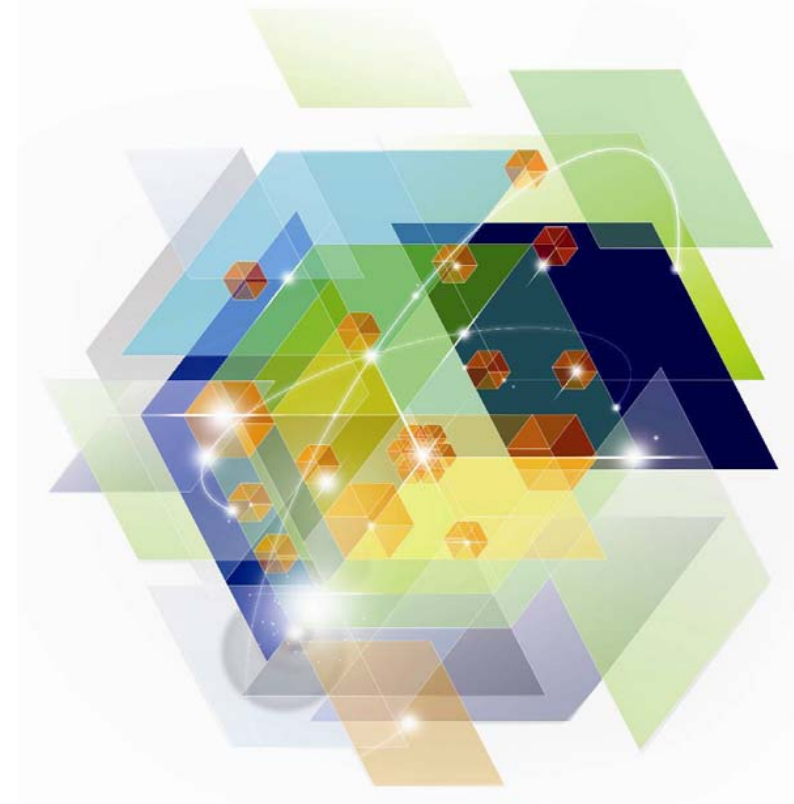# Smarter Computing With zEnterprise

Dr. John J. Shedletsky

Vice President

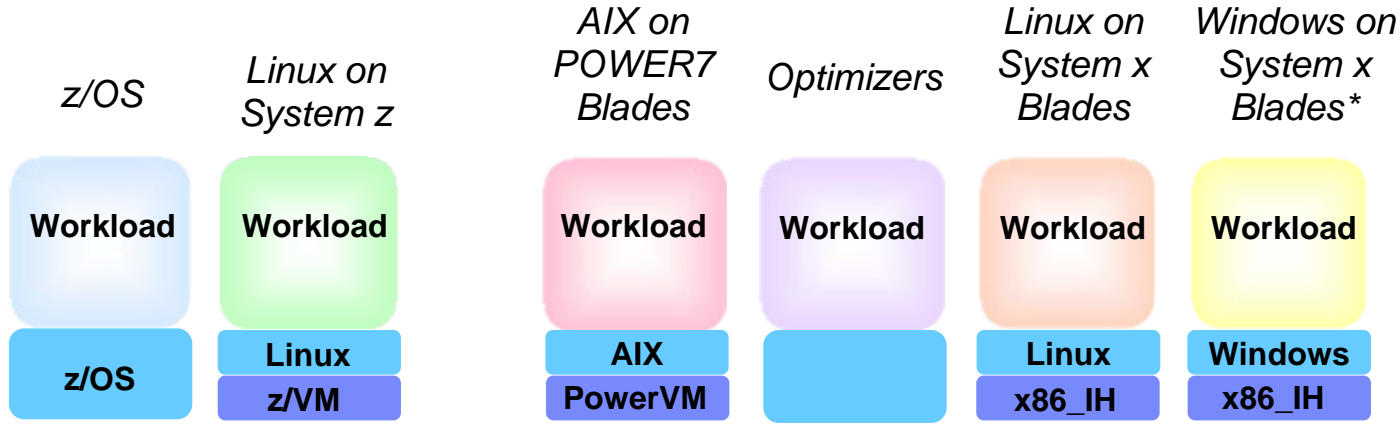**Competitive Project Office**

Smarter Computing

New metric for the age of Smarter Computing

COST PER WORKLOAD

zEnterprise – Broadest Architectural Support For Virtualized Environments

z/OS	Linux on System z	AIX on POWER7 Blades	Optimizers	Linux on System x Blades	Windows on System x Blades*
Workload	Workload	Workload	Workload	Workload	Workload
z/OS	Linux / z/VM	AIX / PowerVM		Linux / x86_IH	Windows / x86_IH

zEnterprise z114 / z196

zEnterprise BladeCenter Extension (zBX)

Fit-For-Purpose Strategy

Assign workloads to the environment that best satisfies requirements

Integrated Service Management
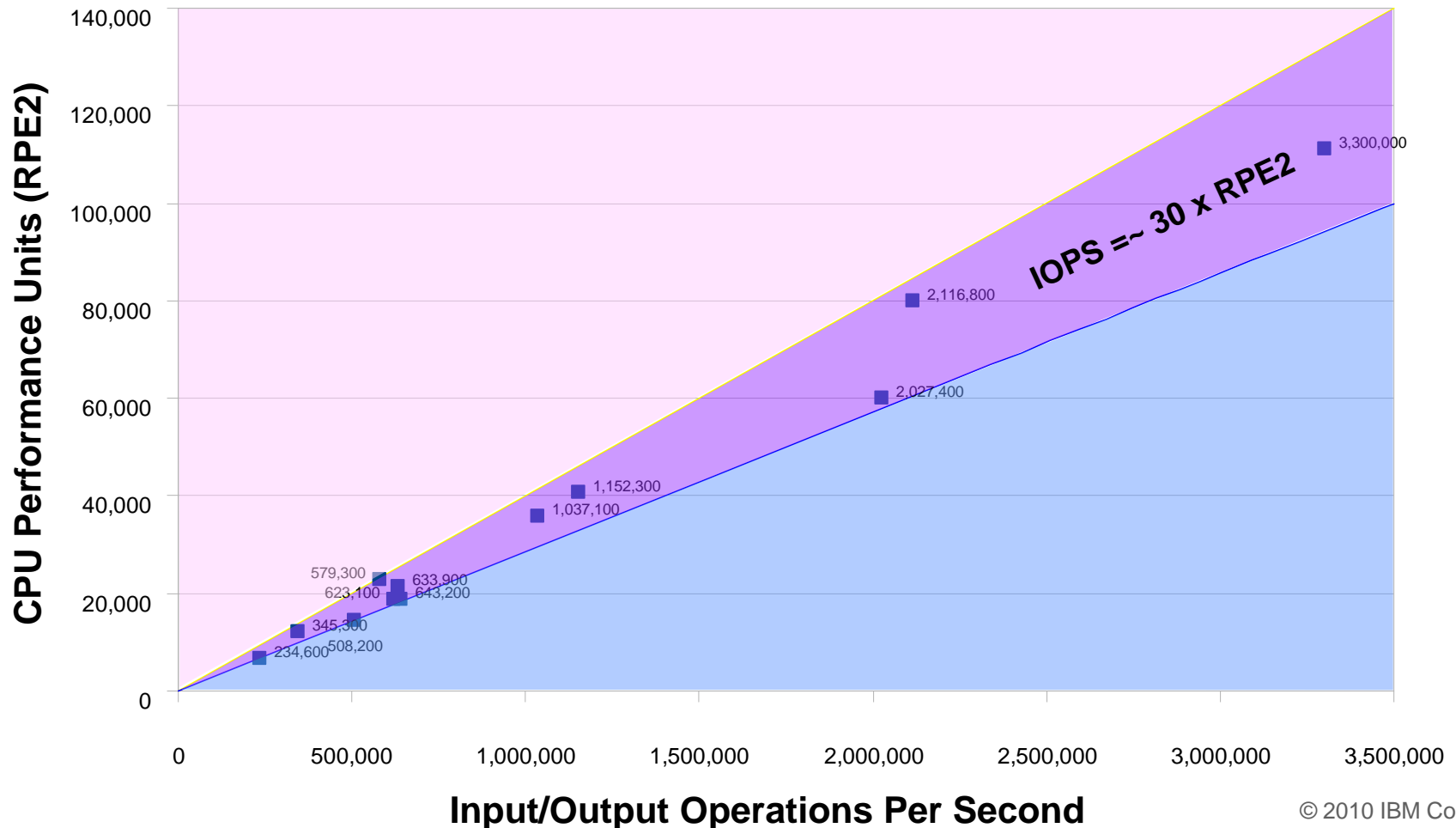
Visibility, Control, Automation

Achieves overall *lowest cost per workload*

*All statements regarding IBM future direction and intent are subject to change or withdrawal without notice, and represents goals and objectives only.

3

Fit For Purpose Example –
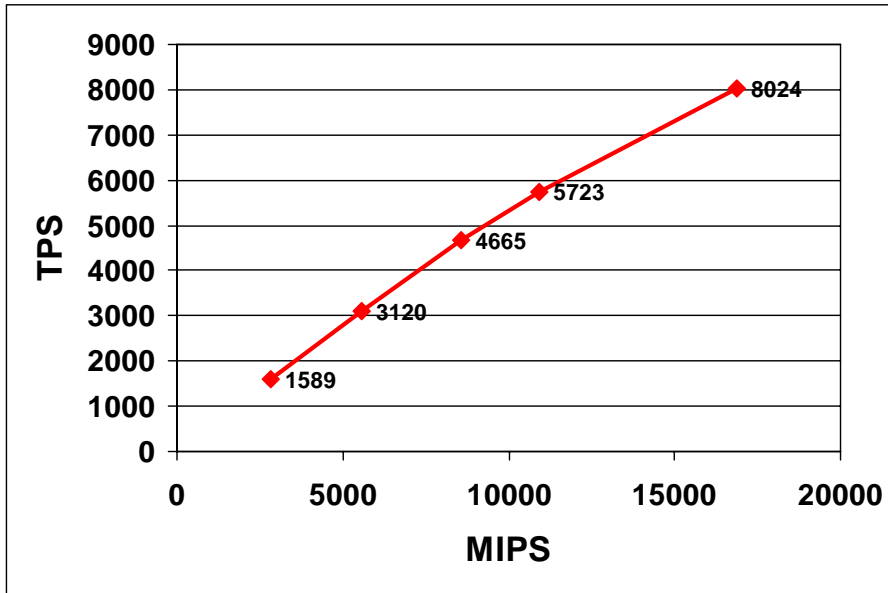## Which Environment Is Best For Transaction Processing?

An Interesting Relationship

CPU processing power and IOPS capacity in top 30% Best Optimized TPC-C Benchmarks

Chart: Y-axis labeled "CPU Performance Units (RPE2)" ranging 0 to 140,000; X-axis labeled "Input/Output Operations Per Second" ranging 0 to 3,500,000. Diagonal band labeled "IOPS =~ 30 x RPE2". Data points: 234,600; 345,300; 508,200; 579,300; 623,100; 633,900; 643,200; 1,037,100; 1,152,300; 2,027,400; 2,116,800; 3,300,000.
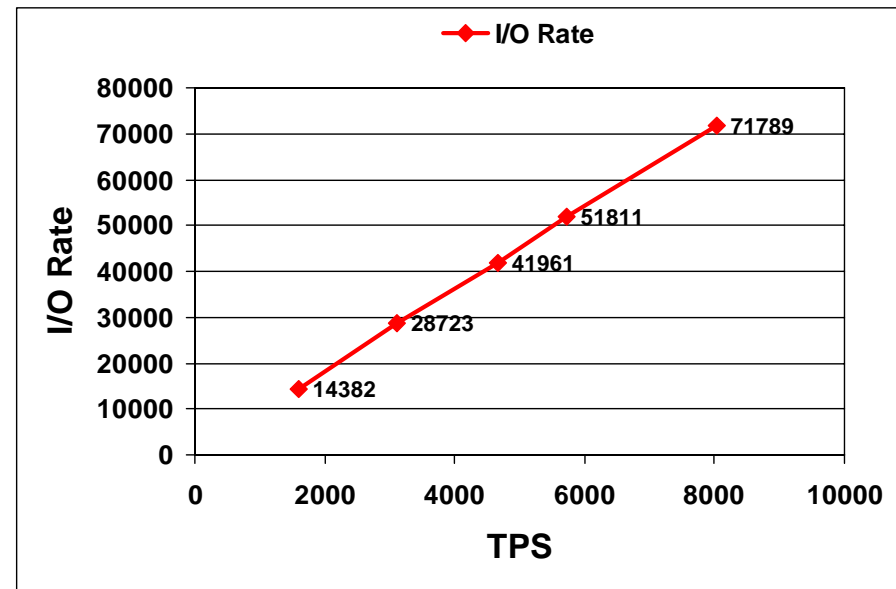
Bank Of China Benchmark Demonstrates Linear Relationship Between I/O Rate And Processing Capacity

