



***The Modern Mainframe...  
At the Heart of Your Business***

**Delivering Next Generation Solutions at the  
Lowest Cost**



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## Key Points – Distributed Costs

- The cost of running additional workload on distributed servers goes up linearly
  - ▶ Labor is now the highest cost element in distributed environments
  - ▶ Administrative staff costs increase in proportion to the number of servers
  - ▶ New workload requires additional servers
  - ▶ Cost of additional servers is linear
  - ▶ Cost of software licenses is linear
  - ▶ Electrical and air conditioning costs also increasing
  
- **Result – scale out strategies do not reduce the cost per unit of work as the workload grows**

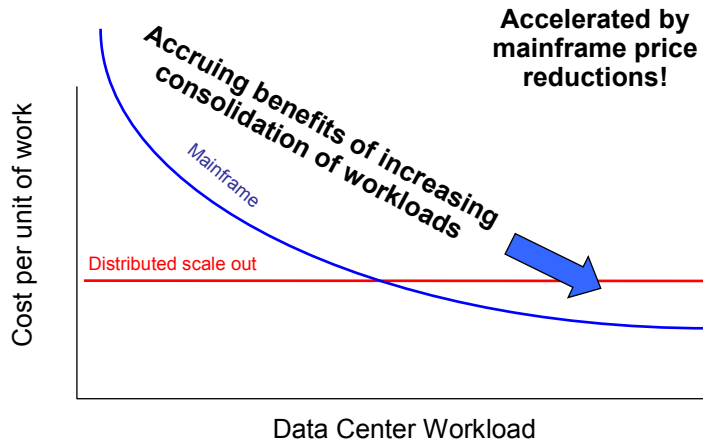
*Owing to the nature of individual contracts, some details of this pricing discussion may be at variance with specific instances*

## Key Points – Mainframe Costs

- The cost of running incremental workload on the mainframe goes down as the total workload grows
  - ▶ Labor costs hold steady as workload grows
  - ▶ IBM pricing policies designed to favor the addition of more workload
  - ▶ Special hardware pricing for new workload types
  - ▶ Lower software costs per transaction as workload grows
  - ▶ Lower electrical and air conditioning consumption than server farms
  - ▶ Trade-in value is recoverable for growth customers
  
- **Customers have learned that mainframes running high workloads are the most cost efficient platform**

*Owing to the nature of individual contracts, some details of this pricing discussion may be at variance with specific instances*

## Mainframe Cost Per Unit of Work Goes Down as Workload Increases



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6

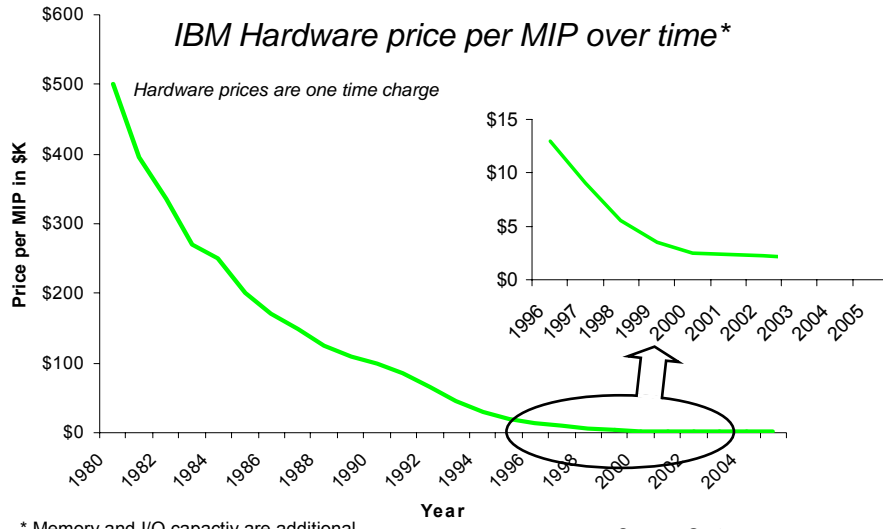
## Let's Break Down the Elements of Cost

Total Cost of Acquisition =  
Cost of hardware +  
Cost of software +

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8

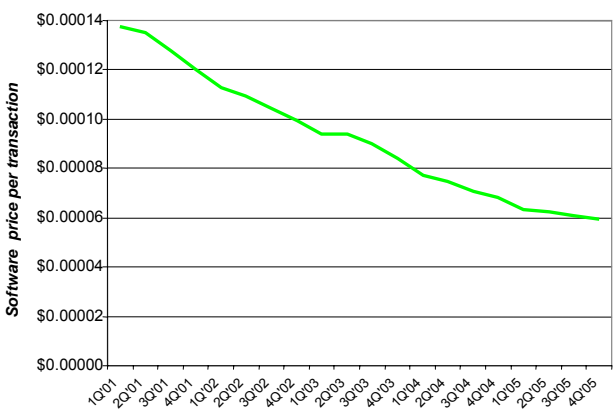
## Mainframe Hardware Cost is Decreasing



\* Memory and I/O capacity are additional feature charges

Source: Gartner

## IBM Software Price Per Transaction is Also Going Down



**57% decrease in past 60 months**

➤ **17% decrease per year**

**What makes the price go down?**

- Pricing curves favor growth
- Specialty processors (zAAPs, zIIPs, IFLs)
- Technical pricing allowances

— Inflation-adjusted IBM software price per transaction

Source: IBM SWG Finance  
Data is WW customer revenue only (not IGS)  
Data includes specialty engines  
'Highway conditions .. mileage may vary'

