zEnterprise – An Ideal Basis For Smarter Computing

Understanding The Value Of The Mainframe Today

Track Agenda

60 minutes	**Understanding The Value Of The Mainframe Today**
60 minutes	**Simplify And Compress Hardware Infrastructure With zEnterprise**
15 minutes	*Break*
60 minutes	**System z – 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	**TCO Lessons From Customer Engagements**
5 minutes	Close

The Mainframe Has Changed!

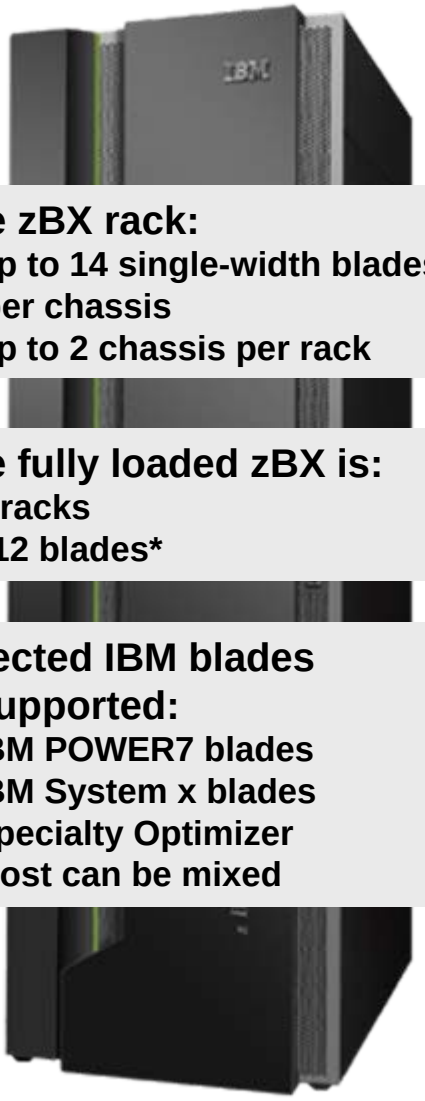
- zEnterprise system offers zBX racks attached to a traditional z114 or z196 central processing facility
  - World's first multi-architecture platform supporting multiple, virtualized operating system environments

- Enables fit-for-purpose mapping of workloads to optimum execution environments
  - Consolidate data center workloads
  - Manage from central point

z114/z196 zBX

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**

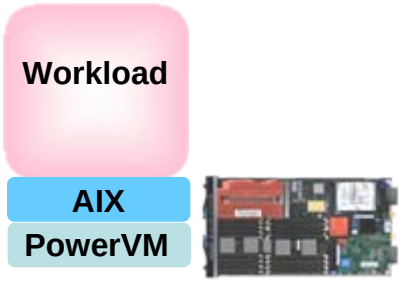
One fully loaded zBX is:
- **4 racks**
- **112 blades***

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. Power, x and DP blades can be mixed in same chassis.

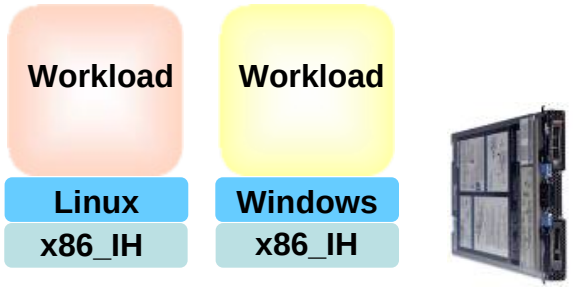
zBX Supports POWER, System x And DataPower Optimizer Blades

POWER7 Blades



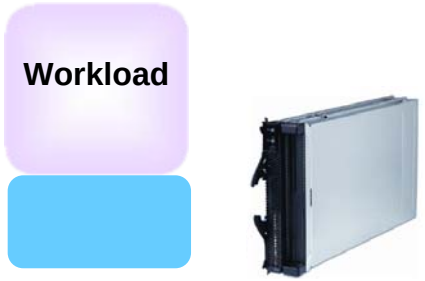
- POWER7 PS701 Express
  - Single-width, **8cores**, 3.0 GHz
    - Up to 4 threads per core
  - AIX 5.3+
  - PowerVM hypervisor

System x Blades



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

DataPower XI50z

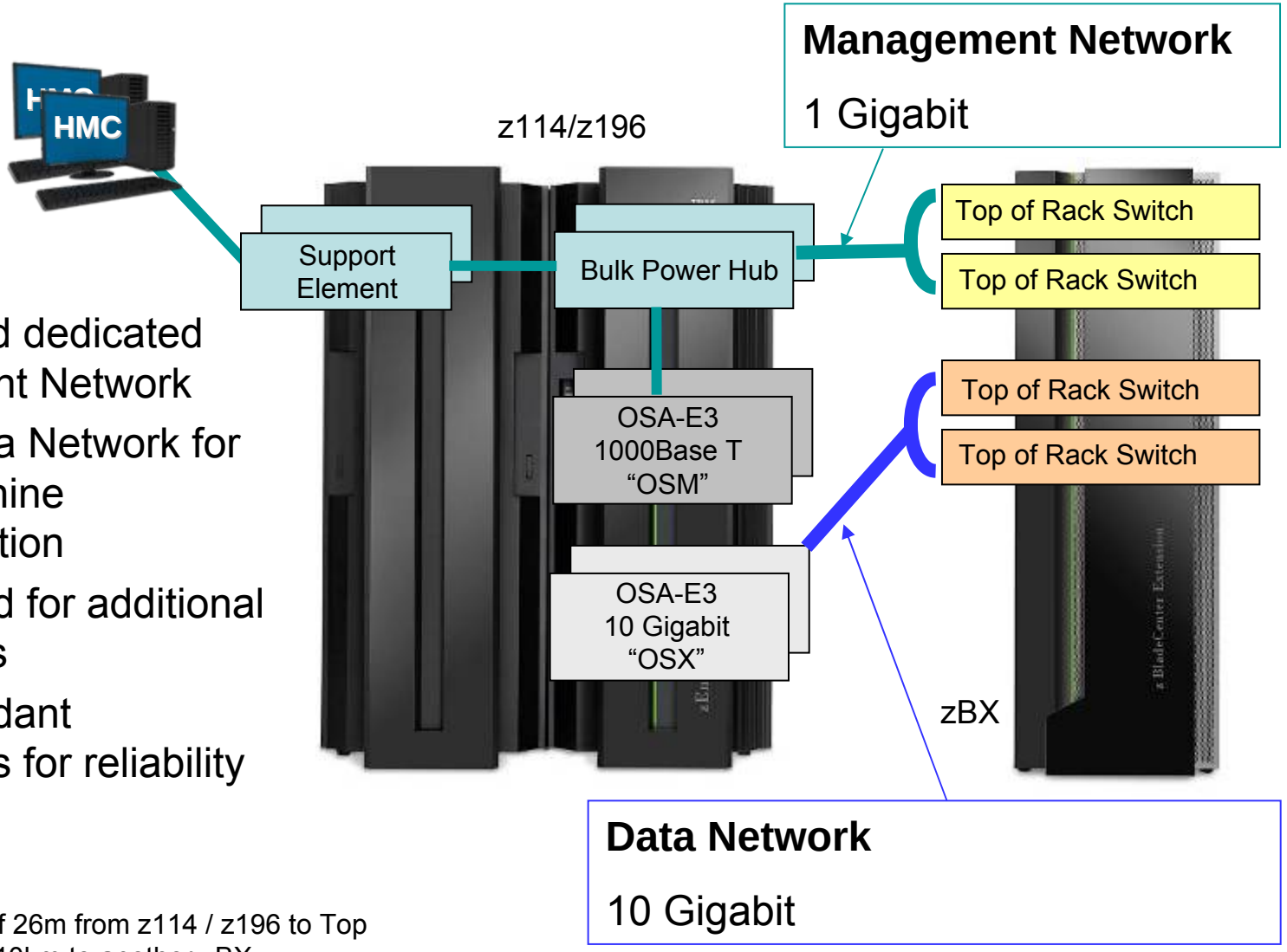


- Blade appliance designed for integration with and management by zEnterprise
- Optimized for specific message processing functions
  - Pre-packaged including hardware, software, memory

Blades run distributed software purchased through Passport Advantage

zEnterprise Is Connected Via Secure Networks

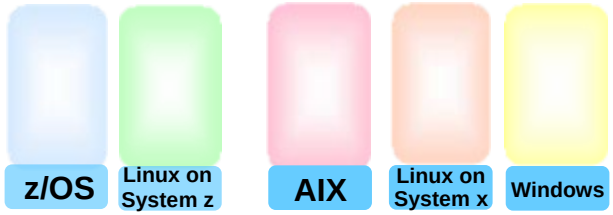
- Isolated and dedicated Management Network
- Secure Data Network for virtual machine communication
  - No need for additional firewalls
- Fully redundant components for reliability