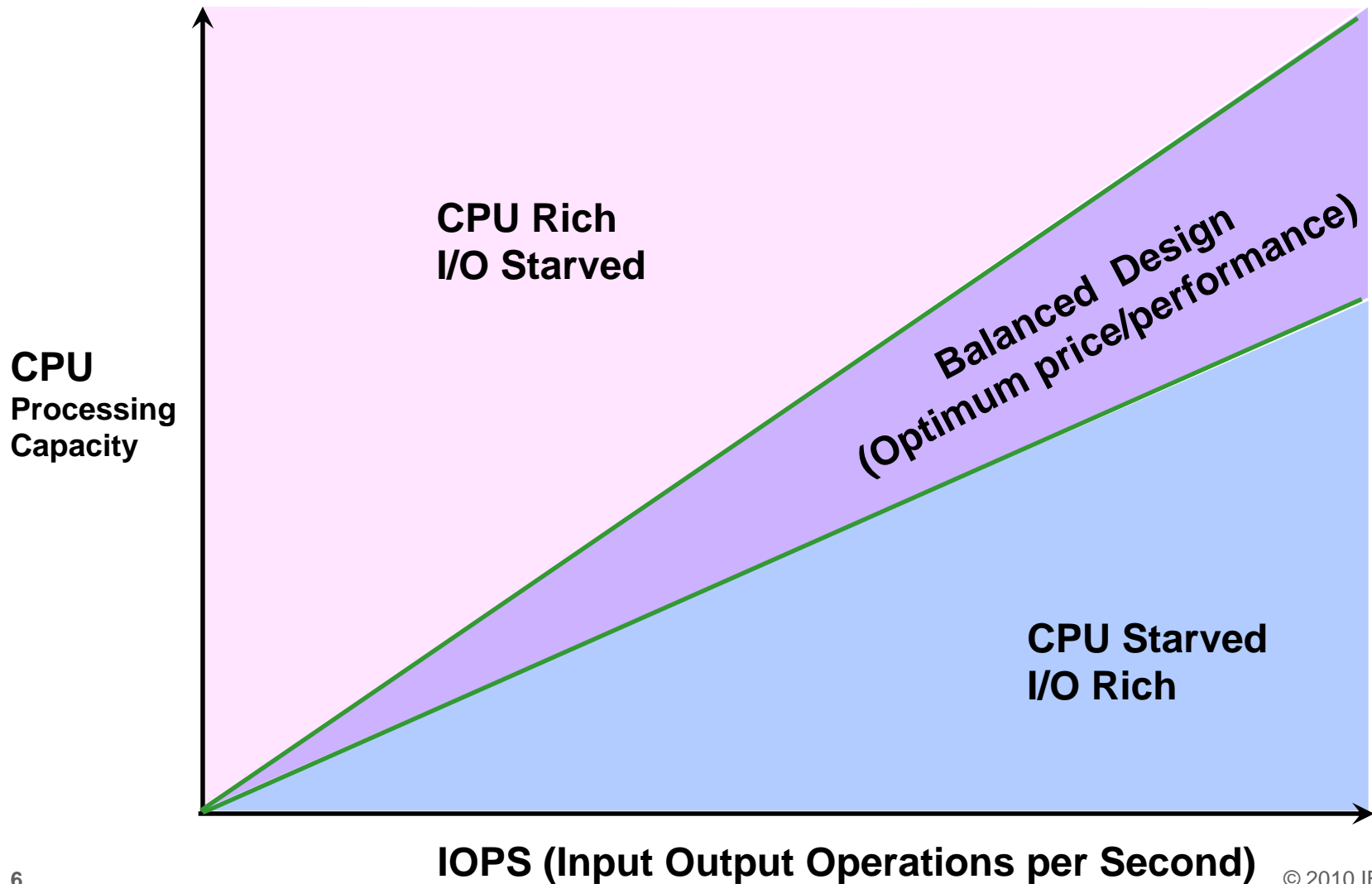## Complex banking transactions (BaNCS – CICS/DB2 z/OS workload)

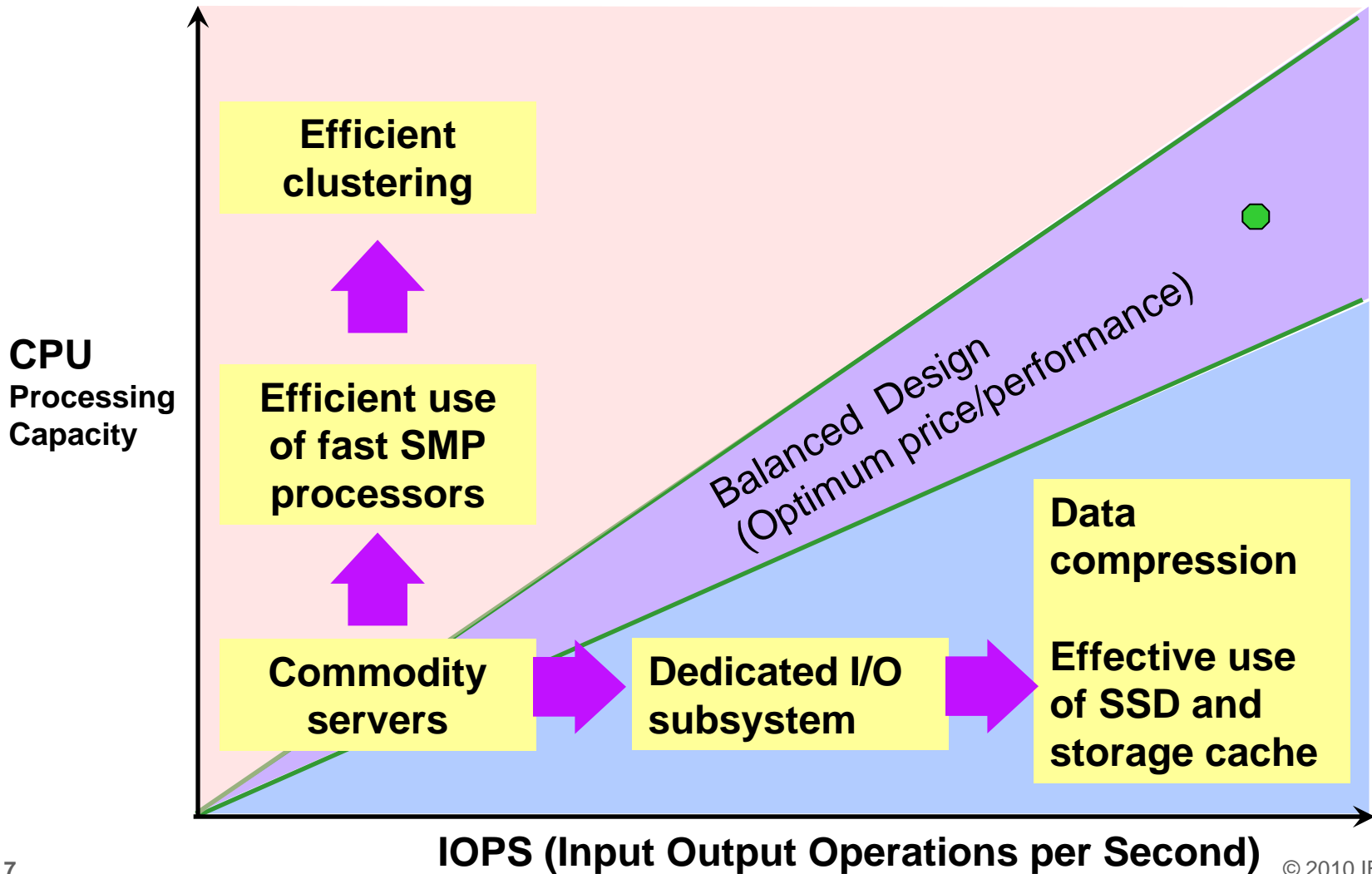**Add MIPS as needed to increase transaction rate**

I/O rate scales to sustain transaction rate

# Environments Optimized For Transaction Processing Must Balance Processing Power And I/O Bandwidth

CPU Rich
I/O Starved

Balanced Design
(Optimum price/performance)

CPU Starved
I/O Rich

CPU Processing Capacity

IOPS (Input Output Operations per Second)

Optimization Technologies Take You Much Further Into The Balanced Region

CPU
Processing
Capacity

Efficient clustering

Efficient use of fast SMP processors

Balanced Design (Optimum price/performance)

Data compression

Effective use of SSD and storage cache

Commodity servers

Dedicated I/O subsystem

IOPS (Input Output Operations per Second)

z/OS Sysplex - Optimized For Efficient Clustering

- **Specialized hardware - Coupling Facility**

  - Dedicated processor with specialized microcode to coordinate shared resources

  - High speed inter-connect to clustered systems

  - Hardware invalidation of local cache copies

  - Special machine instructions

- **Exploited by IMS, CICS, DB2, MQ, and other middleware on z/OS for transaction processing scale**
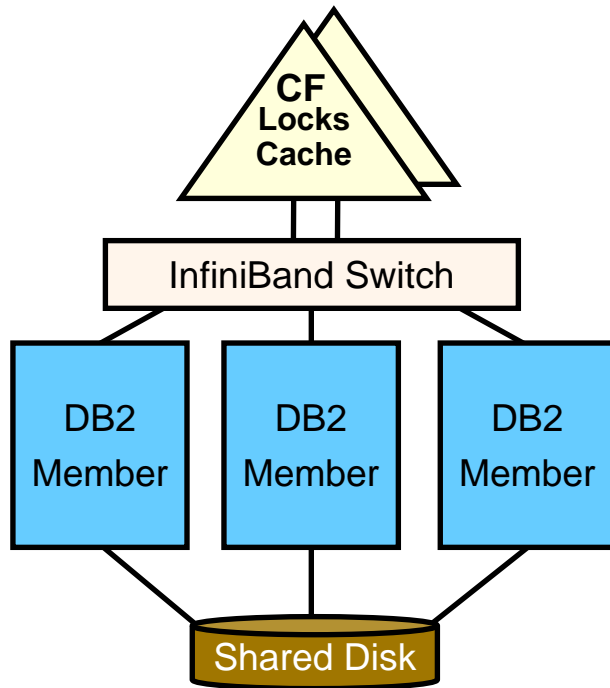
CF

Data Sharing
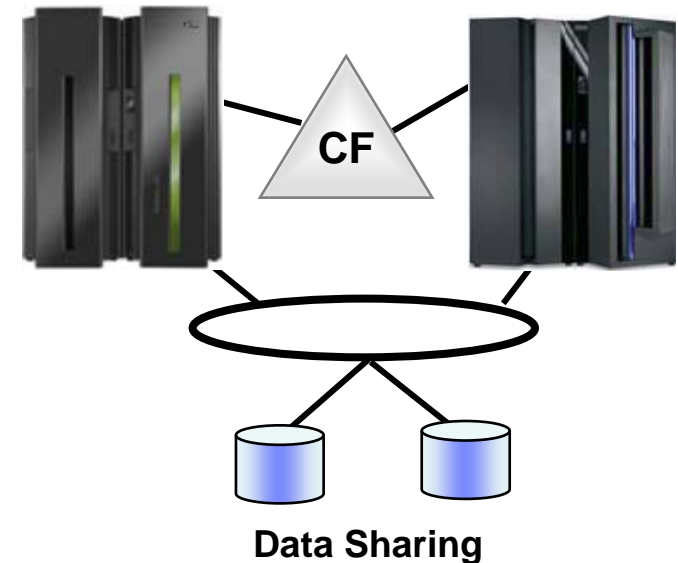
A single 80-way zEnterprise delivers 52,286 transaction processing MIPs. Up to 32 of these can be clustered in a parallel sysplex, delivering ultimate scalability and availability.