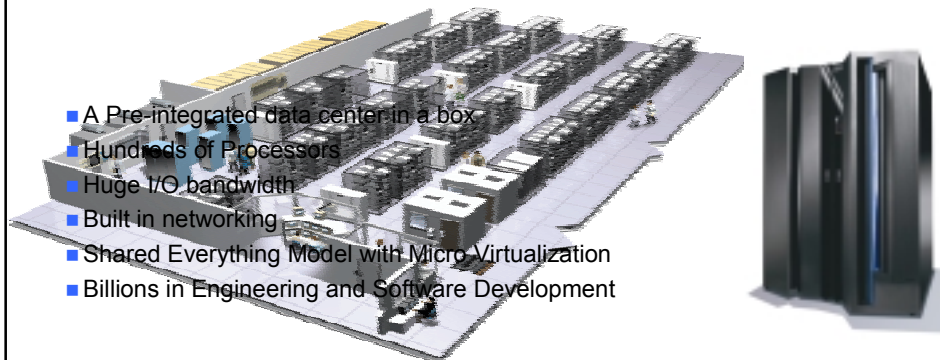
## Mainframe Hardware and Software Cost Reduction Features

- Hardware
  - ▶ Capacity on demand processors (free until you use)
  - ▶ Up to 336 I/O offload processors at feature prices
  - ▶ Specialty processors IFL, zIIP, and zAAP discounted 91%
  - ▶ Disaster recovery processors discounted 98%
  - ▶ Growing customers may upgrade installed MIPS without cost
  - ▶ IBM storage subsystems cost less than HP
  
- Software
  - ▶ MLC per incremental MIP goes down as system gets larger
  - ▶ No charge for software on zIIP and zAAP
  - ▶ One time charges are per processor for IFL (at Intel rate)
  - ▶ Sub-capacity pricing, Sysplex aggregation, technology dividend, zNALC

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11

## Data Center in a Box



- A Pre-integrated data center in a box
  - Hundreds of Processors
  - Huge I/O bandwidth
  - Built in networking
  - Shared Everything Model with Micro-Virtualization
  - Billions in Engineering and Software Development
- 
- Building your own datacenter is costly and complex
  - Install and configure hundreds of devices
  - Networking
  - Data Silos and Synchronization
  - Power consumption
  - Linear Staffing Costs
  - Frequent Outages
- Resulting in tremendous efficiencies**
- No extra charge for this deep pre-integration!**

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12

# TCO Comparisons

Earlier today we saw that incremental growth on System z with zIIP costs less than HP/Oracle for

- ▶ Data Warehouse
- ▶ SAP Data Server

We also saw examples of Linux roll-up consolidation with IFL's reducing cost

Let's consider a web application that can exploit zAAP



IBM

# Case Study: Consolidate New WebSphere Application on Mainframe

**Existing Mainframe**



Existing processors:  
2 general purpose

**Existing Disaster Recovery Site**



Existing processors:  
Pay for one general purpose processor for hot disaster switch over and one "dark" DR processor at \$30K

**Add 3 LPARs for New Web Application w 42 TB storage**

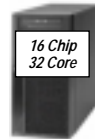
Prod	Dev	QA
<b>900 MIPS additional workload</b>		

Add two processors:  
one zAAP  
510 MIPS WAS (85%)  
one General Purpose  
300 DB2 MIPS  
90 WAS MIPS (15%)

**Or Add Superdome 9000 Servers w 75 TB storage**



82,531 \*  
RPE's



82,531  
RPE's

**And Add Disaster Recovery w 42 TB storage**

Prod	Dev	QA
(Dashed box)		

3 year cost of acquisition \$6.21M

Pay for Capacity Backup  
two processors  
\$30K each

**And Add Disaster Recovery w 75 TB storage**



82,531  
RPE's

3 year cost of acquisition \$10.74M

\* Assume dev and QA = 25% of 900 MIPS total. Then production RPE's required =  $900 \times .75 \times 122 = 82,350$

# WebSphere Application Server Incremental Cost Breakdown

Mainframe Incremental Hardware				Mainframe Incremental Software			
OTC		ANNUAL		OTC		ANNUAL	
1 GP Processor	\$1,450,000	Processor Maintenance * (For year 2, 3)	\$88,500	Utilities + WAS	\$556,140	Utilities S&S	\$44,454
zAAP	\$125,000			DB2 MLC x12	\$72,240	QMF MLC x12	\$34,716
2 DR Processors	\$60,000			Storage SW	\$281,588	zOS MLC x12	\$67,368
IBM Storage (42x2TB)	\$2,899,602			SubTotal MLC x12	\$174,324		
<b>TOTAL</b>	<b>\$1,635,000</b>	<b>TOTAL</b>	<b>\$88,500 (year 2, 3)</b>	<b>TOTAL</b>	<b>\$837,728</b>	<b>TOTAL</b>	<b>\$218,778</b>