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

Smarter Computing With zEnterprise Delivers Breakthrough Economics

Platforms Optimized For Different Workloads



Best fit for workload

Consistent Structured Management

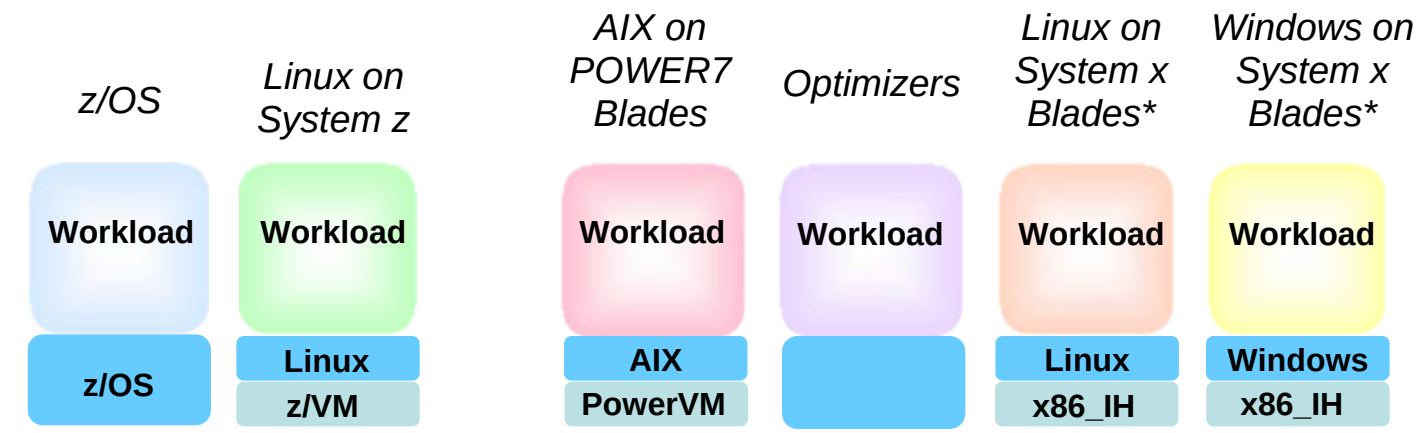
Lowest labor costs

Lowest Cost Of Acquisition Per Workload

Lowest Cost Of Operation Per Workload

Lowest Cost Per Workload

“Best Fit” Assignment Of Workloads Yields Lowest Cost Per Workload

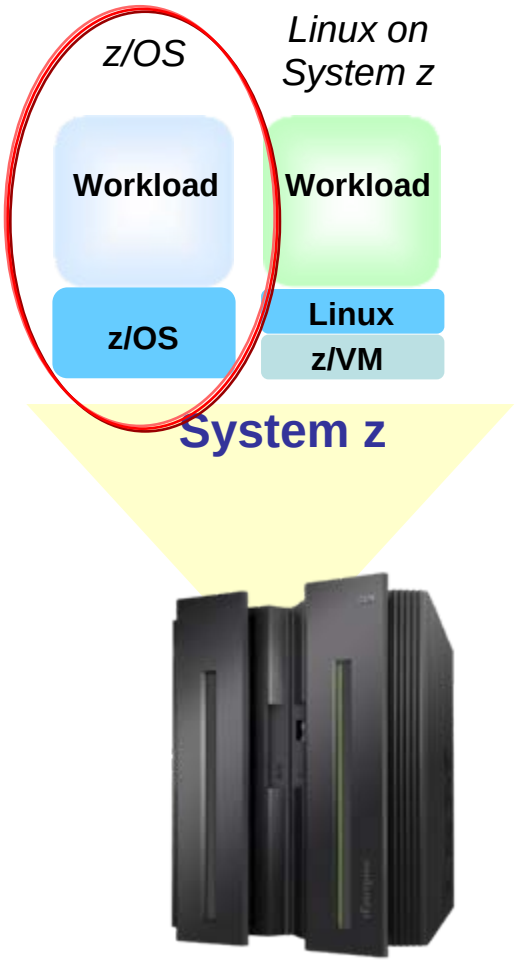


Best Fit Strategy

- Multiple environments to support a broader range of existing workloads
- When there is a choice, workloads can be assigned to environment with the best match for cost and quality of service

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

Best Fit Assignment Of Workloads Yields Lowest Cost Per Workload



Let's look at some best-fit workloads for the traditional z/OS environment first

IBM

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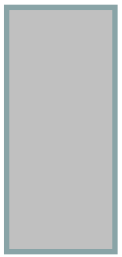
Competitors Claim Equivalent Performance At Lower Cost

Competitor On Intel



Quarter Rack
2 DBMS Nodes **16 cores** (Intel)
111,062 RPE
3 Storage Servers

Hardware	$1,043,921
Software	$1,186,560

Total (3yr TCA) **$2.23M** (List)

System z

DB2 v10 on z/OS
z196 **16 cores** (8GP+ 8zIIP)
14,371 total MIPS
1.8TB DS8000 100% SSD

Hardware	$12,967,018
Software	$6,498,814

Total (3yr TCA) **$19.47M** (List)

Competitors claim equivalent performance

“Parity per core”

“Lower cost”

Let’s Set The Record Straight!

- Server cost and simple benchmarks do not illustrate the true value of System z
- Real world deployment experiences tell a different story
- System z is the lowest cost solution for a class of enterprise workloads

Surveys Confirm Mainframes Are Lowest Cost For Core Business Workloads

Industry	Measure	Average IT Cost of Goods	Mainframe Biased	Server Biased	% Improvement
Bank	Per Teller Transaction	$0.31	$0.12	$0.35	-66%
Mortgage	Per Approved Loan	$263.67	$98.38	$290.80	-66%
Credit Card	Per Transaction	$0.16	$0.10	$0.18	-44%
Railroads	Per Ton Mile	$0.0014	$0.0012	$0.0018	-33%
Armed Service	Per Person	$8,036	$6,871	$9,839	-30%
Automotive	Per Vehicle	$333	$275	$370	-26%
Retail	Per Store (Door)	$494,818	$421,346	$560,300	-25%
Utilities	Per MegaWatt Hour	$2.63	$2.21	$2.94	-25%
Hospitals	Per Bed per Day	$64.30	$54.4	$71.7	-24%
Oil & Gas	Per Barrel of Oil	$2.10	$1.78	$2.32	-23%
Consulting	Per Consultant	$53,060	$48,900	$62,344	-22%
Trucking	Per Road Mile	$0.177	$0.155	$0.194	-20%
Airlines	Per Passenger Mile	$0.007	$0.0061	$0.0076	-20%
Chemicals	Per Patent	$57,717	$55,800	$59,552	-6%
Web Sites	Per Search	$0.042	$0.046	$0.041	12%

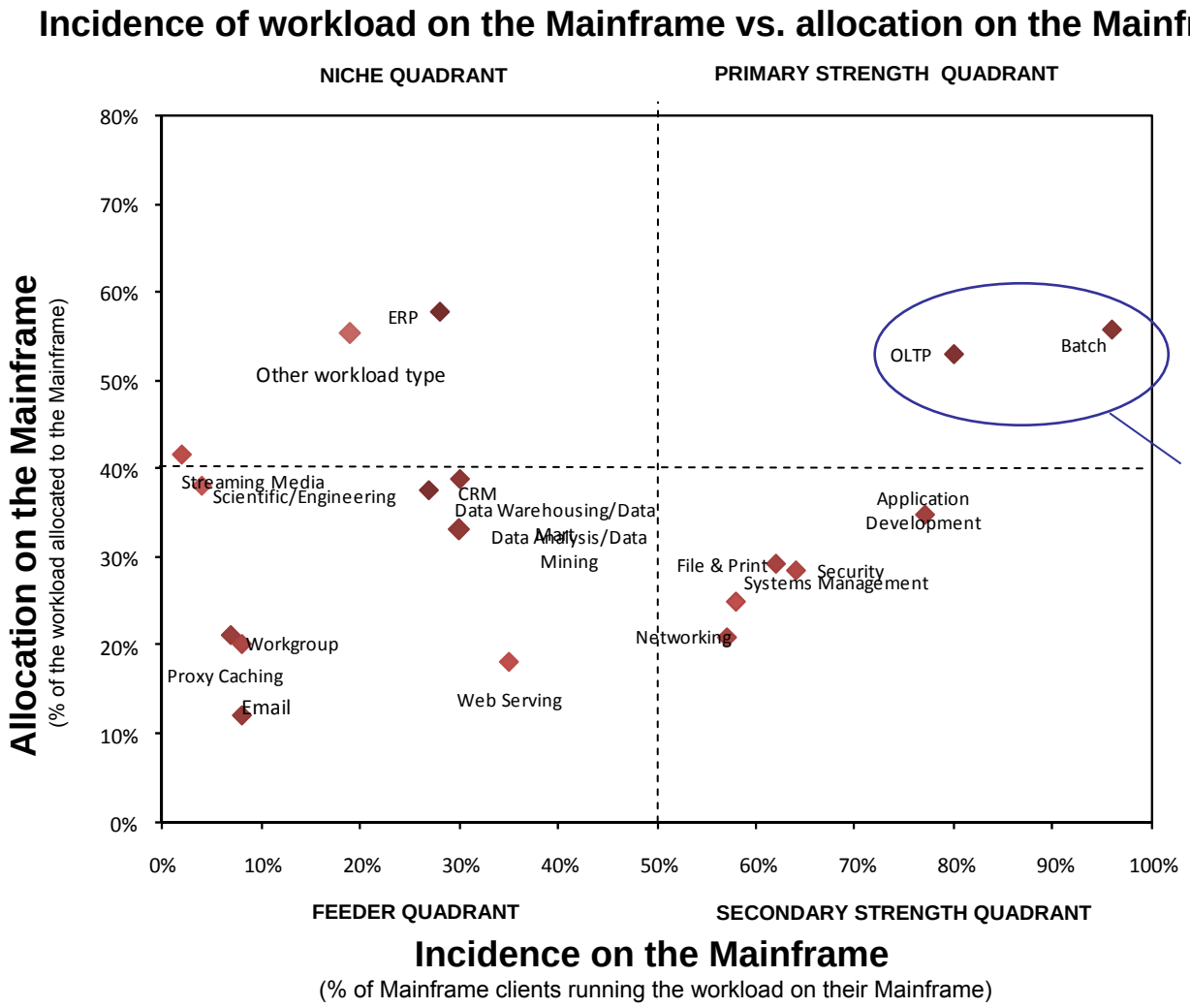
Most businesses running core workloads on mainframes had 6% to 66% lower IT costs per good than those using distributed servers

From Rubin Worldwide analysis of customer data and Gartner Research IT costs

Core Business Workloads Are Fit Best On System z

- System z is optimized for real-world **transaction processing** workloads
  - Online and batch
  - DB2 on z/OS beats Oracle in price/performance
- System z is optimized to run **multiple work loads** thereby enabling higher levels of utilization
  - Consolidating SAP Databases on z/OS beats Oracle in price/performance
- System z is optimized to run **business analytics**
  - Co-locating data marts on z/OS reduces costs
  - IBM DB2 Analytics Accelerator (IDAA) beats Exadata hands down!

