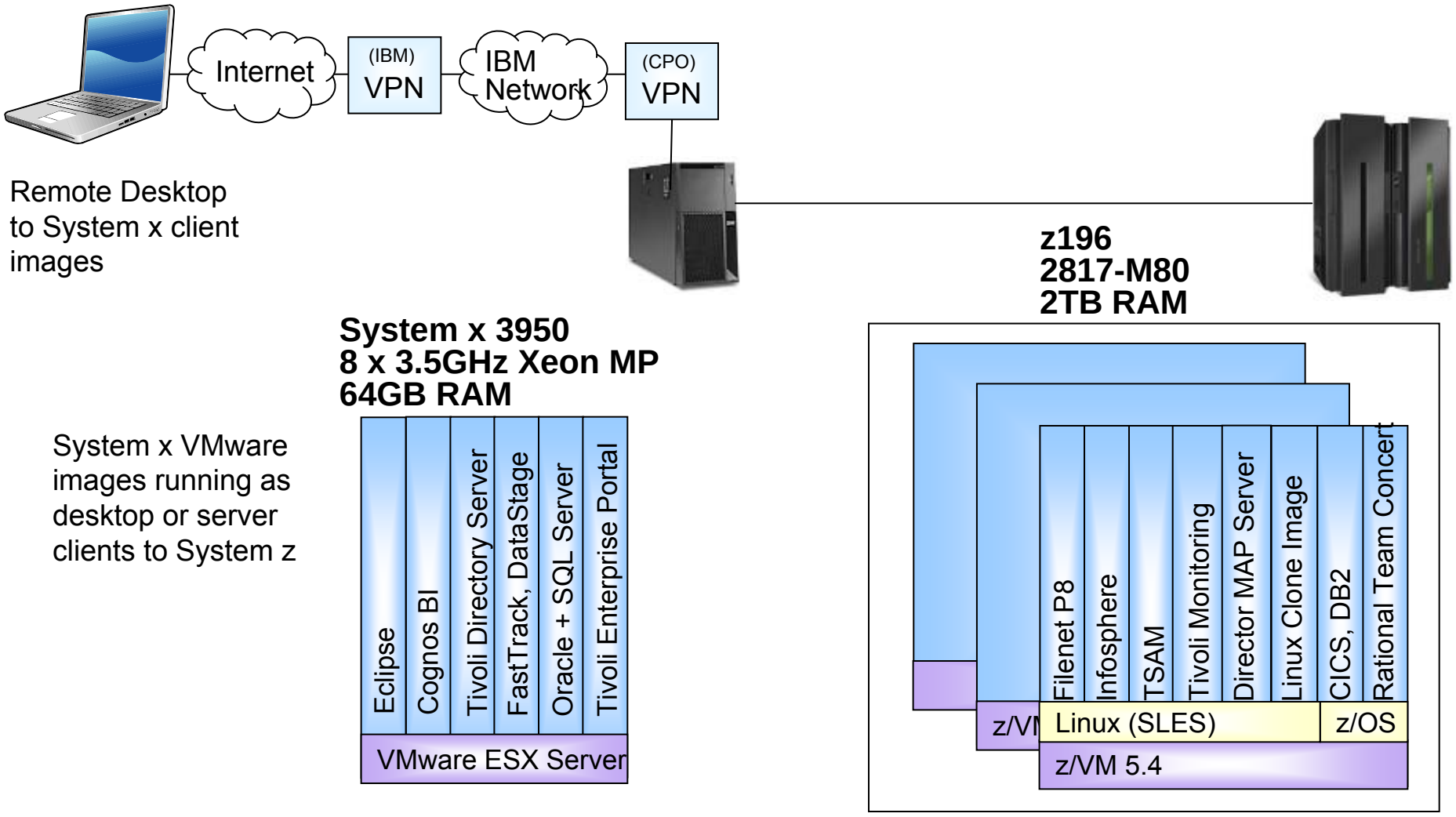
zEnterprise – The Ideal Platform For Workload Optimization

Track Agenda

60 minutes	**zEnterprise – An Ideal Platform For Workload Optimization**
60 minutes	**Simplify And Compress Hardware Infrastructure With zEnterprise**
15 minutes	*Break*
60 minutes	**System z – Still The Best Place For Business Analytics**
45 minutes	*Lunch*
60 minutes	**Improving Service Delivery With Private Cloud Computing**
10 minutes	*Break*
60 minutes	**The Reality Of Rehosting**
60 minutes	**Tales From The Eagle TCO Team**
5 minutes	Close

DEMO: Architecture



Today's Business Workloads Are Putting Ever-Increasing Demands On IT

Typical workloads

Batch
OLTP
Data Warehouses
Financials
Business Processing

ERM
CRM
Web Commerce
Email
File/Print services

- ***32.6M*** servers WW
  - But with ***85%*** idle computer capacity
- ***1.2T GB*** of data WW
  - But only ***25%*** of data is unique
- In last 10 years, servers grew ***6x*** and storage grew ***69x***

The data center *explosion*

The result...

… costs are going through the roof!

Smarter Computing Means Transforming IT With Workload Optimized Systems

Typical workloads

Batch
OLTP
Data Warehouses
Financials
Business Processing

ERM
CRM
Web Commerce
Email
File/Print services

zEnterprise

IDAA

DS8800

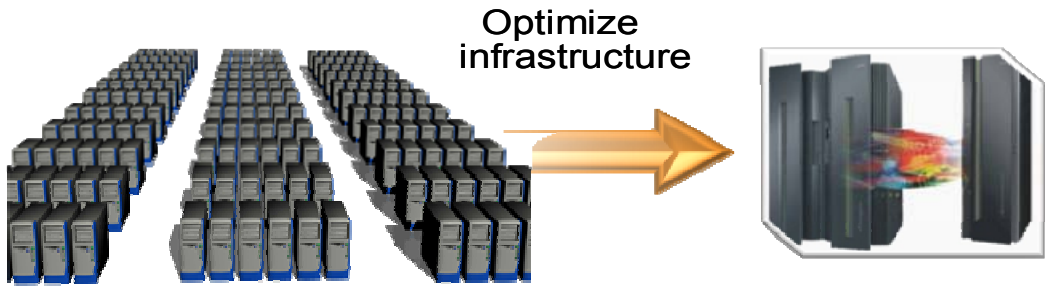
Workload Optimized Systems

New metric for the age of Smarter Computing

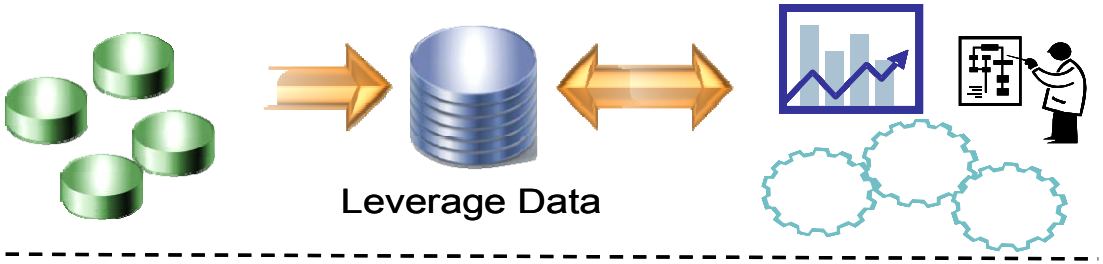
Cost Per Workload

What Are Workload Optimized Systems?

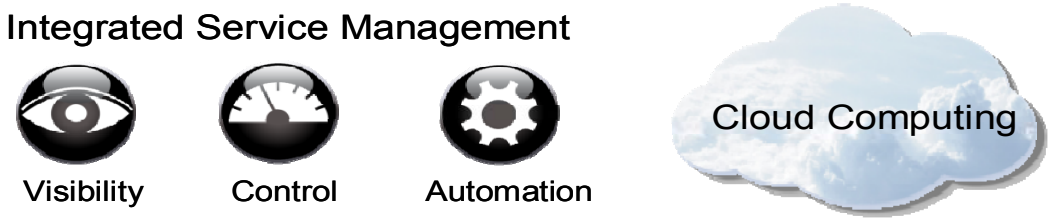
Tuned to the Task



Designed for Data



Managed as a Cloud



How Is Lowest Cost Per Workload Achieved With zEnterprise?

- Still best for handling core business workloads
- Enables hardware consolidation at unprecedented levels
- Ideal platform for data consolidation and business analytics optimization
- Uniquely designed to meet requirements for private cloud computing