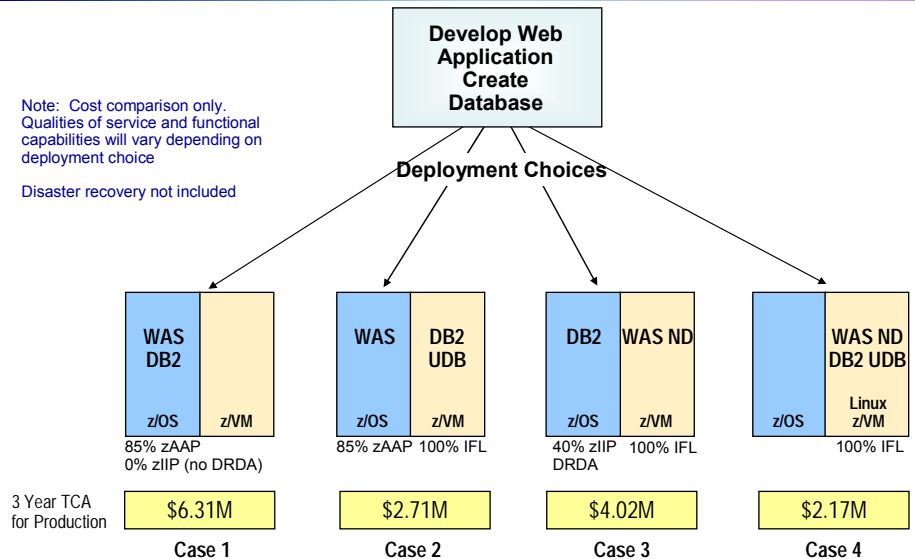
Distributed Incremental Hardware				Distributed Incremental Software			
OTC		ANNUAL		OTC		ANNUAL	
3 16x32 Itanium Superdome Servers	\$1,451,817	Servers Maintenance (Prepaid in year 1 for 3 years)	\$123,139	Oracle EE & Utilities	\$858,000	Oracle S&S	\$188,760
HP storage (75x2TB)	\$6,214,938			Storage Maintenance	\$61,902	WebSphere	\$259,875
				Unix	\$98,397	Unix S&S	\$44,242
				HP Storage SW	\$450,200	(prepaid in year 1 for 3 years)	
<b>TOTAL</b>	<b>\$7,666,755</b>	<b>TOTAL</b>	<b>\$431,319 (year 1) \$61,902 (year 2, 3)</b>	<b>TOTAL</b>	<b>\$1,666,472</b>	<b>TOTAL</b>	<b>\$373,461 (year 1) \$240,735 (year 2, 3)</b>

\* Mainframe Processor Maintenance includes the maintenance for general purpose processors and specialty engines

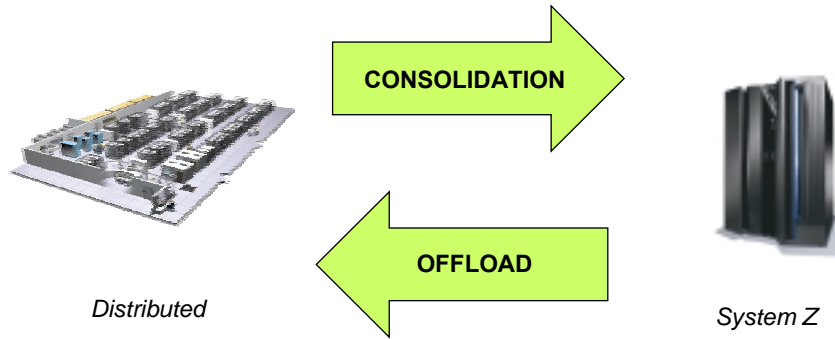
# Other Mainframe Deployment Options Can Reduce the Cost of the WebSphere Application Even Further

Note: Cost comparison only.  
Qualities of service and functional capabilities will vary depending on deployment choice

Disaster recovery not included



## TCO Comparisons



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21

## Tough Customer

The distributed servers run twice as fast as the mainframe processors, and they are cheap.

I don't believe your TCO comparison.

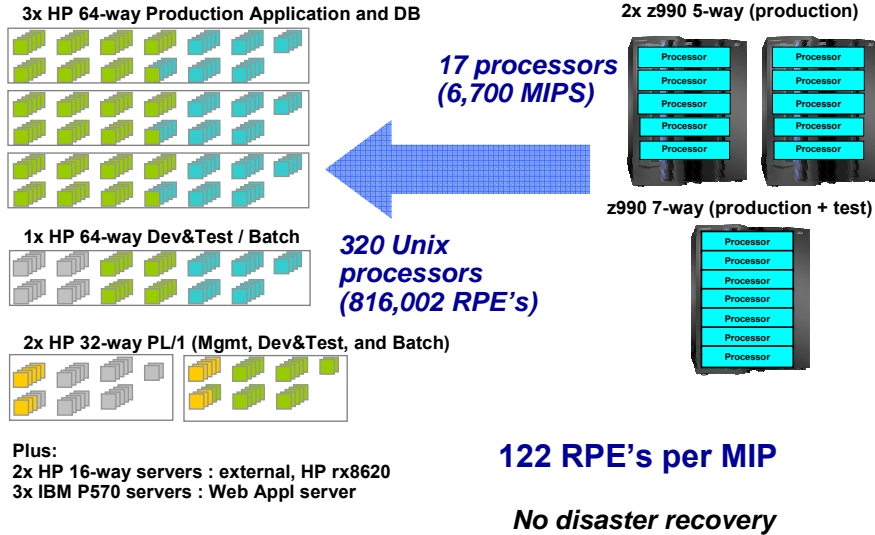


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22



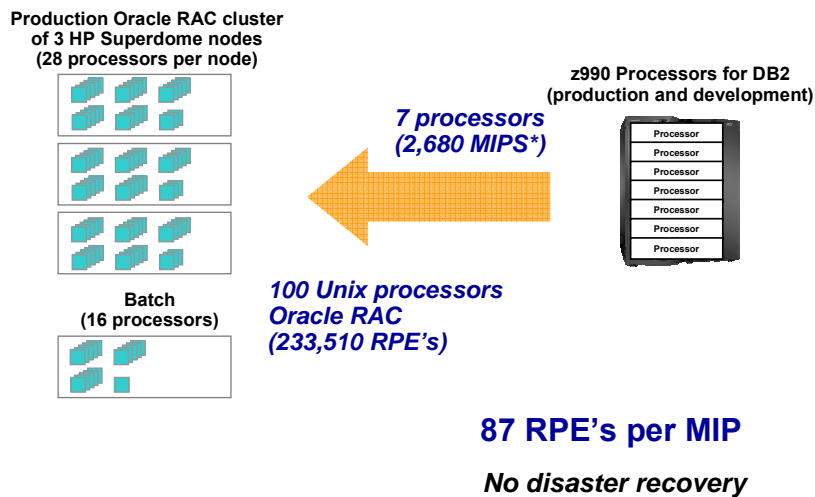
## This Was a Real Project – Why Couldn't The Same Workload Be Done With 8½ Fast Processors?