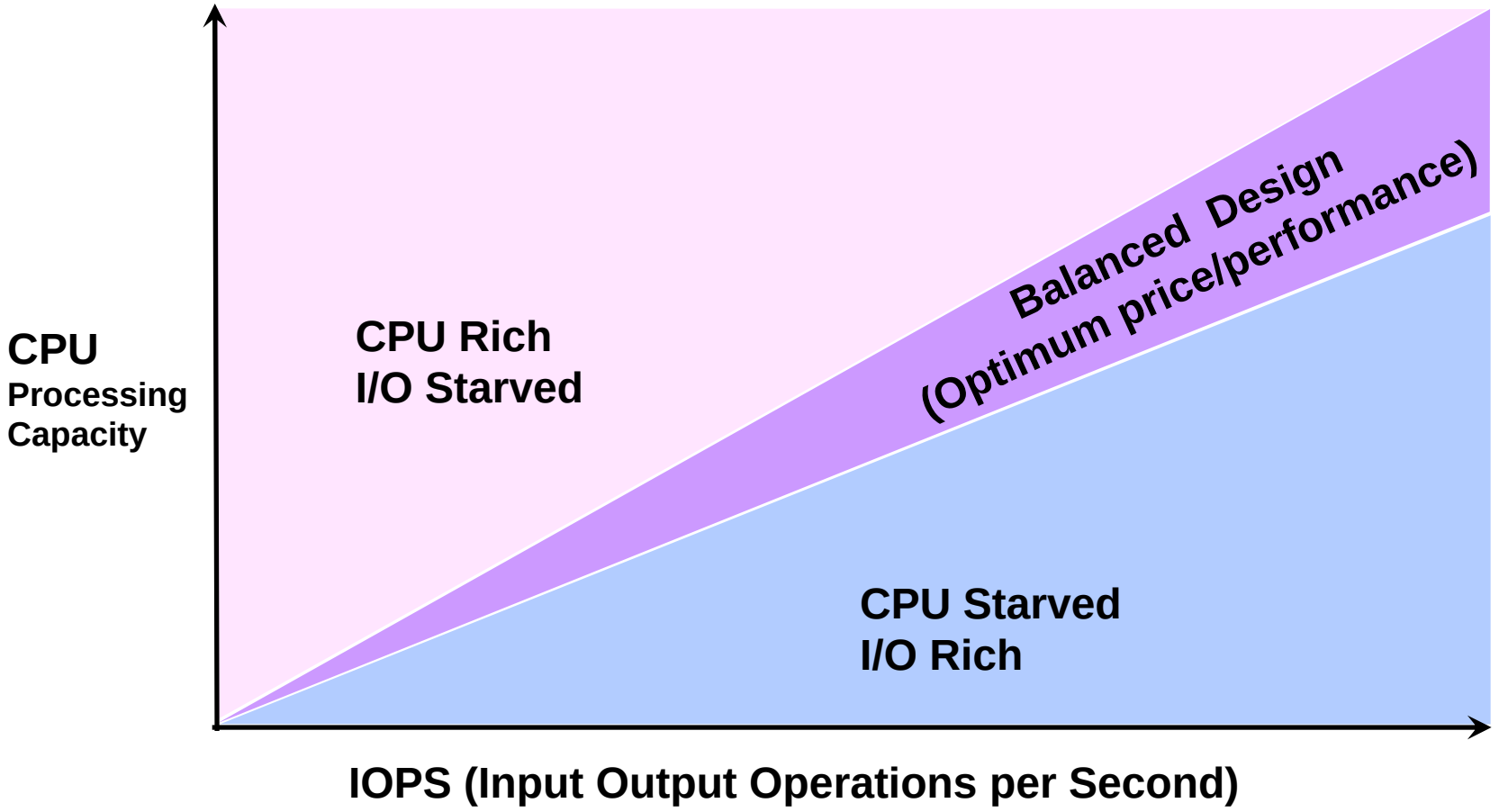
Customers Validate Batch And OLTP As Core Business Workloads For System z



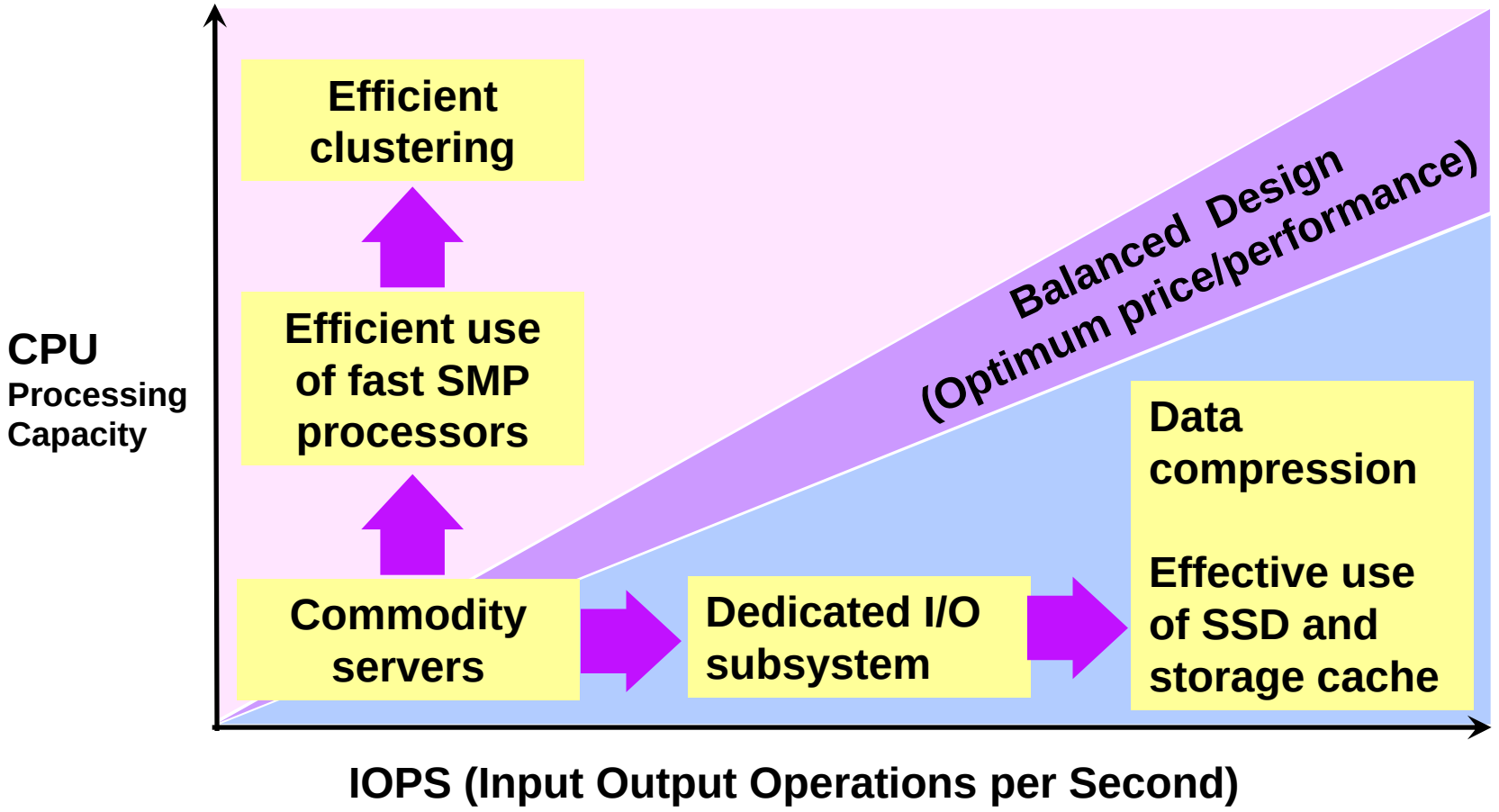
High incidence plus high allocation means OLTP and Batch are core mainframe workloads

Source: IBM Market Intelligence Customer Survey

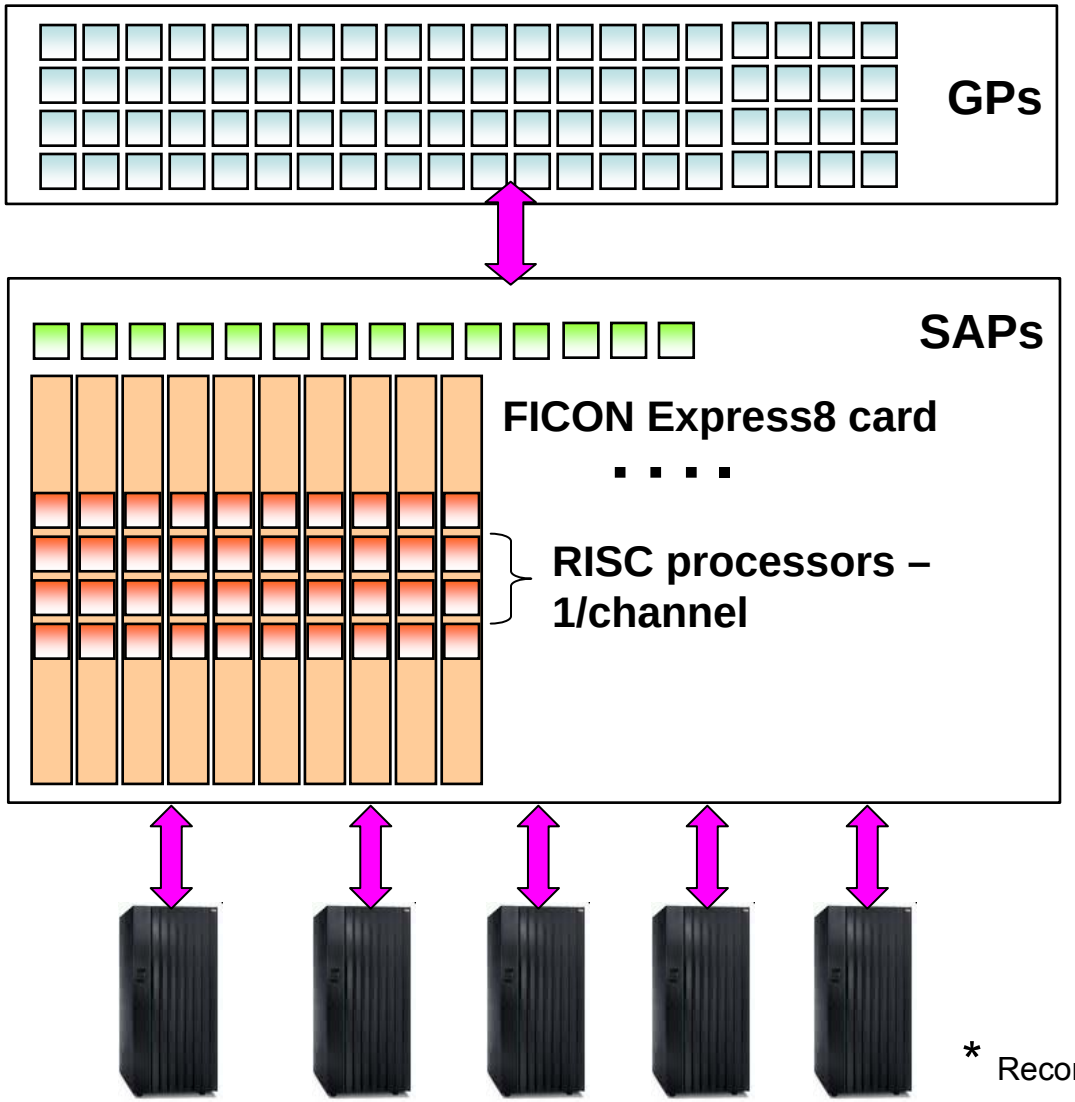
Environments Optimized For Transaction Processing Must Balance Processing Power And I/O Bandwidth