Clusters Grow Database Processing Power Beyond Single Server Solutions
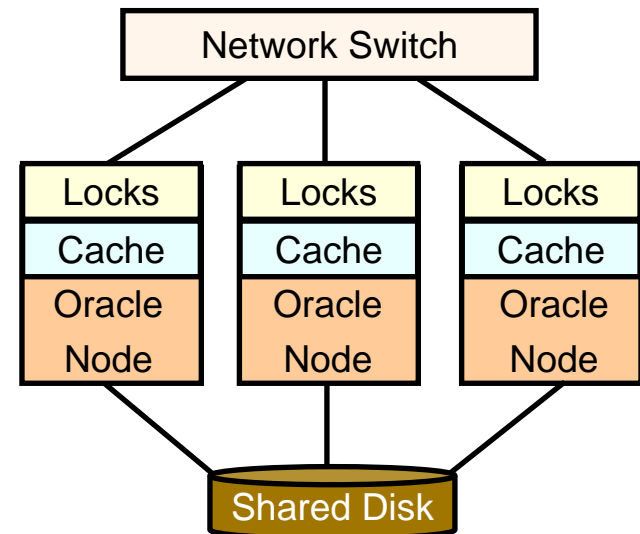
DB2 for z/OS
Centralized Coupling Facility Design

Oracle RAC
Distributed Design

DB2 for z/OS

- CF Locks Cache
- InfiniBand Switch
- DB2 Member | DB2 Member | DB2 Member
- Shared Disk

Efficient lock and buffer management achieve near linear scalability

Oracle RAC

- Network Switch
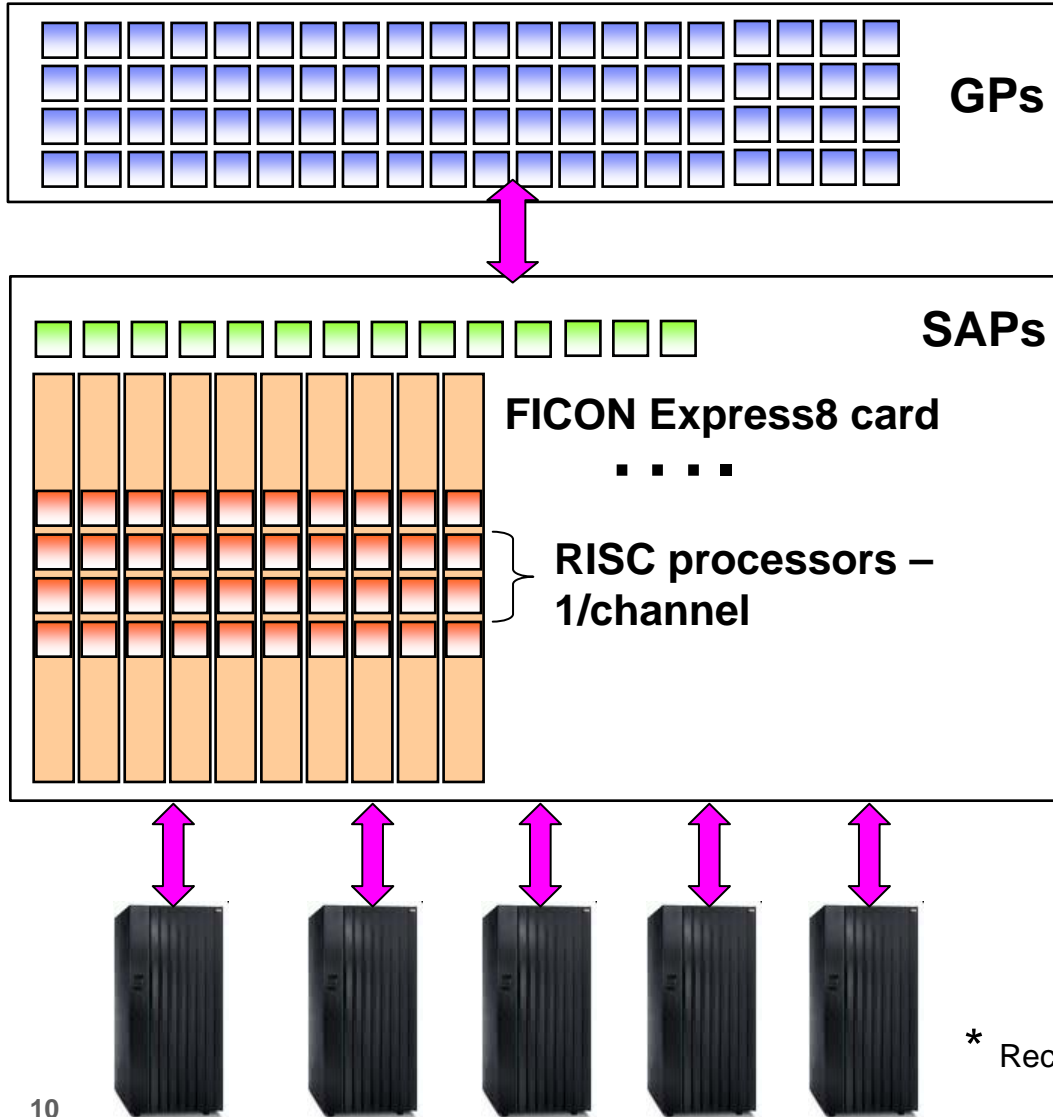- Locks / Cache / Oracle Node | Locks / Cache / Oracle Node | Locks / Cache / Oracle Node
- Shared Disk

Inefficient distributed locking and buffer management limits scaling

Z196 Dedicated I/O Subsystem - Optimized For High I/O Bandwidth

GPs

SAPs
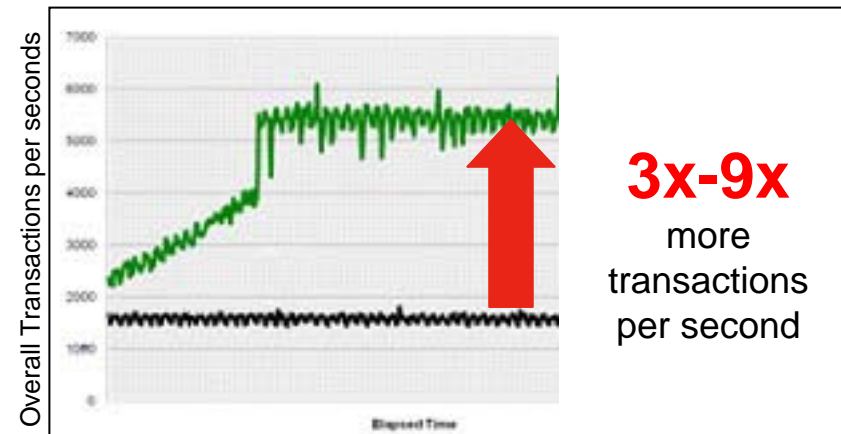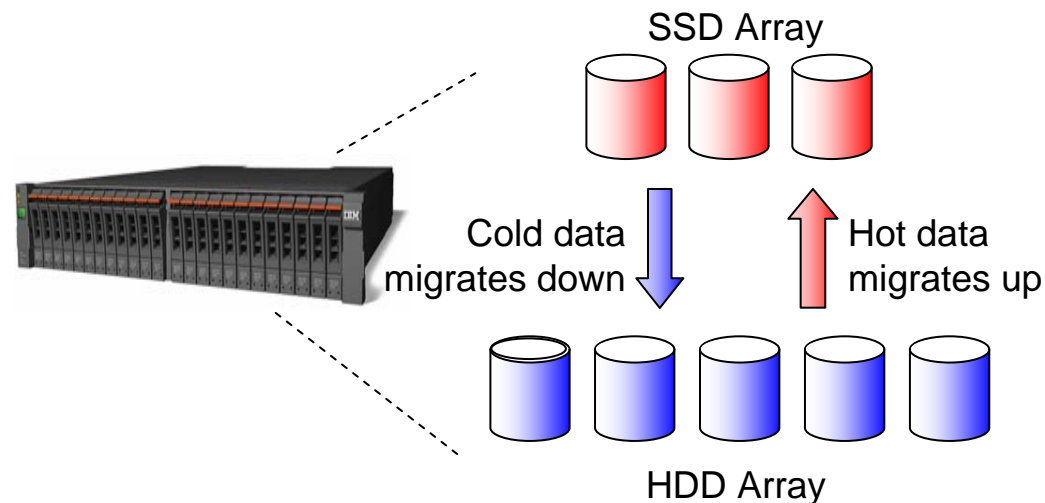
FICON Express8 card

RISC processors – 1/channel

- **Up to 80 General Purpose (GP) or Specialty Engine processors**
  - Execute business logic

- **Up to 14 System Assist Processors (SAP) to manage I/O requests**
  - Can sustain up to **2.2M IOPS*** operations per second

- **Up to 84 physical FICON cards for I/O transfers**
  - Up to **336 RISC channel I/O processors**
  - Up to 1024 logical channels

- **IBM DS8800 Storage System**
  - Up to **440K IOPS capability**

* Recommend 70% max SAP Utilization – 1.5M IOPS

DS8000 – Optimized For Automatic Exploitation Of Solid State Storage

- **Easy Tier migrates data extents between solid state drives and hard disk drives**
  - Automatic hotspot detection
- **Virtualized SSD is shared across all workloads using the pool**
  - Most effective use of SSD resource
- **Transparent to applications, no code changes required**

SSD Array

Cold data migrates down   Hot data migrates up

HDD Array

Overall Transactions per seconds

Elapsed Time

3x-9x more transactions per second

Example: Complex database transactional workload

Small Amounts Of Optimally Managed SSD Can Improve Storage Performance

Transactional Database Performance as Blend of SSD is increased

Easy Tier achieved 78% of the maximum SSD performance potential with just 13% blend of SSD
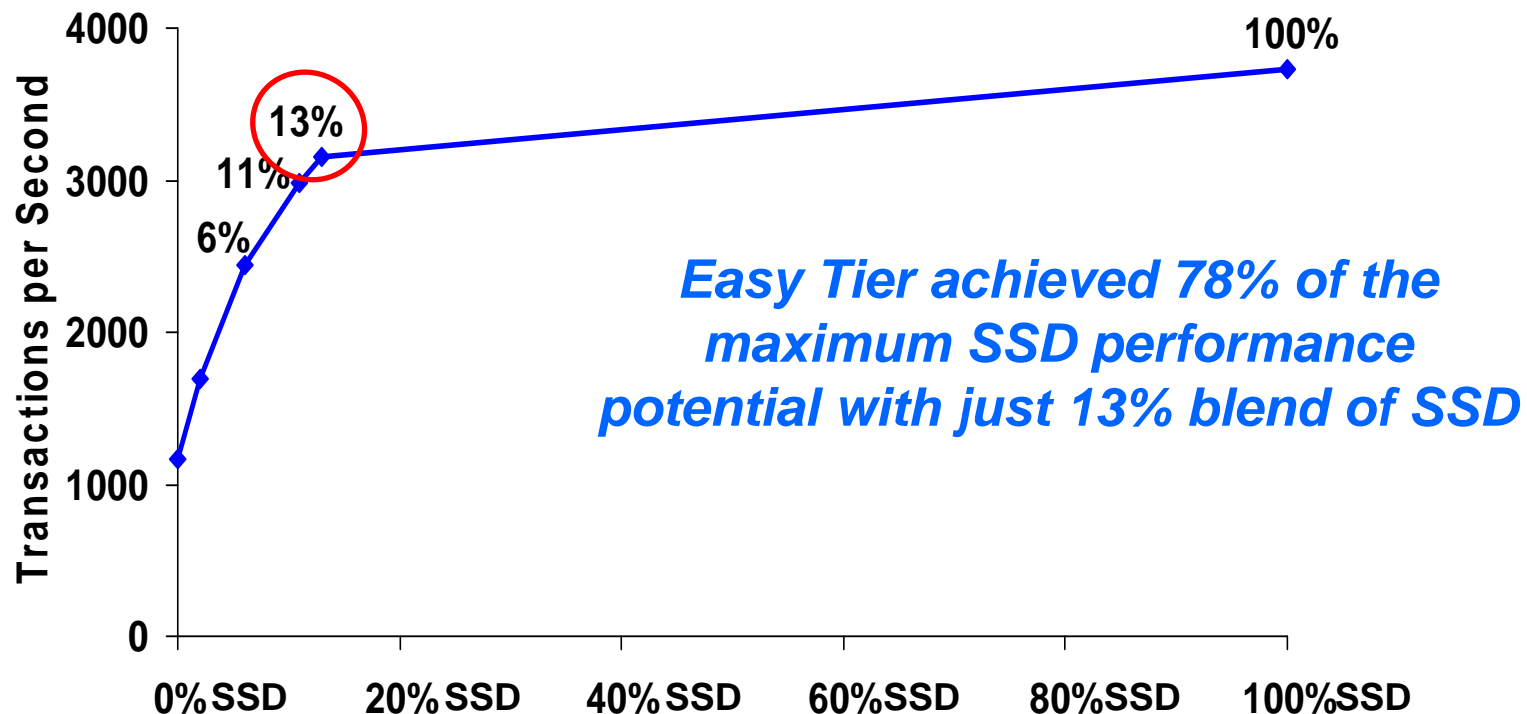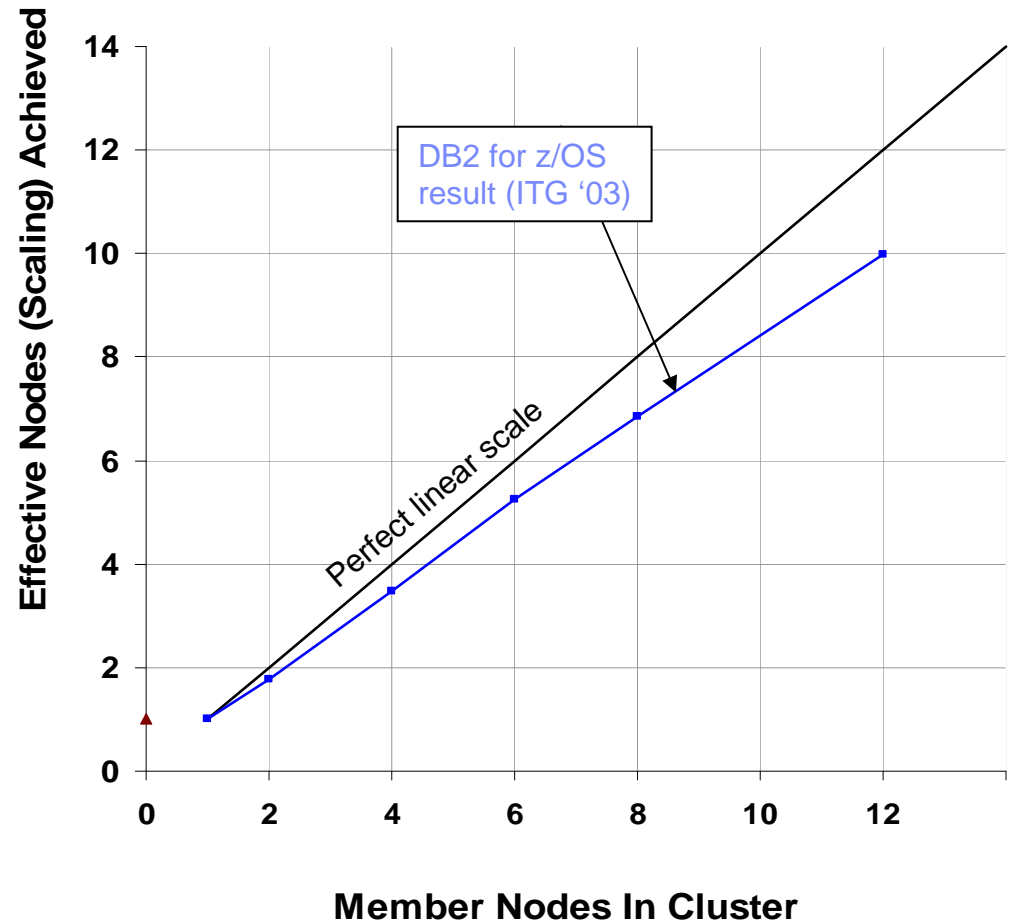
Source: IBM Internal Study of Benchmark Factory transactional database workload performance as Easy Tier migrates data to SSD. The performance data contained herein was obtained in a controlled, isolated environment. Actual results that may be obtained in other operating environments may vary.