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23

## Asia Pacific Financial Services Customer Offload Project – Database Only



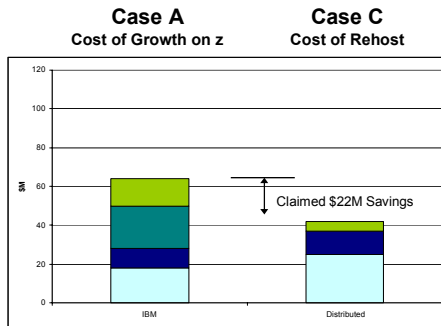
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24

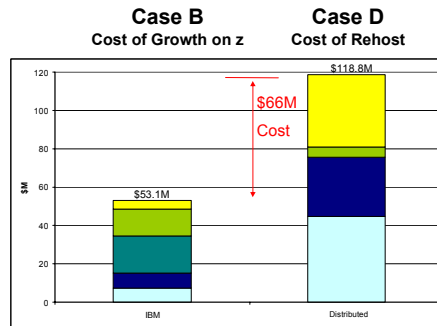
## Did They Save Money by Offloading?

- Competitors told the customer they would save \$22M over 4 years
- IBM analysis determined that the offload solution would actually cost **\$66M more** than growing on z

### Competitor's 4 Year Cost / Savings Prediction



### IBM Analysis



Investment Maint MLC Operations Disaster Recovery

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25

## Lessons Learned About the Promises Made by the Competitors

- They **over-estimated** the mainframe costs
  - Over-provisioned too early  $\Delta\$3.6M$
  - Used highest hardware purchase & maintenance list prices  $\Delta\$9.4M$
  - Continued using older software; no sub-cap pricing  $\Delta\$2.7M$

**OVERESTIMATED BY  $\Delta\$15.7M$**
- They **under-estimated** the offload costs
  - Forgot about mainframe coexistence during migration  $\Delta\$9.5M$
  - Forgot about high cost of power & cooling  $\Delta\$1.1M$
  - Forgot about the financing charges  $\Delta\$2.5M$
  - Added a test server  $\Delta\$2.1M$
  - Under-provisioned batch processing (15 % growth case)  $\Delta\$6.3M$
  - Failed to take into account technology updates  $\Delta\$14.6M$
  - Did not provide Disaster Recovery  $\Delta\$40.6M$

**UNDERESTIMATED BY  $\Delta\$76.7M$**

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26

## Why Do Servers Proliferate in Offload Scenarios?

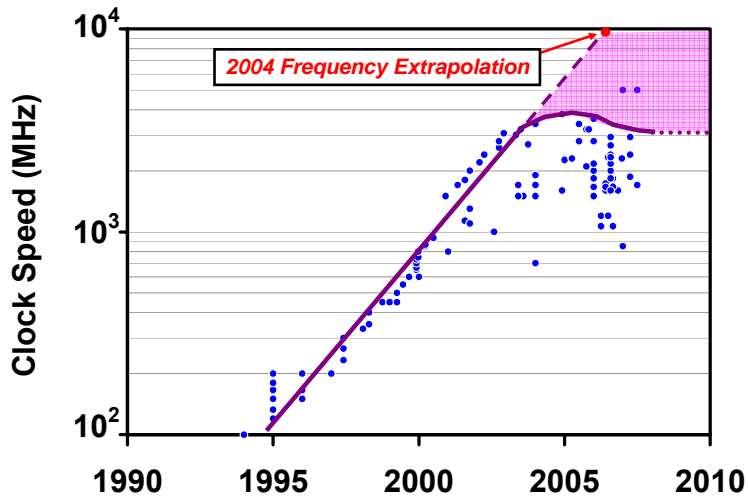
- The following considerations contribute to server proliferation
  - ▶ De-multiplexing of applications to dedicated servers
    - One application workload per server group
    - Low utilization due to peak-to-average and growth provisioning
    - Batch workload may stress I/O capabilities
    - Separate servers for production, failover, development/test, disaster recovery
  - ▶ Processing comparisons
    - Language expansion (CICS/COBOL path lengths are highly optimized)
    - Conversion factor (MIPS to RPE) worsens as I/O rates increase
    - Oracle RAC inefficiencies compared to DB2
- Other TCO considerations
  - ▶ 3 to 5 year lifetime for distributed servers requires repurchase
  - ▶ Dual environments during migration

## Let's Consider The Other Elements of Cost

Total Cost of Ownership =  
Cost of hardware +  
Cost of software +  
Environmentals +  
Cost of labor +  
Financial terms

# Fast and Hot Distributed Servers

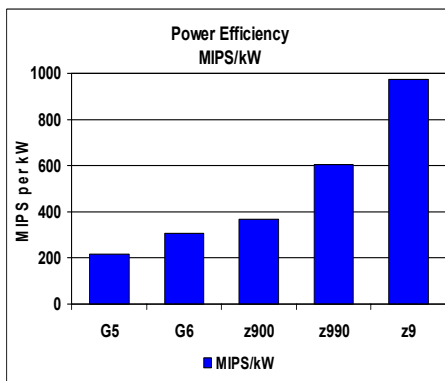
Managing power dissipation is limiting clock speed increases