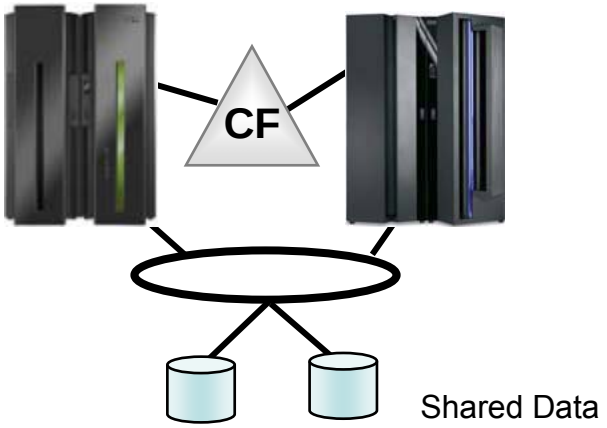
zEnterprise

IBM DB2 Analytics Accelerator

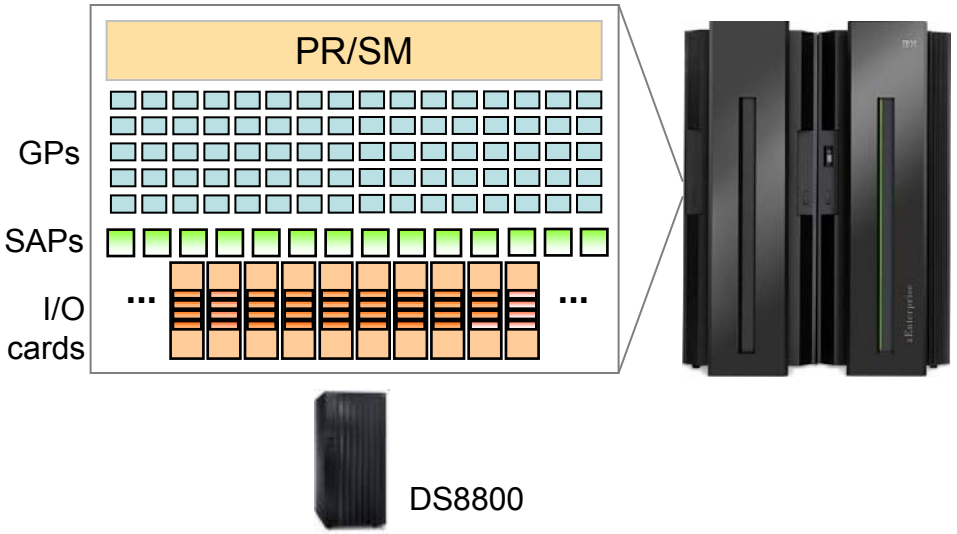
DS8800

Core Business Workloads Require Extreme Scalability And High I/O Bandwidth

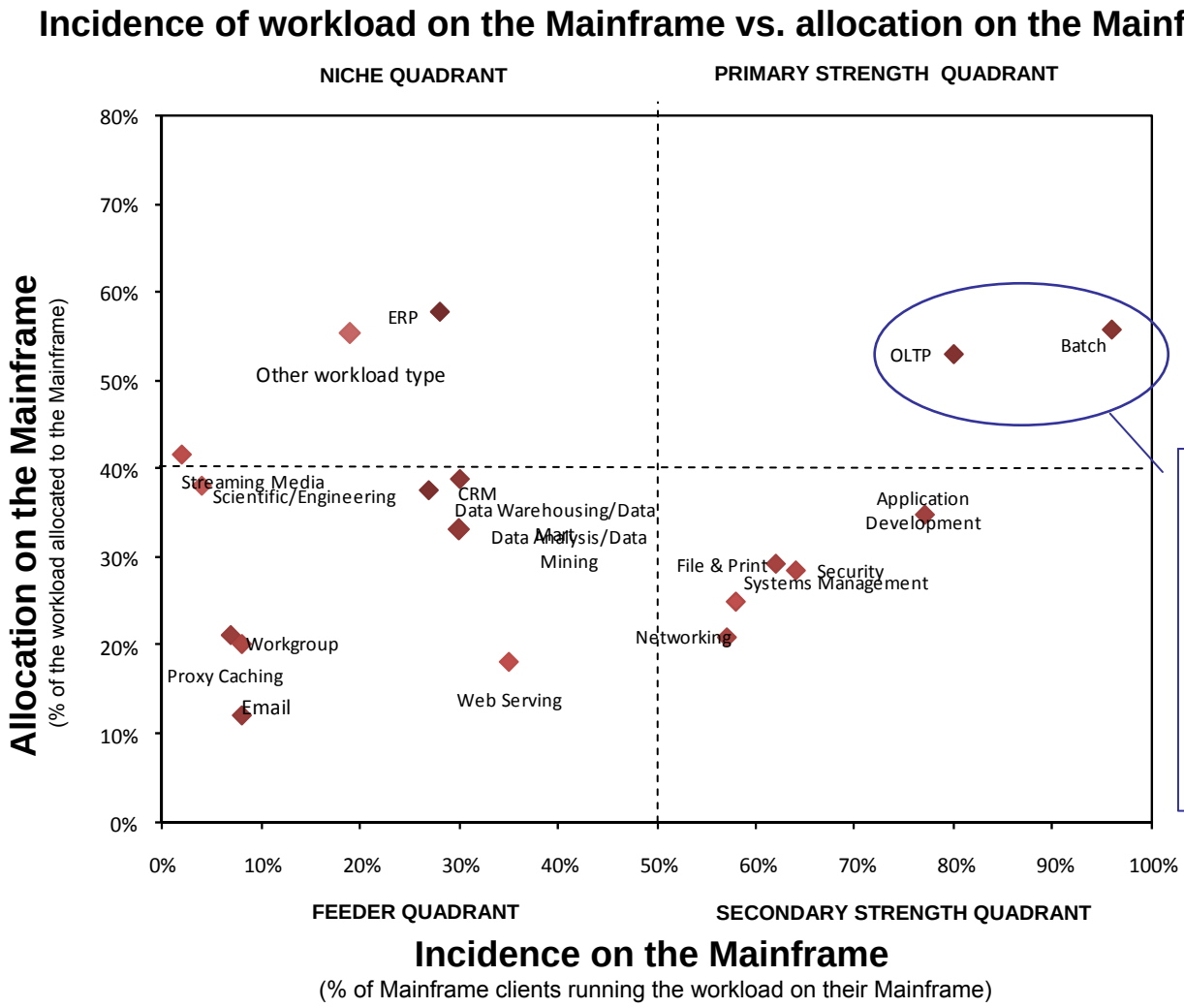
- Parallel sysplex architecture enables very large scale clustering
  - Up to 32 System z mainframes can be clustered
  - Coupling Facility centralizes management of data locks, cache and lists across all attached systems
  - Competitor's design leads to increased network traffic and limited scalability
- Exploited by IMS, CICS, DB2, MQ, and other z/OS workloads



- Designed with dedicated I/O subsystem
- Up to 14 system assist processors (SAPs) manage I/O requests
  - Can sustain up to 2.2M IOPS
  - Supports up to 84 high speed I/O cards
  - Connects to high capacity DS8800 storage system
- Exploited by z/OS and z/VM workloads



Customers Validate Batch And OLTP As Core Business Workloads For System z

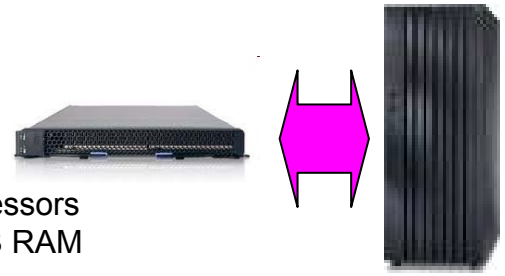


High incidence plus high allocation means OLTP and Batch are core mainframe workloads

Source: IBM Market Intelligence Customer Survey

System z Is Optimized For Batch Processing And Heavy I/O Workloads

Power PS701 + DS8300



8 processors
128 GB RAM

zEnterprise + DS8300

8 processors
256 GB RAM

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

Sorting Total Elapsed	6,900 secs	Sorting Total Elapsed	860 secs
Concurrency	20	Concurrency	45
Bytes Per Sec	280 MB	Bytes Per Sec	2,250 MB

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

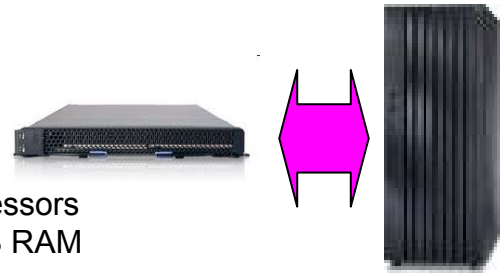
Merging Total Elapsed	7,920 secs	Merging Total Elapsed	1,218 secs
Concurrency	10	Concurrency	10
Bytes Per Sec	244 MB	Bytes Per Sec	1,580 MB

Batch window is reduced by 89% on zEnterprise

Source: IBM Internal Study. Results may vary based on customer workload profiles/characteristics.

DEMO: Batch Race

Power PS701 + DS8300



8 processors
128 GB RAM

zEnterprise + DS8300

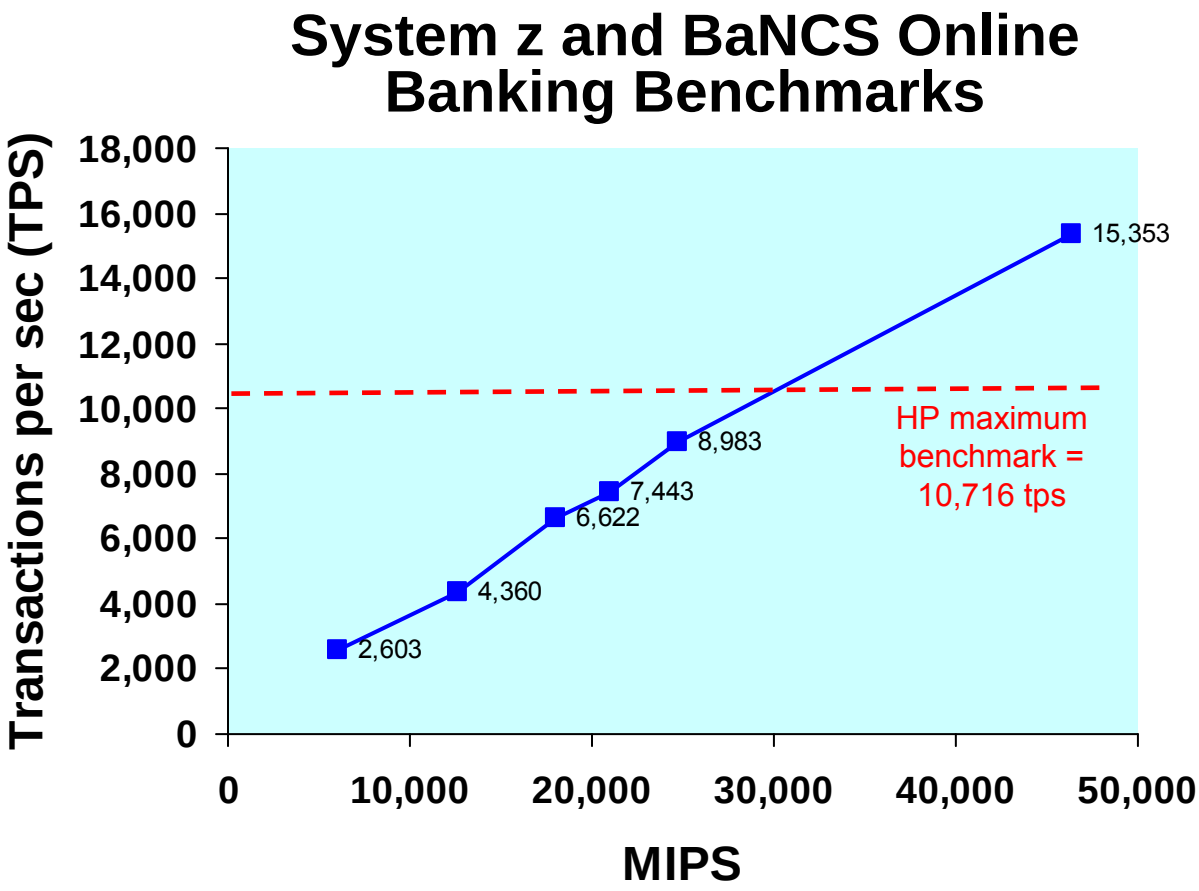
8 processors
256 GB RAM

- Watch the dial to see who wins!

System z Is Optimized For OLTP Processing

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

State Bank of India [3]
- **HP Superdome**
- **TCS BaNCS**
- **10,716** Transactions/second
- **500** Million Accounts
- Largest banking benchmark performance claimed by HP



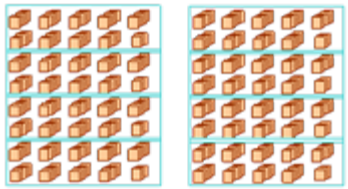
[1] Source: http://www.enterprisenetworksandservers.com/monthly/art.php?2976 and *InfoSizing FNS BANCS Scalability on IBM System z – Report Date: September 20, 2006*
[2] Standard benchmark configuration reached 8,024 tps, a modified prototype reached 9,445 tps
[3] **SOURCE**:**Clement Report; http://h20195.www2.hp.com/v2/GetPDF.aspx/4AA1-4027ENW.pdf Feb 2010

Even At Same Throughput, System z Costs 49% Less Than HP Platform

Compare processors needed to achieve 10,716 tps

HP Superdome Servers

896 processors
3,668,608 Performance Units



HP-UX, Oracle

49 Processors (41 GPs + 8 zIIPs)
38,270 MIPS

z/OS, DB2

IBM z196

Total (5yr TCO) **$195M**

Hardware	$113,215,984
Software	$78,185,950
Networking	$948,000
Space	$1,061,710
Energy	$1,522,488

Scalability Not Demonstrated

Total (5yr TCO) **$99M**

Hardware	$54,159,840
Software	$44,277,400
Networking	$39,500
Space	$78,067
Energy	$131,400

Excellent Scalability

Note: Cost of platform infrastructure for production. Cost of packaged application software not included. List prices used.