Result: z/OS Is Uniquely Optimized To Support Large Scale Transaction Processing

- **More processors, memory and cache than other enterprise servers**

- **I/O offloaded to dedicated subsystem**

- **Sysplex clustering designed for near linear scaling**

- **DS8000 Easy Tier can boost performance even further for some workloads**

Example of near-linear scalability:

Chart: Effective Nodes (Scaling) Achieved vs. Member Nodes In Cluster, showing "Perfect linear scale" and "DB2 for z/OS result (ITG '03)".

Without Application Changes And Database Tuning, Oracle RAC Does Not Scale
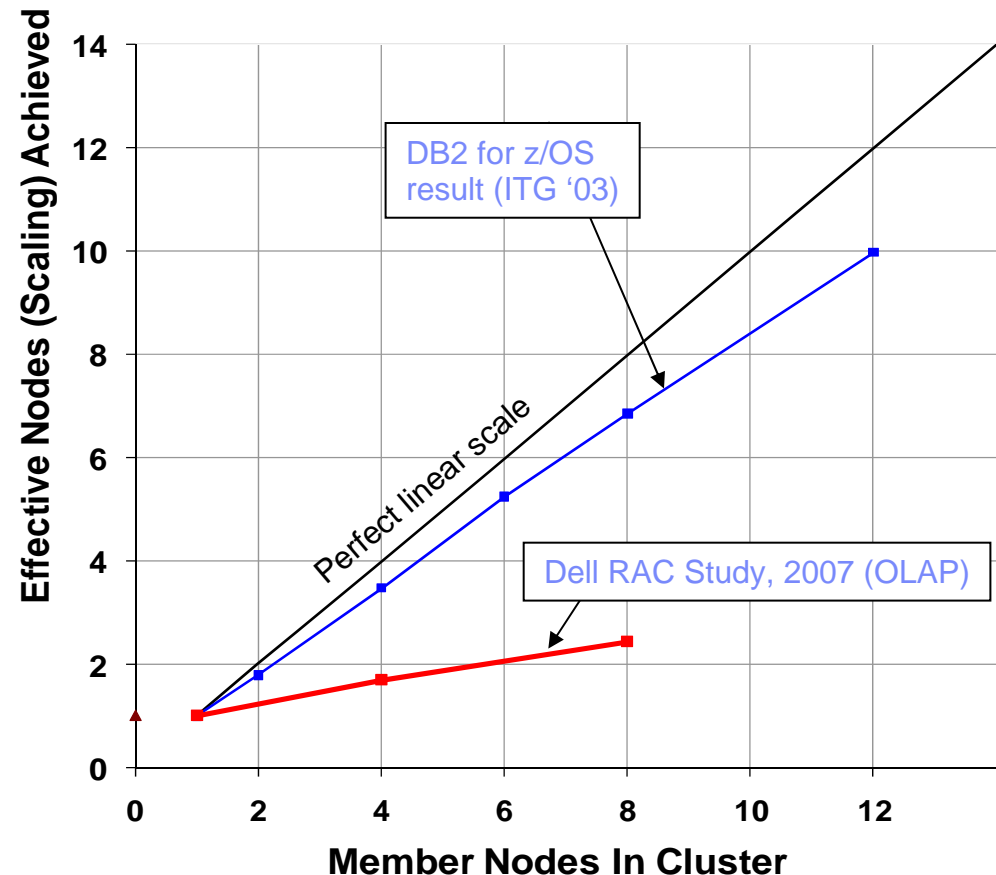
- **Inefficient design**

  – Scaling requires data partitioning and complex tuning

- **Published studies demonstrate poor scalability**

  – Dell (shown in chart): Poor scalability despite using InfiniBand for interconnect

  – CERN: Four month team effort to tune, change database, change application

  – Insight Technology: Even a simple application on two node system requires complex tuning and partitioning to scale

Example of near-linear scalability:

Chart — Y-axis: Effective Nodes (Scaling) Achieved (0 to 14); X-axis: Member Nodes In Cluster (0 to 12). Lines labeled "Perfect linear scale", "DB2 for z/OS result (ITG '03)", and "Dell RAC Study, 2007 (OLAP)".

z/OS Beats The Best HP Benchmark

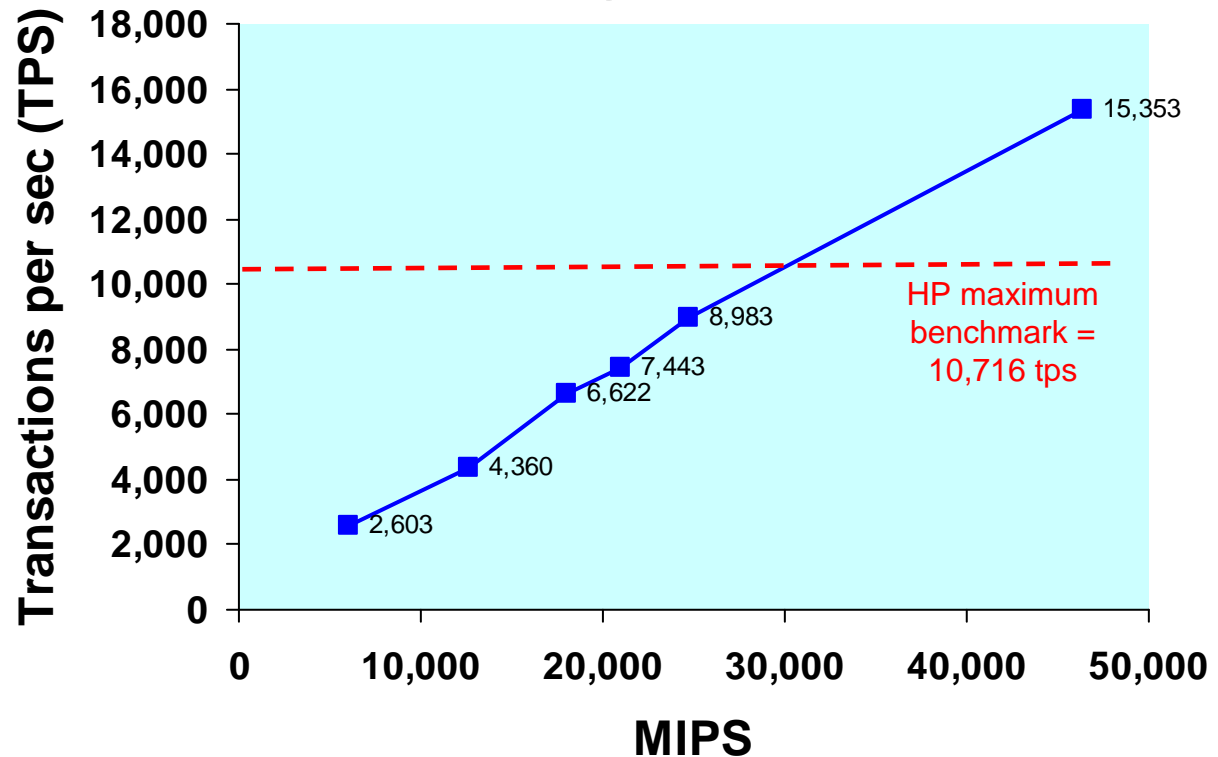## System z and BaNCS Online Banking Benchmarks

- **Kookmin Bank**
  - **IBM System z9 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

Transactions per sec (TPS) vs MIPS:
- 2,603
- 4,360
- 6,622
- 7,443
- 8,983
- 15,353

HP maximum benchmark = 10,716 tps

Compare Processors Needed To Achieve Same Throughput (10,716 tps)

BaNCS Application Servers:
16x HP Superdome (16ch/32co)

TCS BaNCS
1x z196-756

56 processors
47 GPs + 9 zIIPs
40,313 MIPS
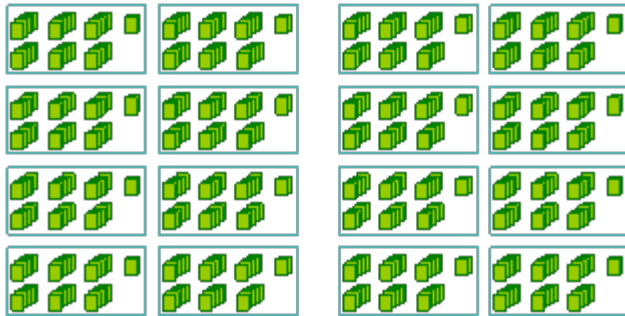
BaNCS Database Servers:
8x HP Superdome (24ch/48co)

896 processors
3,668,608
Performance Units

DB2 on z/OS

Oracle on HP-UX

NOTE: Benchmarks configurations were for production only. To cover DEV/QA capacity, 100% capacity was added to distributed server configuration, and 25% MIPS (8,000) were added to System z for a total of 39,811 MIPS. Model z196-756 provides 40,313 MIPS.

Compare The 5-Year Platform Acquisition Costs

HP-UX, Oracle

HP Superdome Servers

z/OS, DB2

IBM z196

44% less

Total (5yr TCO)　**$194.93M**
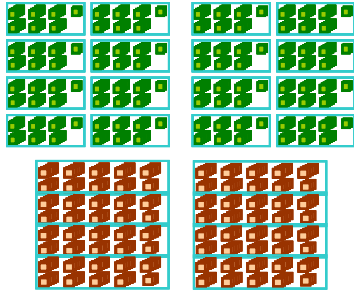
Total (5yr TCO)　**$109.76M**

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

Hardware	$61,163,580
Software	$48,349,448
Networking	$39,500
Space	$78,067
Energy	$131,400

Scalability Not Demonstrated
Energy (kWh) 3,045K per yr

Excellent Scalability
Energy (kWh) 263K per yr

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

Data Base Cost Per Processing Capacity Increases With Size For Distributed Servers

