



The Modern Mainframe – At the Heart of Your Business

When the Mainframe Really IS the Lowest Cost Platform



Where Should ODI's Applications Be Deployed?

We are going to be rolling out lots of new applications. Which is the best server to run them on?



**On Demand Insurance
CIO**

It's quite simple... the mainframe. You already have one, and you know it has the best qualities of service and lowest risk.



IBM

What About TCO?

But won't that be too expensive?



**On Demand Insurance
CIO**

No, on the contrary. The more you put on the mainframe, the more you save. Let me show you how!



IBM

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**

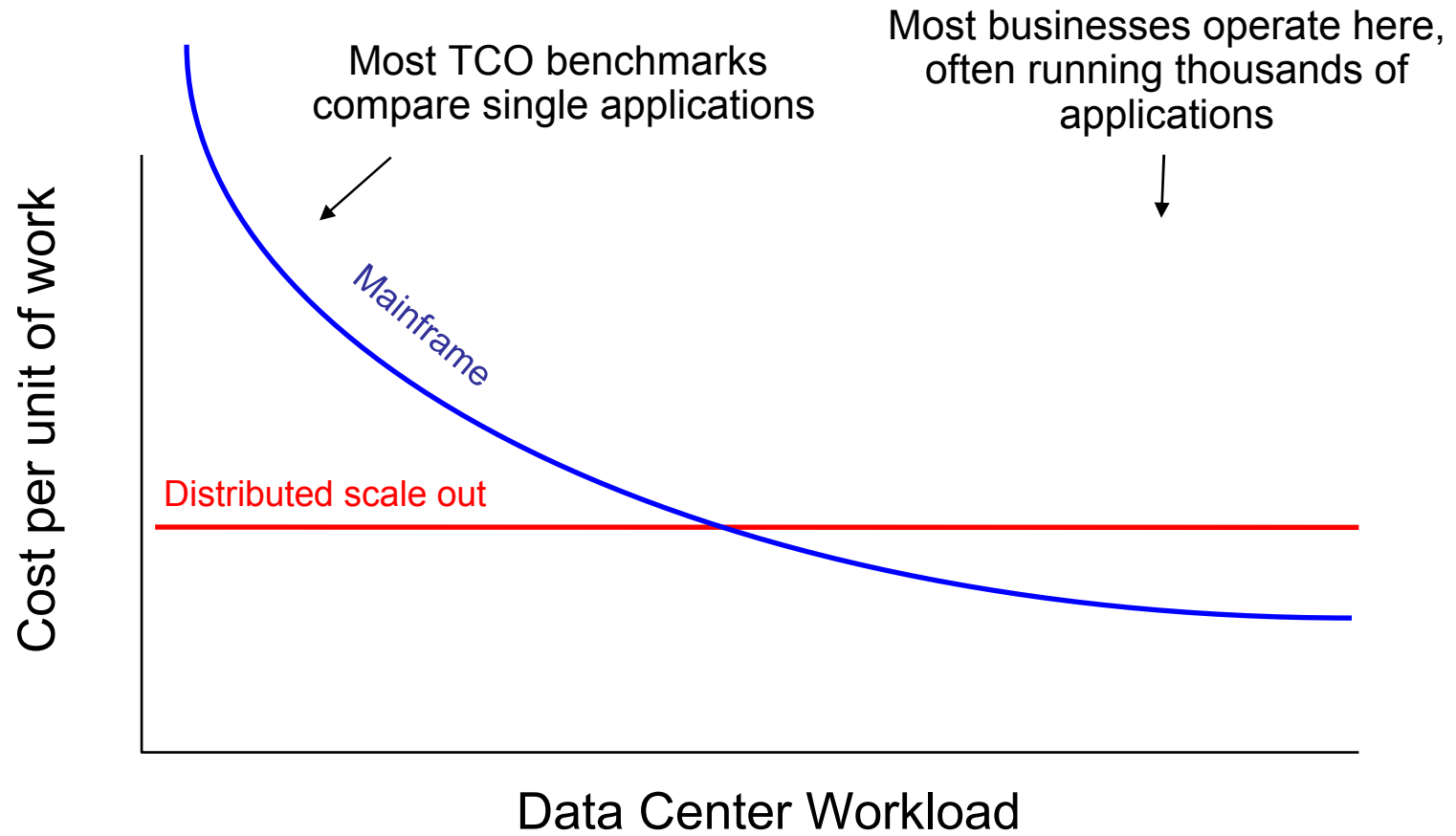
Owing to the nature of individual contracts, some details of this pricing discussion may be at variance with specific instances

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
 - ▶ Mainframe design and pricing favors 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
- **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



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.