Data Shows Keeping Core Business Workloads On Mainframes Reduces Costs

IT cost of goods per industry:

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

From Rubin Worldwide analysis of Gartner Research customer data and costs

Running core business workloads on distributed platforms meant costs increased by 33%

Enhancements In z196 Means Core Business Workloads Run Even Better

	z10 Enterprise Class	*zEnterprise 196 (z196)*
Clock speed	4.4 GHz	**5.2 GHz**
Processors per MCM	5	**6**
Total processors	77 (64 configurable)	**96 (80 configurable)**
Total Memory	1.5 TB	**3TB**
*Performance***	920 MIPS	**1,202 MIPS**
*Total Capacity**	30,657 MIPS	**52,286 MIPS**
Power per MCM	1800 W	**1800 W**

• Based on LSPR ratings for fully configured system
** Single process performance
MCM = Multi-chip module

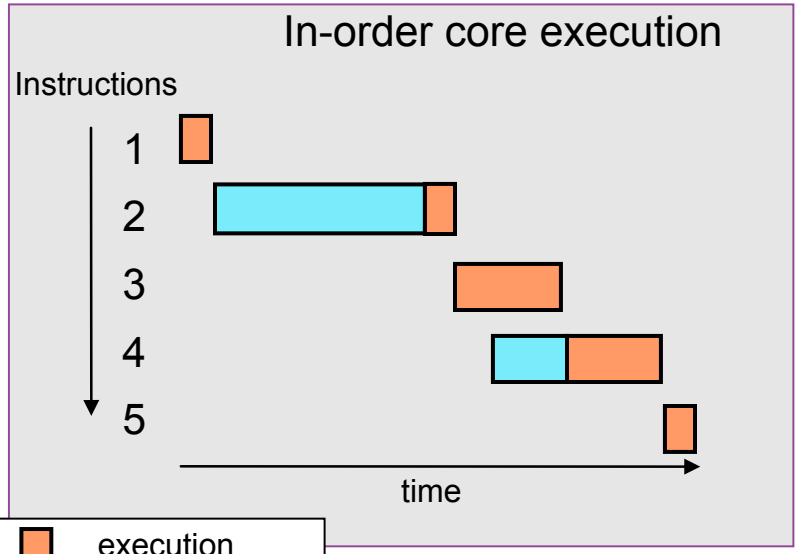
zEnterprise 114 Provides A Upgraded Mid-Range Option

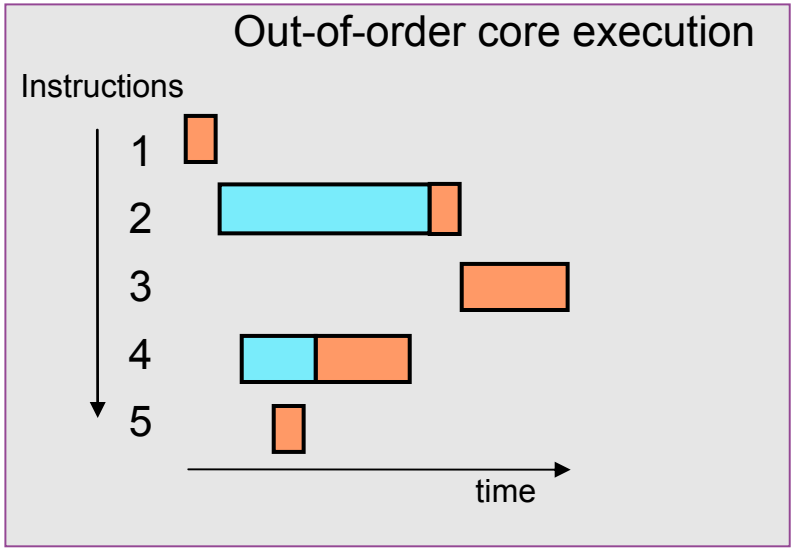
	z10 Business Class	*zEnterprise 114 (z114)*
Clock speed	3.5 GHz	**3.8 GHz**
Total processors	10 (0 spare)	**M05: 7 (0 spare)** **M10:14 (2 spare)**
Total Memory	256 GB	**M05: 128 GB** **M10: 256 GB**
*Performance***	673 MIPS	**782 MIPS**
*Total Capacity**	2,760 MIPS	**3,139 MIPS**

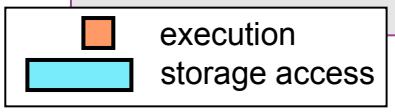
• Based on LSPR ratings for fully configured system
** Single process performance

Out-Of-Order Processing Benefits Compute-Intensive Workloads

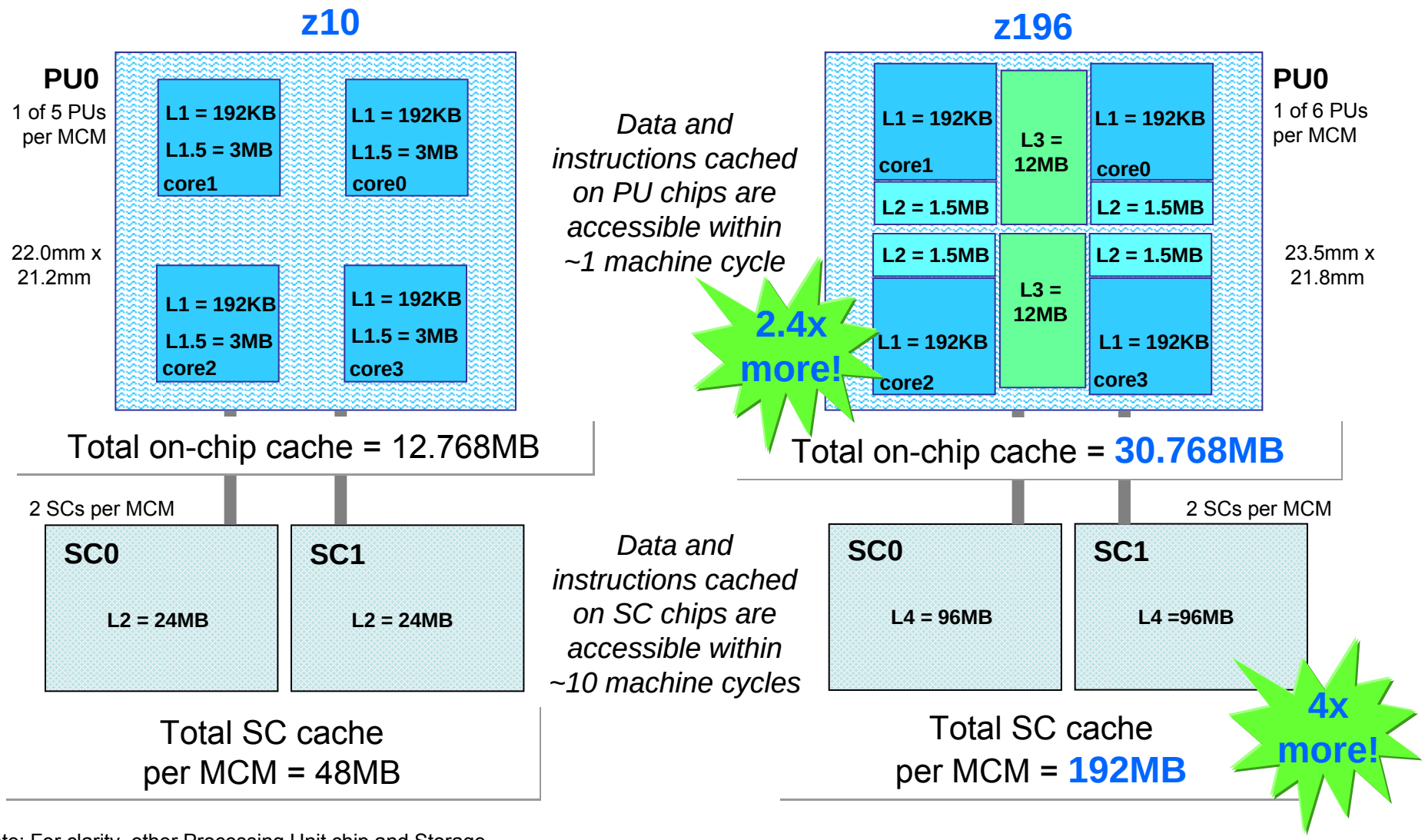
- Superscalar architecture enhancements:
  - Decodes up to 3 instructions per cycle (up from 2 on z10)
  - Executes up to 5 instructions per cycle (up from 2 on z10)
- >100 new instructions added
  - In particular, Instruction Cracking and Register Renaming which enable Out-of-Order (OOO) instruction execution
- Added to both z196 and z114







Core Workloads Take Advantage Of Redesigned Cache To Improve Performance, Reduce Latency

