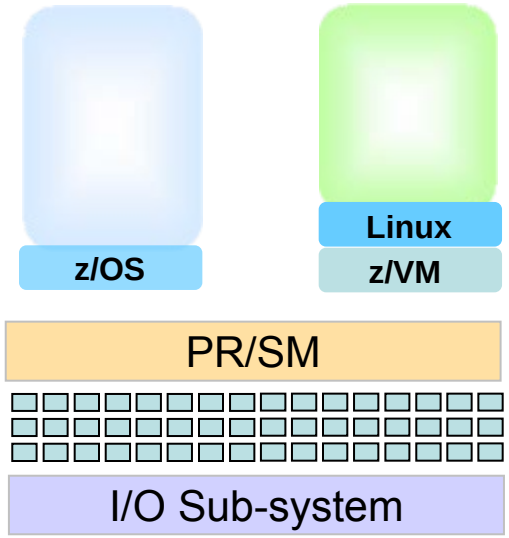
23 POWER7 blades
in zBX
184 cores total

Consolidate on zEnterprise

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

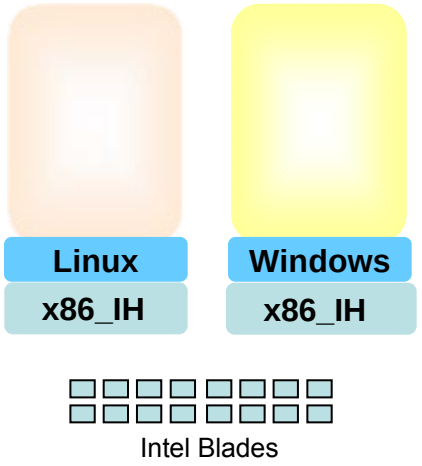
Source: IBM Internal sizing benchmarks for SAP. 3 yr. TCA calculation includes hardware acquisition, maintenance, software acquisition and S&S. US list prices. Prices may vary by country.

A Closer Look At Fit-For-Purpose Workload Assignment



- Scale up to 80 cores in a frame (z/OS clusters with sysplex)
- Dedicated I/O sub-system
- Superior qualities of service

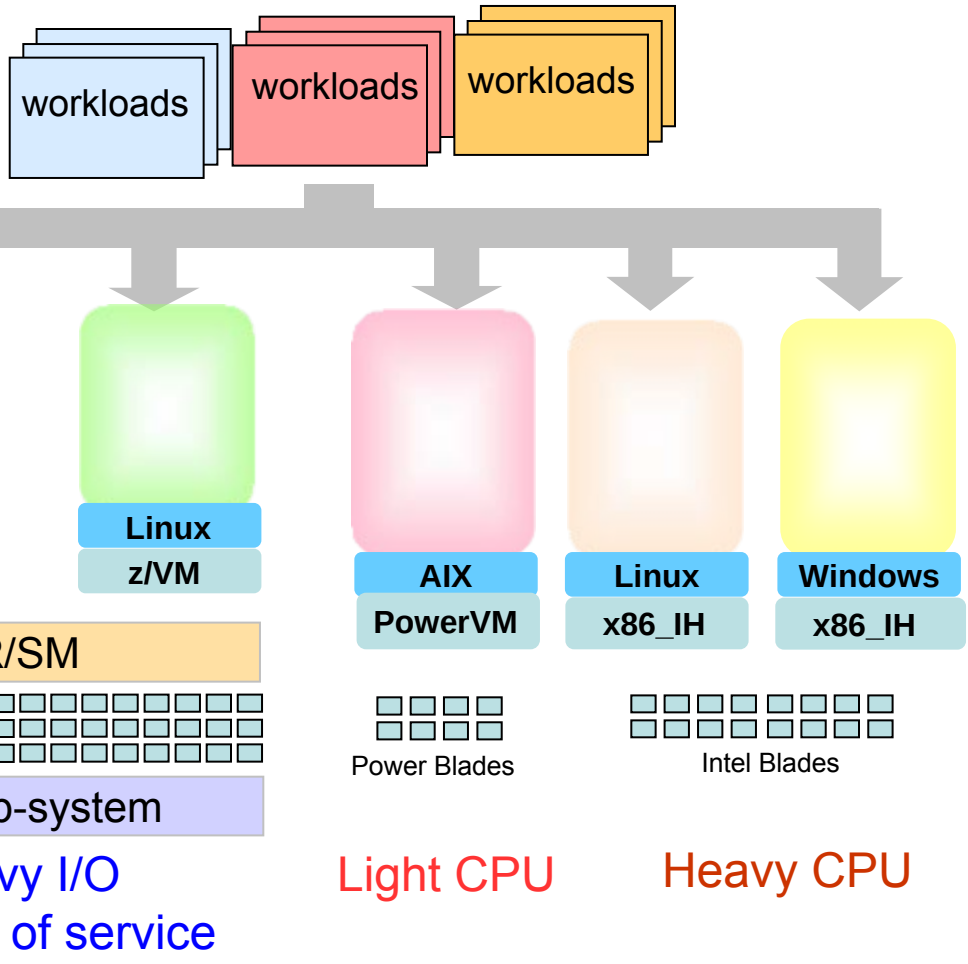
- Scales to 8 cores per blade
- 4 fast processing threads per core
- Floating point accelerators



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

Workload Characteristics Influence The Best Fit Deployment Decision

Easiest architectural fit



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

Deploying Stand Alone 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**

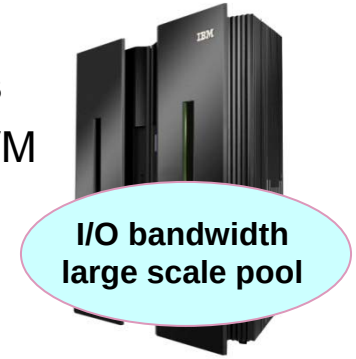
1 workload per Intel blade

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



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.

