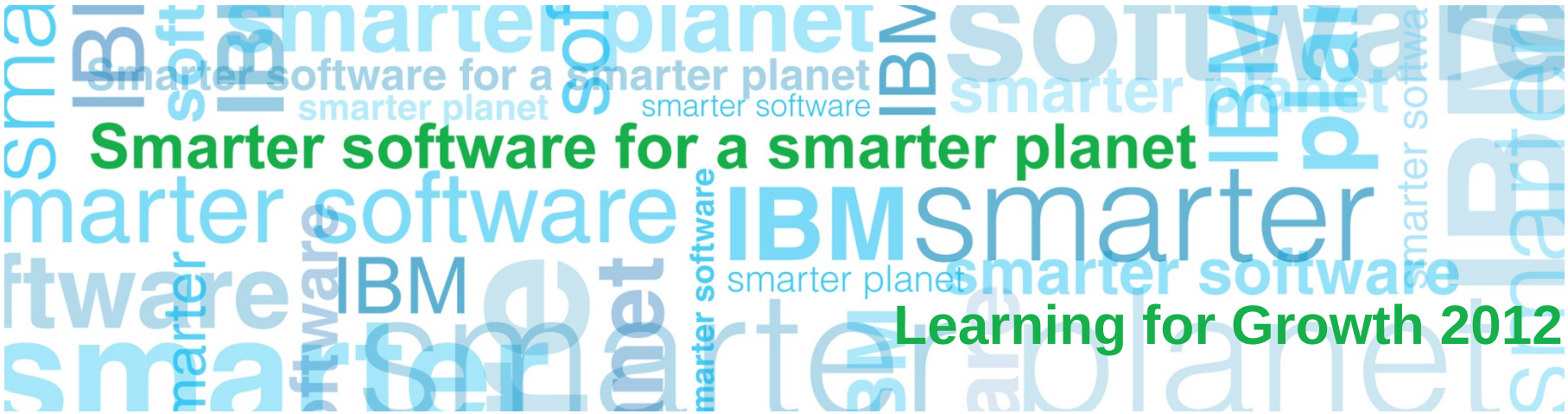
Emily Farmer – System z Evangelist, SWG CPO

05 January 2012

zEnterprise Economics



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

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CRM
Web Commerce
Email
File/Print services

zEnterprise

IDAA

DS8800

Workload Optimized Systems

New metric for the age of Smarter Computing

Cost Per Workload

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

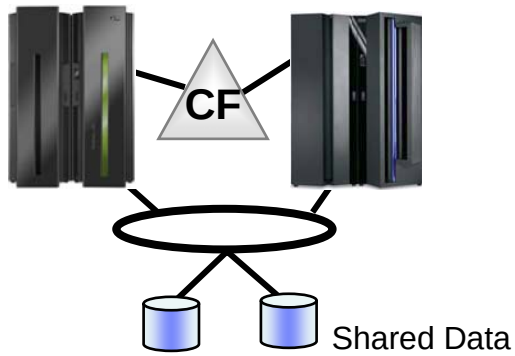
zEnterprise

IBM DB2 Analytics Accelerator

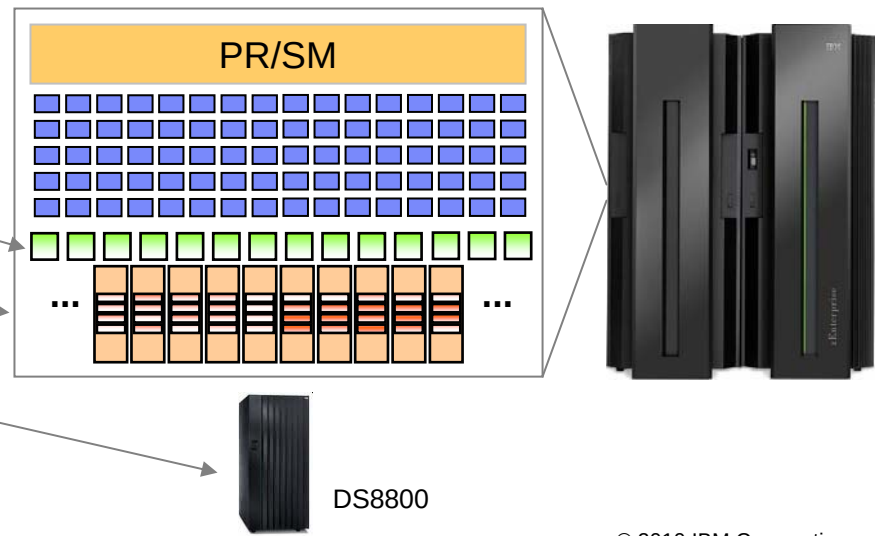
DS8800

System z is designed for extreme scalability, and optimized for very high I/O bandwidth