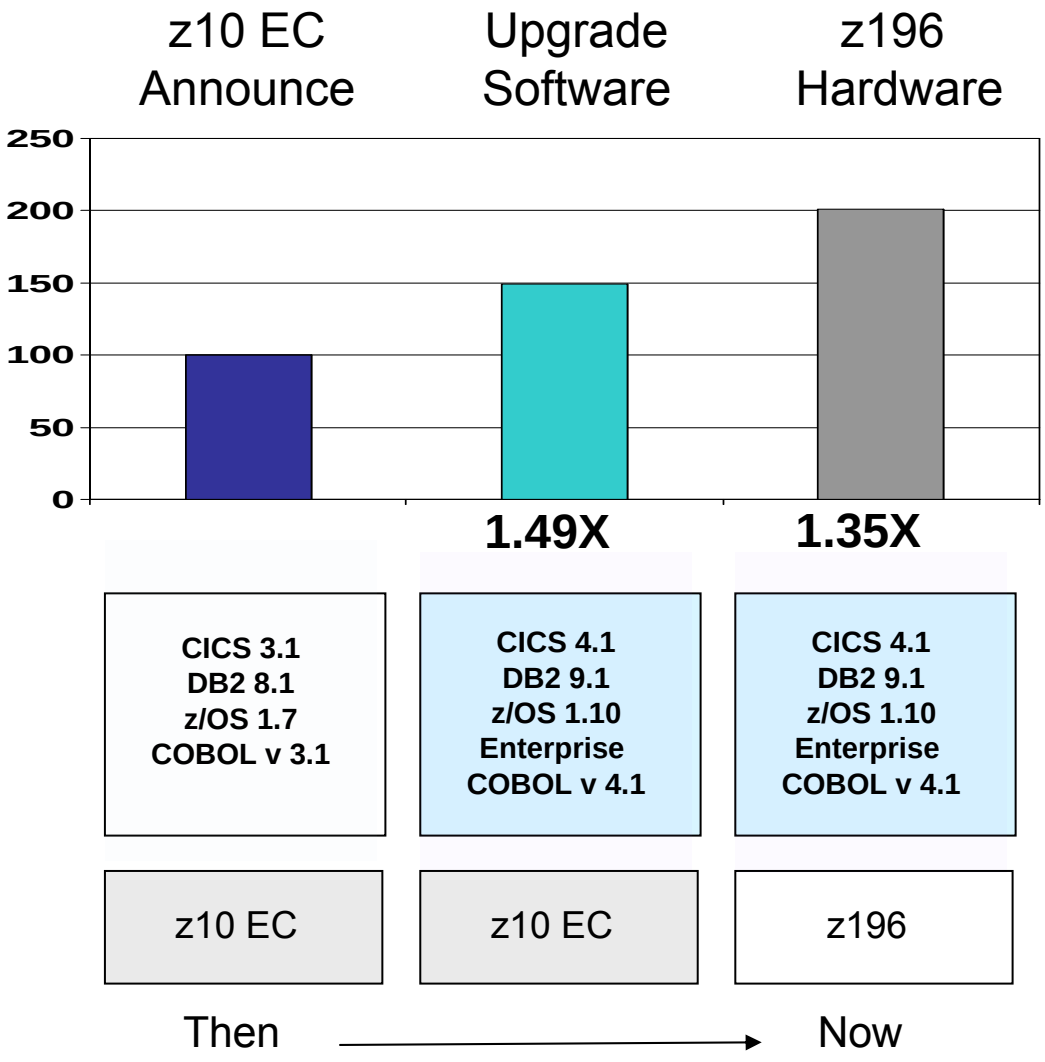


*Note: For clarity, other Processing Unit chip and Storage Control chip components including controllers, coprocessors, and connectors are not drawn in.

CICS/DB2 Optimizations For z/OS

Continued investment in optimization of key z/OS software

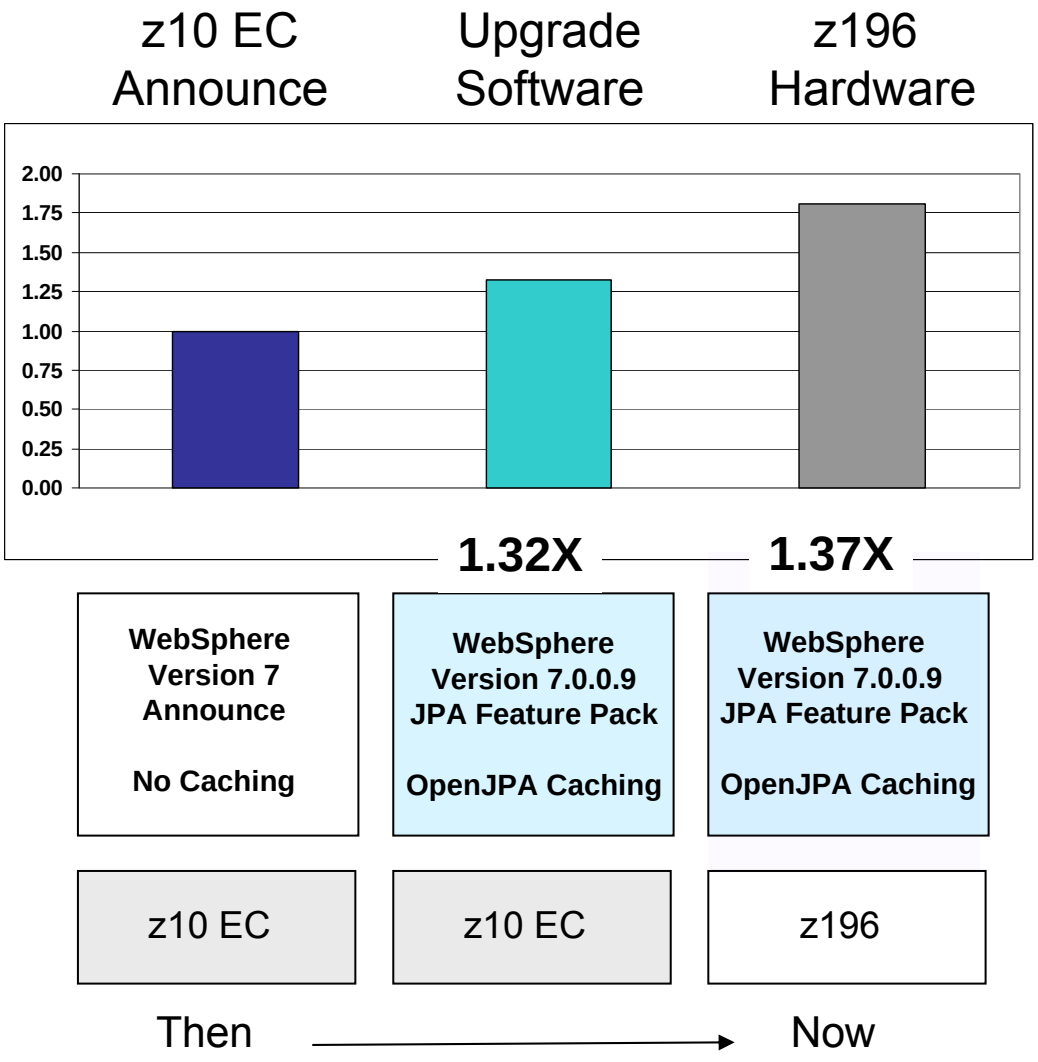
1. Upgraded CICS/DB2 stack produces 1.49x performance improvement
2. Move to z196 hardware produces 1.35x performance improvement
3. Combined hardware and software updates – **2.01x** performance improvement



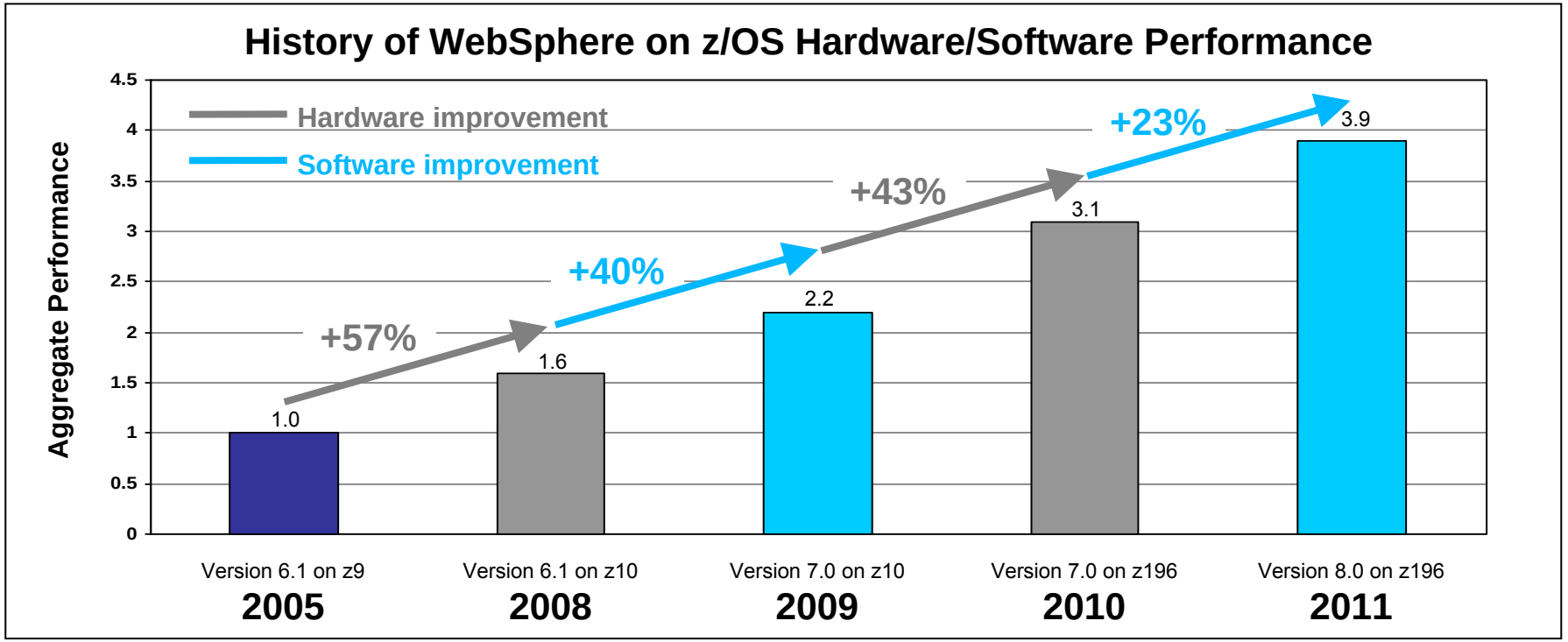
WebSphere Optimizations For Linux

Similar results achieved for WebSphere on Linux environment

- Upgraded WebSphere and Java feature pack produces 1.32x performance improvement
- Move to z196 hardware produces 1.37x performance improvement
- Combined hardware and software updates - **1.81x** performance improvement



Continual HW And SW Innovations Yield Steady Performance Improvements For z/OS Workloads



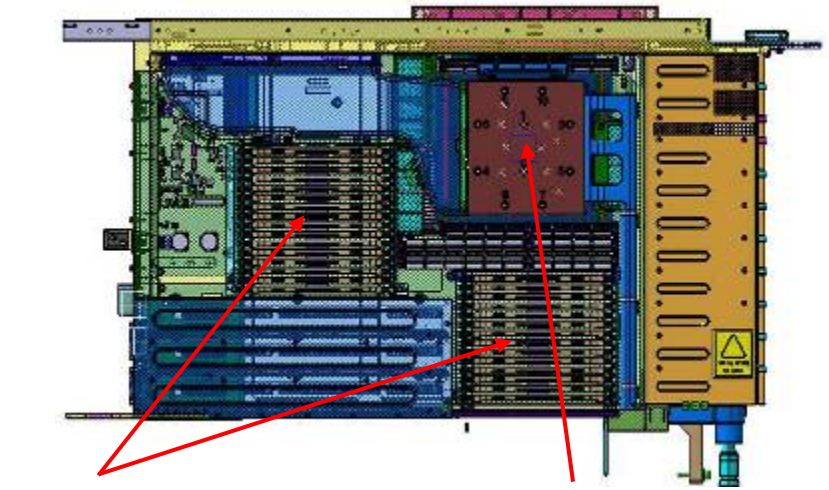
- Hardware component increase of ~2.25x (1.57 x 1.43)
- Software component increase of ~1.72x (1.40 x 1.23)
- Aggregate performance improvement of almost 4x from WAS V6.1 on a z9 to WAS V8.0 on a z196
- Similar improvements have been measured for CICS, DB2, and IMS

Data measurements done using DayTrader EJB workload.