Deploying Stand Alone Workloads With Heavy CPU Requirements

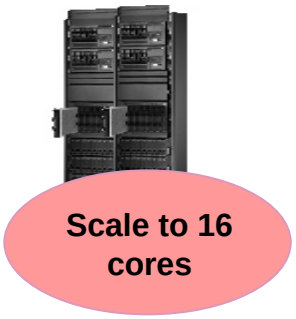
Benchmark to determine which platform provides the lowest TCA over 3 years

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



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.

Deploying Stand Alone Workloads With Light CPU Requirements

Benchmark 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
$8,086 per workload

28 workload per POWER7 blade

Fast low cost threads

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

Best Fit

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.

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

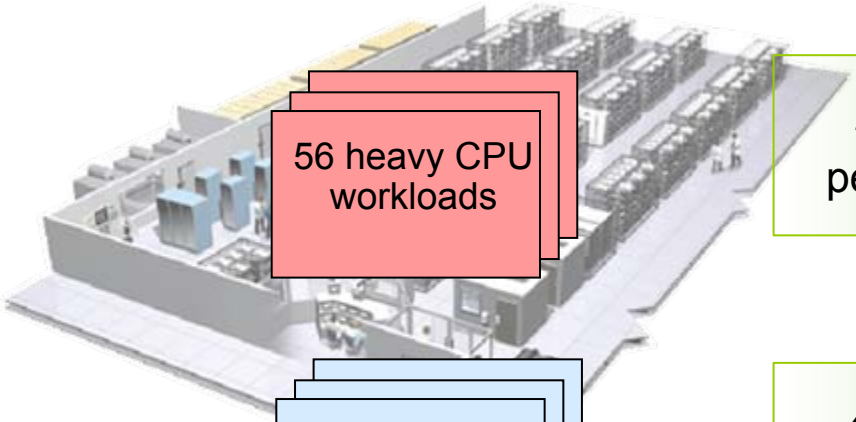
zEnterprise

A Best Fit Assignment Of 880 Standalone Workloads On zEnterprise

784 light workloads

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

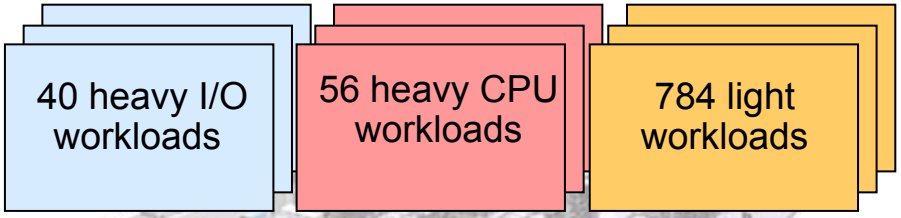
40 workloads per 32 IFLs

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 47% Less On zEnterprise



Deployed on Sun Fire X4470

95 Sun Fire Servers

1520 cores

$43K

per workload

3yr TCA

HW+SW

Best fit on zEnterprise

z196

32 IFLs

56 Blades

672 cores

$23K

per workload

3yr TCA

HW+SW

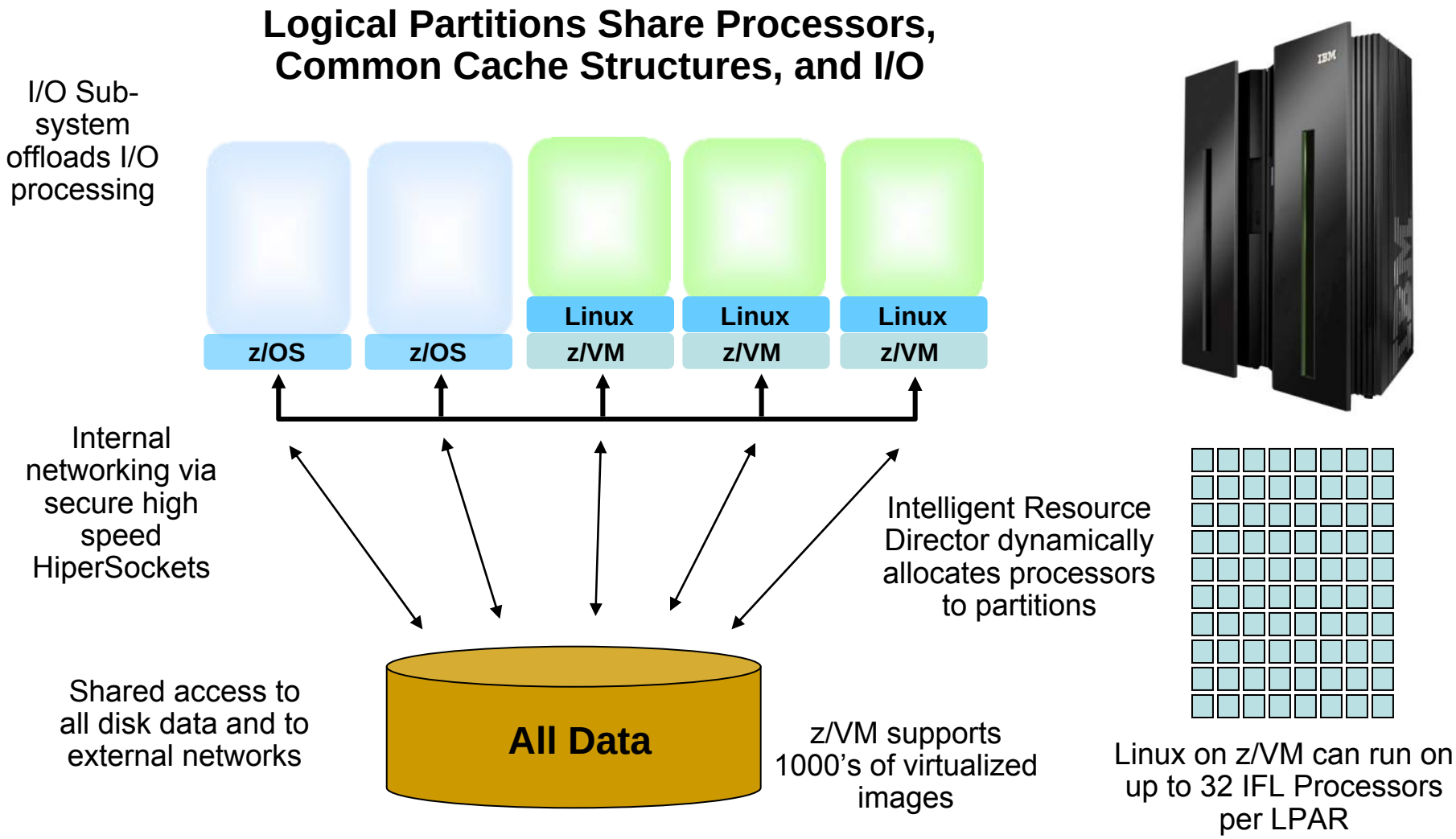
47% less

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

A Deeper Look At Linux On z/VM Capabilities

- Cost benefit of Enterprise Linux Server Solution Edition pricing
  - Cost of IFL's
- Cost benefit of software pricing for IFL's
- Dedicated I/O Sub-system offloads I/O processing
- Greater I/O bandwidth
- Virtualization of I/O processing resources
- Superior Reliability, Serviceability, and Security
- Achieves lowest TCA for heavy I/O workloads