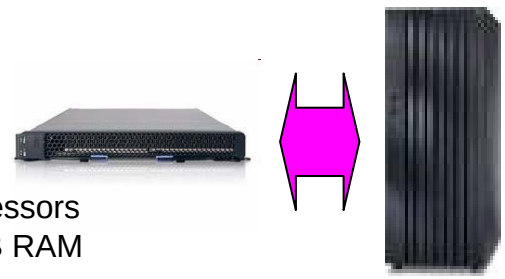
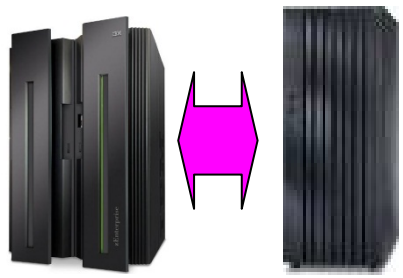
- Parallel sysplex enables very large scale clustering
- Specialized hardware centralizes management of shared data
  - Competitor uses network for lock management which severely impacts scalability
- Exploited by z/OS middleware



- System z designed with dedicated I/O subsystem
- Balanced system design - lots of I/O capacity
  - System assist processors (SAPs)
  - Very high I/O rates
  - Up to 84 high speed I/O cards
  - Connects to high capacity DS8800 storage system
- Exploited by z/OS and z/VM workloads



System z is optimized for batch processing

Power PS701 + DS8300		zEnterprise + DS8300	
8 processors 128 GB RAM		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

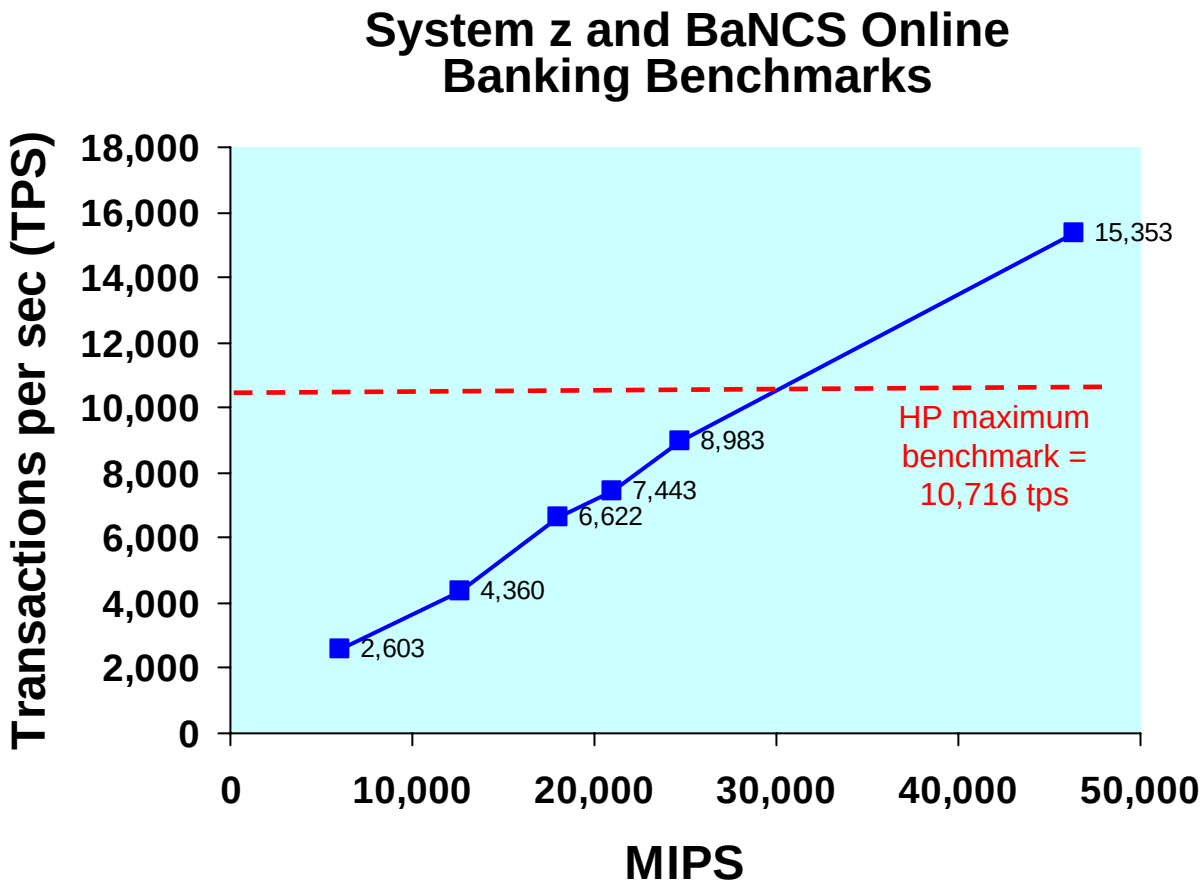
Batch window reduced by 89% on zEnterprise