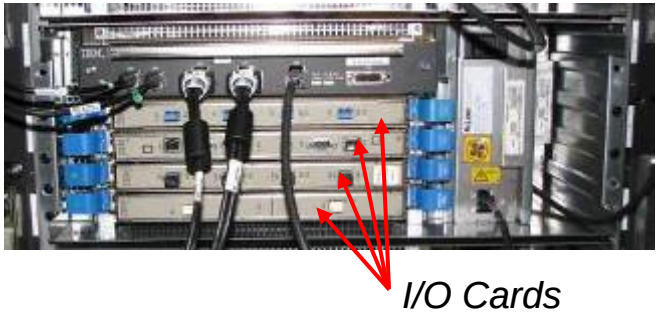
New Availability Enhancements Mean Less Downtime For Core Business Workloads

- RAIM memory provides more protection against failure modes
  - Protects DIMM and memory channel components
  - More robust than ECC
  - 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

z196 Book Layout



z196 I/O Drawer (Front)



SDV Realizes Significant Cost Savings By Migrating Core Banking Application To System z

Business Need

- Foresaw rapid growth for their Internet Home Banking (IHB) application running on WebSphere Portal (WP)
- Recognized that further expansion of their HP x86 platform would result in significant increases in SW license costs

Solution

- Migrated IHB and WP to existing System z machines running z/OS
  - Only purchased 2 GPs as incremental addition
  - Offloaded more than 80% of workload onto 8 zAAPs – resulted in no additional software license costs
- Anticipating double-digit percent overall HW and SW cost savings over 5 years

Sparda Datenverarbeitung eG (SDV) provides centralized and decentralized IT solutions for banks throughout Germany.

System z yielded major advantages compared to their former distributed HP x86-based environment

Canadian Financial Company Moves To System z For Security And Scalability

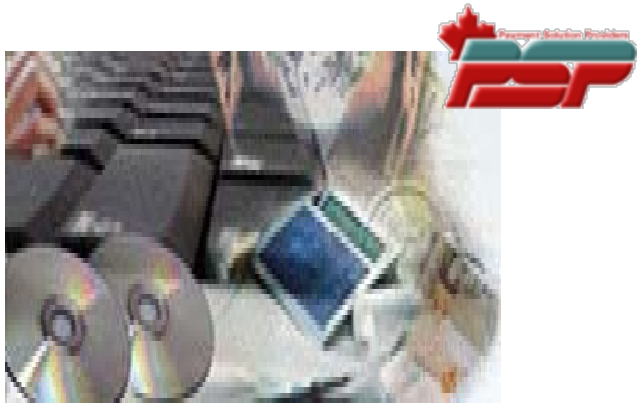
Business Need

- Existing Oracle database and HP server technology created problems
  - Lacked security features to meet banking PCI protocols
  - Not scalable enough to meet growing business requirements
  - Sprawling, inefficient infrastructure generated excessive SW license costs

Solution

- Moved core business to System z running z/OS and DB2
  - Attained 99.999% availability and highest levels of security
  - Sustained processing capacity of 5,000 tps, meeting peak requirements
  - Reduced # of servers, power/cooling costs, database licensing and IT costs

Located in Toronto, Payment Solution Providers is an industry leader specializing in business consulting, e-payment applications, smart card solutions and enterprise fleet management products.



The reliability, availability and scalability offered by System z will allow them to pursue new business opportunities while realizing superior IT economics

How Is Lowest Cost Per Workload Achieved With zEnterprise?

- Still best for handling core business workloads
- Enables hardware consolidation at unprecedented levels
- Ideal platform for data consolidation and business analytics optimization
- Uniquely designed to meet requirements for private cloud computing

zEnterprise

IBM DB2 Analytics Accelerator

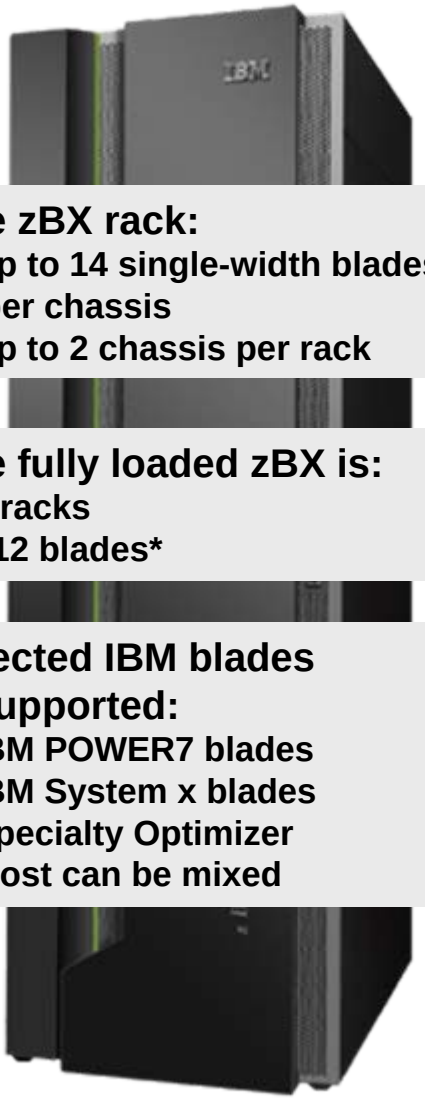
DS8800

zEnterprise Architecture Enables Consolidation Of Hybrid And Standalone Workloads

- Fully virtualized, centrally managed platform
- Supports multiple operating systems
- Managed as one system to reduce operational costs
- Allows efficient, large-scale consolidation of all systems and workloads across the data center
  - Consolidate hybrid workloads
  - Consolidate standalone workloads

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 single-width blades per chassis**
- **Up to 2 chassis per rack**

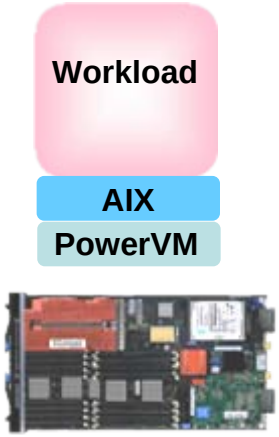
One fully loaded zBX is:
- **4 racks**
- **112 blades***

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

* Blade capacity per rack varies with blade type. Max number of blades per zBX is as follows: 112 Power blades, 28 x blades, 28 DataPower blades, 56 ISAO blades. Power, x and DP blades can be mixed in same chassis, ISAO blades require own chassis, but can share a rack.

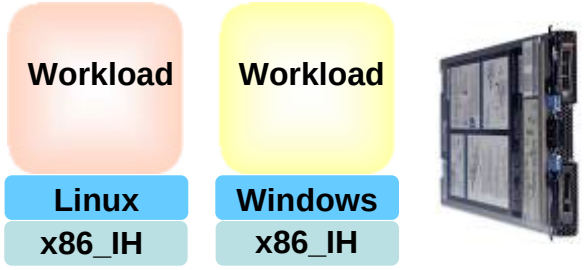
zBX Support POWER, System x And Special Optimizer Blades

POWER7 Blades



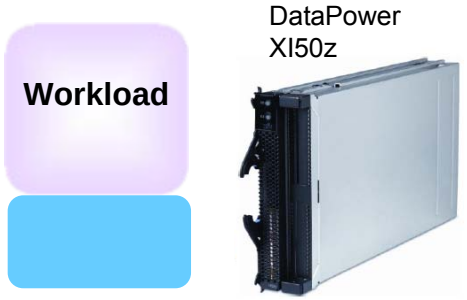
- POWER7 PS701 Express
  - Single-width, 1ch/8co, 3.0 GHz
    - Up to 4 threads per core
  - AIX 5.3+
  - PowerVM

System x Blades



- System x HX5 (Westmere-EX)
  - Single-width, 2ch/16 co, 2.13 GHz
    - Up to 2 threads per core
  - Windows and Linux
  - KVM-based integrated hypervisor

Optimizers



- Designed for integration with and management by zEnterprise
- Targeted for specific workload functions
  - Pre-packaged, self-contained units including hardware, software, memory, etc.

Blades run distributed software purchased through Passport Advantage – No MIPs or MSU rating!

IBM IT Consolidation = Cost Savings

- Consolidated and virtualized over 5,000 server images onto larger servers (System z, Power, and System x)
- Energy savings - > 20,000 megawatt hours per year
- Reduction in floor space - 47,000 square feet
- Cumulative benefit yield of ***$4.1B over the last 5 yrs***

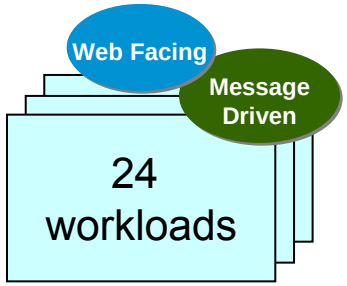
	1997	Today
Host Data Centers	**155**	**7**
Web Hosting Centers	**80**	**5**
Network	**31**	**1**
Applications	**15,000**	**4,700**

Consolidate Web Front End Workloads On zEnterprise And Save 59% Over Three Years

Deploy on Sun hardware

Competitive Packaged System

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



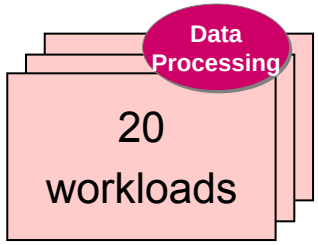
Web front-end workloads

Power Blades in zBX

WebSphere App Server and DataPower

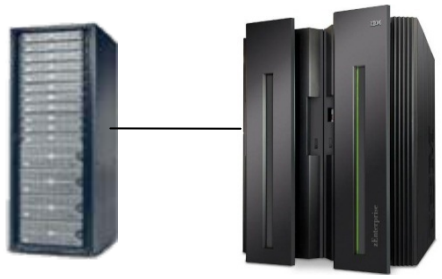
$177K
per workload
3yr TCA
Front end HW+SW