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

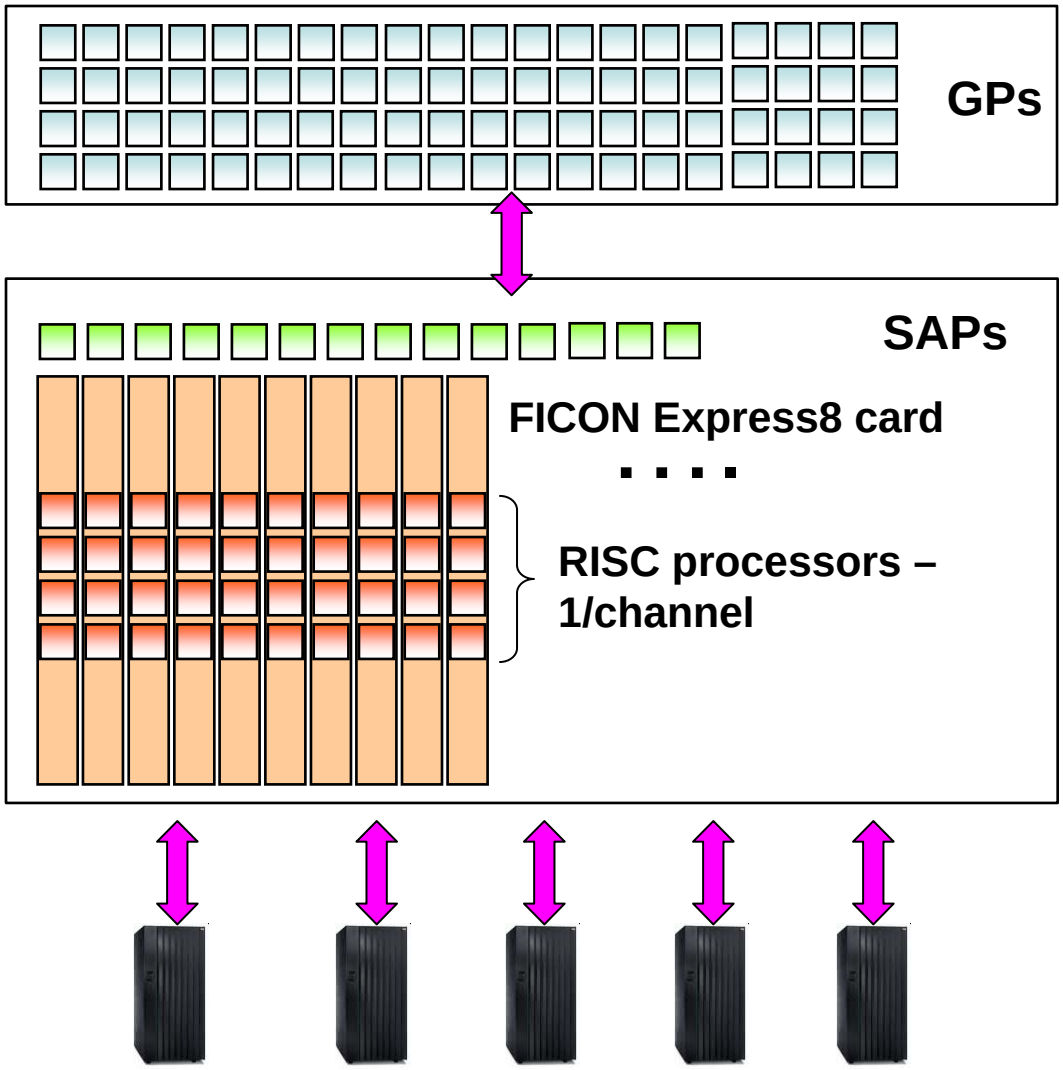


System z Solution Editions For Linux Offer Significant Cost Reductions

Special Package Prices

- System z Solution Edition for Enterprise Linux
  - **Add** Integrated Facility for Linux (IFL) processors, memory and z/VM to an existing mainframe
  - Hardware and software maintenance for three or five years