System z Balanced Optimization Technologies Yield Best Performance With Most Efficiency



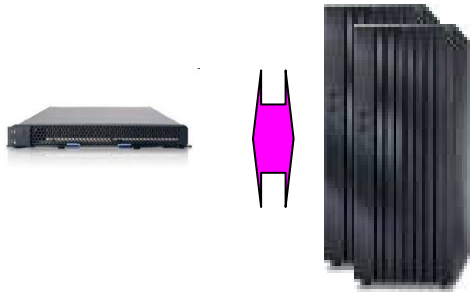
System z Dedicated I/O Subsystem - Optimized For High I/O Bandwidth



- Z196 has 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

Batch Sort/Merge Benchmark – Demonstrates I/O Bandwidth Capacity

Intel x3550 + DS8300	z/OS + DS8800
12 processors 128 GB RAM	8 z196 processors 128 GB RAM
	
Sorting Average CPU 89%	Sorting Average CPU 72%

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

	Intel x3550 + DS8300	z/OS + DS8800
Sorting Total Elapsed	28,800 secs	644 secs
Concurrency	12	45
Bytes Per Sec	**64 MB**	**3,072 MB**

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

	Intel x3550 + DS8300	z/OS + DS8800
Merging Total Elapsed	16,800 secs	558 secs
Concurrency	10	10
Bytes Per Sec	**109 MB**	**3,543MB**

48x more I/O bandwidth than Intel

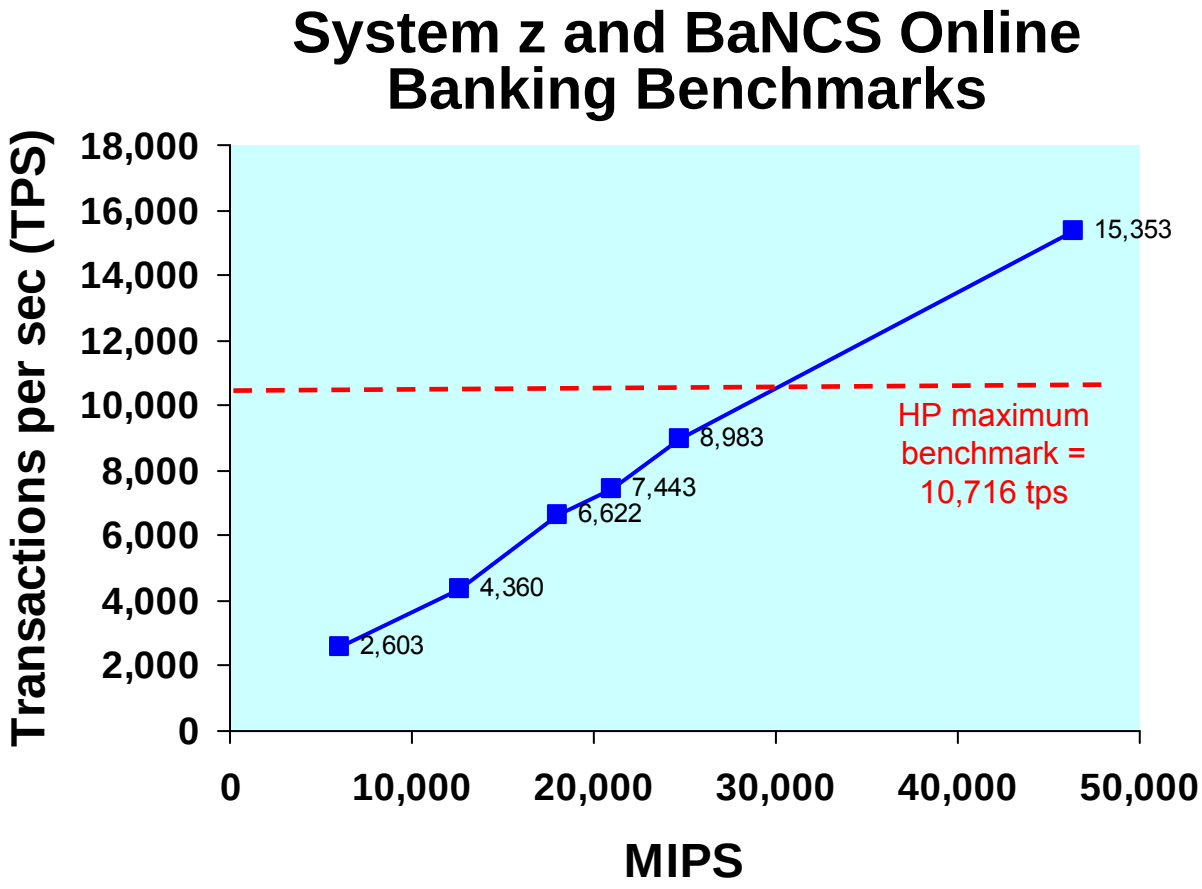
Intel Batch window is 38x longer than z/OS

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

Real-World Benchmarks Show DB2 For z/OS Delivers Better Performance Than Oracle On HP

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

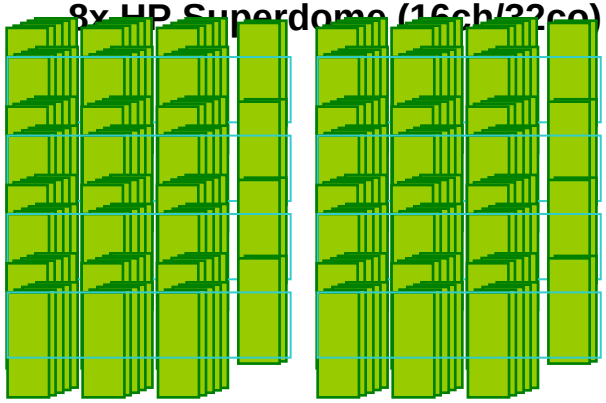
State Bank of India [3]
- **HP Superdome**
- **TCS BaNCS**
- **10,716** Transactions/second
- **500** Million Accounts
- Largest banking benchmark performance claimed by HP



[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

Compare The Cores Needed To Achieve Equivalent Throughput (10,716 Transactions Per Second)

BaNCS Application Servers:
8x HP Superdome (16ch/32co)



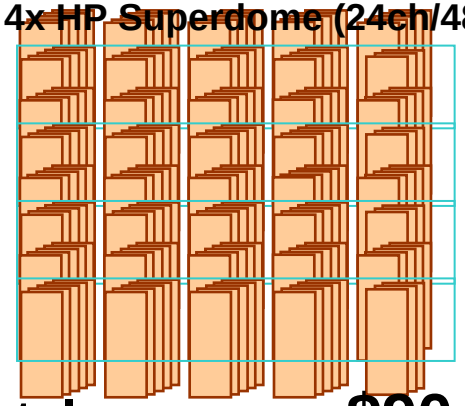
37 processors

(31 GPs + 6 zIIPs)

(30,837 MIPS)

TCS BaNCS
1x z196-731
with 6 zIIPs

BaNCS Database Servers:
4x HP Superdome (24ch/48co)



448 processors

(1,834,300 PerfUnits)