Cost Per Processing Capacity

- Cost per 43.5 Performance Units in distributed server
- Trend line

Server	Cost
Sun x4275 2ch/8co	$0.57
Sun x4275 4 node RAC 8ch/32co	$1.35
Sun T5440 4ch/32co	$1.43
Sun T5440 4 node RAC 16ch/128co	$3.39
Sun M8000 16ch/64co	$3.96
Sun M8000 4 node RAC 64ch/256co	$9.37
Sun M9000 64ch/256co	$5.20
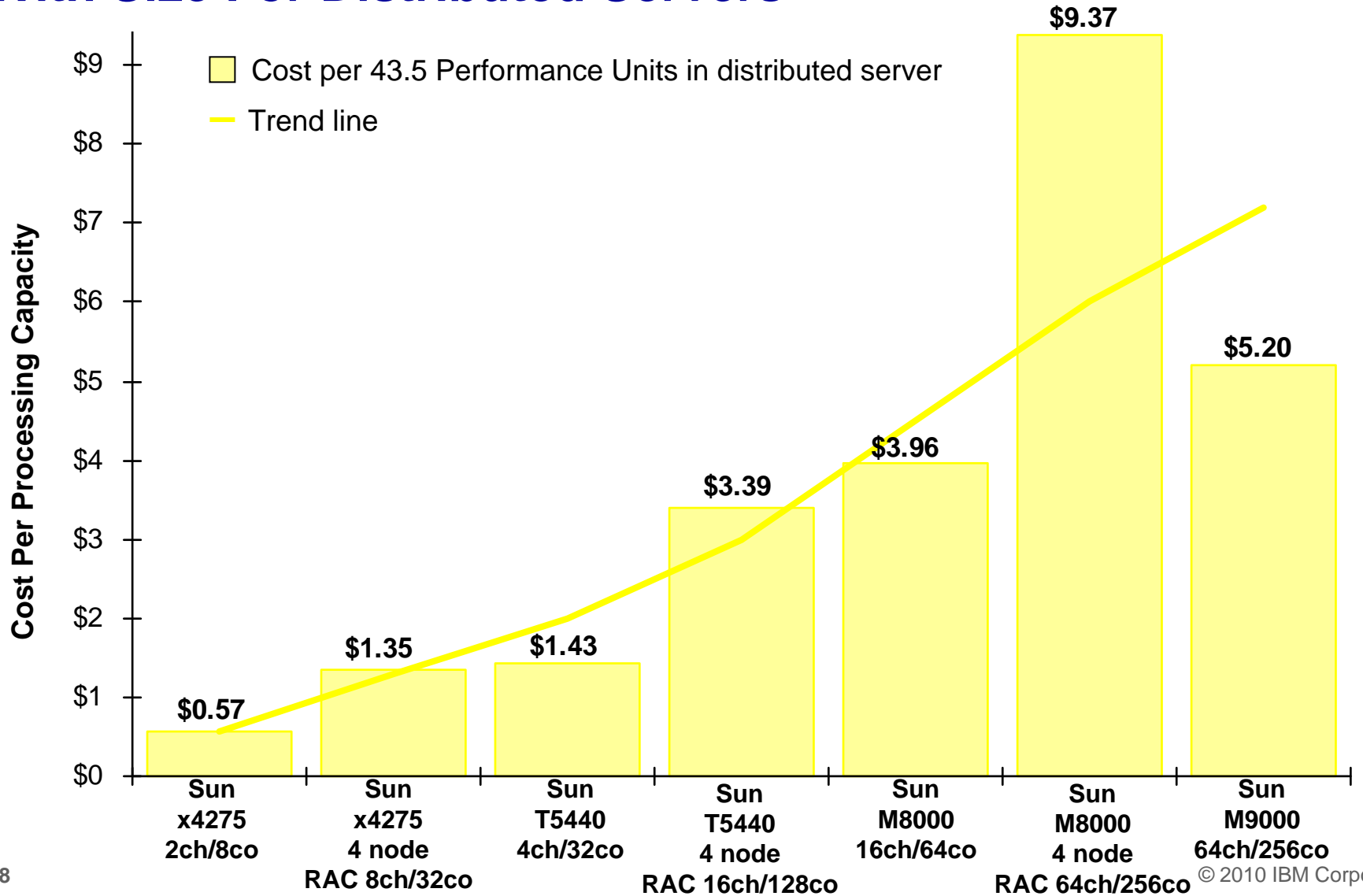
Data Base Cost Per Processing Capacity Decreases With Size For DB2 For z/OS

Cost Per Processing Capacity

Legend:
- Cost per 43.5 Performance Units in distributed server
- Cost per MIP System z
- Trend line System z
- Trend line distributed

Data values:
- $0.57 — Sun x4275 2ch/8co
- $3.34 — 1452 MIPS
- $1.35 — Sun x4275 4 node RAC 8ch/32co
- $2.96 — 2457 MIPS
- $1.43 — Sun T5440 4ch/32co
- $2.93 — 2359 MIPS
- $3.39 — Sun T5440 4 node RAC 16ch/128co
- $2.61 — 3990 MIPS
- $3.96 — Sun M8000 16ch/64co
- $2.77 — 3091 MIPS
- $9.37 — Sun M8000 4 node RAC 64ch/256co
- $2.50 — 5228 MIPS
- $5.20 — Sun M9000 64ch/256co
- $2.30 — 9357 MIPS

19

Moving Transaction Processing Workloads Off z/OS Rarely Reduces Cost

Some Typical Eagle Studies Under 3,000 MIPS - All Stayed on System z

Customer	z (MIPS)	distributed (RPE)	5-Year TCO		
			z	distributed	z/dist %
Average	**1,166**	**218,472**	**9,050,451**	**16,325,492**	
SA Government Agency	475	241,291	19,773,442	25,261,624	78.27%
German Financial	1,200	263,177	3,939,889	4,701,033	83.81%
NA Financial Servieces	2,526	308,144	3,456,611	5,939,476	58.20%
US utility company	456	163744	6,157,295	13,380,866	46.02%
European Insurance	904	171,062	13,019,980	15,877,484	82.00%
US Manufacturor	900	453,168	11,277,266	16,019,269	70.40%
Asian Bank	1,416	136,013	2,342,300	7,237,681	32.36%
US Retailer	1,700	215,124	3,543,154	8,951,851	39.58%
US County Government	88	43,884	4,717,394	8,108,668	58.18%
US Retailer	1,500	184,732	9,254,186	20,861,515	44.36%
AP bank	1,336	168,113	17,300,000	27,200,000	63.60%
AP bank	300	24,162	5,200,000	11,500,000	45.22%
US Manufacture	1,917	261,040	4,758,313	7,350,216	64.74%
US Food Services	1,600	424,952	21,966,475	56,167,206	39.11%

Typical Decision Factors: Cost and Risk

Typical Eagle TCO Offload Study For A Financial Services Customer

4 HP Proliant DL 980 G7 servers

Production   Development

256 cores total
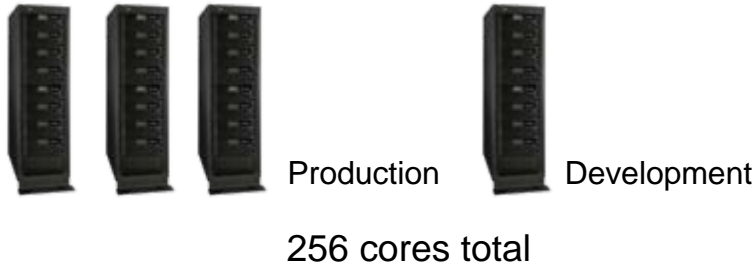
Hardware	$1,594,801
Software	$80,617,966
Labor (additional)	$8,250,000
Power and cooling	$43,756
Space	$79,385
Disaster Recovery	$4,210,728
Migration Labor	$24,000,000
Parallel Mainframe costs	$31,474,052
Total (5yr TCO)	$150,270,688

System z z/OS Sysplex

CF

2760 MIPS

Hardware	$1,408,185
Software	$49,687,845
Labor	Baseline
Power and cooling	$31,339
Space	$79,385
Disaster recovery	$1,250,000
Total (5yr TCO)	$52,456,754

65% less

Why Do Distributed Alternatives Cost More?

- **De-consolidation of applications to dedicated servers**
  - Separate servers for production, development, quality assurance test
  - Dedicated servers for functional roles - application, database, security, batch, systems management
  - Low utilization due to provisioning for the peak on each server and pre-provisioning for growth

- **Disaster Recovery**
  - 100% coverage doubles the number of cores required

- **Processing comparisons**
  - Language expansion (IMS/CICS/COBOL path lengths are highly optimized)
  - Networking drives up cycles spent on protocols
  - Mainframe has dedicated processors for I/O operations, distributed does not
  - Converting IMS hierarchical database to relational typically results in a 3x expansion
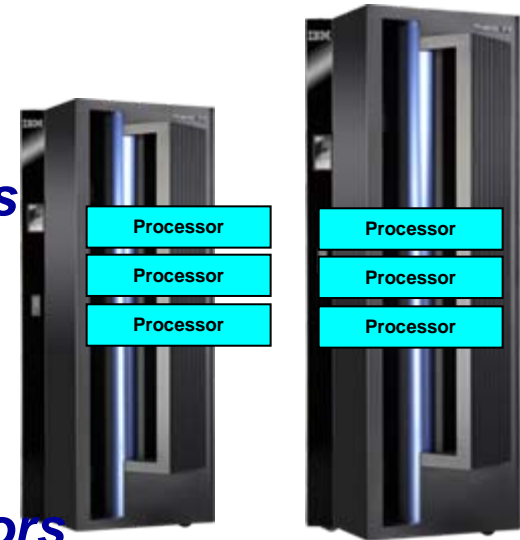
Resulting in *core proliferation!*

A Customer Offload Project

6x 8-way Production / Dev
2x 64-way Production / Dev
    Application/MQ/DB2/Dev partitions
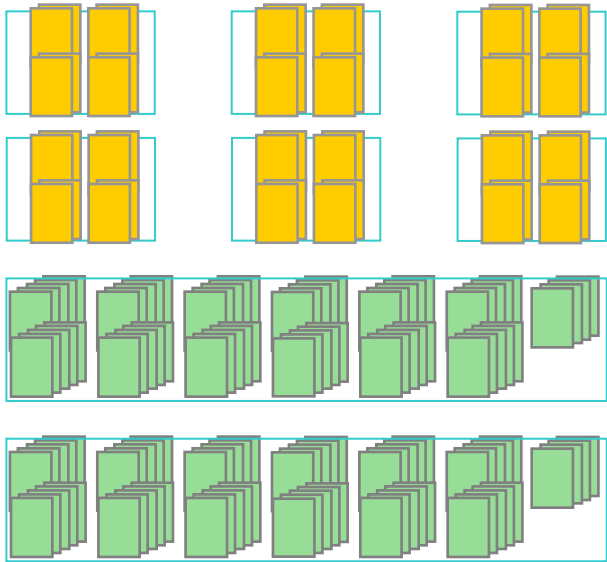
2x z900 3-way Production / Dev / QA / Test

6 processors
(1,660 MIPS)

176 distributed processors
(800,072 Performance units)

Processor	Processor
Processor	Processor
Processor	Processor

$25.4M TCO (5yr)

$17.9M TCO (5yr)

Core Proliferation 29 to 1

482 Performance Units per MIPS

How To Achieve Lowest Cost Per Workload With zEnterprise

- **Most existing z/OS workloads are already best-fit**
  - Spinning off these workloads increases cost
  - zEnterprise environments enable a different strategy

- **Consolidate peripheral workloads into zEnterprise**
  - Use fit for purpose assignments to reduce cost of acquisition
  - Managed as one system to reduce operational costs

- Distributed databases and data marts

- Hybrid workload front ends

- Standalone workloads

Consolidating SAP Databases On z196 Reduces 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

CF
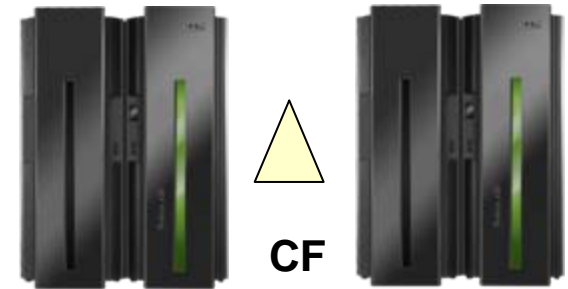
z196-727 + 27 zIIP 39,117 MIPS

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.

Then Collapse SAP Front End Applications Into zEnterprise Platform
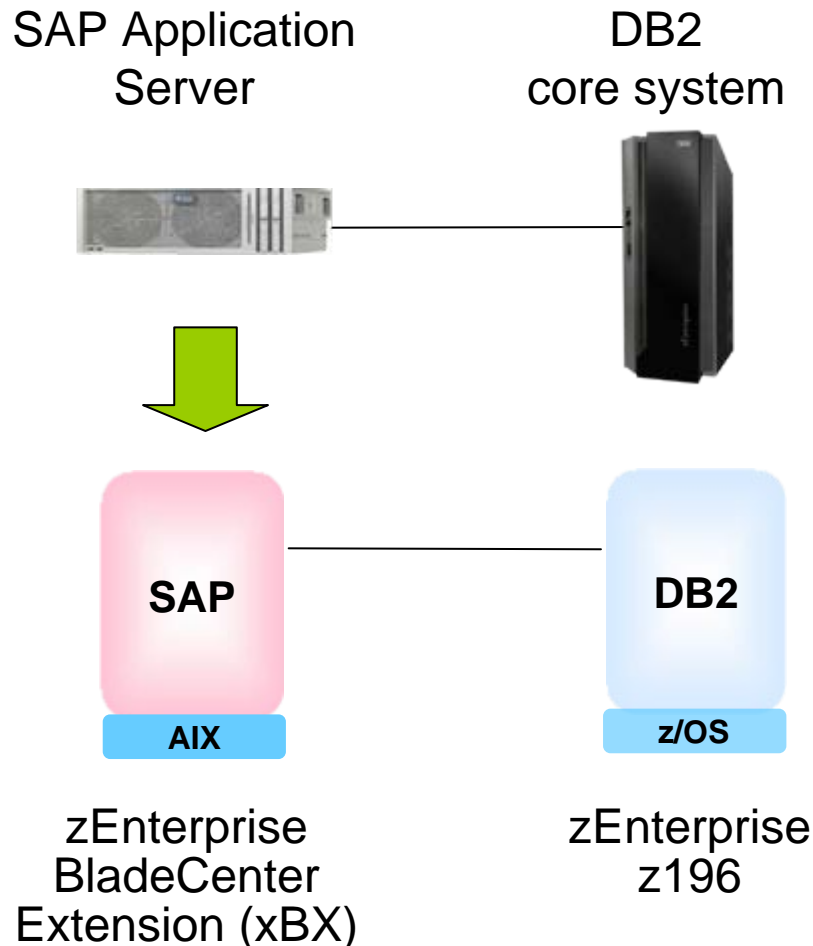
SAP Application
Server

DB2
core system

SAP

AIX

DB2

z/OS

zEnterprise
BladeCenter
Extension (xBX)

zEnterprise
z196

- Run as ensemble of virtual servers

- Unified management of virtual machines

- Manage ensemble as a single workload with service goals

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

- Embedded pre-configured data network

SAP Applications Cost 18% Less On zEnterprise

SAP applications on older SPARC T2+ servers

Data Processing

20 workloads

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

Upgrade to new SPARC T3 hardware

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

23 POWER7 blades in zBX
184 cores total

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.