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

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

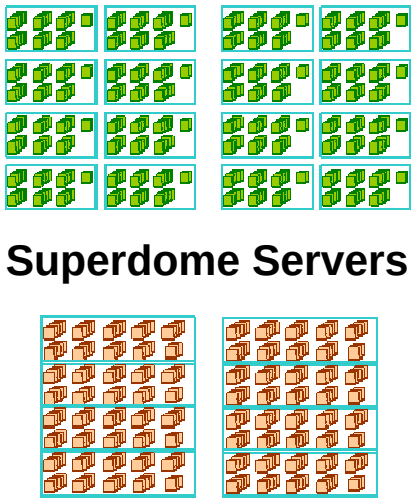
- **State Bank of India** [3]
  - **HP Superdome**
  - **TCS BaNCS**
  - **10,716** Transactions/second
  - **500** Million Accounts
  - Largest banking benchmark performance claimed by HP



[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 10,176 tps throughput



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.

How is lowest cost per workload achieved with zEnterprise?

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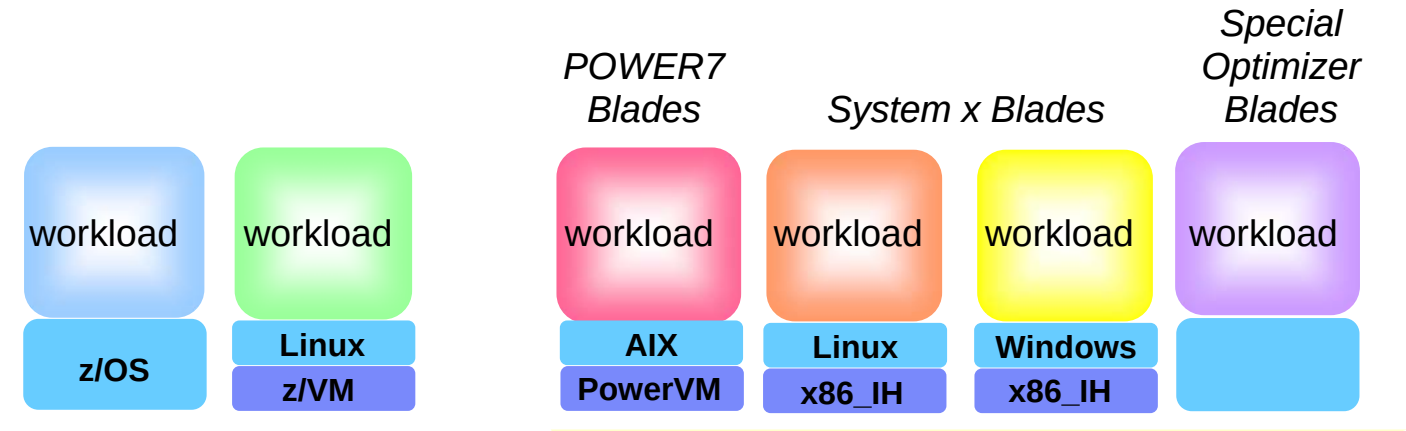
zEnterprise

IBM DB2 Analytics Accelerator

DS8800

zEnterprise has broadest architectural support for diverse workloads

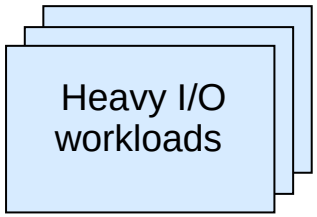


Fit-For-Purpose Strategy

Assign workloads to the environment that best satisfies requirements

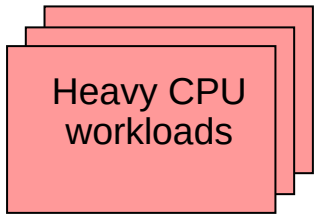
Achieve overall *lowest cost per workload*

Standalone workloads have different characteristics



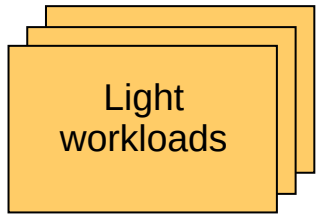
- High volume OLTP workload
- High I/O bandwidth
- High quality of service requirements

System z



- High processing intensity
- Integer or floating point

System x blades



- Light to moderate processing
- Modest quality of service requirements

Power blades

zEnterprise environments are optimized for different workload types

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A best fit assignment of 880 standalone workloads on zEnterprise