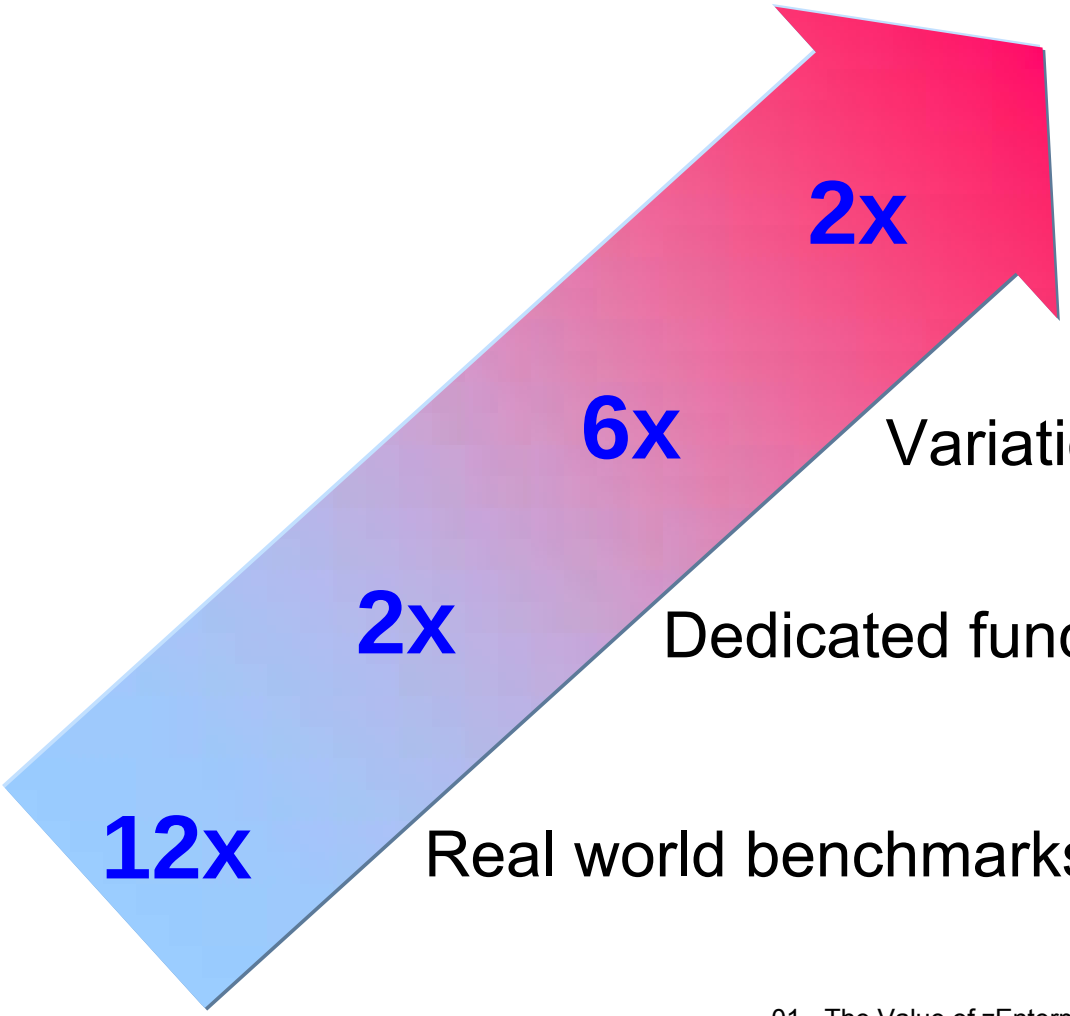
12x more cores

Total (5yr TCA) **$90.0M**

Total (5yr TCA) **$90.7M**

Cores Proliferate Far Beyond Parity

Cores required for equivalent distributed solution



Real world benchmarks

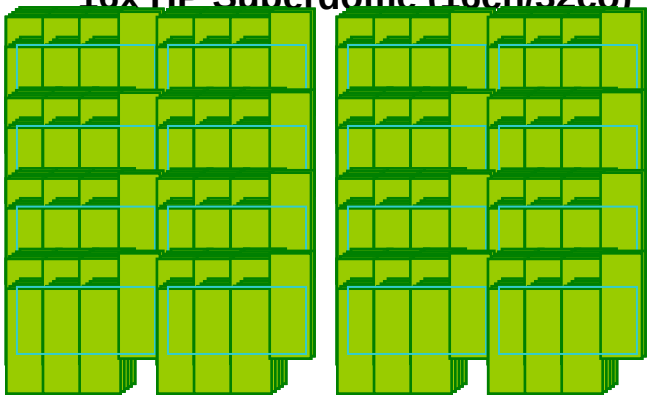
Dedicated functional environments

Variation in workload demand

System management and tools replacements add up

Core Proliferation Drives Up The Cost Of The Distributed Solution (Development And Test Processors Included)

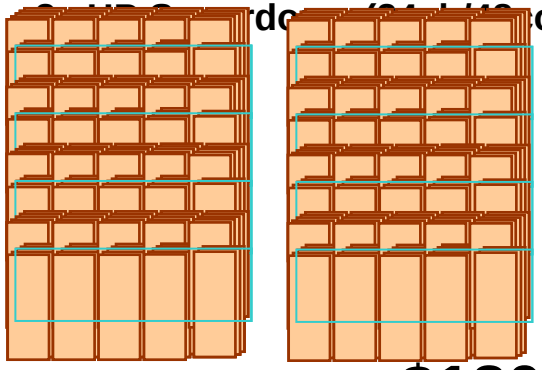
BaNCS Application Servers:
16x HP Superdome (16ch/32co)



49 processors
(41 GPs + 8 zIIPs)
(39,112 MIPS)

TCS BaNCS
1x z196-741
with 8 zIIPs

BaNCS Database Servers:
[illegible]dome (24ch/48co)



896 processors
(3,668,600 PerfUnits)

18x more cores

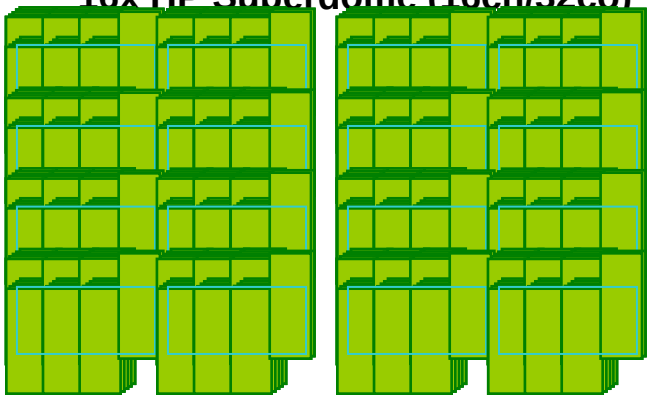
Total (5yr TCA) **$180M**

Total (5yr TCA) **$110M**

NOTE: To cover DEV/QA capacity, add 100% servers for distributed servers, add 25% MIPS (8,000) to System z

Hardware And Software Costs Are Primary

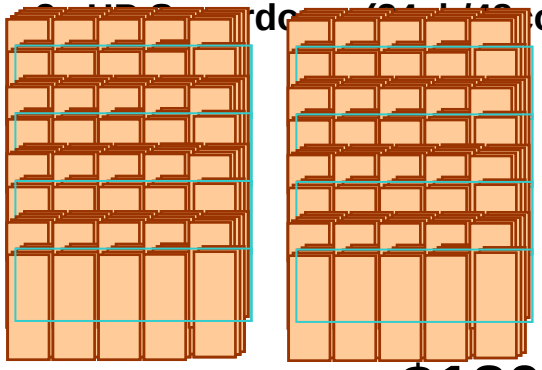
BaNCS Application Servers:
16x HP Superdome (16ch/32co)



49 processors
(41 GPs + 8 zIIPs)
(39,112 MIPS)

896 processors
(3,668,600 PerfUnits)

BaNCS Database Servers:
[illegible]



Hardware	*$98.2M*
Software	*$78.2M*
Power	*$1.5M*
Space	*$1.1M*

Total (5yr TCA) **$180M**

TCS BaNCS
1x z196-741
with 8 zIIPs

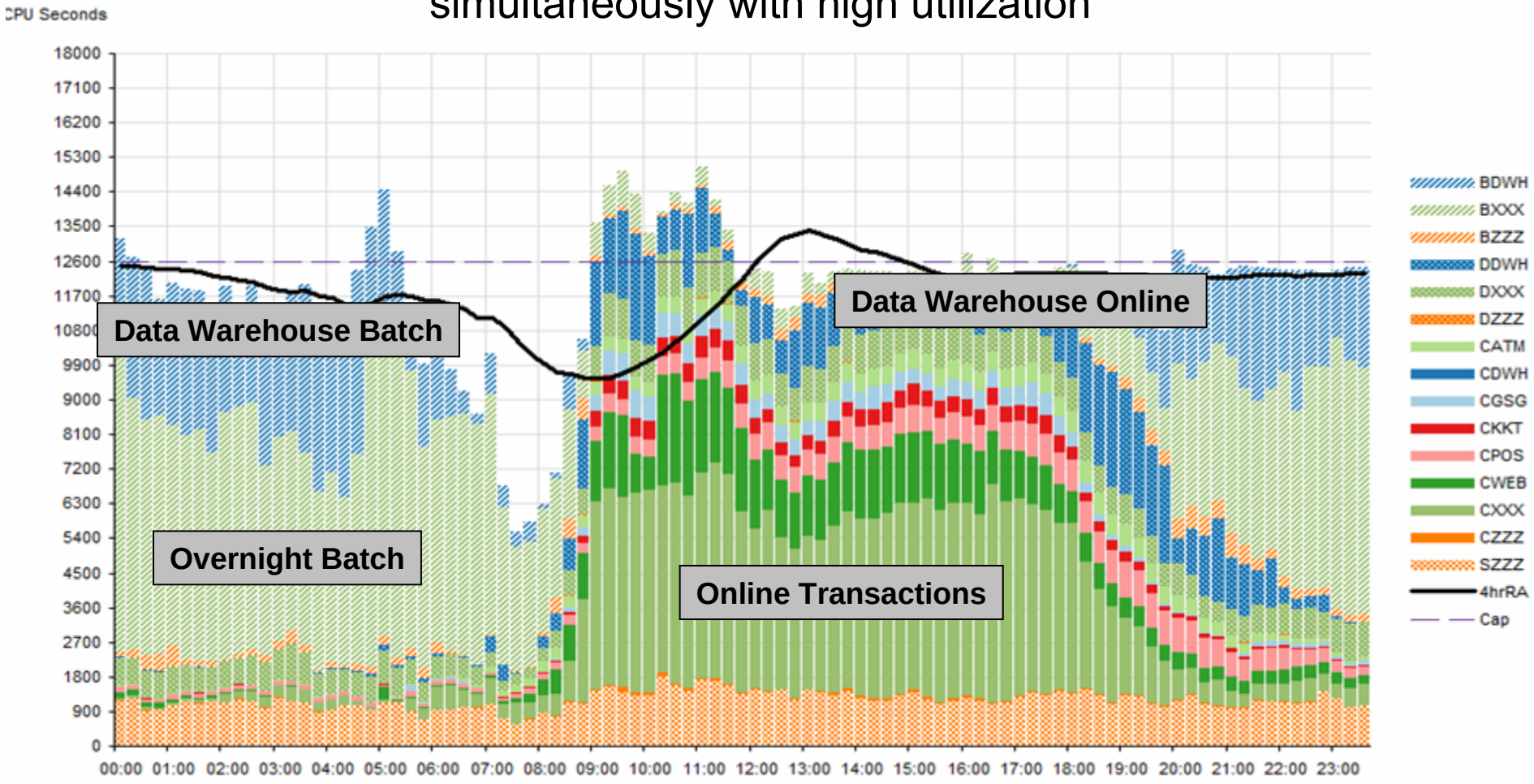
Hardware	*$64.2M*
Software	*$45.6M*
Power	*$0.13M*
Space	*$0.08M*

Total (5yr TCA) **$110M**

NOTE: To cover DEV/QA capacity, add 100% servers for distributed servers, add 25% MIPS (8,000) to System z

System z Workload Manager Easily Handles Workload Peaks For Optimum Core Efficiency

Example: Core banking workloads running on z/OS simultaneously with high utilization



Euro Bank Study – Consolidate SAP On DB2

Six SAP databases, Oracle on Intel

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 with Oracle

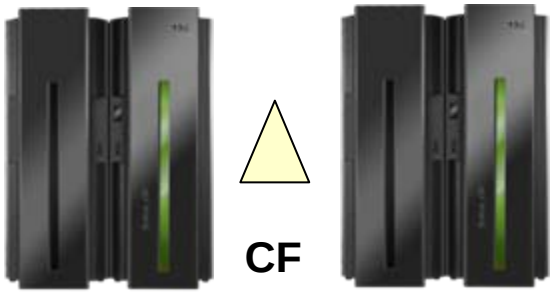
864 cores

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

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

Multi-Tenancy, DB2 on z/OS

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

88% less

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.