- Enterprise Linux Server
  - **Standalone** System zEnterprise server with IFLs, memory, I/O connectivity, and z/VM
  - Hardware and software maintenance for three or five years
- Linux on System z available from distribution partners

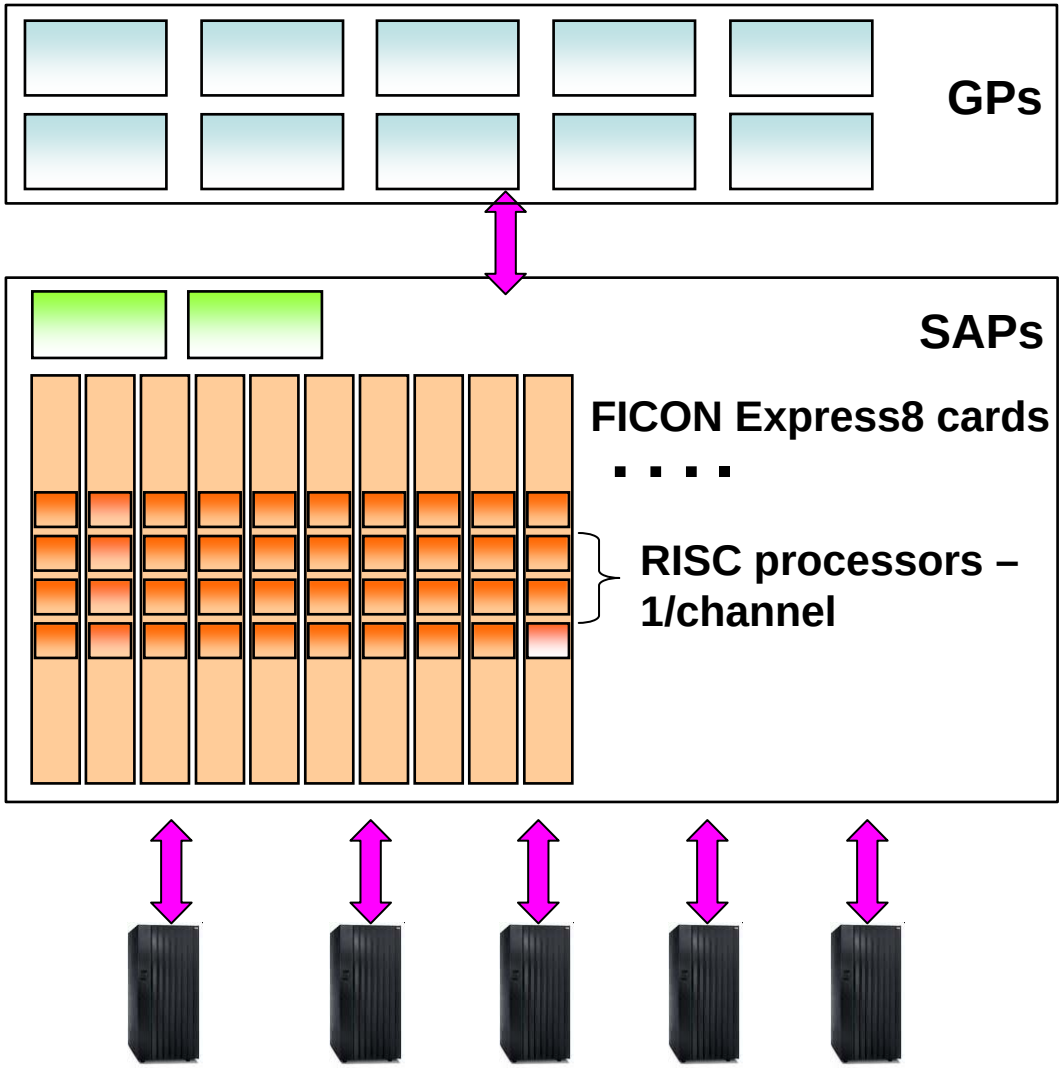
Linux On z/VM Benefits From High I/O Bandwidth Provided By z196