784 light workloads

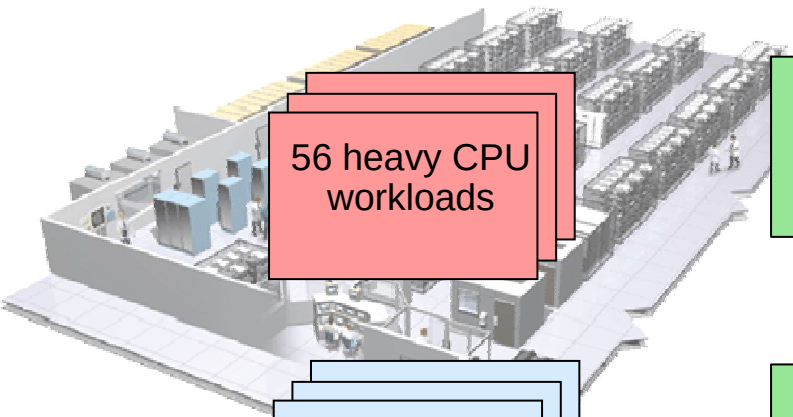
56 heavy CPU workloads

40 heavy I/O workloads

28 workloads per POWER7 blade

2 workloads per HX5 blade

40 workloads per 32 IFLs



28 IBM POWER7 blades in 1 zBX

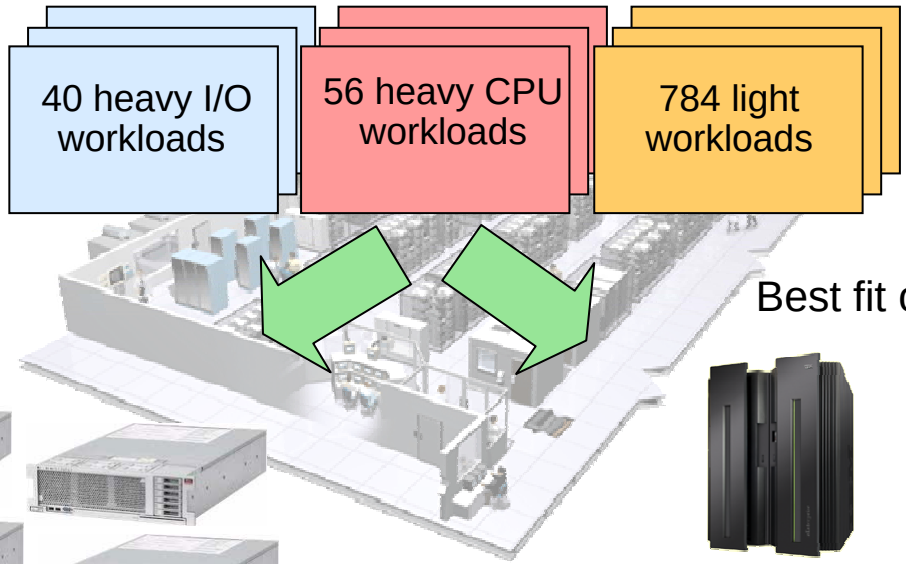
28 IBM HX5 Blades in same zBX

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

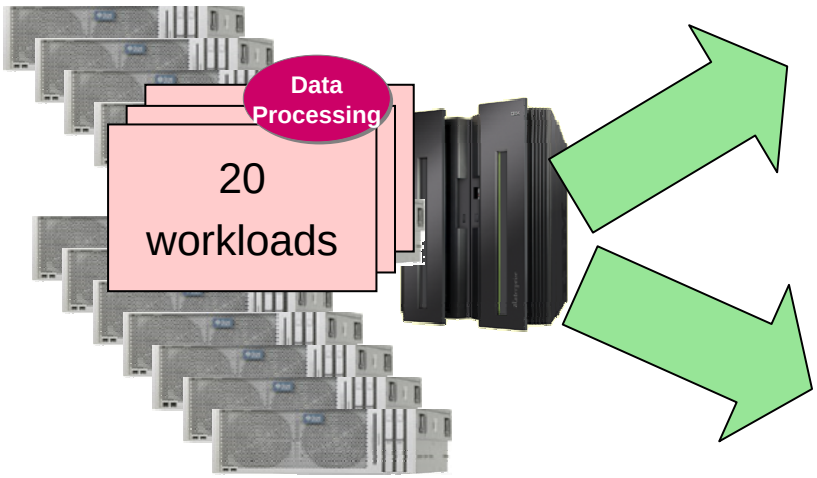
per workload

3yr TCA HW+SW

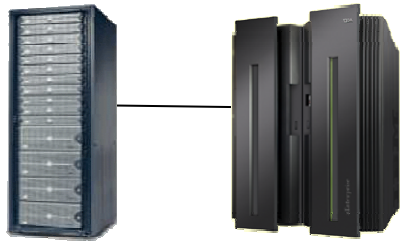
Server configurations are based on consolidation ratios derived from IBM internal studies. Projected Sun Fire X4470 2.0GHz 2ch/16co from x3550 2.66GHz 2ch/12co measurements. Prices are in US currency, prices will vary by country

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.