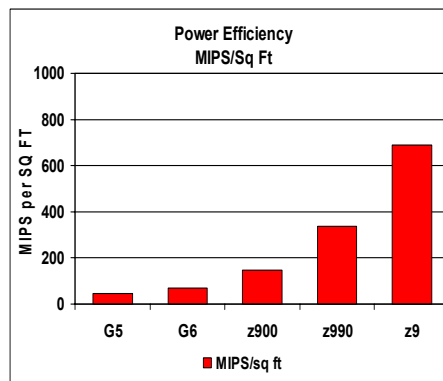
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30

# Mainframe Exhibits Increasing Power and Space Efficiencies with Each Generation



22% annual increase in MIPS/kW



46% annual increase in MIPS/square foot

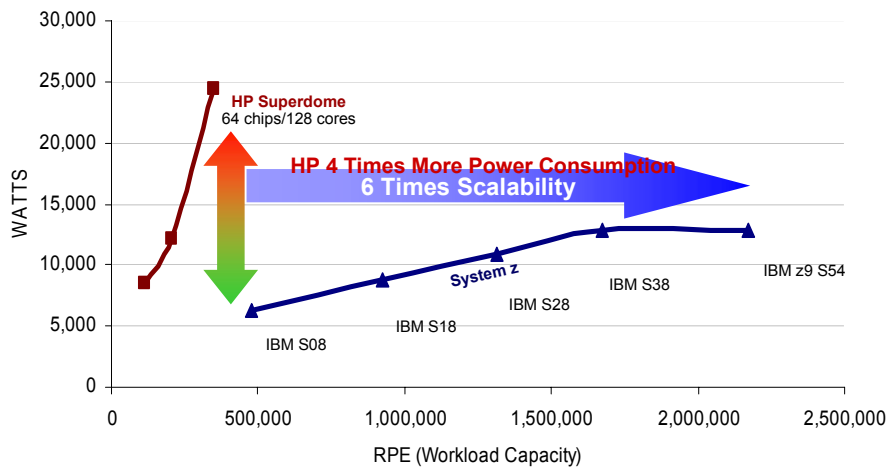
Decreasing energy consumption per MIP

Decreasing square footage per MIP

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31

## Mainframe Consumes Less Power Than HP Superdome



Source for HP Servers: Ideas International, Nov 06  
 Note: Uses equivalence ratio of 122 RPE's per MIP

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32

## Do the Math

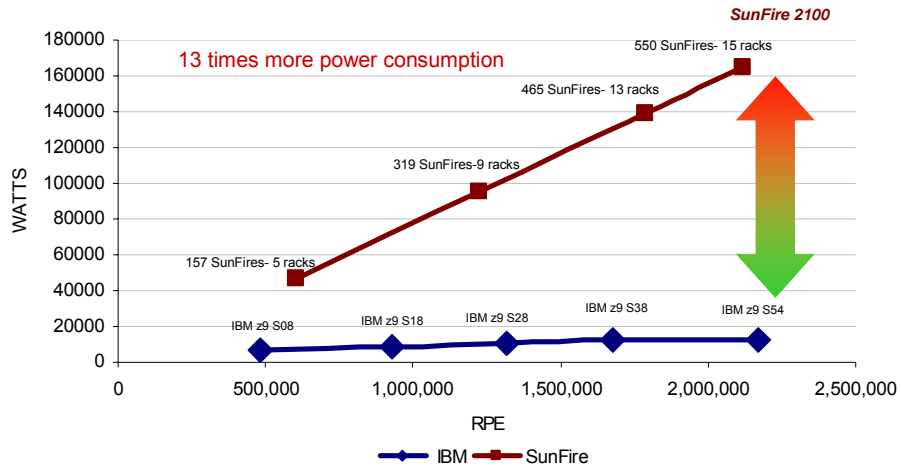
- HP Itanium 2 Superdome 9050 (64ch/128co)\* consumes a maximum of 24,392 watts
  - ▶  $[24,392 \times \$0.09 \times (24 \times 365)]/1000 = \$19,230$  per year for electricity
- Mainframe with similar computing capacity - a System z9 S08 machine using 6.3 kW
  - ▶  $\$4,967$  per year for electricity
- Similar savings on cooling capacity
  - ▶ Cost of cooling is about 60% additional
  - ▶ Superdome total  $\$30,768$  per year vs. Mainframe  $\$7947$
  - ▶ Cost of mainframe power and cooling is  $\$22,821$  per year less than HP

\*Rated at 350,041 RPE

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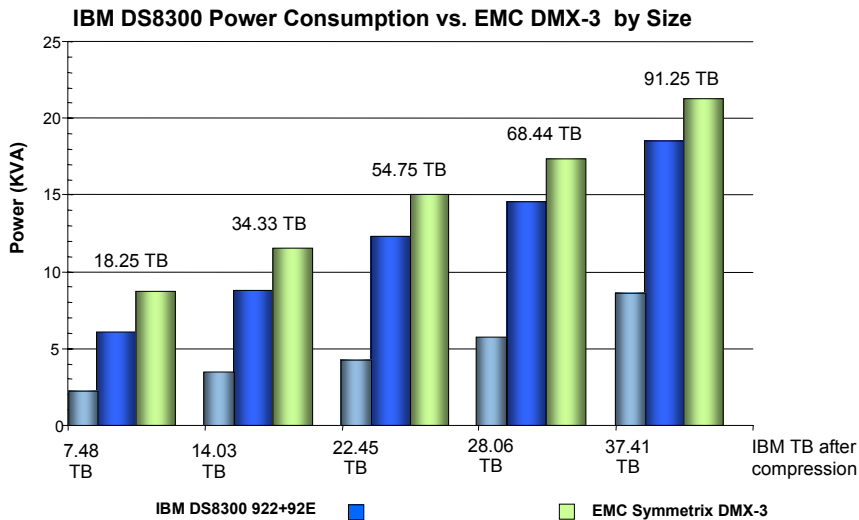
33