- 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

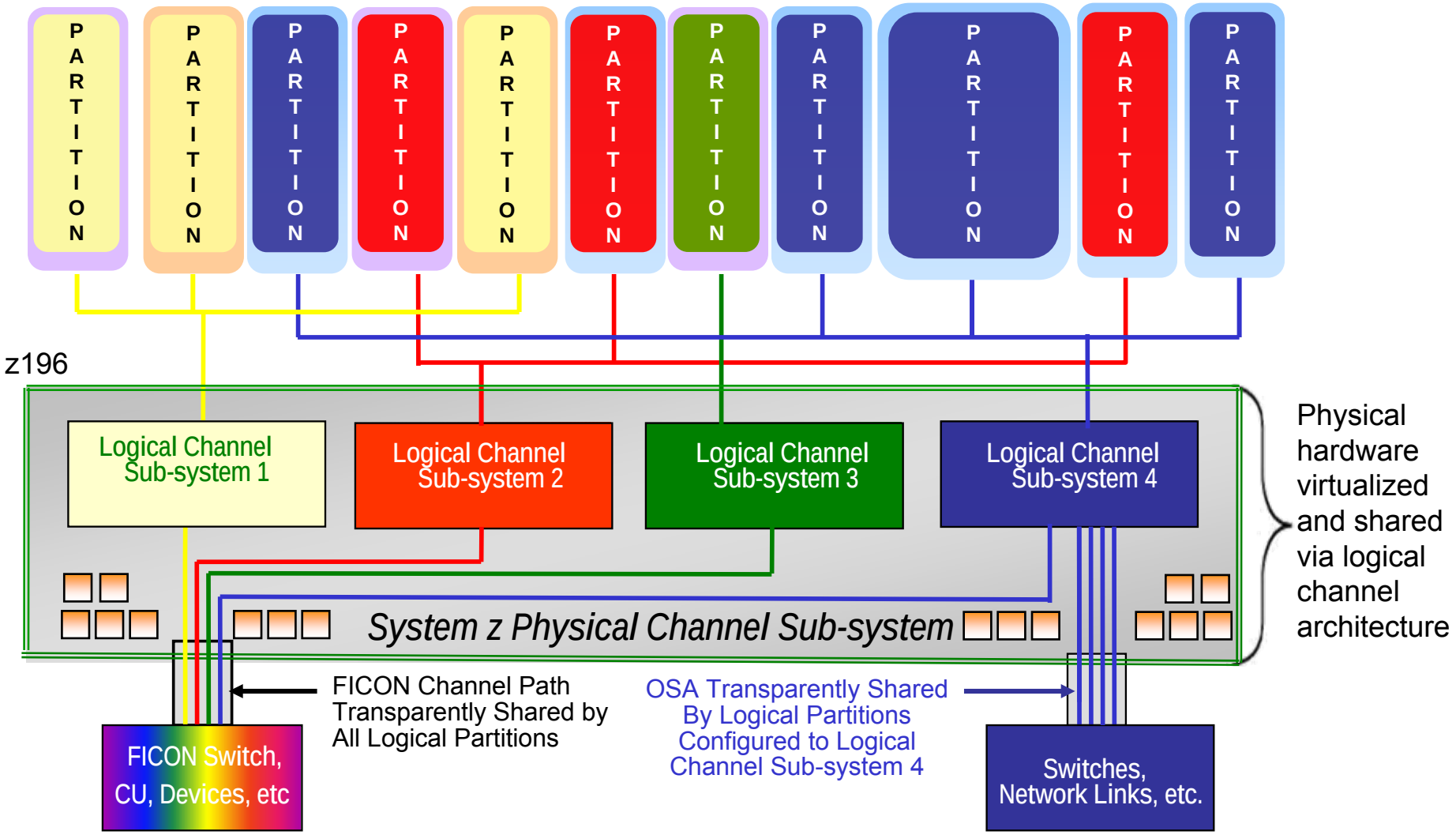
Linux On z/VM Also Benefits From High I/O Bandwidth Provided By z114



- Up to 10 General Purpose (GP) or Specialty Engine processors
  - Execute business logic
- Up to 2 System Assist Processors (SAP) to manage I/O requests
  - Can sustain up to **230K IOPS***
- Up to 64 physical FICON cards for I/O transfers
  - Up to **128 RISC channel I/O processors**

* Recommend 70% max utilization – 161K IOPS

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



z/VM Security For Linux Workloads

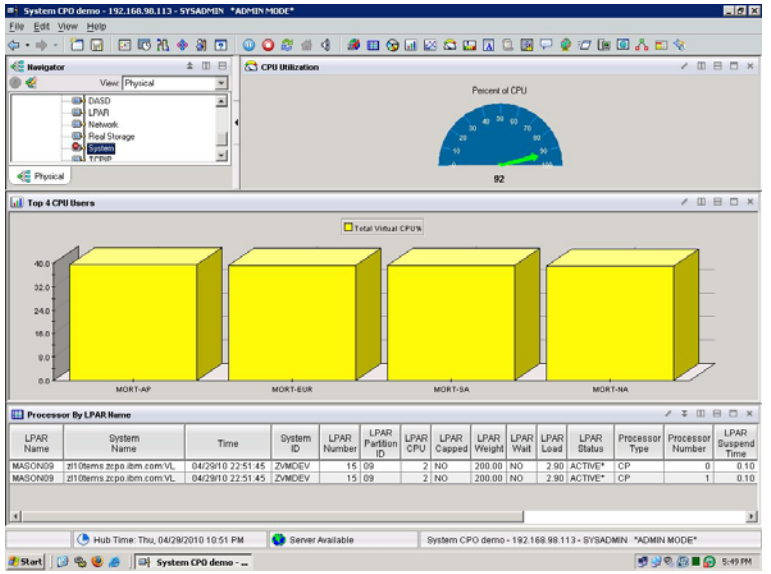
- Protects Linux virtual machines from each other
  - Operates without interference/harm from guest virtual machines
  - Virtual machines cannot circumvent system security features
  - z/VM certified at Common Criteria EAL4+
  - LPAR certified Common Criteria EAL5
- RACF Ensures that a user only has access to resources specifically permitted
  - Tracks who is accessing all system resources
- HiperSockets for highly secure internal networking
- Access to System z Crypto features
  - CPACF, CryptoExpress3