Consolidate Hybrid SAP Workloads On zEnterprise And Save 18% Over Three Years



SAP applications

Upgrade to new SPARC T3 hardware



$60K

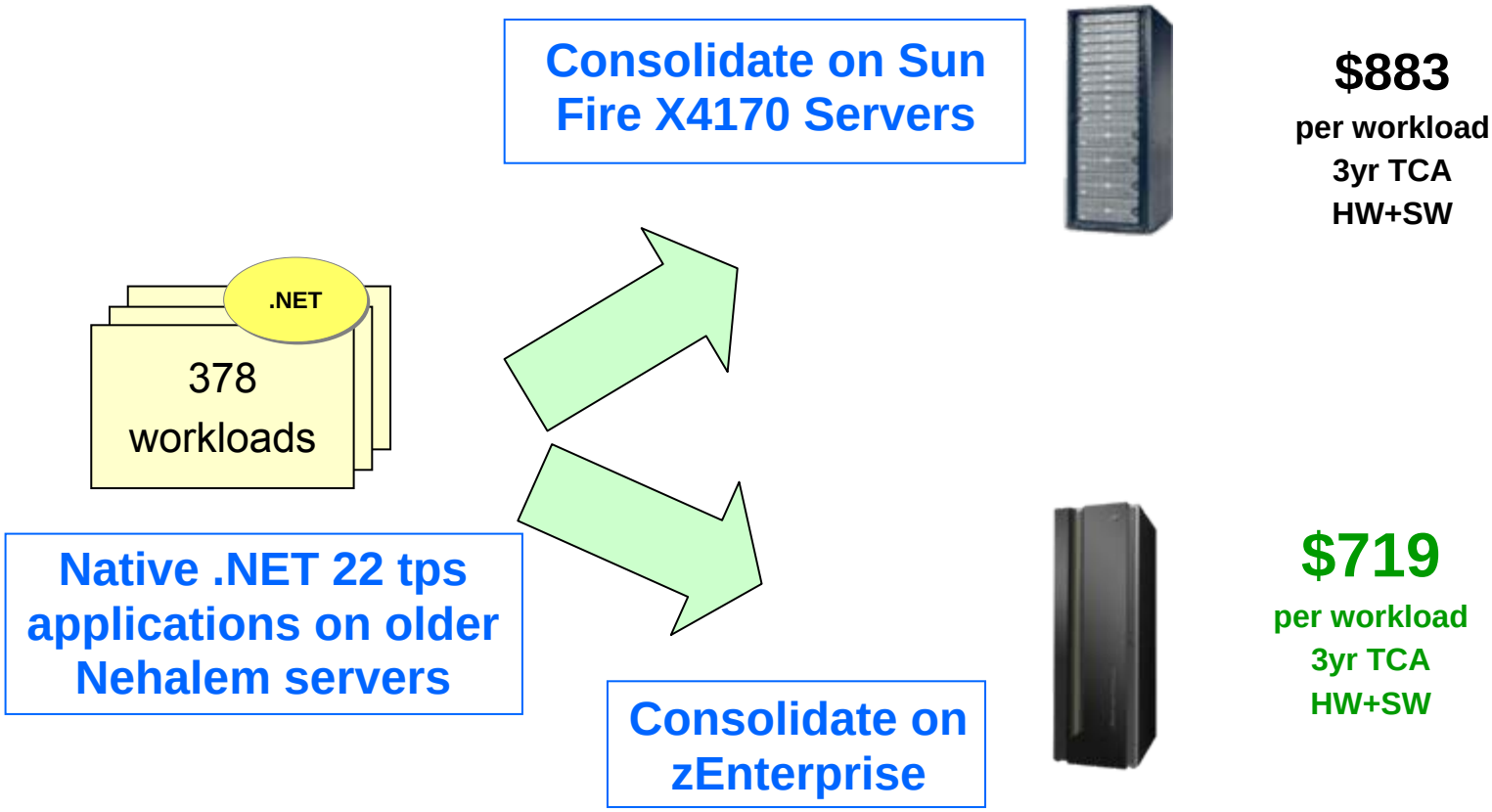
per workload
3yr TCA
Front-end HW+SW

Consolidate on zEnterprise

$49K

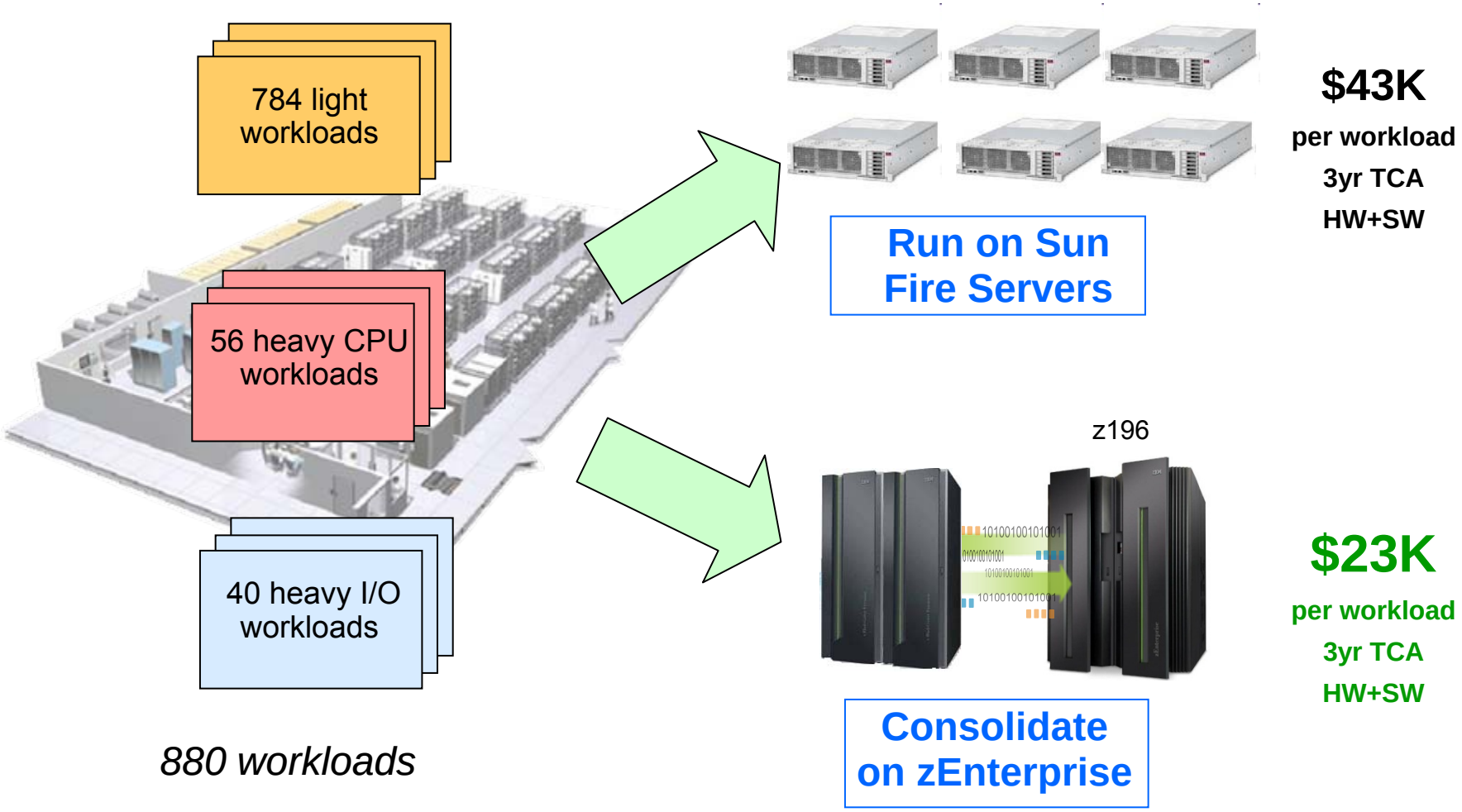
per workload
3yr TCA
Front-end HW+SW

Consolidate .NET Applications on zEnterprise And Save 19% Over Three Years



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.

Consolidate Standalone Workloads On zEnterprise And Save 47% Over Three Years



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

How Is Lowest Cost Per Workload Achieved With zEnterprise?

- Still best for handling core business workloads
- Enables hardware consolidation at unprecedented levels
- Ideal platform for data consolidation and business analytics optimization
- Uniquely designed to meet requirements for private cloud computing

zEnterprise

IBM DB2 Analytics Accelerator

DS8800

Consolidating SAP Databases On z196 Greatly Reduces Performance Requirements

6 separate SAP databases

2 x 100% Production and Pre-production with active/passive failover; 18% Dev/QA, no failover

- **Banking Services** (272 cores)
- **PI** (72 cores)
- **Payment Engine** (272 cores)
- **BI** (72 cores)
- **Bank Analyzer** (136 cores)
- **Solution Manager** (40 cores)

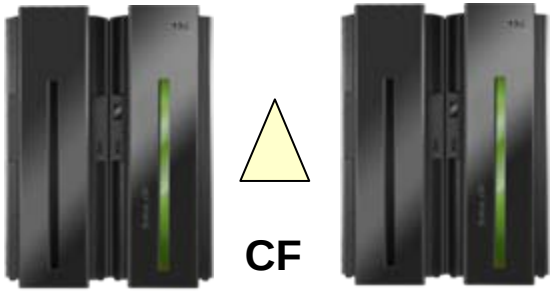
30 x HP DL Servers X7560 2.27GHz

864 cores

Total RPE	4,294,618

Multi-Tenancy

Consolidated Databases DB2 for z/OS Sysplex 100% Production, 33% Pre-Production, 18% Dev/QA



z196-727 + 27 zIIP
39,117 MIPS

z196-727 + 27 zIIP
39,117 MIPS

108 cores

Total MIPS	78,234

RPE/MIPS = 54.89

6 SAP DB Instances with total Prod. DB QuickSizer SAPS = 177,000 consolidated into DB2 z/OS (multi-tenancy)

Consolidating SAP Databases On z196 Also Reduces Total Cost Of Acquisition By 88%

6 separate SAP databases

2 x 100% Production and Pre-production with active/passive failover; 18% Dev/QA, no failover

- **Banking Services** (272 cores)
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30 x HP DL Servers X7560 2.27GHz

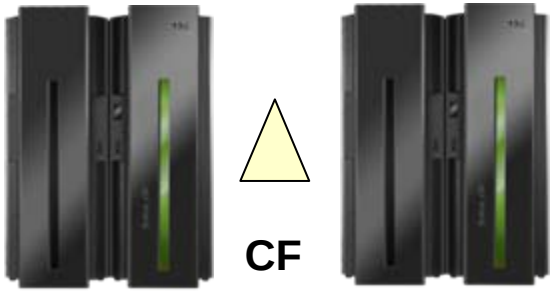
864 cores

Total (5yr TCA) **$97.2M**

Hardware	$3,097,858
Software	$92,908,752
Networking	$1,185,000

Multi-Tenancy

Consolidated Databases DB2 for z/OS Sysplex
100% Production, 33% Pre-Production, 18% Dev/QA