Collapse Web Front End Workloads Into zEnterprise

Web facing front-end

Message hub

CICS/DB2 core system

WAS

AIX

DataPower XI50z

DB2 CICS

z/OS

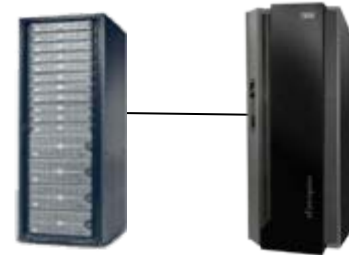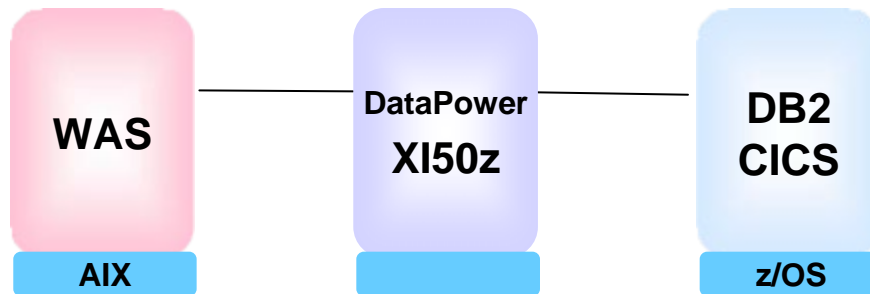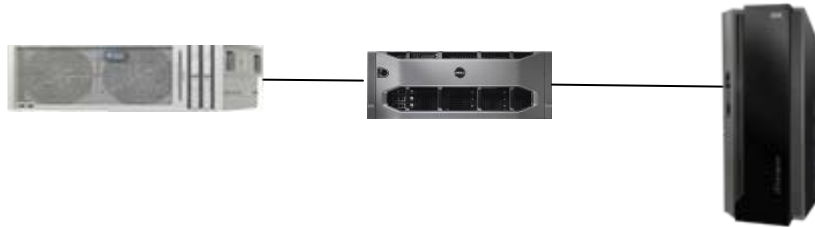zEnterprise BladeCenter Extension (zBX)

zEnterprise z114

- 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

Web Front Ends Cost 59% Less On zEnterprise

Web front-end workloads

Web Facing

Message Driven
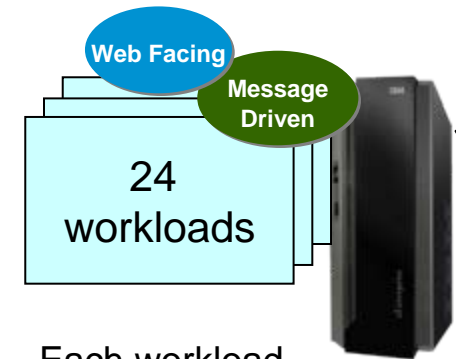
24 workloads

Each workload driving 3080 tps

High availability Workload isolation

Competitive Packaged System

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

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

1010010010101001
101001001010101
101001001010101
101001001010101
10100100101001001

$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.

Data Mart Proliferation At A Local Government Department

Copy #1

Copy #2

Repository 700GB

Operational Data Store 700GB

Data Marts 350GB

Copy #3

web front end

Data Mart

Data Mart

Data Mart

Data Mart

⋮

Data Mart

Local Database 350GB

Copy #4

Excel analysis

Data Mart 350GB

Copy #5

Public

Dev Copy 140GB

Copy #6

Development and test

New Data
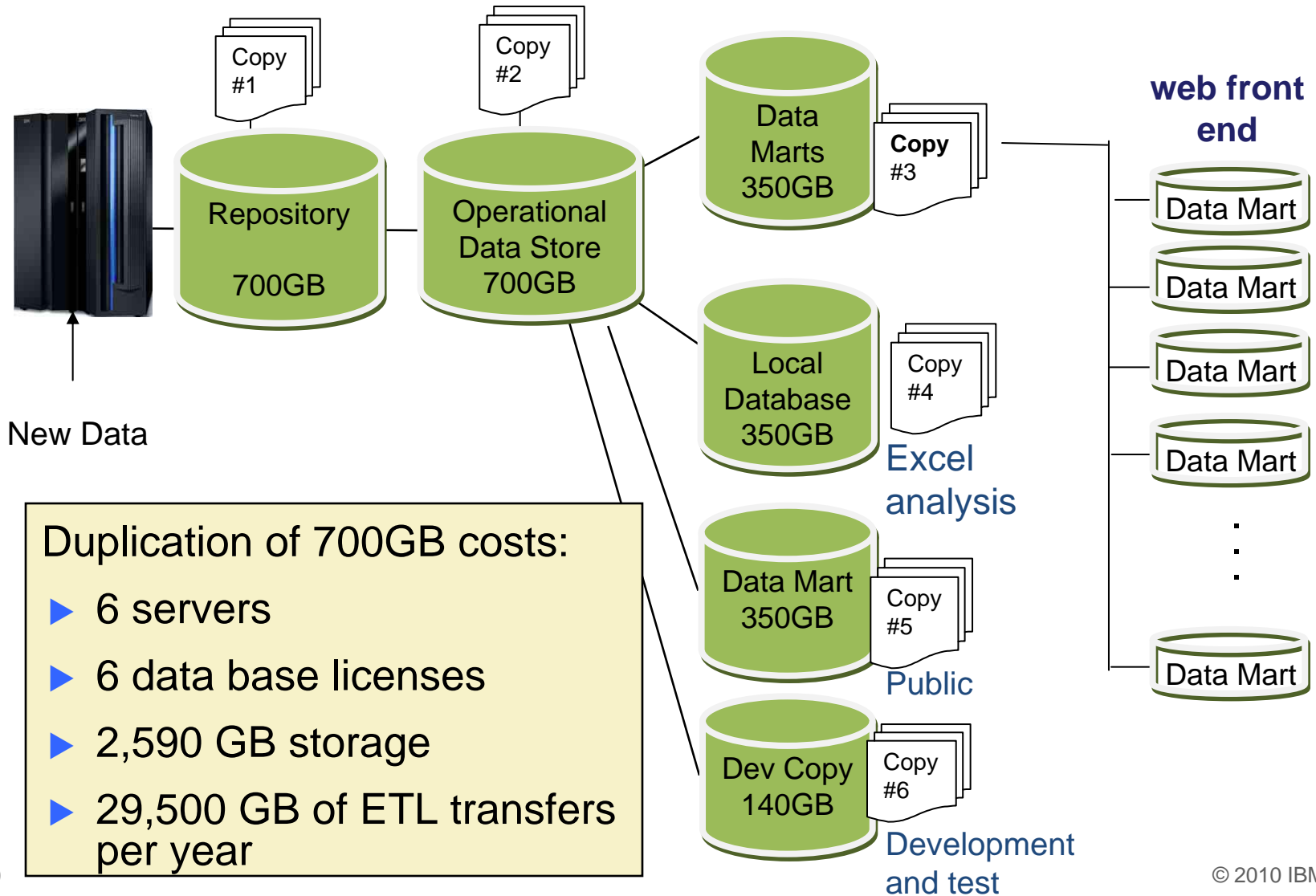
Duplication of 700GB costs:

- ▶ 6 servers
- ▶ 6 data base licenses
- ▶ 2,590 GB storage
- ▶ 29,500 GB of ETL transfers per year

Duplicating Data Off The Mainframe Is Costly

The Cost Of Duplicating 2TB To A Data Mart

Data Mart Server

Enterprise WAN

2TB
Send file

2TB
Receive file

10TB
provisioned

Cost of storage - send file $12.33/GB x 2048 GB	$25,252

Storage acquisition cost
$246,436

Cost of storage - receive file $18/GB x 2048 GB	$36,864
Cost of storage - data mart $18/GB x 10,240 GB	$184,320

System z Storage Admin $5.88/GB/yr x 2048 GB	$12,042

Annual storage admin cost
$122,511

Distributed Storage Admin $8.99/GB/yr x 12,288 GB	$110,469

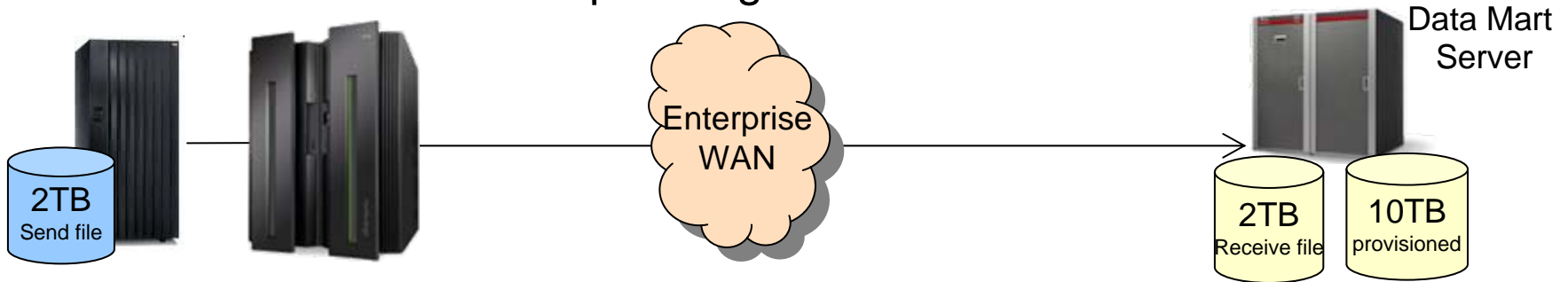|	
System z CPU extract $1.38/GB x 2048 GB	$2,826
System z CPU cost FTP $0.58/GB x 2048 GB	$1,188
System z extract labor $9.33/job	$9
System z FTP labor $5.88/job	$6

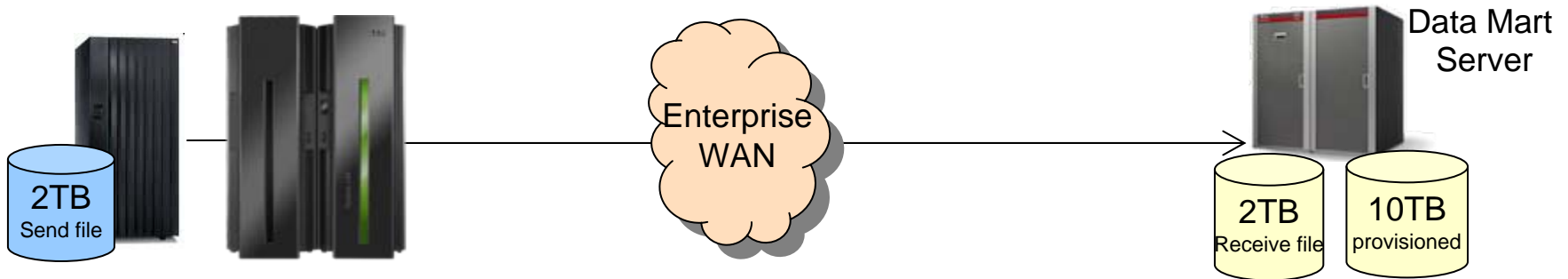|	
On Premises Network $0.0024/GB x 2048 GB x 4 hops	$20
Off Premises Network $0.29/GB x 2048 GB x 2 hops	$1,188

Cost per Transfer
$6,146

Distributed CPU cost load $0.39/GB x 2048 GB	$799
Distributed CPU cost FTP $0.05/GB x 2048 GB	$96
Distributed load labor $14.00/job	$14

Data Mart analysis costs not included
Based on IBM internal study

Transfer Costs Add Up Over One Year

The Cost Of Duplicating 2TB To A Data Mart

Data Mart Server

Enterprise WAN

2TB — Send file

2TB — Receive file

10TB — provisioned

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Distributed Storage Admin $8.99/GB/yr x 12,288 GB	$110,469

System z CPU extract $1.38/GB x 2048 GB x 365	$1.03M
System z CPU cost FTP $0.58/GB x 2048 GB x 365	$434K
System z extract labor $9.33/job x 365	$3.3K
System z FTP labor $5.88/job x 365	$2.2K

On Premises Network $0.0024/GB x 2048 GB x 4 hops x 365	$7.1K
Off Premises Network $0.29/GB x 2048 GB x 2 hops x 365	$434K

Annual Transfer Costs
$2,243,290

Distributed CPU cost load $0.39/GB x 2048 GB x 365	$292K
Distributed CPU cost FTP $0.05/GB x 2048 GB x 365	$35K
Distributed load labor $14.00/job x 365	$5.1K