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

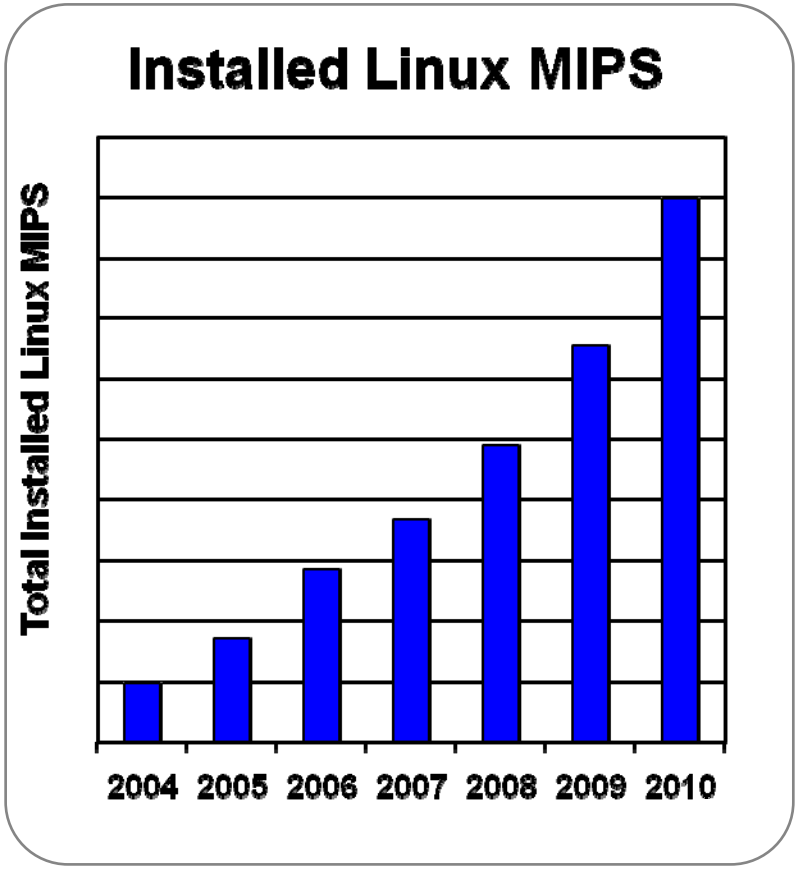


VMware can't recognize and take advantage of additional physical processors without bringing down and rebooting the system

Note: Assumes available processors on installed books

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



[1] Based on YE 2004 to YE 2010

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:

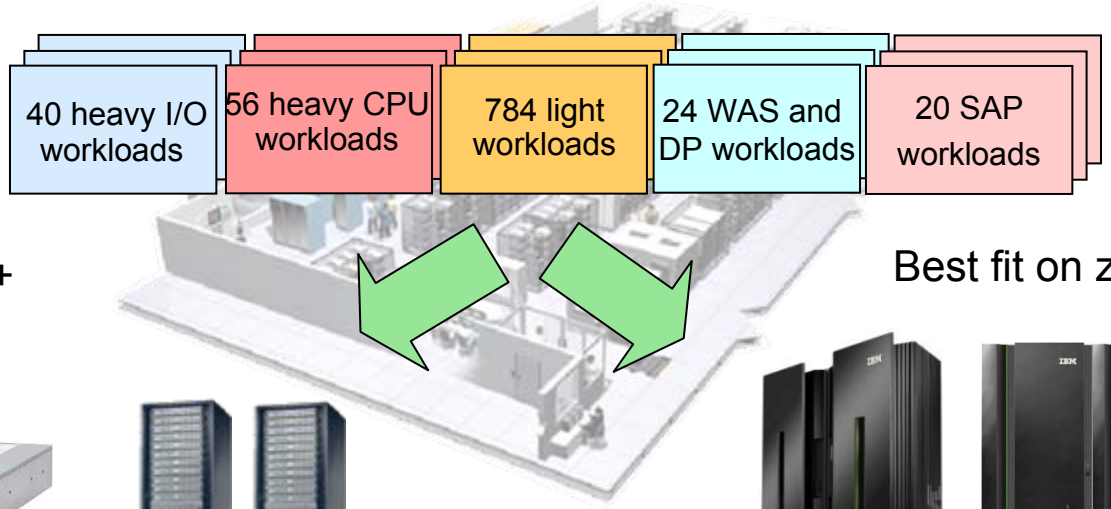
6 IFL processors for
SUSE applications
DB2 for z/OS