z196-727 + 27 zIIP
39,117 MIPS

z196-727 + 27 zIIP
39,117 MIPS

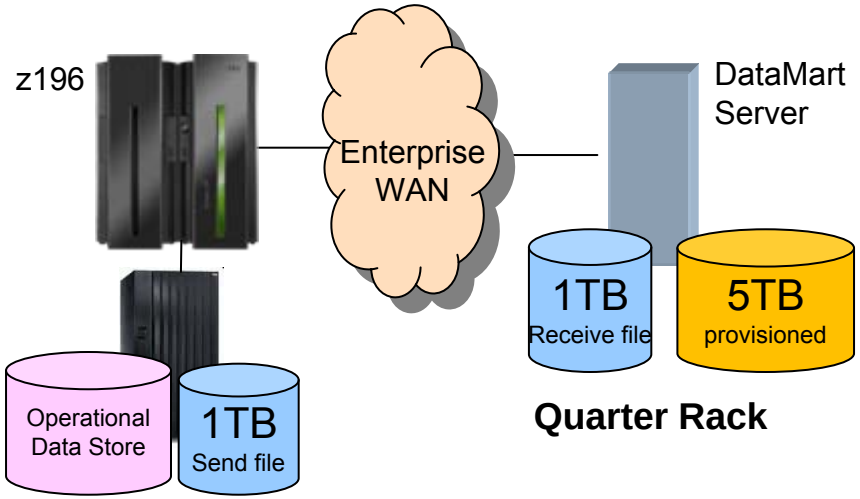
108 cores

Total (5yr TCA) **$11.8M**

Hardware & Software (Solution Edition SAP)	$11,699,122
Networking	$79,000

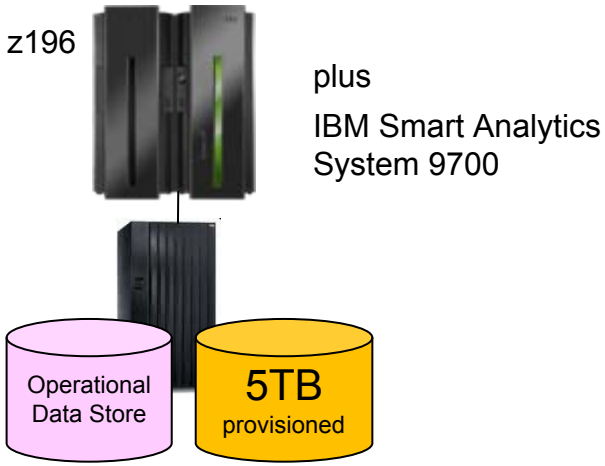
6 SAP DB Instances with total Prod. DB QuickSizer SAPS = 177,000 consolidated into DB2 z/OS (multi-tenancy) , Performance Equivalence = 64, US Prices with System z Solution Edition for SAP DB and List Prices for Oracle SW & HP HW. Does not include cost of SAP software.

Cost Of Duplicating Data Marts Across The Enterprise Can Be Surprisingly High



Duplicating data off the mainframe is costly

Annual Transfer Costs =
$953K



Co-locating data reduces concurrent report execution costs by 54%

2x performance at ½ the cost!

Source: Customer Study running 161,166 concurrent operational reports. Results may vary based on customer workload profiles/characteristics.

Running Analytics On Optimized zEnterprise Platform Beats The Competition

Competitor (Quarter Rack)

Unit Cost (3yr TCA)
$97/RpH

z196 + IBM Smart Analytics System 9700

Unit Cost (3yr TCA)
$62/RpH

z196 + IBM Smart Analytics System 9700 + IBM DB2 Analytics Accelerator for z/OS (IDAA)

Netezza TwinFin 12

Unit Cost (3yr TCA)
$24/RpH

5x performance at ¼ the cost!

Source: Customer Study running 161,166 concurrent operational reports. Intermediate/Complex Reports offloaded to IDAA for serial execution. Results may vary based on customer workload profiles/characteristics.

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Requirements For Private Cloud Computing

IT

- Standard services with limited customization
- Flexibility in workload scheduling
- Reduced operational costs, including labor

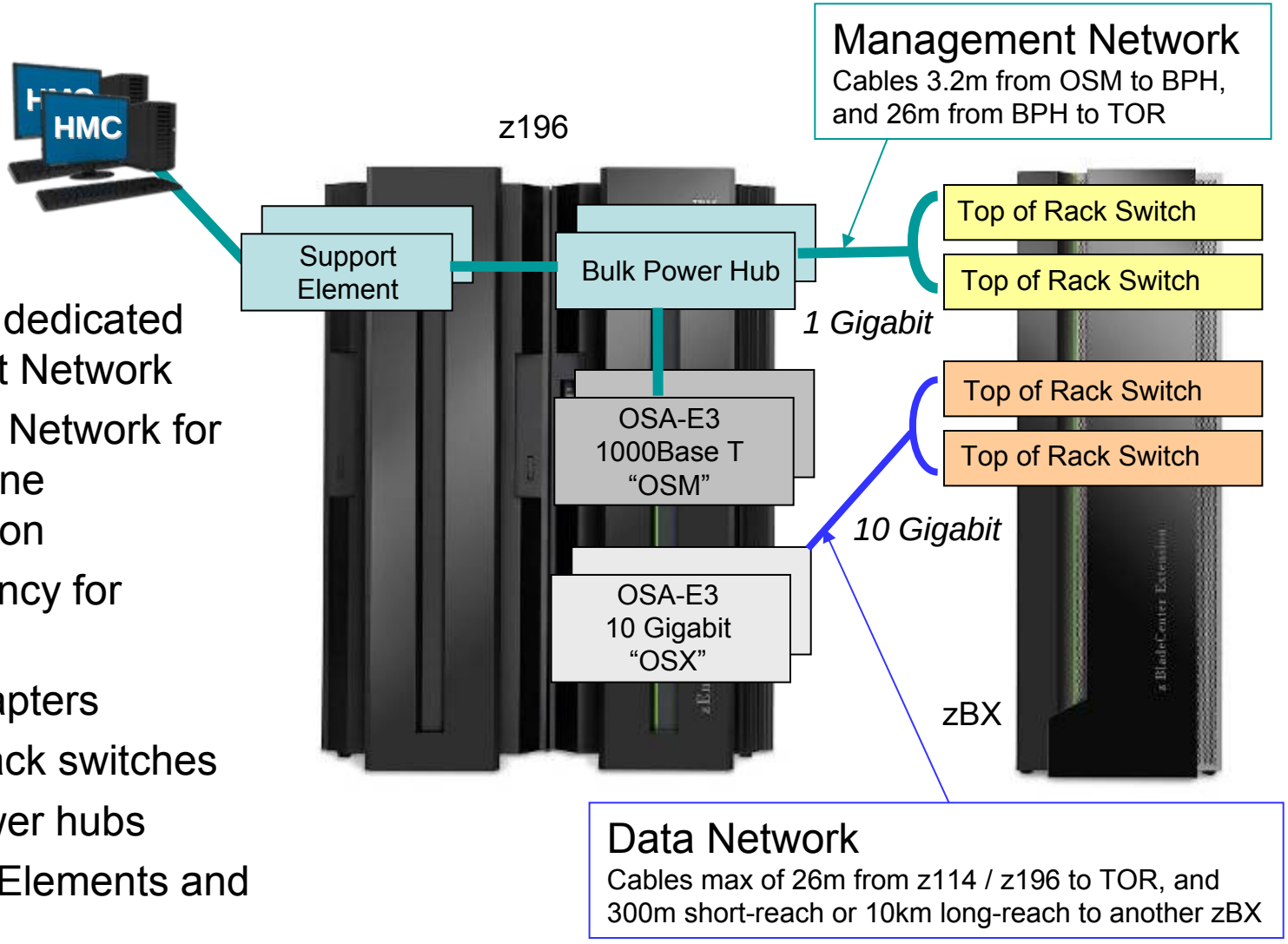
Users

- Self-service, portal-based interface
- Fast, automated provisioning
- Pay-as-you-go options
- Reliability and security

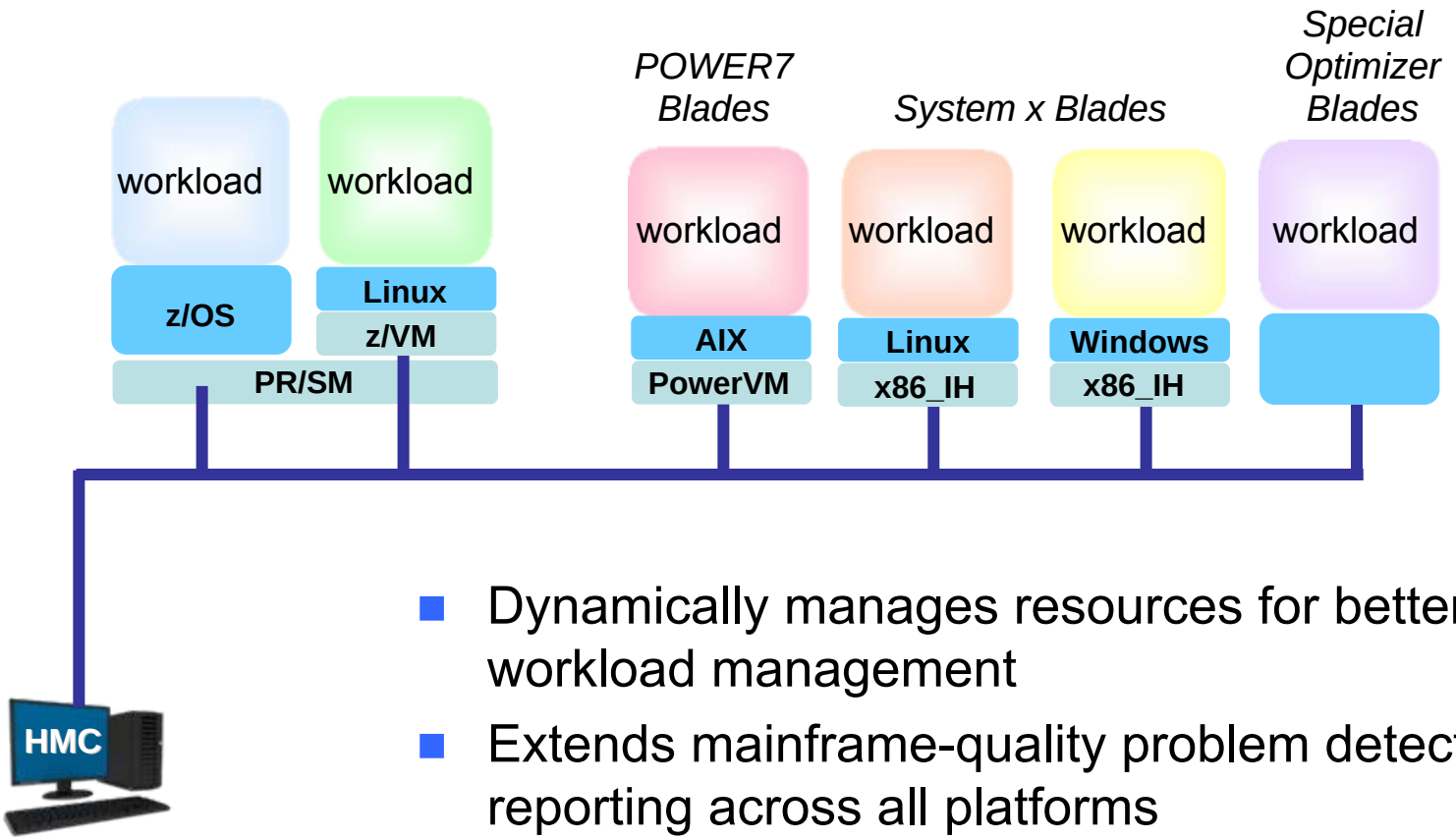
zEnterprise satisfies everyone's requirements