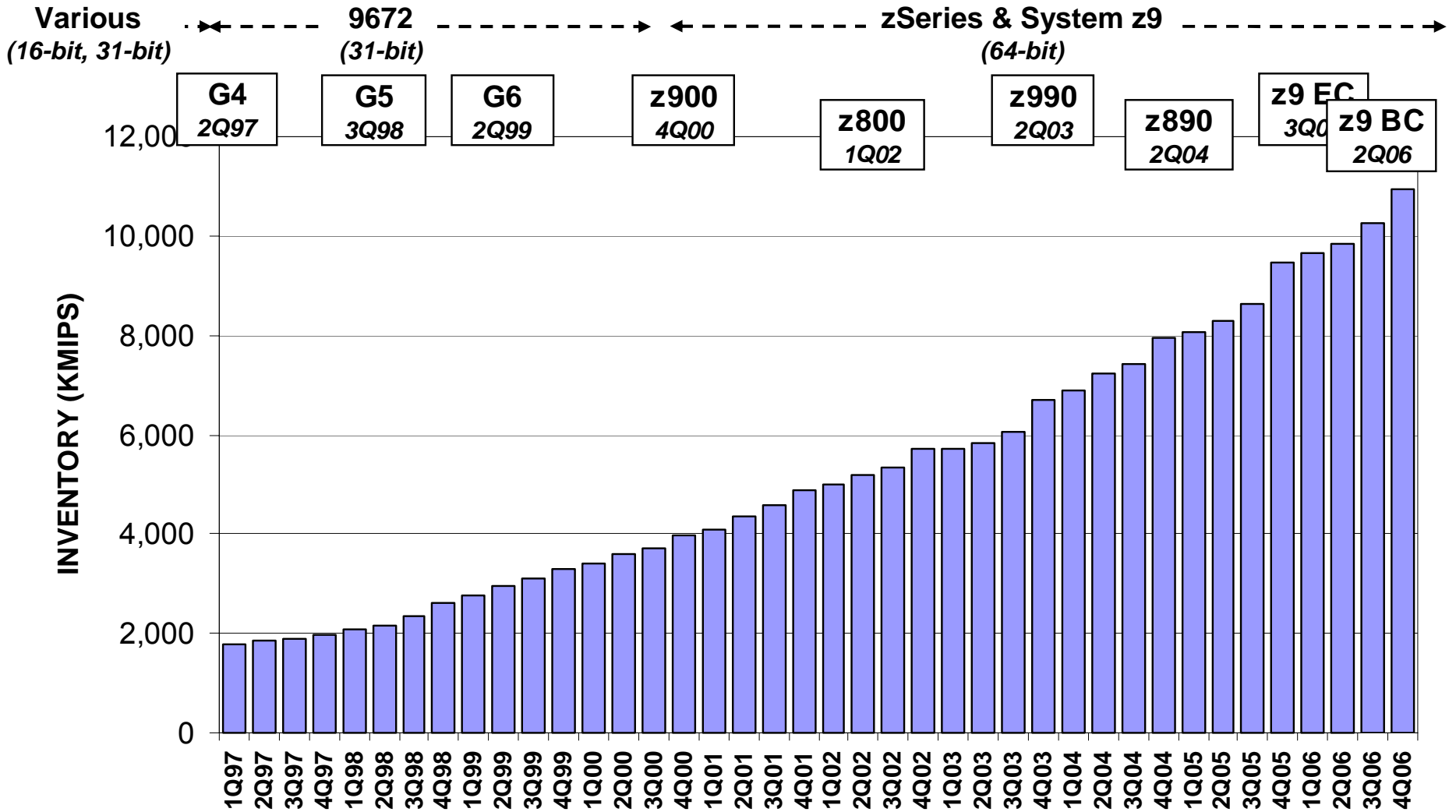
"We have a very stringent requirement of being up all the time ... Weighing heavily in support of the mainframe was its track record. There hadn't been any mainframe downtime since 1997"