CPO Eagle Team Performs Free-of-Charge TCO Studies

- Since 2007, the Eagle Team has performed over 200 TCO studies

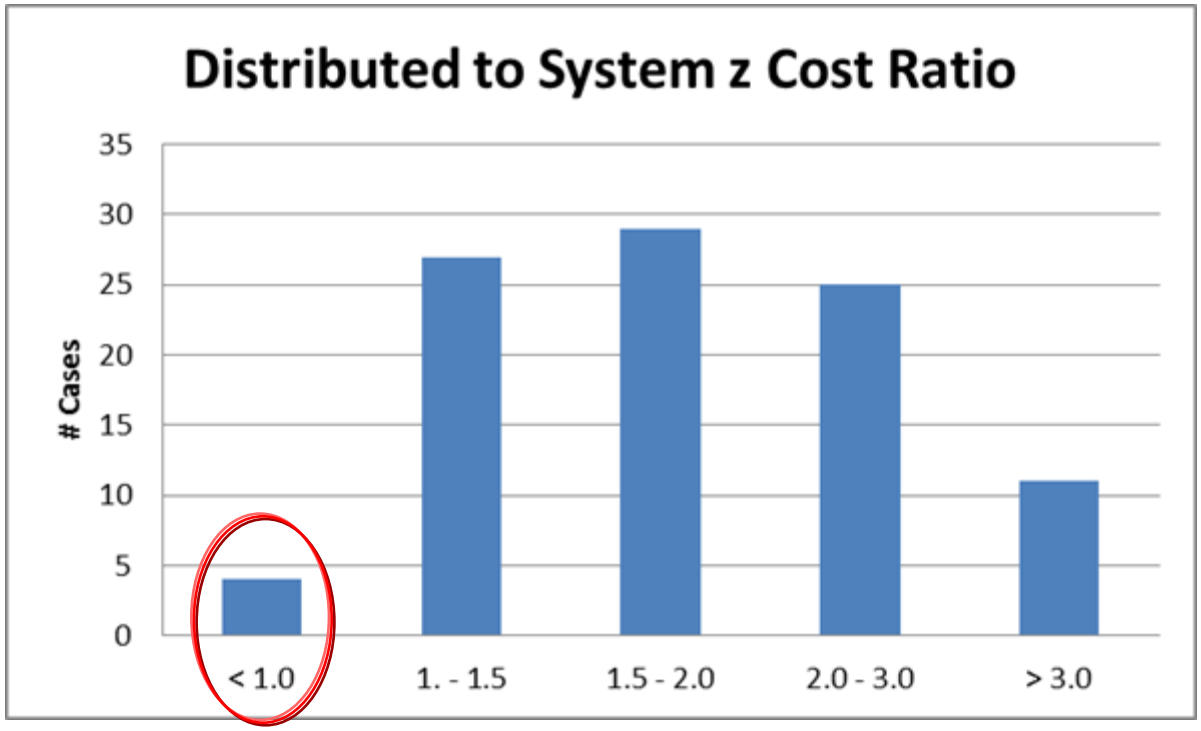
- Typically, TCO study compares three "what-if" scenarios:

  1) Taking applications off the mainframe to a distributed environment
  2) Moving applications from a distributed environment to the mainframe
  3) Identifying the least costly place to put a new application

- Results have shown System z offers better TCO than a distributed alternative… with very few exception

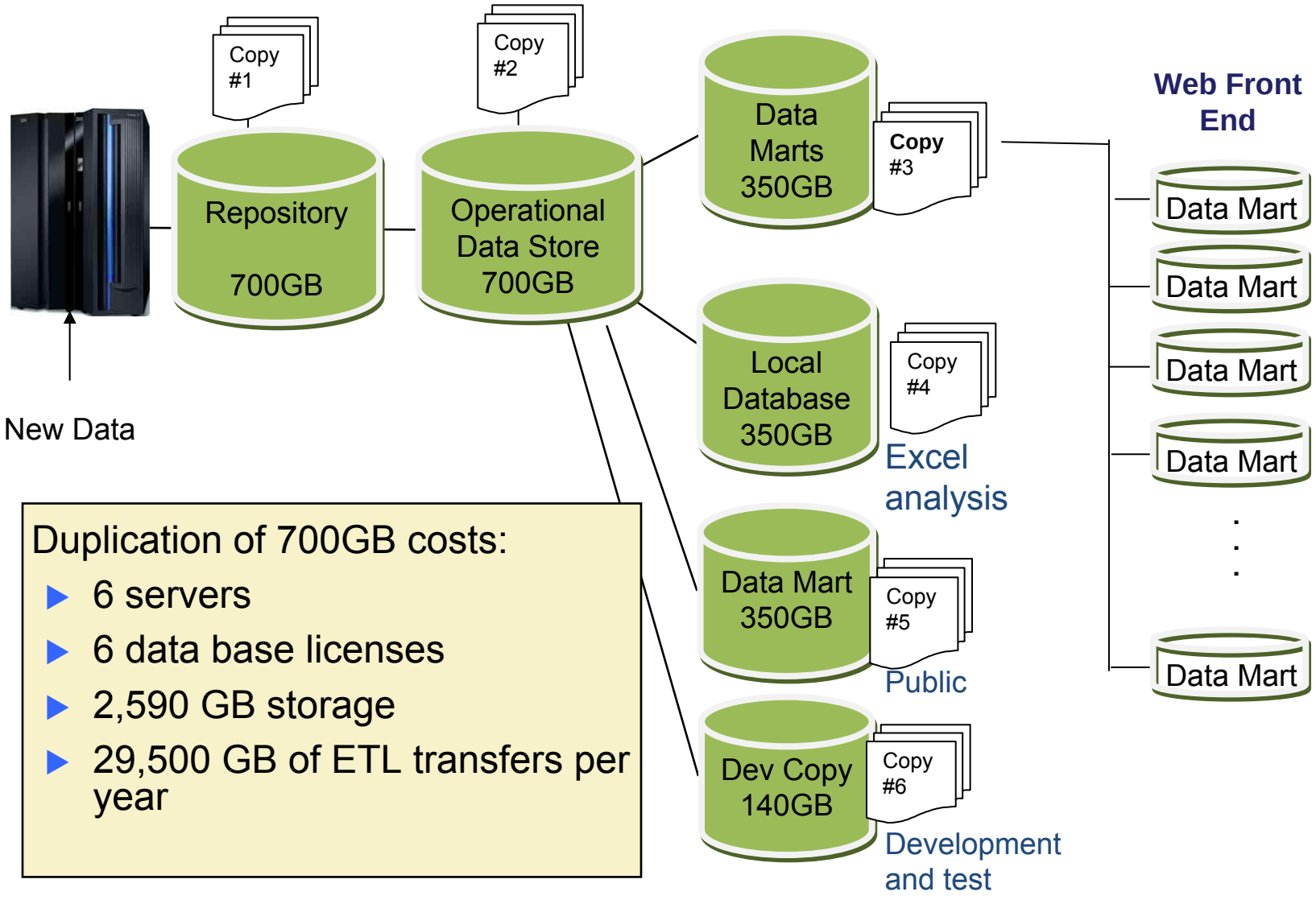
For more information, contact Craig Bender to discuss your particular situation

Summary Of Eagle TCO Studies



- 97 total customer studies from 88 MIPS to 48,750 MIPS
- Average cost of distributed alternative was 2.2 times greater than System z
- Only 4 out of 97 studies showed lower costs on distributed

Data Mart Proliferation At A Local Government Department



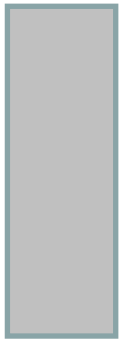
Duplication of 700GB costs:

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

Consolidating Analytics On Optimized zEnterprise Platform Costs 75% Less

Competitor

Quarter Rack



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

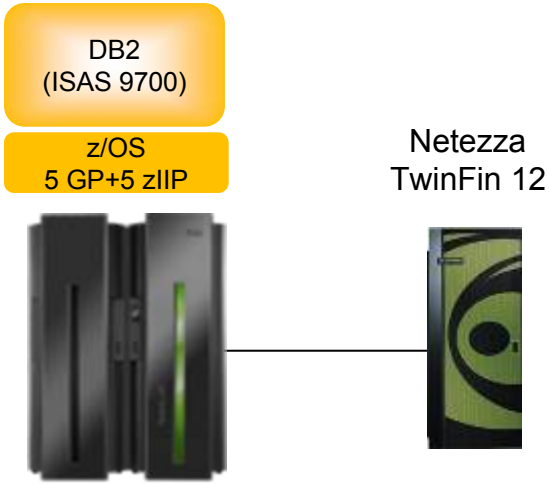
Reports/Hour (RpH)	29,572
Competitor ¼ Rack (HW+SW+Storage)	$2,857,500