zEnterprise Is Connected Via Fast, Secure 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



zManager Firmware Accesses Hypervisors To Manage Resources And Workloads

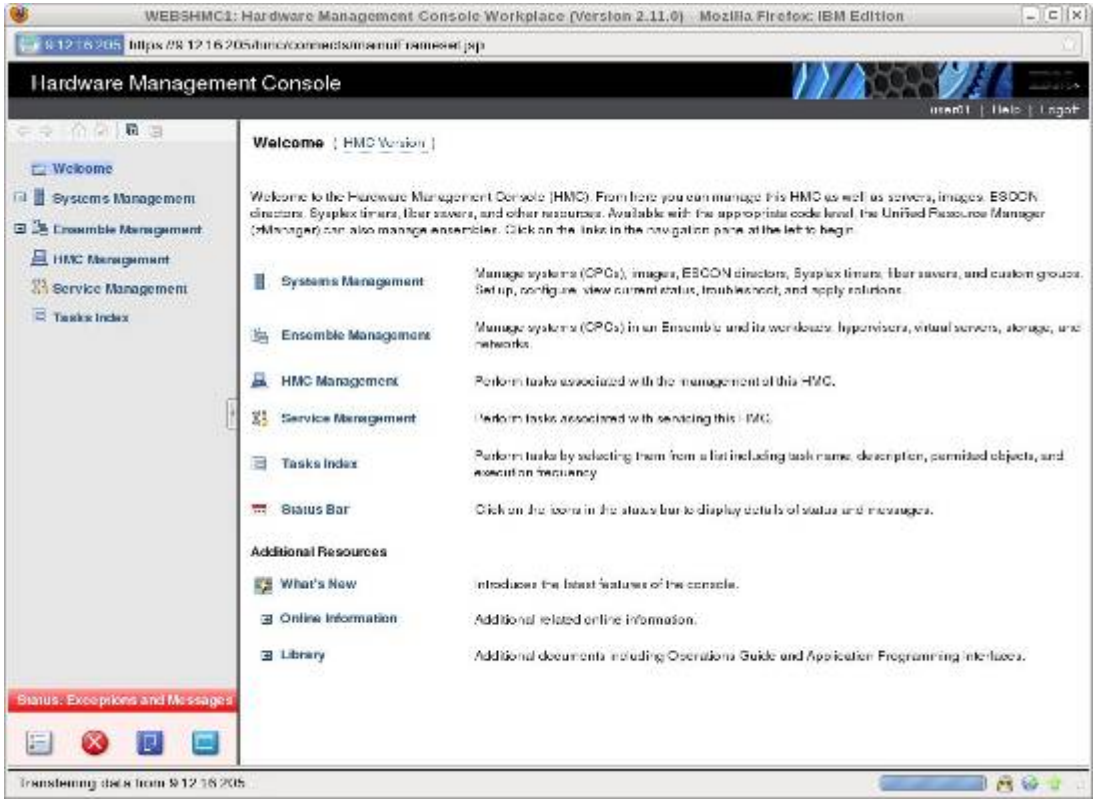


- Dynamically manages resources for better workload management
- Extends mainframe-quality problem detection and reporting across all platforms
- Monitors system-wide energy efficiency

zManager Provides Automation To Reduce IT Labor Requirements And Lower Costs

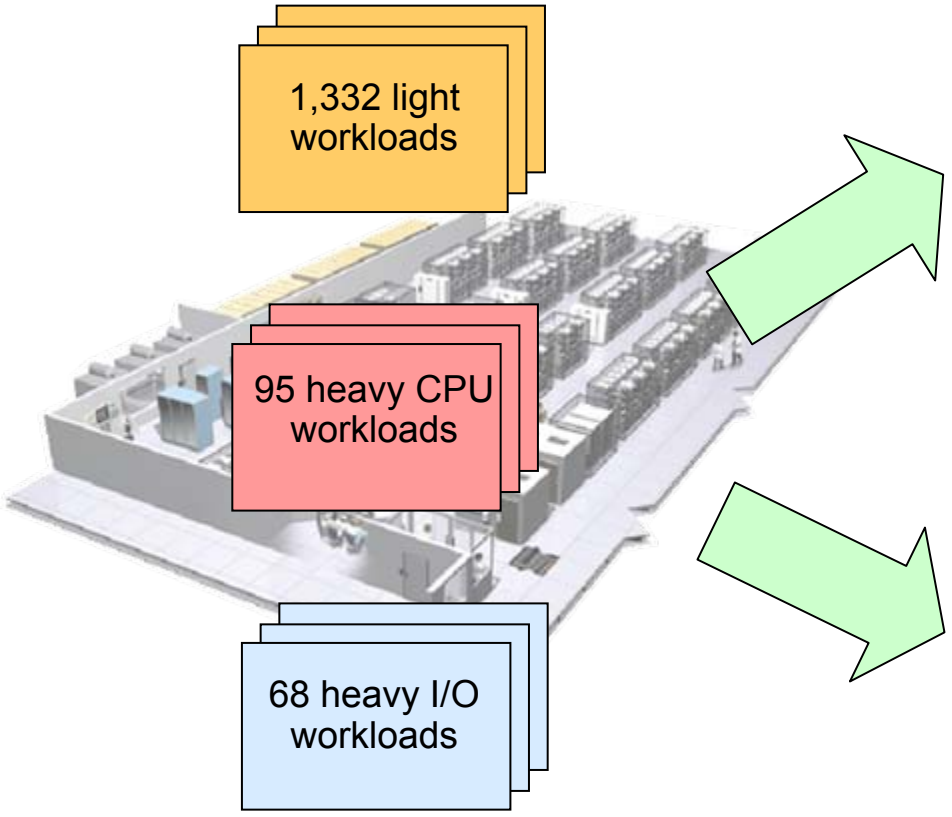
Process	Typical Distributed Management Practices	zManager
Asset Management	■ Discover assets with ad hoc methods ■ Manual entitlement management	■ Automated discovery and management of entitlement assets
Deployment Management	■ Manually configure hypervisor and build networks	■ Automated deployment of hypervisor and attachment to integrated networks
Security Management	■ Different ways to manage administrator access	■ Centralized, fine-grained administrator access management
Change Management	■ No visibility into impact of changes	■ Track dependencies for change impact
Capacity and Performance Management	■ No end-to-end transaction monitoring ■ Manually adjust CPU resources to meet changing workload demands	■ End-to-end transaction monitoring to isolate issues ■ Automatic CPU resource adjustments to meet changing workload demands

DEMO: Manage Resources And Workloads Using zManager



- zManager uses familiar HMC interface
- View and manage all zEnterprise platforms

Deploying A Private Cloud On zEnterprise Is 65% Less Expensive



1495 workloads

Public Cloud

$9.7M Labor

$89.8M Total

3yr TCO

Private Cloud

z196

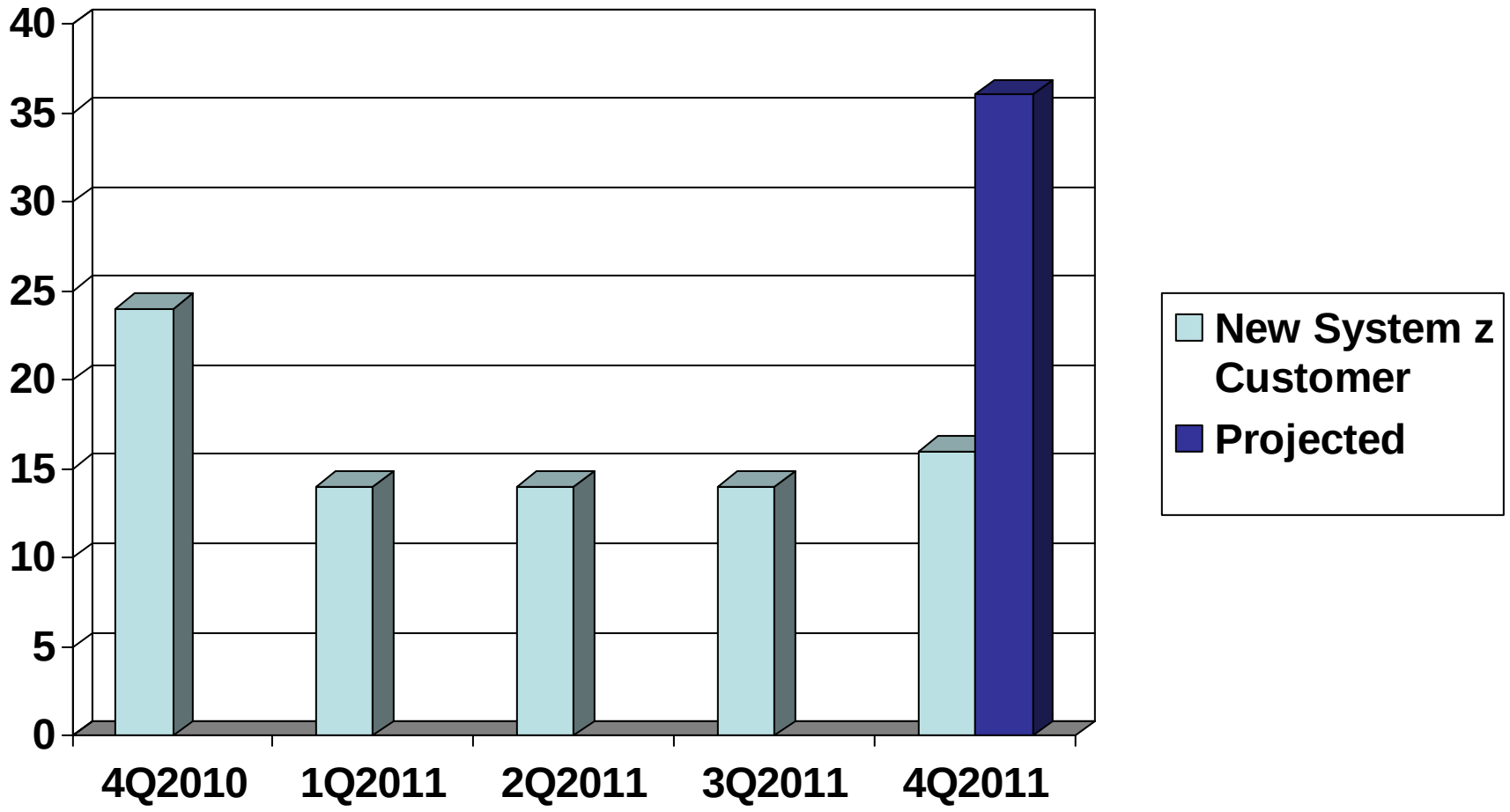
zEnterprise

$7.2M Labor

$31.1M Total

3yr TCO

Number Of Mainframe Customers Continues To Grow



zEnterprise – An ideal Platform For Workload Optimization

Tuned to the Task

Designed for Data

Managed as a Cloud

zEnterprise

Delivers Lowest Cost per Workload

IBM DB2 Analytics Accelerator

DS8800