"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

We've looked at hybrid and 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

95 Sun Fire X4470
1,520 cores

159 servers
2,440 cores

$49.4M Total
3yr TCA HW+SW

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

2 DL380
24 cores

Best fit on zEnterprise

z196
32 IFLs

105 Blades
1,064 cores

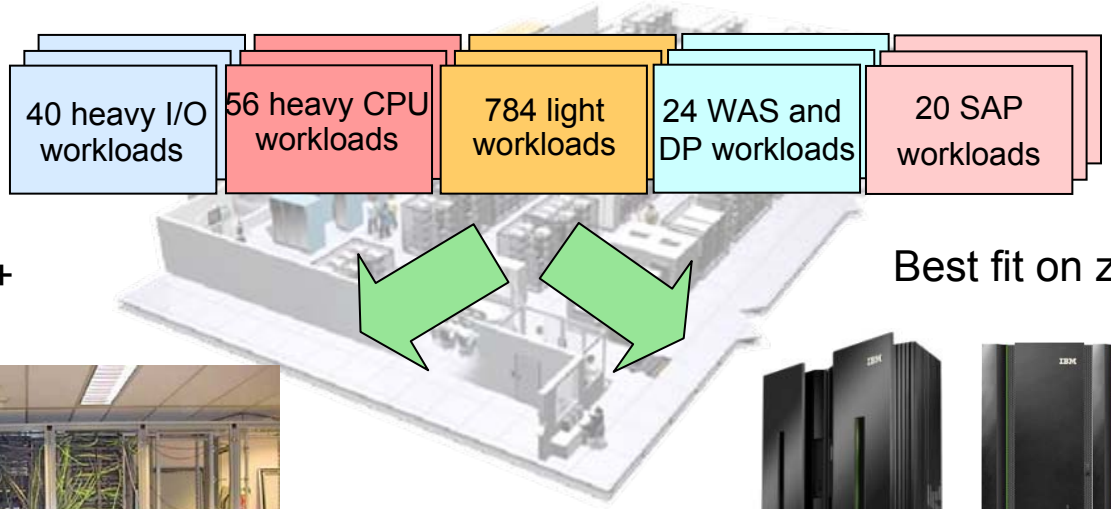
106 servers
1,096 cores

$25.0M Total
3yr TCA HW+SW

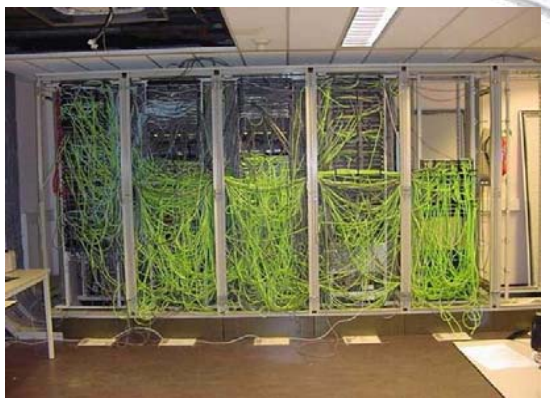
49% less

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
22 switches
480 cables
380 adapters