	<i>Servers</i>	<i>Reliability</i>	<i>Utilization</i>	<i>Staff</i>
First move: Implemented distributed computing architecture that became too difficult to monitor, maintain, upgrade and scale	<ul style="list-style-type: none"> ■ 30+ Sun Solaris servers ■ 560+ Intel servers 	Un-acceptable	12%	24 people growing at 30% year
Next move: Consolidated back on the mainframe	z990	Much improved	84% with additional reserve capacity on-demand	Reduced to 8 people

Seven times better utilization on mainframe hardware

- Seven times better utilization also reduces **storage**, software licensing, labor, power, and air conditioning costs accordingly

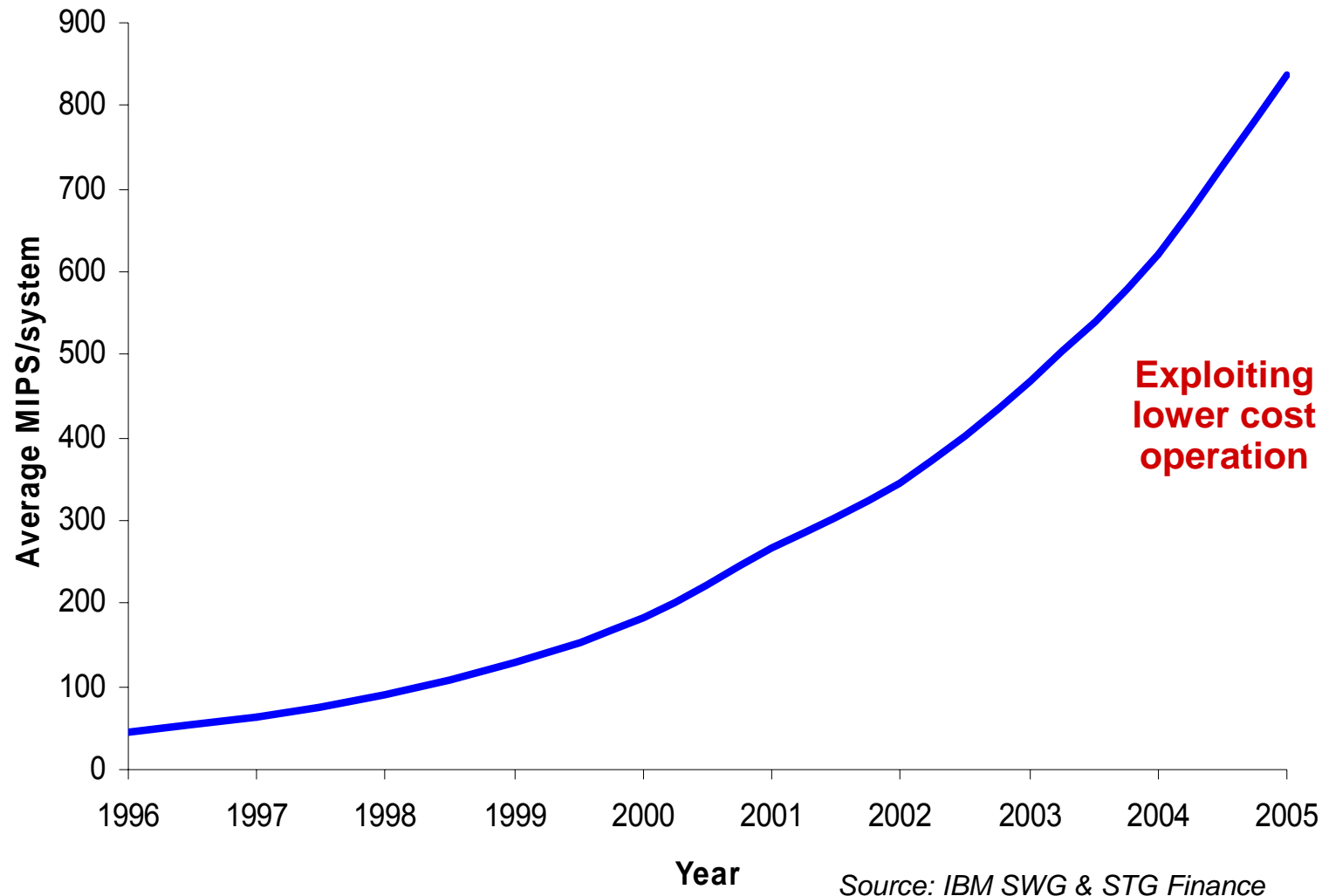
Customers Are Installing More MIPS



CAGR 1997-2006 = 21%

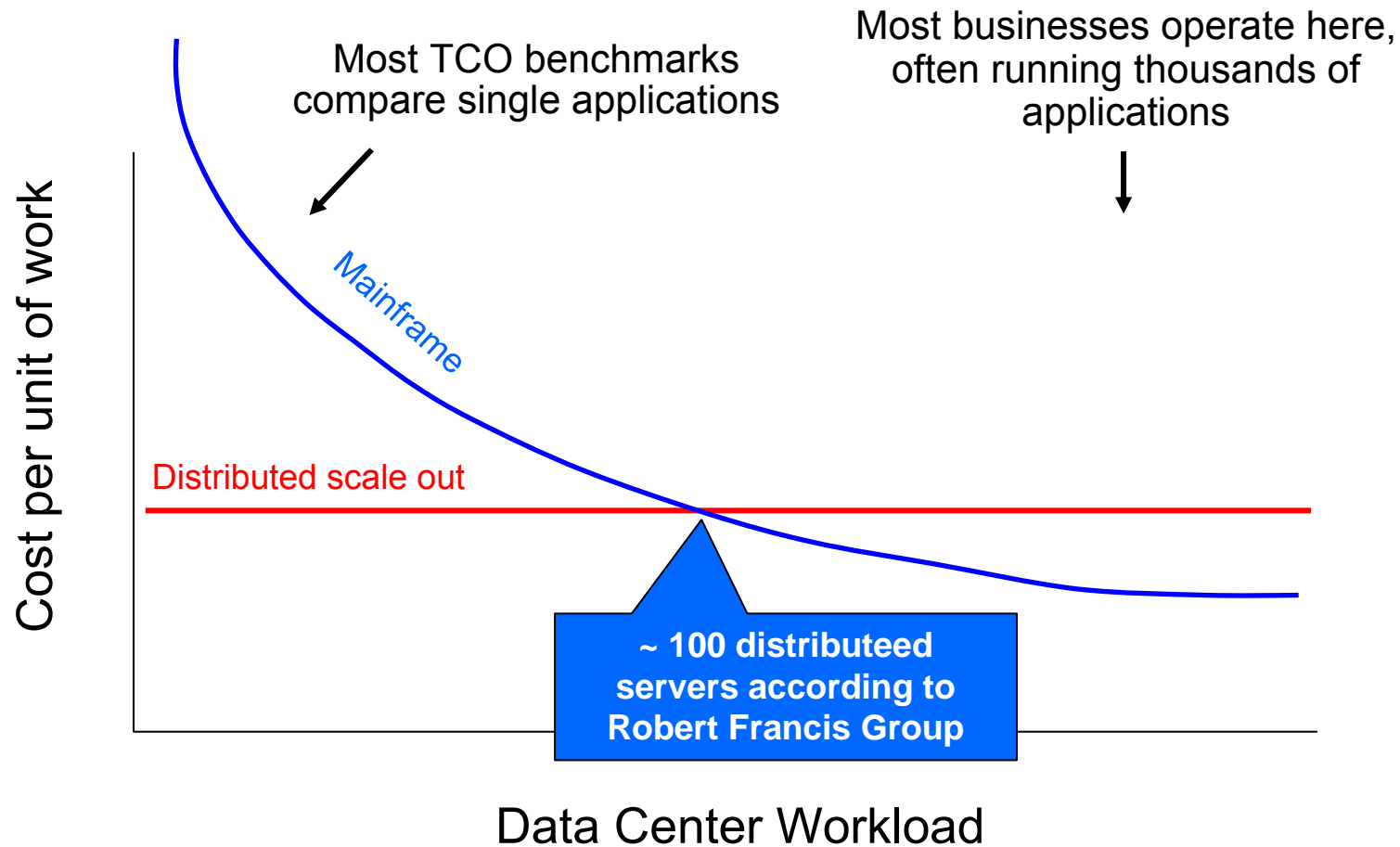
Source: IBM STG Finance

Average Size of Mainframe Systems WW is Increasing



Where is the Cross Over Point?