Web front-end workloads 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

$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

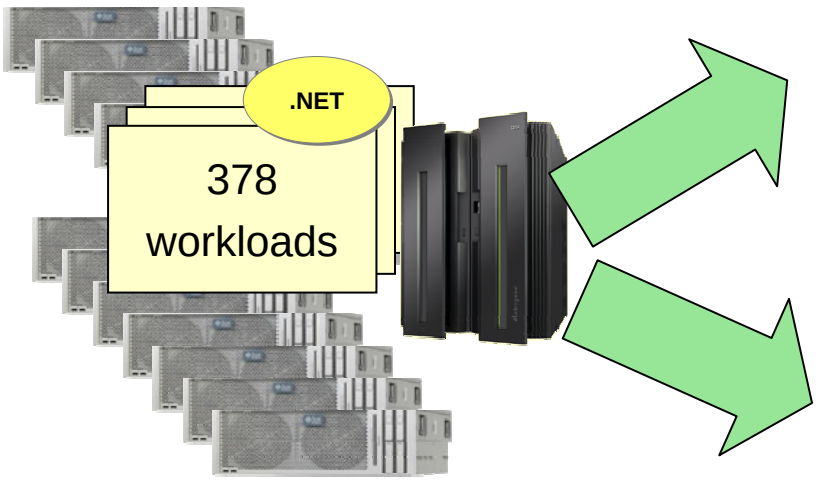
Power blades in zBX

$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.

.NET applications cost 19% less on zEnterprise

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

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.

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zEnterprise

IBM DB2 Analytics Accelerator

DS8800

Consolidating SAP databases on z196 can reduce total cost of acquisition by 88%

6 separate SAP databases

Production, Pre-production with active/passive failover
QA/Development 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

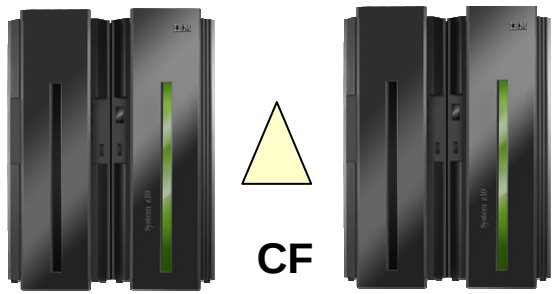
864 cores

Total (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



z196-727 + 27 zIIP
39,117 MIPS

z196-727 + 27 zIIP
39,117 MIPS

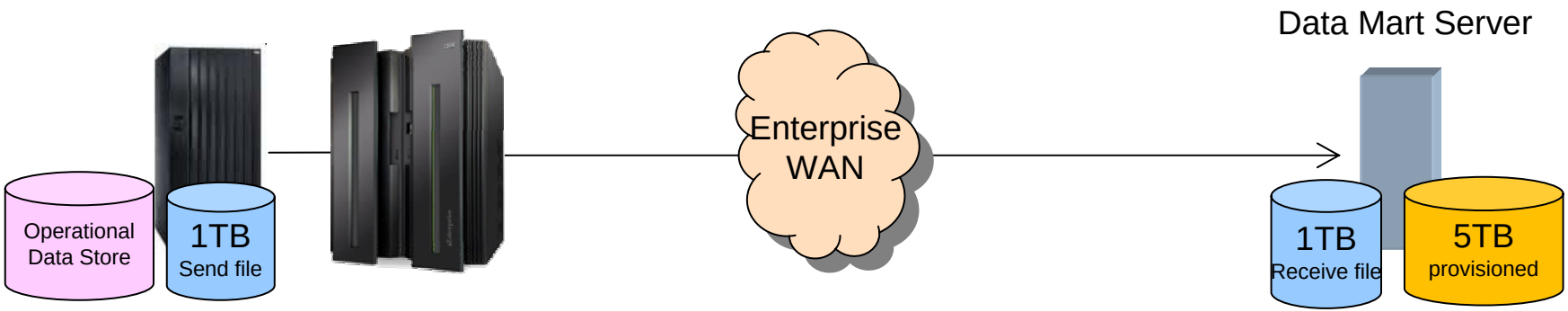
108 cores

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.

Duplicating data off the mainframe is costly



Cost of storage - send file $12.33/GB x 1,024 GB	$13K

Storage acquisition cost
$12,626

System z CPU extract $1.38/GB x 1,024 GB x 365	$515K
System z CPU cost FTP $0.58/GB x 1,024 GB x 365	$217K

On Premises Network $0.0024/GB x 1,024 GB x 4 hops x 365	$3.6K
Off Premises Network $0.29/GB x 1,024 GB x 2 hops x 365	$217K