882 total network parts

$0.32M **Total**

Best fit on zEnterprise

Additional network parts
1 switch
10 cables
10 adapters

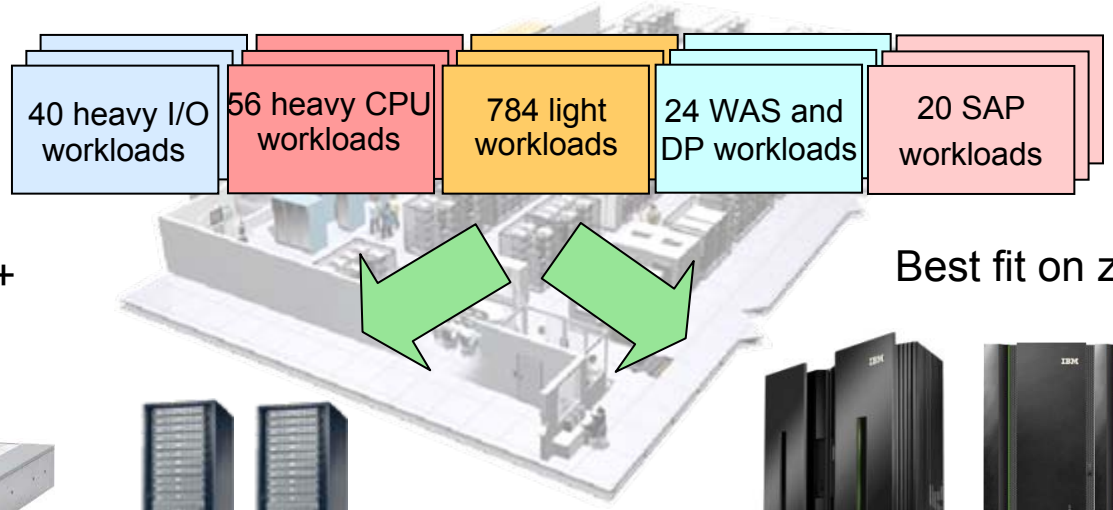
21 total network parts

$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



Deployed on Sun + HP servers

159 servers
115.3 kW

$0.46M **Total**
3 years
@ $0.10 per kWh

Best fit on zEnterprise

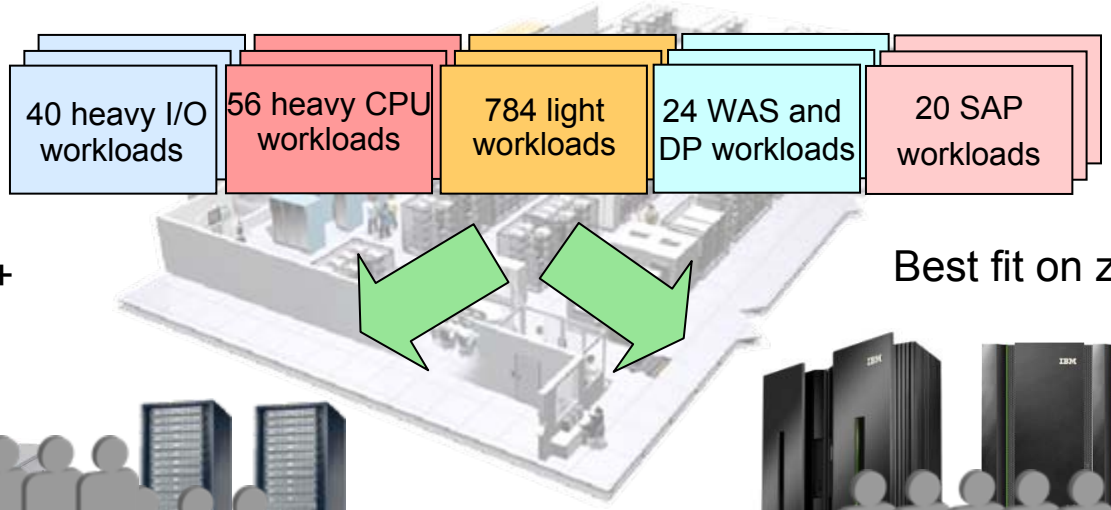
106 servers
47.1 kW

$0.21M **Total**
3 years
@ $0.10 per kWh

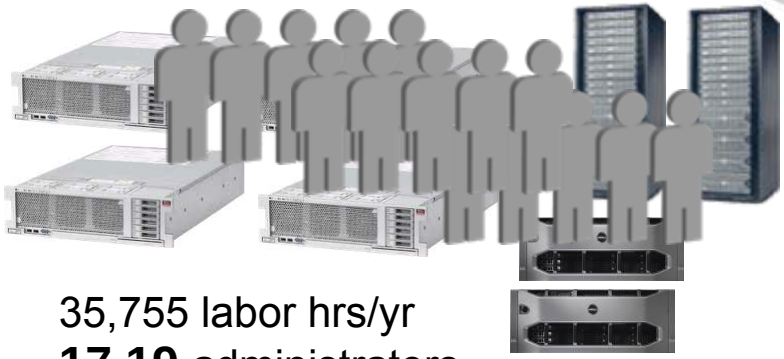
54% less

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



Deployed on Sun + HP servers



35,755 labor hrs/yr
17.19 administrators

$8.23M **Total**

3 years
@ $159,600/yr

Best fit on zEnterprise

26,371 labor hrs/yr
12.68 administrators

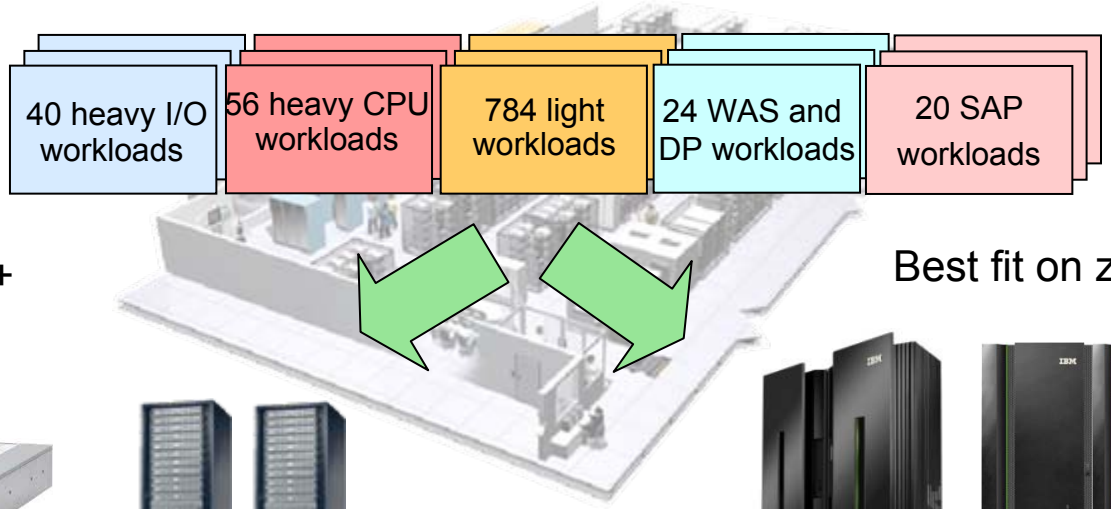
$6.07M **Total**

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



Deployed on Sun + HP servers

159 servers
2,440 cores

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

Best fit on zEnterprise

106 servers
1096 cores

$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