## Mainframe Consumes Less Power Than SunFire Server Farms



Source for SunFire 2100 Servers: Ideas International, Nov 06  
 Note: Uses equivalence ratio of 122 RPE's per MIP  
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## IBM Storage Also Saves Energy Costs

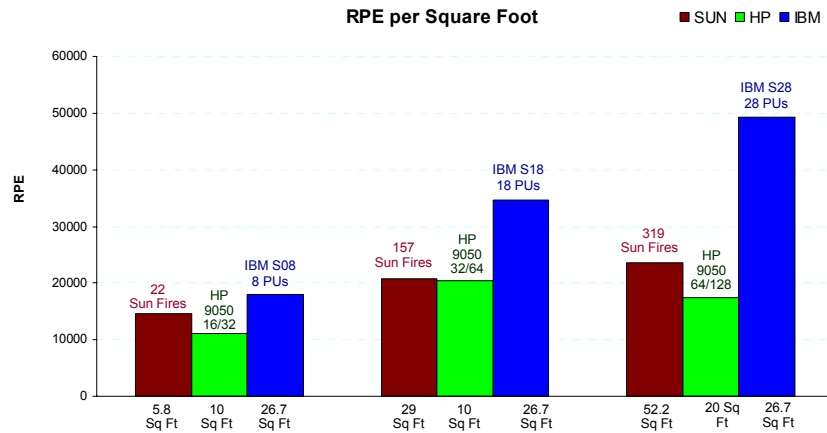


Study used 146 GB 15K rpm drives

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35

## The Mainframe Also Requires a Smaller Footprint



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Based on 122 RPE per MIP

36

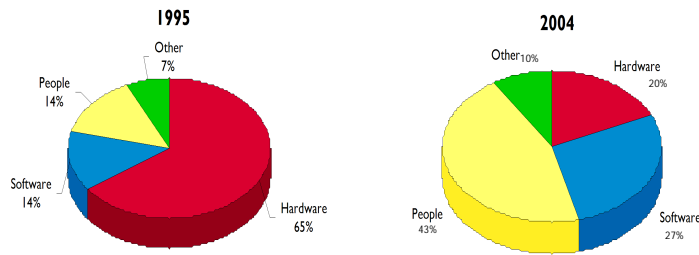
## Power and Space Costs

- The cost of electricity to power and cool the servers
  - ▶ Electricity usage differences are large, but the costs are typically small in magnitude compared to other project costs
- The cost to re-arrange servers on the floor to take advantage of existing cooling vents
  - ▶ One customer spent \$250K to place Superdomes near the vents
- The cost to upgrade cooling capacity
- The ultimate cost – build a new data center facility at \$400 per square foot or more

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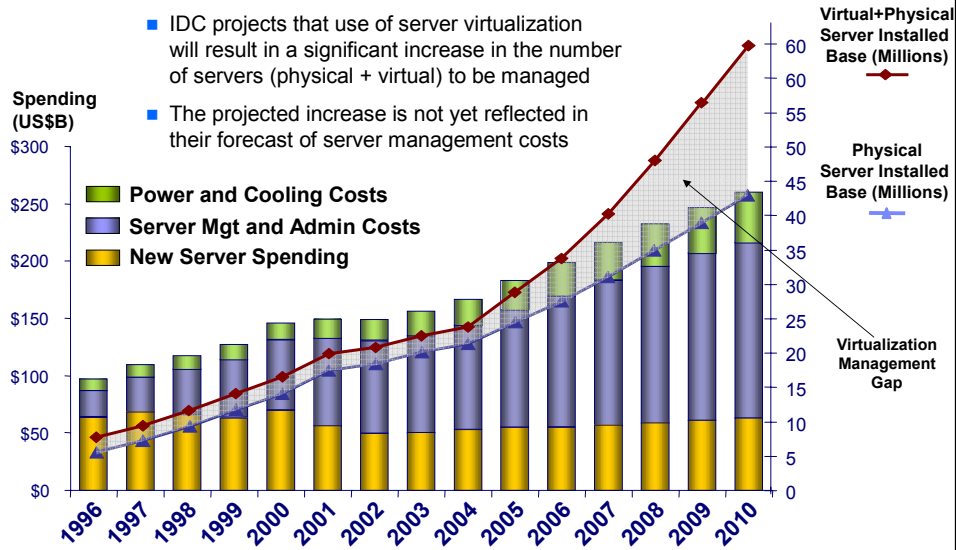
37