Cost of running Data Mart analysis jobs not included

Smart Analytics 9600 Faster Than Exadata Under Concurrent Mixed Workload

- **Meets service levels for timely execution of simple reports**

- **More than double the number of intermediate reports per hour**

- **70% better throughput for complex reports**

2.4X More Intermediate Reports

Reports Per Hour at 1 TB data size
(Higher is Better)

Legend: 9600-24, Competitor
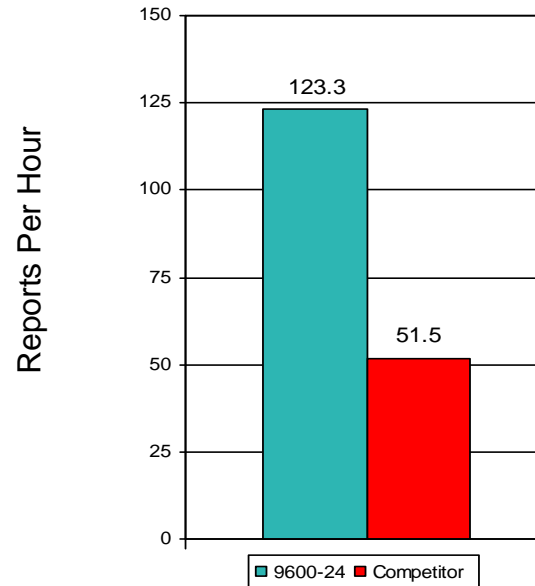
Values: 123.3 (9600-24), 51.5 (Competitor)

1.7X More Complex Reports

Reports Per Hour at 1 TB data size
(Higher is Better)

Legend: 9600-24, Competitor
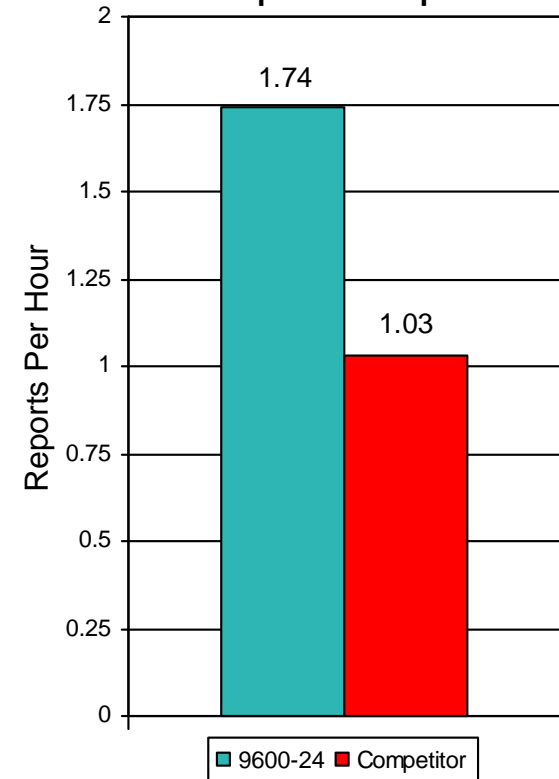
Values: 1.74 (9600-24), 1.03 (Competitor)

System Comparison Of Exadata Versus IBM Smart Analytics 9600

Competitor Database Machine
(2 DBMS Nodes, 3 Storage Devices)
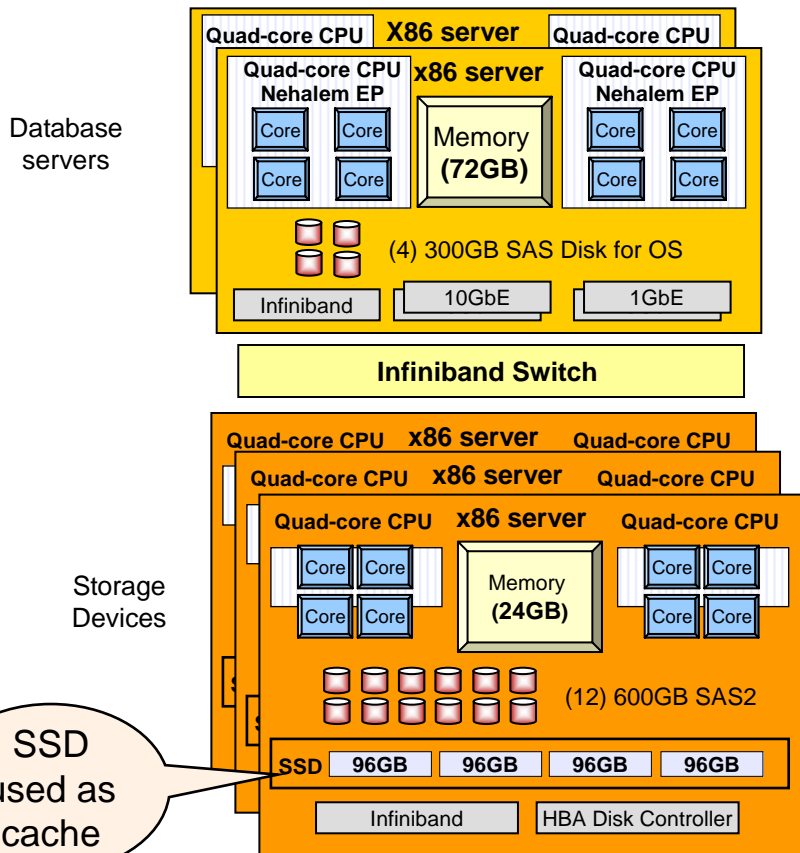
IBM Smart Analytic System 9600
Extra Small Configuration
(Custom 24-core config)

Database servers

X86 server		
Quad-core CPU		Quad-core CPU

Quad-core CPU Nehalem EP — x86 server — **Quad-core CPU Nehalem EP**

Core Core | Memory **(72GB)** | Core Core
Core Core | | Core Core

(4) 300GB SAS Disk for OS

| Infiniband | 10GbE | 1GbE |

Infiniband Switch

Storage Devices

Quad-core CPU **x86 server** Quad-core CPU
Quad-core CPU **x86 server** Quad-core CPU
Quad-core CPU **x86 server** **Quad-core CPU**

Core Core | Memory **(24GB)** | Core Core
Core Core | | Core Core

(12) 600GB SAS2

SSD | **96GB** | **96GB** | **96GB** | **96GB**

| Infiniband | HBA Disk Controller |

SSD used as cache

3YR TCA = $2,857,500

Z196-M80 **Mainframe**

12 GPs and 12 zIIPs

Core Core Core Core Core Core Core Core
Core Core Core Core Core Core Core Core
Core Core Core Core Core Core Core Core

Memory **(128GB)**

| FICON | FICON |

SAN Switch

DS8800 (x1)
(8) 600 GB X 4

3 YR TCA = $3,600,000

zManager Provides Platform And Resource Management Across zEnterprise Environments

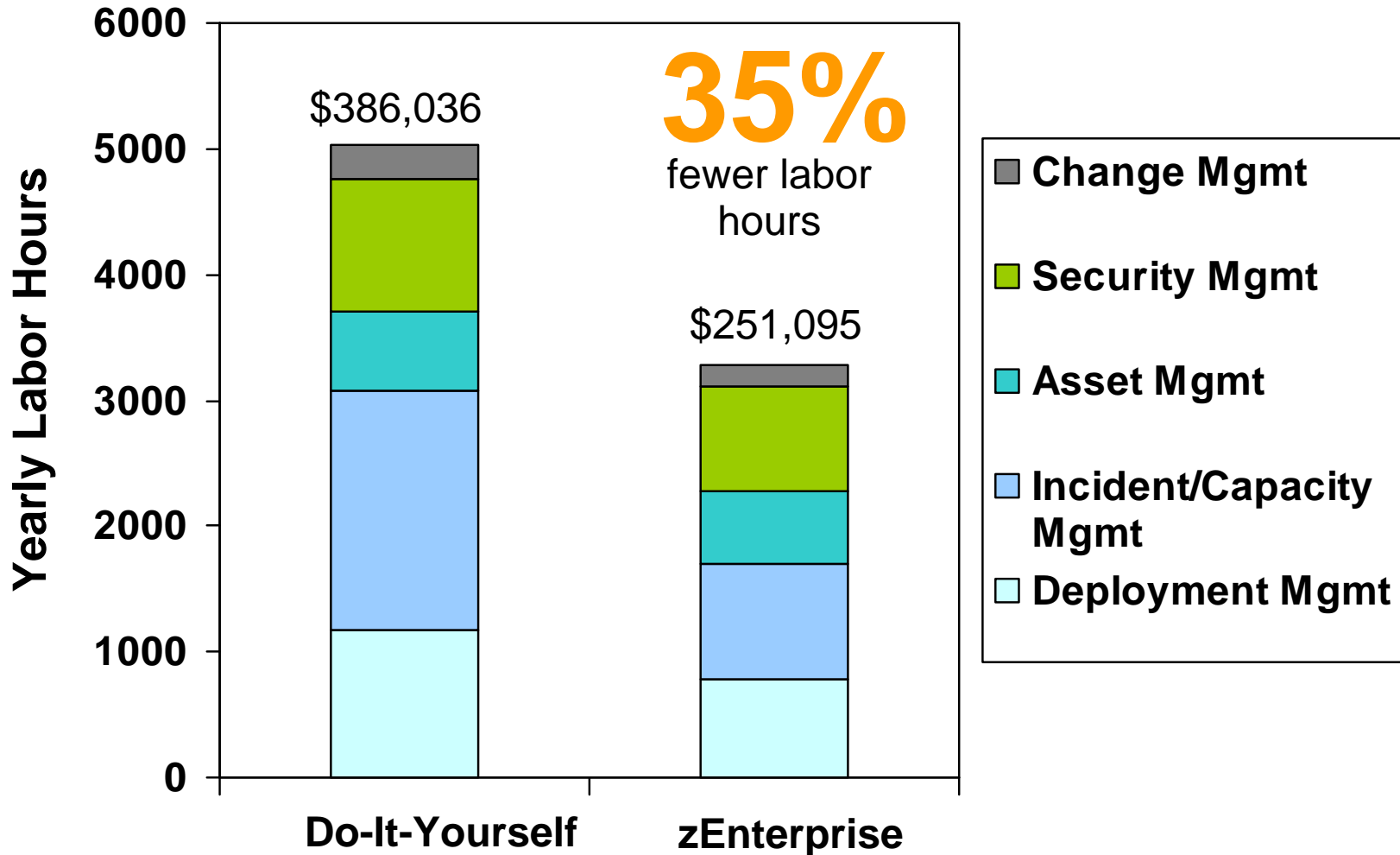| Process	Typical Distributed Management Practices	zManager
Asset Management	■ Discover assets with ad hoc methods ■ Manual entitlement management	■ Automated discovery and management of entitlement assets
Deployment Management	■ Manually configure hypervisor and build networks	■ Automated deployment 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

Centralized, Structured Management With zEnterprise Cuts Infrastructure Labor Hours

35% fewer labor hours

$386,036

$251,095

Yearly Labor Hours

6000
5000
4000
3000
2000
1000
0

Do-It-Yourself   zEnterprise

Legend:
- Change Mgmt
- Security Mgmt
- Asset Mgmt
- Incident/Capacity Mgmt
- Deployment Mgmt

Financial Charge Back Is May Not Be Optimized For Accuracy!

Two Commercial Claims Processing Systems

IBM System z CICS/DB2

Total MIPS 11,302

MIPS Used for commercial claims processing production/dev/test **2418**

Claims per year **4,056,000**

Which system costs less for future growth?