IBM Smart Analytics System 9700

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

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

IBM Smart Analytics System 9700 + IDAA



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

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

Cost of data duplication not included

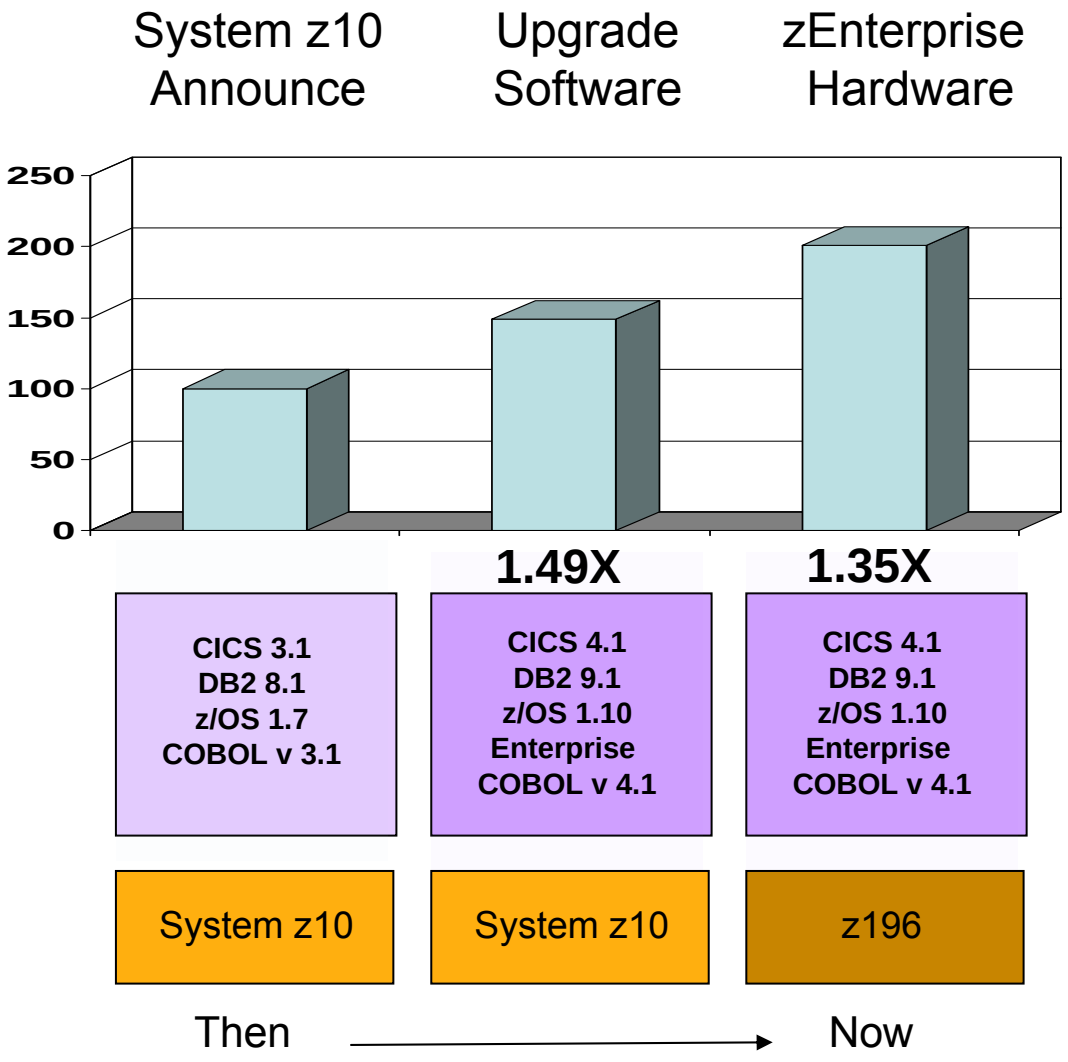
5x performance at ¼ the cost!

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.

Continued Investment In Optimization Of Key z/OS Software

CICS/DB2 Optimizations for z/OS –
From Then to Now

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

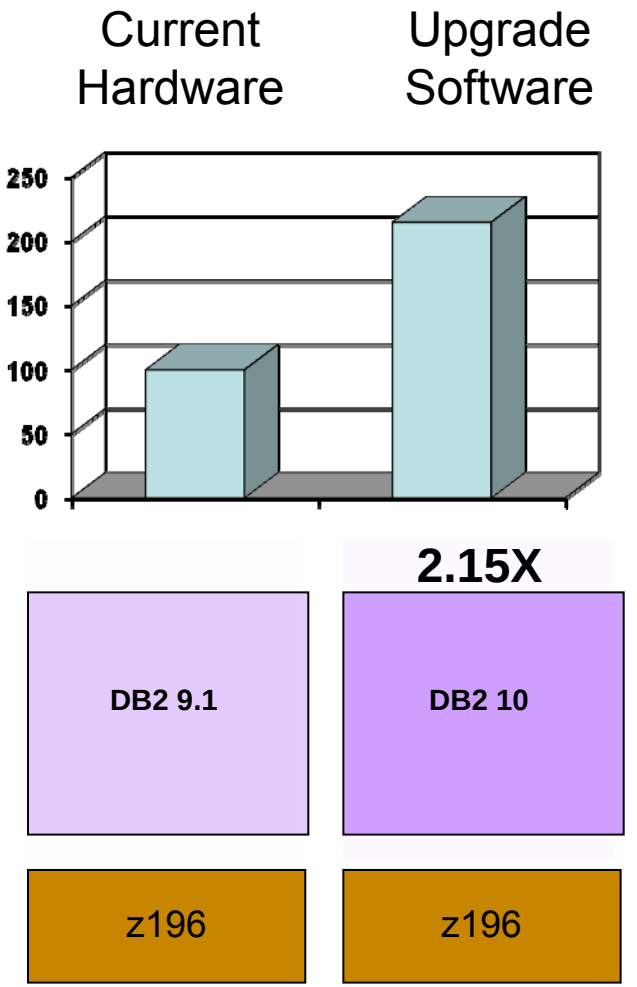


Results may vary

US Financial Company Doubles Performance After Upgrading To DB2 10 And Tuning

Tests showed **2.15x** boost in performance of business intelligence application

- First computed 42 operational BI reports serially
- Then database software upgraded to DB2 10
  - Performed tuning such as computing additional indexes, collecting additional statistics and pre-computing global Temp tables
- Results showed **54%** reduction in response time

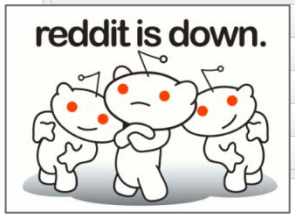


Results may vary

A Complex Scale Out Of Distributed Servers Has Its Risks

North America | Europe | Asia Pacific

	Apr 26	Apr 25	Apr 24	Apr 23	Apr 22	Apr 21	Apr 20
Amazon CloudFront	✓	✓	✓	✓	✓	✓	✓
Amazon CloudWatch (N. California)	✓	✓	✓	✓	✓	✓	✓
Amazon CloudWatch (N. Virginia)	✓	✓	✓	✓	✓	✓	✓
Amazon EC2 (N. California)	✓	✓	✓	✓	✓	✓	✓
Amazon EC2 (N. Virginia)	✓	✓	⚠	⛔	⛔	⛔	✓
Amazon EMR (N. California)	✓	✓	✓	✓	✓	✓	✓
Amazon EMR (N. Virginia)	✓	✓	✓	✓	✓	✓	✓
Amazon Flexible Payments Service	✓	✓	✓	✓	✓	✓	✓
Amazon Mechanical Turk (Requester)	✓	✓	✓	✓	✓	✓	✓
Amazon Mechanical Turk (Worker)	✓	✓	✓	✓	✓	✓	✓
Amazon RDS (N. California)	✓	✓	✓	✓	✓	✓	✓
Amazon RDS (N. Virginia)	✓	✓	⚠	⛔	⛔	⛔	✓
Amazon Route 53	✓	✓	✓	✓	✓	✓	✓
Amazon Simple Email Service (N. Virginia)	✓	✓	✓	✓	✓	✓	✓
Amazon SNS (N. California)	✓	✓	✓	✓	✓	✓	✓
Amazon SNS (N. Virginia)	✓	✓	✓	✓	✓	✓	✓
Amazon SQS (N. California)	✓	✓	✓	✓	✓	✓	✓
Amazon SQS (N. Virginia)	✓	✓	✓	✓	✓	✓	✓
Amazon S3 (N. California)	✓	✓	✓	✓	✓	✓	✓
Amazon S3 (US Standard)	✓	✓	✓	✓	✓	✓	✓
Amazon SimpleDB (N. California)	✓	✓	✓	✓	✓	✓	✓
Amazon SimpleDB (N. Virginia)	✓	✓	✓	✓	✓	✓	✓
Amazon VPC (N. Virginia)	✓	✓	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓	✓	✓
	✓	✓	✓	⚠	⚠	⚠	✓
	✓	✓	✓	✓	✓	✓	✓
	✓	✓	✓	✓	✓	✓	✓