## People Expense has Become the Dominant Component of TCO



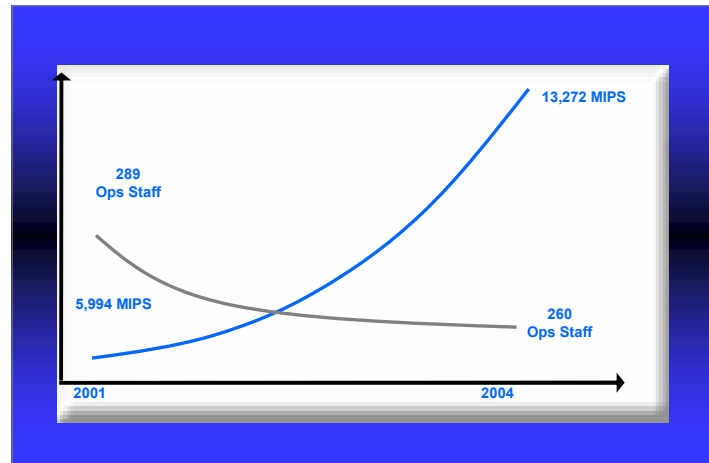
Based on IBM Scorpion customer analyses

## Server TCO Predictions Updated for the Virtualization Effect





## Data Center Staffing Levels for System z Have Not Increased Despite Large Increase in MIPS



$$\frac{5,994}{289} = 21 \text{ MIPS/HC}$$

$$\frac{13,272}{260} = 51 \text{ MIPS/HC}$$

Source: Gartner

## A Comparison of Labor Costs for Two Environments That Execute Roughly Equivalent Workloads

Topic	System z- 3,192 MIPS	900 Distributed Servers
Operations	\$105K ..... 10% of 6 FTEs	none
Customer Engineers	\$52K..... 0.3 FTEs \$50K LAN charges \$35K z- charges	\$400K SUN charges \$300K LAN charges \$40K p- charges \$100K HP charges
Systems Engineers	\$551K ..... 3.15 FTEs	\$5,250K.....30 FTEs (Operations in the Systems charge)
Security Admin	None	\$600K
Total	<u>\$793K</u>	<u>\$6,690K</u>

Here, System z requires 1/8 the labor costs of the distributed environment

Previously discussed IBM Internal Consolidation Project also calculated a 1 to 8 ratio in admin costs

Source: IBM SWG Data Center

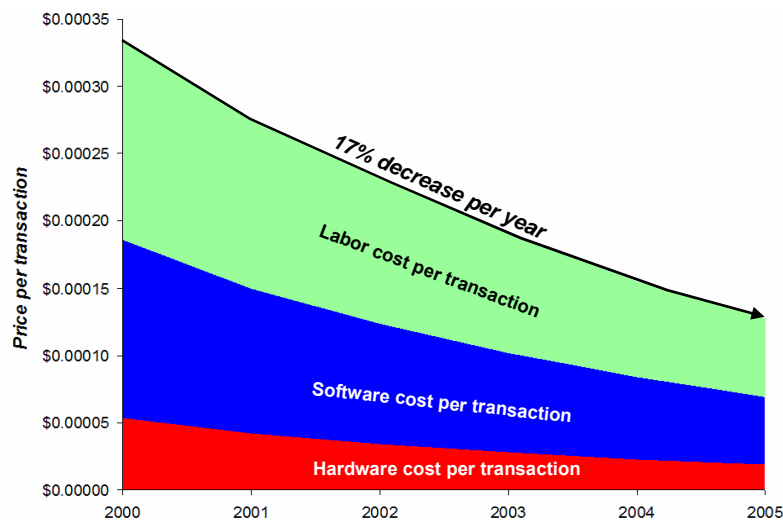
## Trade-In Value Reduces Mainframe Net Present Value Costs

- Upgrade to next generation mainframe
  - ▶ Specialty processors are upgraded to next generation free of charge
  - ▶ Growing customers typically receive credit for existing MIPS investment when upgrading to new generation
  - ▶ Full **trade-in value** applied to upgrade and growth MIPS
- Upgrade to next generation distributed systems
  - ▶ Life time of 3 to 5 years
  - ▶ Must **repurchase** existing processor capacity plus any growth
- Long term TCO implications can be important

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43

## Conclusion: Total Mainframe Hardware, Software & Labor Costs Reduced by 62% in 5 Years



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44

## Tale of Two Customers

	Baldor	Welch's
Supplier	IBM	Dell
Moved From....	3 Mainframes and 8 Unix Servers	S/390 and AS/400
Moved to...	1 z990 System z Server	100 Intel Servers
Virtualization	z/VM	VMWare
Decision to Completion Time	Approximately 6 months	Started sometime before June 2005 "...project will continue into 2007"
IT Staff	Down to 38	50
IT Spending	1.2% of Sales (and still declining....now down to 0.9%)	About 2.5% of Sales
Max Power consumption	15.8 kW	48.4 kW

Three years ago, Baldor's IT director had investigated migrating to a Windows server environment with cluster fail-over. *"We thought we were going to save a ton of money,"* but the systems crashed all the time, he noted, and the idea was quickly abandoned.

*"We have a very stringent requirement of being up all the time ... Weighing heavily in support of the mainframe was its track record. There hadn't been any mainframe downtime since 1997"*

## Case Studies Summary

- Roll up consolidation of Linux servers onto System z **saves** big money
- Incremental Data Server on System z costs **less** than Oracle RAC on HP Superdome
- Incremental Data Warehouse workload on System z costs **less** than Oracle RAC on HP Superdome
- Incremental WebSphere workload on System z costs **less** than distributed deployment
- System z uses less power and requires fewer operational staff

## Customer Objections

Your story makes sense, but my charge back for the mainframe is still much higher.



## Data Center Cost Accounting

- Two terms used to describe data center cost accounting
  - ▶ IT cost accounting
    - Assign costs to department budgets
  - ▶ Charge back policies
    - Bill departments for IT resources used
  
- In this pitch we will use term “Charge Back” to refer to both

## Charge Back Follies

- Bad charge back practices can create the **false impression** that the **mainframe costs too much**
  - ▶ Good practices allow business units to understand the economic impact of IT resource decisions
  
- Mainframe Charges are typically overstated
  - ▶ It's easy to assign unrecoverable cost to the mainframe
  - ▶ Unrelated allocation of corporate overhead
  - ▶ Disproportional allocation of data center overhead
  - ▶ System Programming teams that support specific business projects
  - ▶ Security support for all platforms and businesses...