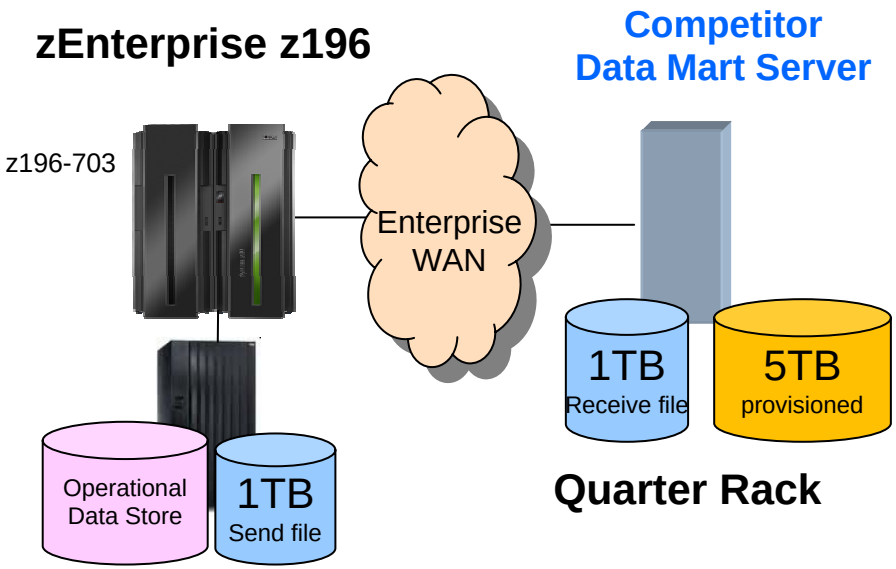
Cost of data transfer (receive file, CPU cycles) already included in the cost of the data mart system

Annual Transfer Costs
$952,938

IBM Smart Analytics System 9700 – a comprehensive package for business analytics

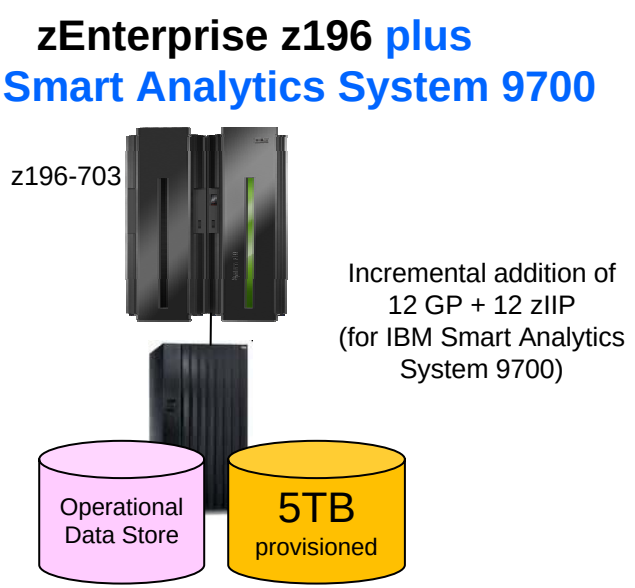
- Built on z196 platform
  - Unparalleled scalability, security, availability and reliability
- Adds business analytics processing to an operational environment
  - Offers high performance data warehousing and storage optimization
  - Include operational analytics, deep data mining, and extensive reporting options
  - Designed to minimize data movement
- Supports z/OS V1.12 and DB2 10 on z/OS

Co-locating data mart on z196 reduces concurrent report execution cost by 54%



Unit Cost (3yr TCA) **$194/RpH**

Reports per Hour (RpH)	29,572
Competitor Data Mart Server (HW+SW+Storage)	$2,857,500
Data Duplication Cost	$2,871,440



Unit Cost (3yr TCA) **$89/RpH**

Reports per Hour (RpH)	57,904
IBM Smart Analytics System 9700 (HW+SW+Storage)	$3,600,000
Data Duplication Cost	$1,547,366

2x performance at ½ the cost!

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

Next generation IBM DB2 Analytics Accelerator (IDAA) capitalizes on Netezza technology

What is the IDAA?

A workload-optimized, blade-based appliance

Deeply integrated with DB2 for z/OS, transparent to applications

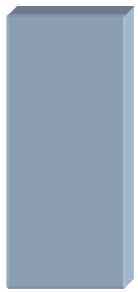
Significantly speeds up the response time for a wide variety of complex queries

How does it work?

- Incorporates Netezza Twinfin 12 technology
  - 96 cores of query processing power
  - Patented parallelized design based on Field Programmable Gate Arrays (FPGAs)
  - Yields extremely fast query response times
- Integrated storage
- Supported on DB2 for z/OS v9 or DB2 for z/OS v10 running on a z/196

Running analytics on optimized zEnterprise platform saves 75% over competition

Competitor (Quarter Rack)



Unit Cost (3yr TCA) **$97/RpH**

Reports per Hour (RpH)	29,572
Competitor ¼ Rack (HW+SW+Storage)	$2,857,500

z196 + IBM Smart Analytics System 9700

Unit Cost (3yr TCA) **$62/RpH**

Reports per Hour (RpH)	57,904
IBM Smart Analytics System 9700 24-cores (HW+SW+Storage)	$3,600,000

z196 + IBM Smart Analytics System 9700 + IDAA

Unit Cost (3yr TCA) **$24/RpH**

Reports per Hour (RpH)	154,893
IBM Smart Analytics System 9700 10-cores (HW+SW+Storage)	$1,500,000
IDAA (HW+SW+Storage)	$2,140,600

5x performance at 1/4 the price!