Calculate cost per workload

HP Servers + ISV

Production Servers
HP 9000 Superdome rp4440
HP Integrity rx6600

Dev/Test Servers
HP 9000 Superdome rp5470
HP Integrity rx6600

Claims per year **327,652**

Build   Buy

Allocated Annual Costs For Two Systems

	Mainframe	Distributed
Hardware	1,302,205	87,806
Hardware Maint	315,548	
Software IBM MLC	4,842,384	
Software Non IBM OTC	647,843	196,468
Software Non IBM MLC	5,027,936	
Storage	877,158	
Network	418,755	
Support Staff	2,324,623	257,289
Platform + Staff Total	15,756,452	541,563
Platform + Staff Claims Allocation	3,371,880	541,563
Billing Center	1,611,650	
Call Center	2,920,090	
Development	1,907,382	
Total	9,811,002	541,563
Claims Processed	4,056,000	327,652
$ Per Claim	**2.42**	**1.65**

Provided by customer finance department

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Mainframe costs easily identified, distributed costs difficult to identify

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Billing and Call center costs allocated to mainframe, but would be the same for either option

Allocated Annual Costs For Two Systems

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Hardware Maint	315,548		
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Software Non IBM MLC	5,027,936		
Storage	877,158		
Network	418,755		
Support Staff	2,324,623	257,289	Billing and Call center costs allocated to mainframe, but would be the same for either option
Platform + Staff Total	15,756,452	541,563	
Platform + Staff Claims Allocation	3,371,880	541,563	
Billing Center	1,611,650		
Call Center	2,920,090		Development still required to customize packaged software for each new contract
Development	1,907,382		
Total	9,811,002	541,563	
Claims Processed	4,056,000	327,652	
$ Per Claim	**2.42**	**1.65**	

True Costs Per Workload

	Mainframe	Distributed
Hardware	1,302,205	87,806
Hardware Maint	315,548	
Software IBM MLC	4,842,384	
Software Non IBM OTC	647,843	196,468
Software Non IBM MLC	5,027,936	
Storage	877,158	?
Network	418,755	?
Support Staff	2,324,623	257,289
Platform + Staff Total	15,756,452	541,563
Platform + Staff Claims Allocation	3,371,880	541,563
Billing Center	same	same
Call Center	same	same
Development	1,907,382	193,271
Total	5,279,262	734,834
Claims Processed	4,056,000	327,652
$ Per Claim	**1.30**	**2.24**

IBM Confidential

Mainframe has lower cost per workload

A Note On Support Staff Annual Costs

IBM System z CICS/DB2

$0.79 per claim →

HP Servers + ISV

Production Servers
HP 9000 Superdome rp4440
HP Integrity rx6600

← **$0.12 per claim**
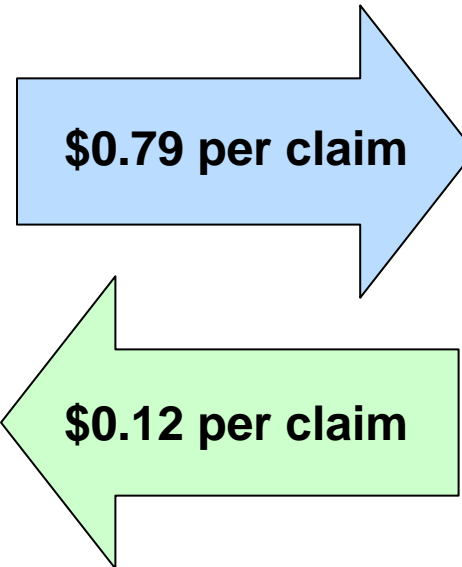
Total MIPS 11,302

MIPS Used for commercial claims processing production/dev/test **2418**

Claims per year **4,056,000**

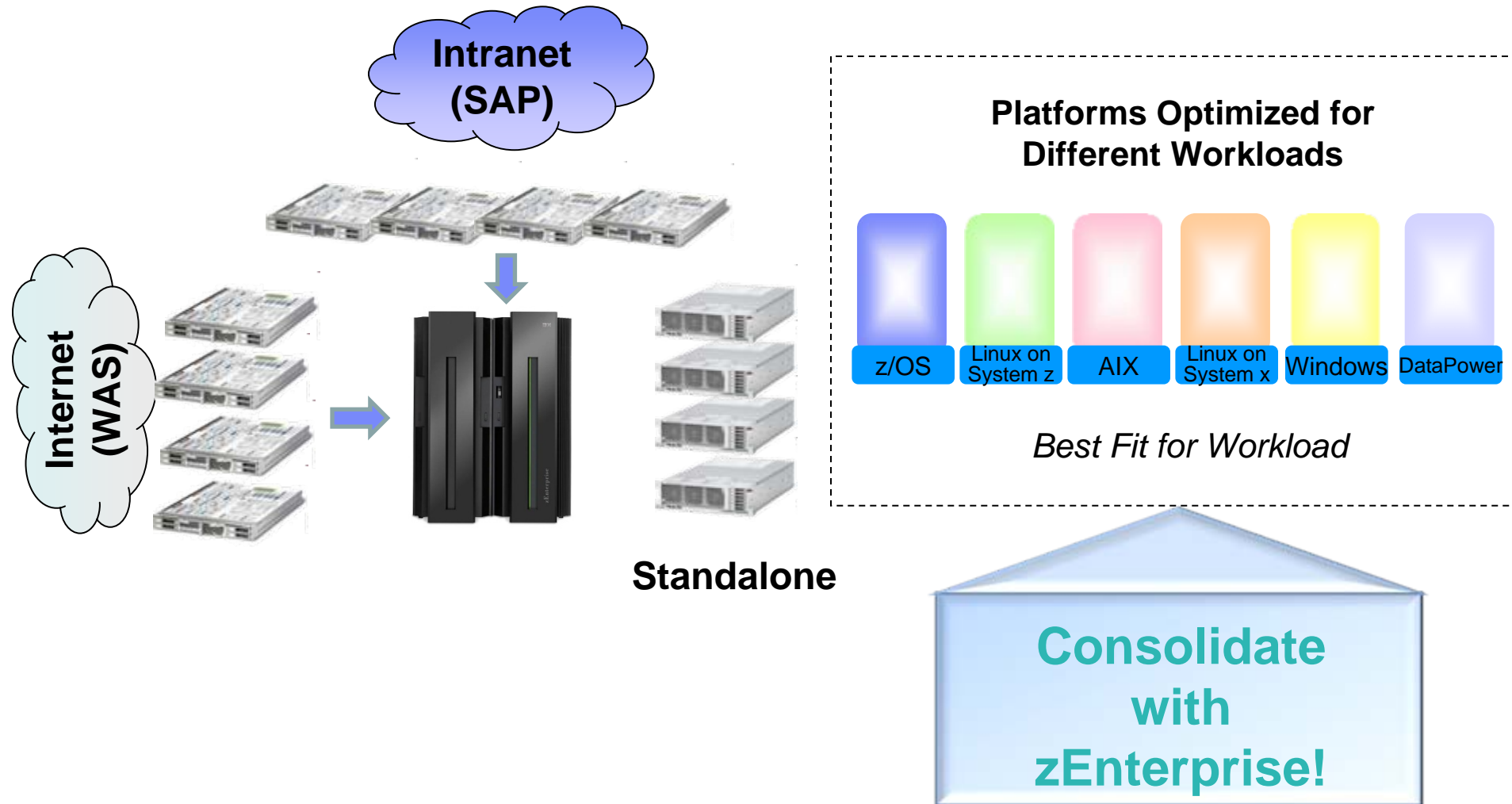**Mainframe support staff has 6.6x better productivity**

Dev/Test Servers
HP 9000 Superdome rp5470
HP Integrity rx6600

Claims per year **327,652**

Smarter Computing - Collapse Peripheral Workloads Into zEnterprise

Intranet (SAP)

Internet (WAS)

Standalone

Platforms Optimized for Different Workloads

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

Best Fit for Workload

Consolidate with zEnterprise!
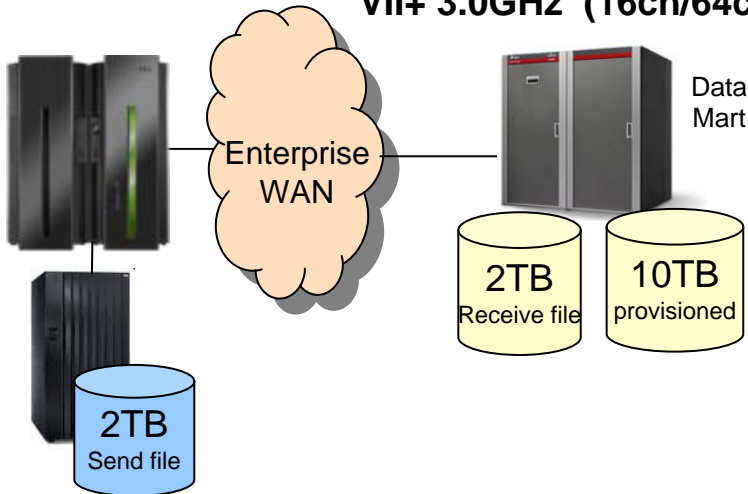
Backup

Compare The Cost Of Database Workloads On System z vs. Intel

- **CPO lab measurements of isolated database workload equivalence**
  - 1 MIP = 7.24 RPE

- **When deployed in a real world mainframe environment with multiple workloads, the resulting ratio scales by a factor of 6**
  - 1 MIP = 43.5 RPE

- **Using this equivalence one can estimate the upper limit of database throughput performance on Intel relative to the throughput of DB2 on System z (expressed in MIPS)**

- **The costs for these two alternatives can be compared at different MIPS levels**

- **Intel delivers lower costs for database workloads up to about 3000 MIPS**

- **System z delivers lower costs for DB2 workloads greater than 3000 MIPS**
  - System z cost advantage increases as the workload gets larger

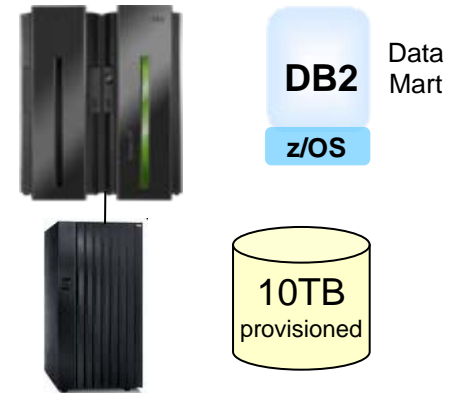* Relative Performance Estimate(1) from Ideas International

Co-locating Data Mart On z196 Costs 89% Less Than Standalone Oracle Data Mart

Add M9000-32 SPARC64 VII+ 3.0GHz (16ch/64co)

Data Mart

Enterprise WAN

2TB
Receive file

10TB
provisioned

2TB
Send file

Equivalent
Data Mart Performance
~116,000 QpH

**Incremental 1GP+ 1zIIP
2,104 MIPS**

DB2

z/OS

Data Mart

10TB
provisioned

Total Incremental Cost
$14.94M 3yr TCA
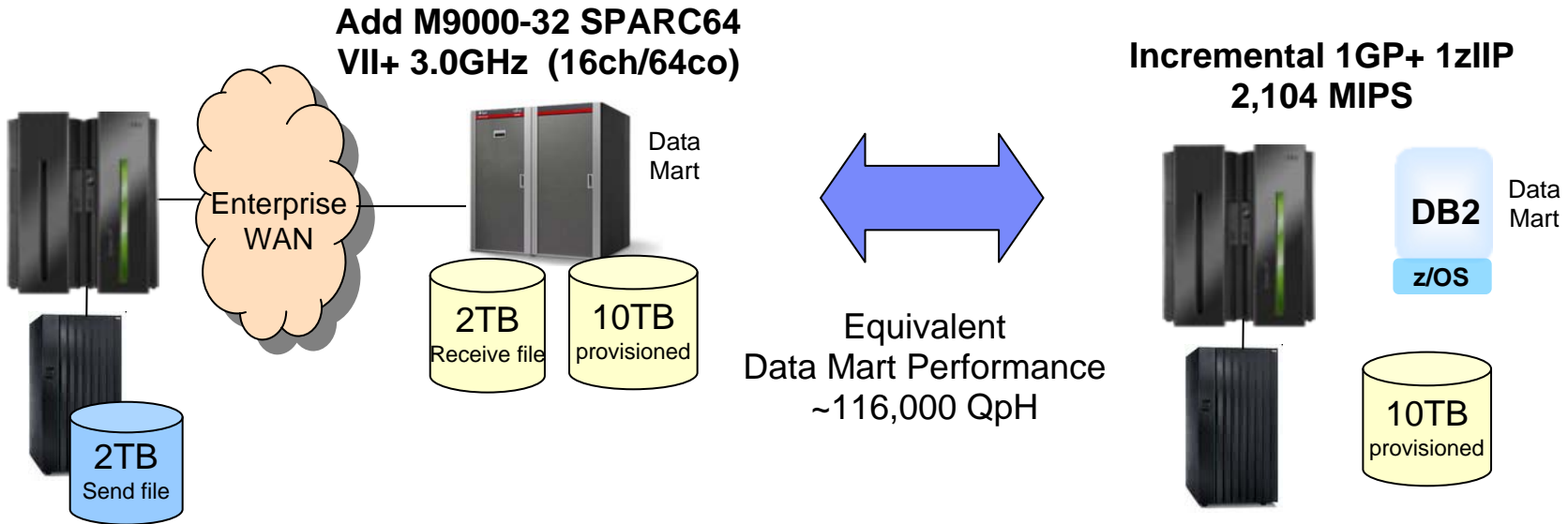
Data Mart Hardware = $2,552,975
Data Mart Software = $5,045,440
Data Mart Storage = $184,320
FTP File Storage = $62,116
Storage Admin = $367,533
Transfer Costs = $6,729,870

Total Incremental Cost
$1.7M 3yr TCA

Data Mart Hardware = $294,293
Data Mart Software = $1,107,102
Data Mart Storage = $117,505

Storage Admin = $180,630

Co-locating Data Mart On z196 Costs 90% Less Than Standalone Oracle Data Mart

Add M9000-32 SPARC64 VII+ 3.0GHz (16ch/64co)

Data Mart

Enterprise WAN

2TB Receive file

10TB provisioned

2TB Send file

Equivalent Data Mart Performance ~116,000 QpH

Incremental 1GP+ 1zIIP 2,104 MIPS

DB2

z/OS

Data Mart

10TB provisioned

Total Incremental Cost
$14.6 3yr TCA

Data Mart Hardware = $2,552,975
Data Mart Software = $5,045,440
Data Mart Storage = $184,320
FTP File Storage = $62,116
Transfer Costs = $6,729,870

Total Incremental Cost
$1.5M 3yr TCA

Data Mart Hardware = $294,293
Data Mart Software = $1,107,102
Data Mart Storage = $117,505
(Solution Edition for DW pricing)