## When Good Charge Back Practices Are Applied

### SAP Data Server With Disaster Recovery

- |  |   |
|--|---|
| ■ Costs on the mainframe over 3 years                    |   |
| ▶ 3 year incremental cost of acquisition                 | \$5.19M                                     |
| ▶ 3 years labor (2 FTE's @ \$120,000/yr times 3 years)*  | \$0.72M                                     |
| ▶ 3 year power cost (\$0.09 per kw.hr)                   | <u>negligible</u>                           |
| ▶ Total cost for 3 years                                 | \$5.91M                                     |
| ▶ Monthly charge   | <b>Mainframe is half the cost \$164,000</b> |
| ■ Cost on the distributed system                         |   |
| ▶ 3 year cost of acquisition                             | \$10.90M                                    |
| ▶ 3 years labor (3 FTE's @ \$120,000/yr times 3 years)** | \$1.08M                                     |
| ▶ 3 year power cost (\$0.09 per kw.hr)                   | <u>\$0.18M</u>                              |
| ▶ Total cost for 3 years                                 | \$12.16M                                    |
| ▶ Monthly charge   | <b>\$378,000</b>                            |

\* One FTE per 500 MIPS

\*\* One FTE per 20 processors

## When Bad Charge Back Practices Are Applied

### SAP Data Server With Disaster Recovery

- Costs on the mainframe over 3 years
  - ▶ Use current cost/MIP figure of \$188/month/MIP for existing hardware and software
  - ▶ 3 year hardware and software \$188x966MIPS x36 months \$6.54M
  - ▶ 3 years additional labor (2 FTE's @ \$120,000/yr times 3 years)\* \$0.72M
  - ▶ Total cost for 3 years \$7.26M
  - ▶ Monthly charge **Mainframe costs 10 times more** \$202,000
  
- Cost on the distributed system
  - ▶ 3 year cost of production server \$0.73M
  - ▶ Disaster recovery allocated to general overhead not charged
  - ▶ Cost of storage allocated to general overhead not charged
  - ▶ Cost of software allocated to general overhead not charged
  - ▶ Cost of labor allocated to general overhead not charged
  - ▶ Additional electricity allocated to general overhead not charged
  - ▶ Total cost for 3 years \$0.73M
  - ▶ Monthly charge **\$20,000**

\* One FTE per 500 MIPS

\*\* One FTE per 20 processors

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51

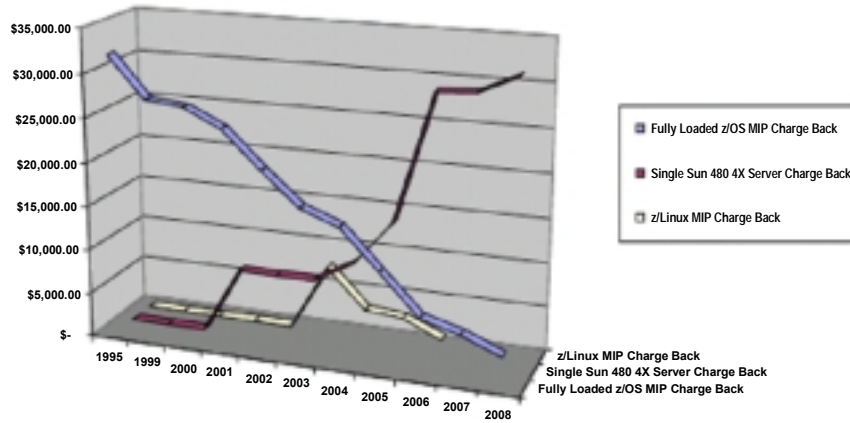
## Typical Evolution of Data Center Charge Back Practices

Early 90's	Mid 90's	2000+
Entire data center budget allocated to MIPS (cost/MIP = data center budget ÷ MIPS)	Cost of storage allocated by usage Cost of tape/slots allocated by usage Remaining data center budget allocated to MIPS	True mainframe costs allocated by usage
Distributed Server hardware is a capital expense (depreciation charged to user)	Distributed server hardware is a capital expense	All distributed costs allocated by usage

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52

## Charge Back Practices Were Improved Over Time at a Large Financial Institution

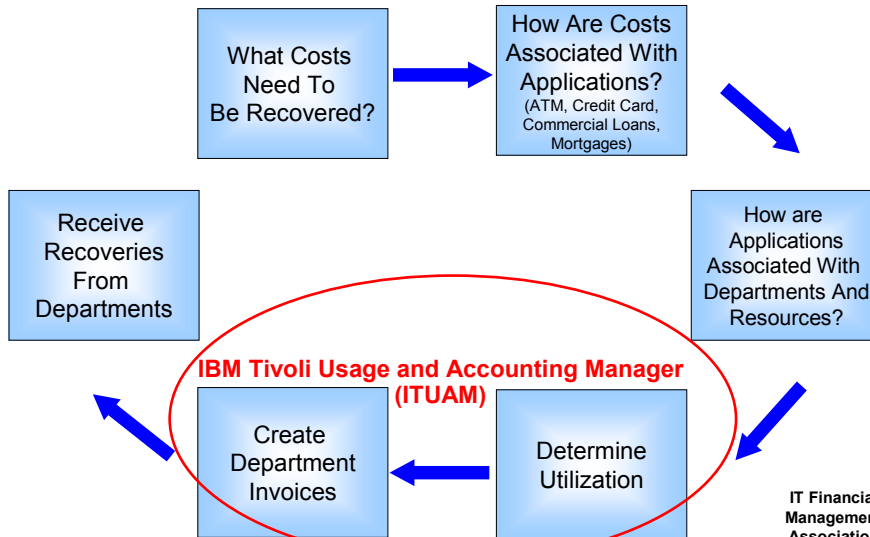


More Accurate Charge Back Can Correct Perceptions of Relative Costs

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53

## Data Center Cost Recovery Model



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## Charge Back Policies are Fixed

Now I'm paying the true cost for my mainframe applications