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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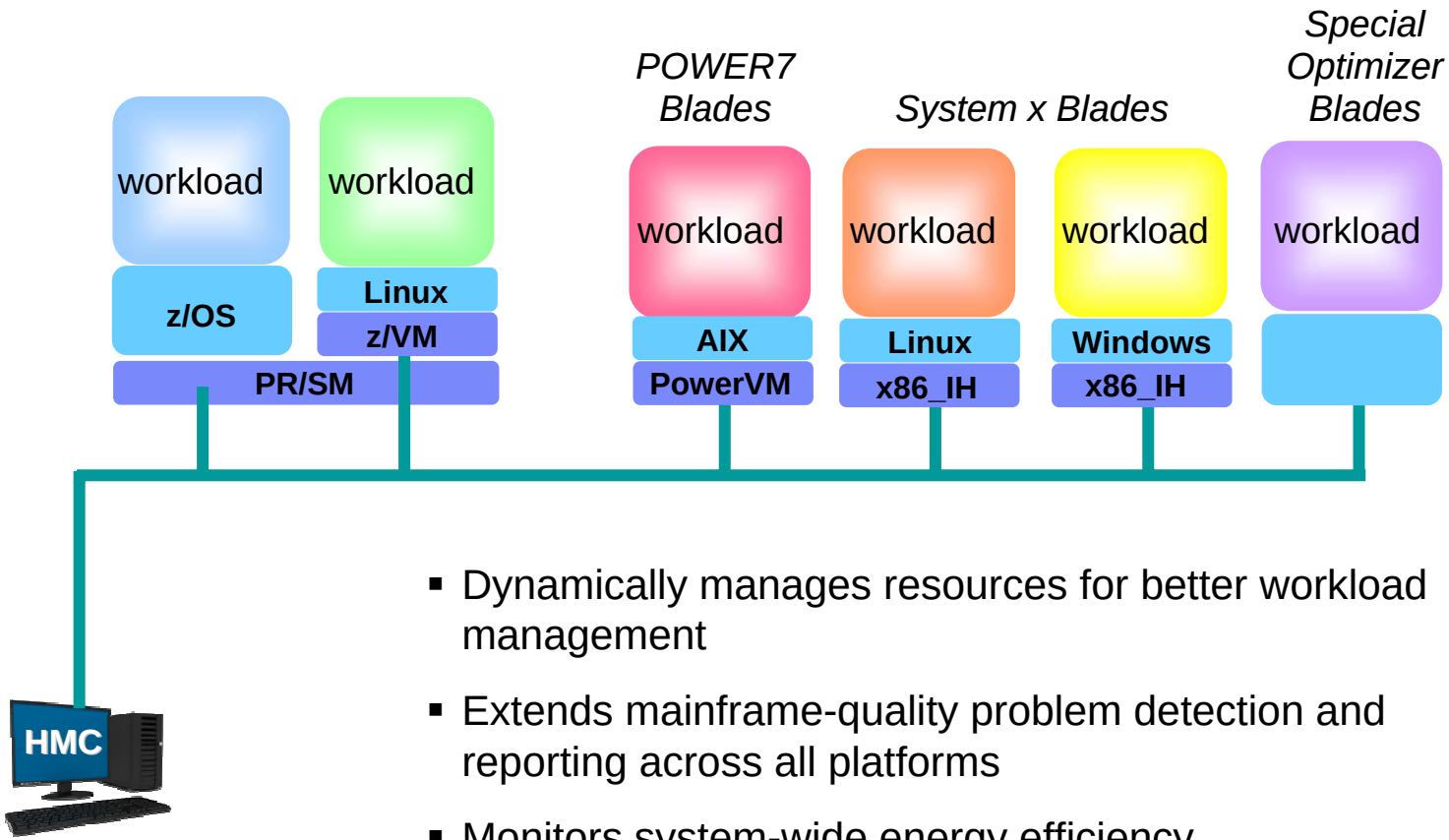
zManager uses the private management network for hypervisor communications