Amazon public cloud platform suffered a 3+ day outage in April, 2011

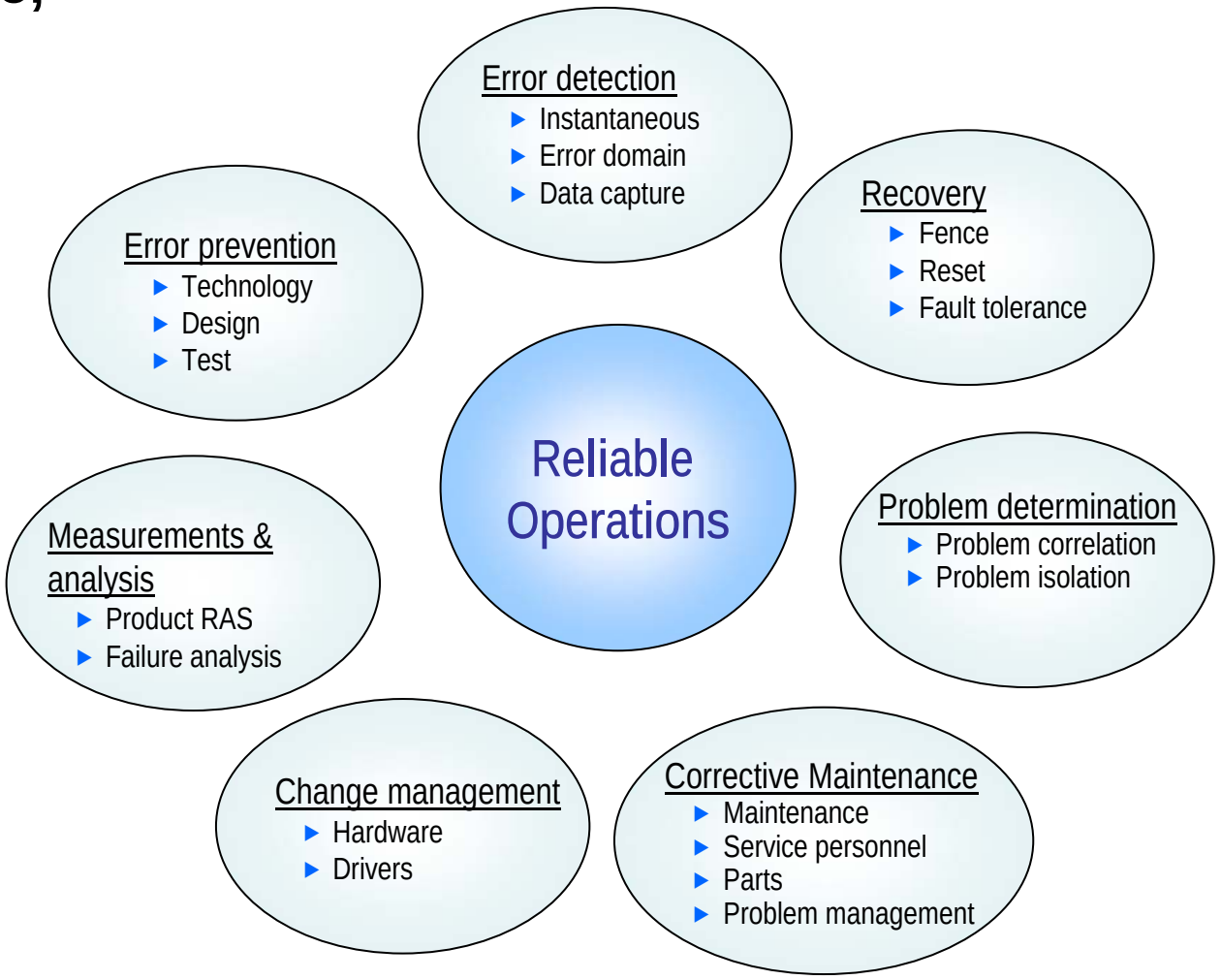
- Distributed architecture designed “for durability and availability”
- Yet a complex *single point of failure* negated the advantage of rapid replacement of failed resources
- Numerous customers suffered significant and unrecoverable data loss

Caveat Emptor!

Source: http://status.aws.amazon.com

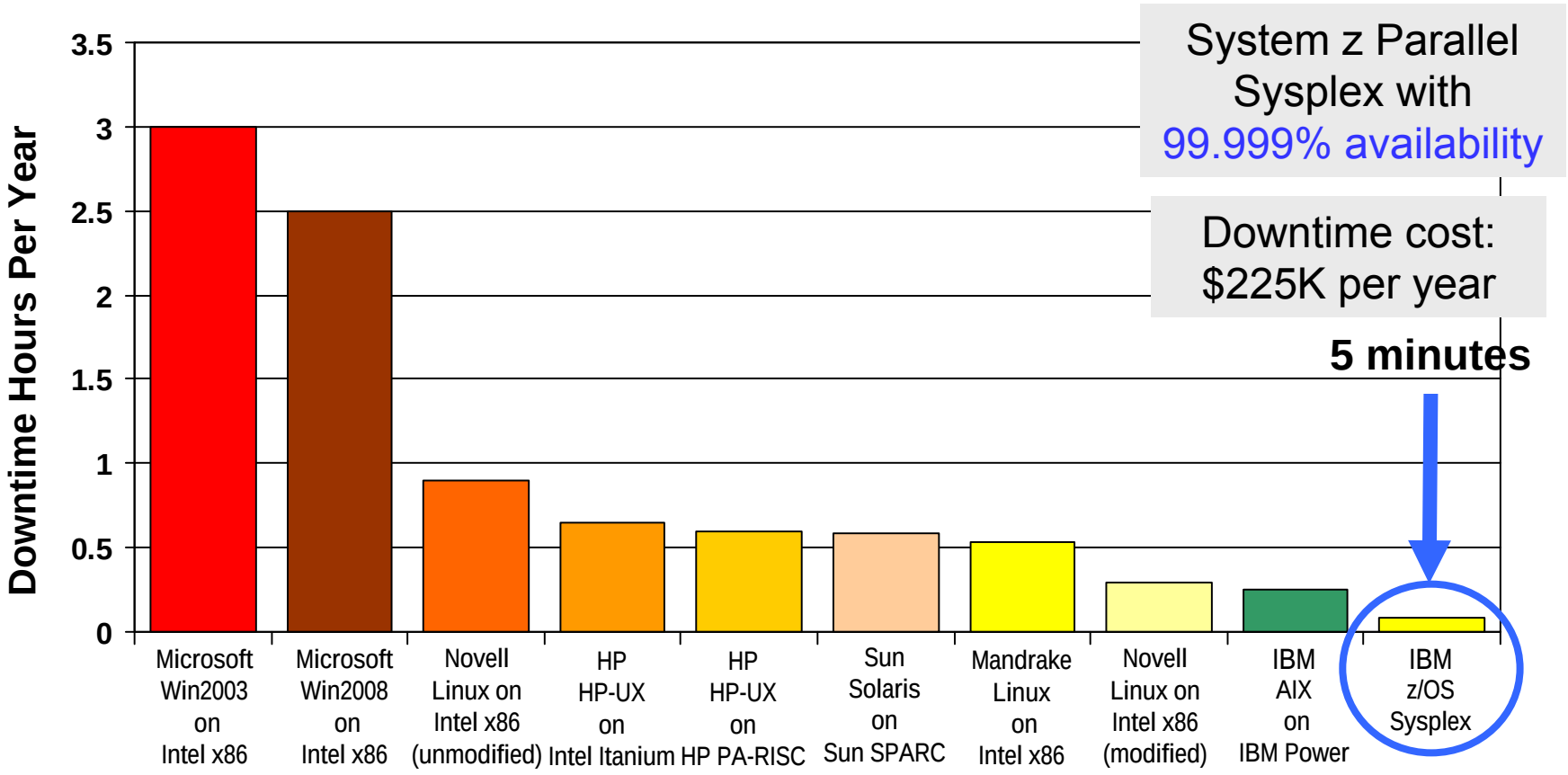
System z Continues A History Of Mainframe Improvements To Reliability And Serviceability

Comprehensive, multi-layered strategy for reliability and serviceability



Result: zOS Delivers The Highest Availability And The Lowest Downtime Cost

(400 participants in 20 countries)



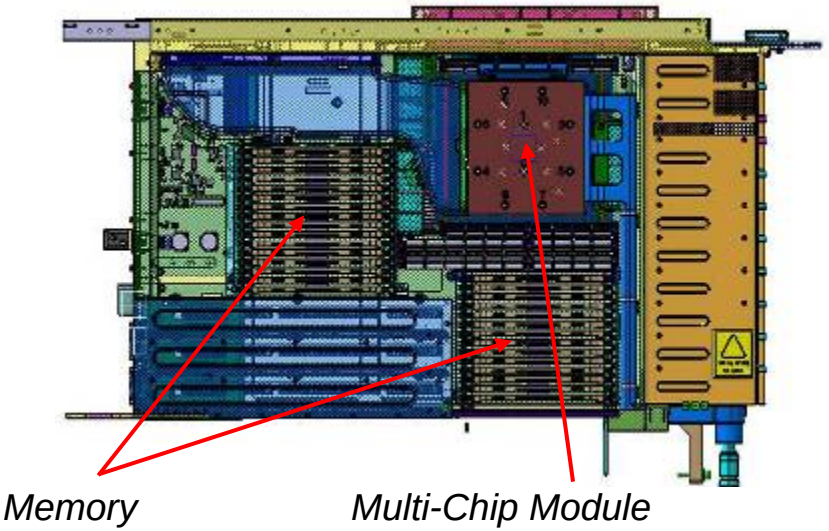
Source: ITIC: ITIC 2009 Global Server Hardware & Server OS Reliability Survey; July 2009; http://itic-corp.com/blog/2009/07/itic-2009-global-server-hardware-server-os-reliability-survey-results/; Results are measured in minutes per year.

*Note: All operating systems included in the survey are not included in this chart. Fifteen operating systems on various processor architectures were included in the survey. The chart will be updated when the full report is available.

Latest Release Continues This Strategy Of Constant Improvements For Availability

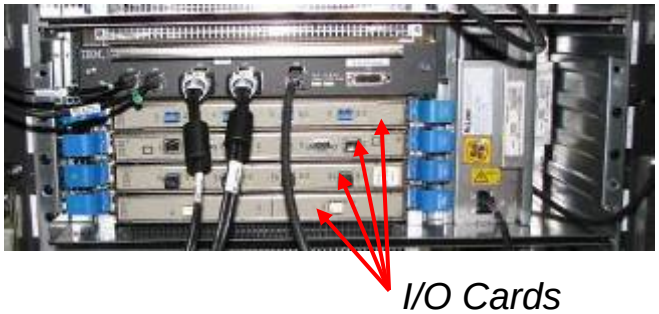
- RAIM memory provides more protection against failure modes
  - Protects DIMM and memory channel components
  - More robust than ECC
  - More cost effective than 100% memory mirroring
  - No performance penalty

z196 Book Layout



- Hot pluggable I/O drawer technology reduces planned down time
  - Perform maintenance while the system keeps running

z196 I/O Drawer (Front)



System z Continues To Deliver Better Administration Productivity

IBM System z CICS/DB2

Total MIPS 11,302

MIPS Used for commercial claims processing production/dev/test **2,418**

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

$0.79 per claim

$0.12 per claim

Mainframe support staff has 6.6x better productivity

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**

Why z/OS Is More Cost Effective, And How You Can Profit From It

- **It's optimized for core business workloads**
  - Run core business workloads with highest reliability and elasticity
- **Workload management reduces cores required**
  - Consolidate SAP data bases into DB2 multi-tenancy
  - Solution Edition pricing
- **No data movement necessary**
  - Consolidate back end data marts on System z
  - IDAA is a game changer
- **Better administrator productivity**
  - For core business workloads

DEMO: Architecture