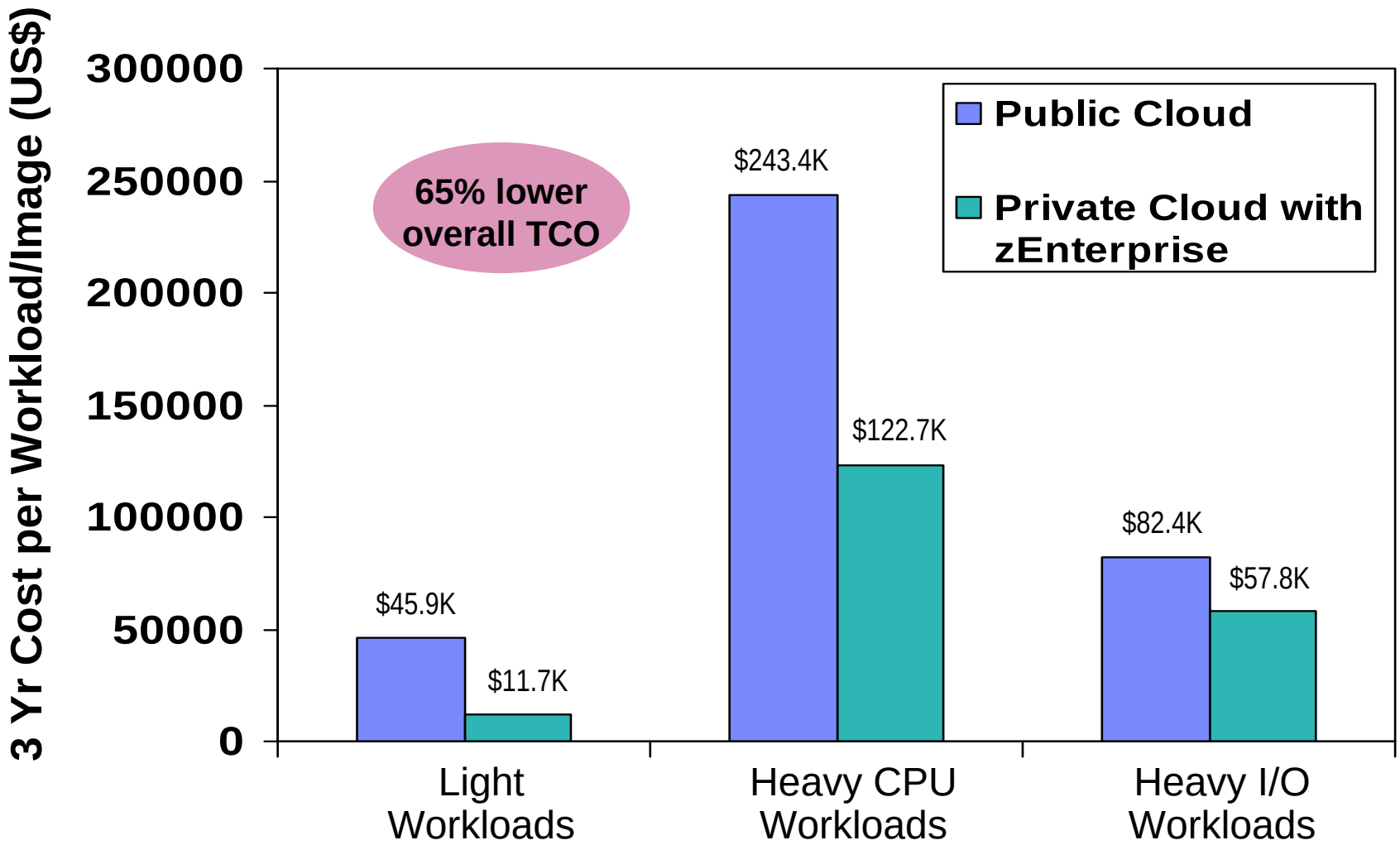
- Dynamically manages resources for better workload management
- Extends mainframe-quality problem detection and reporting across all platforms
- Monitors system-wide energy efficiency

zManager can drive down labor costs

IT Process	zManager	Costs Reduced By*
Asset Management	▪ Automated discovery and management of entitlement	**10%**
Deployment Management	▪ Automated deployment of hypervisors and virtual networks	**33%**
Capacity and Performance Management	▪ Automatic resource adjustments to meet changing workload demands	**52%**
Security Management	▪ Centralized, fine-grained administrator access	**20%**
Change Management	▪ Dependency tracking across platform for change impact	**41%**

*Source: IBM Internal study of 92 hybrid workloads

Private cloud on zEnterprise dramatically reduces costs



Source: IBM internal study. zEnterprise configurations needed to support the three workload types were derived from IBM benchmarks. Public cloud sizing needed to support the three workload types was calculated based on compute capacity of public cloud services. 3 yr TCO for public cloud based on pricing info available by the service provider. 3 yr TCO for zEnterprise includes hardware acquisition, maintenance, software acquisition, S&S and labor. US pricing and will vary by country.

zEnterprise – an ideal platform for workload optimization

zEnterprise

Delivers *lowest*
cost per workload

IBM DB2 Analytics Accelerator

DS8800