It depends on your environment ...



Let's Break Down the Elements of Cost

Total Cost of Ownership =

Hardware

+ Software

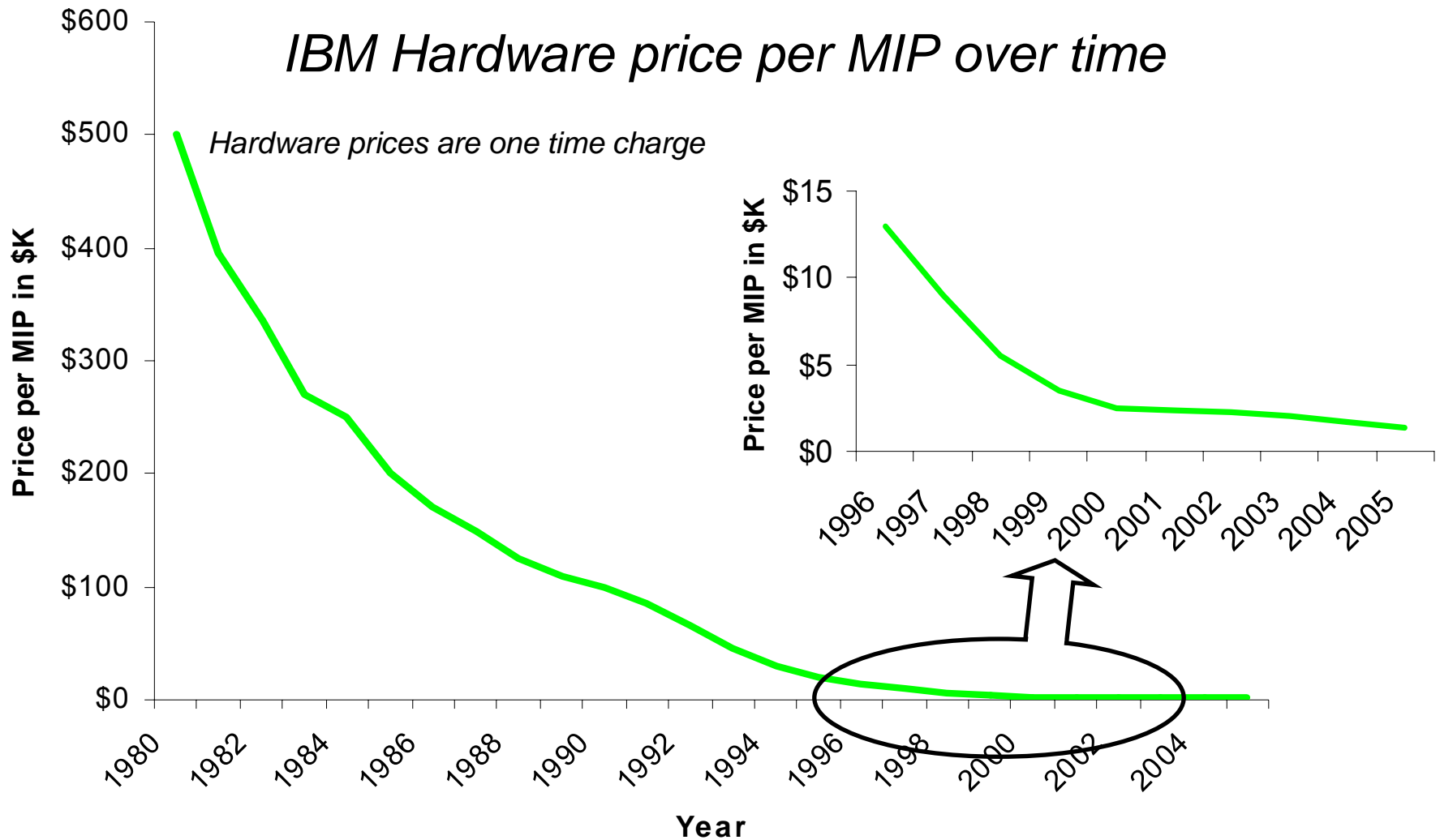
+ Environmentals

+ Labor

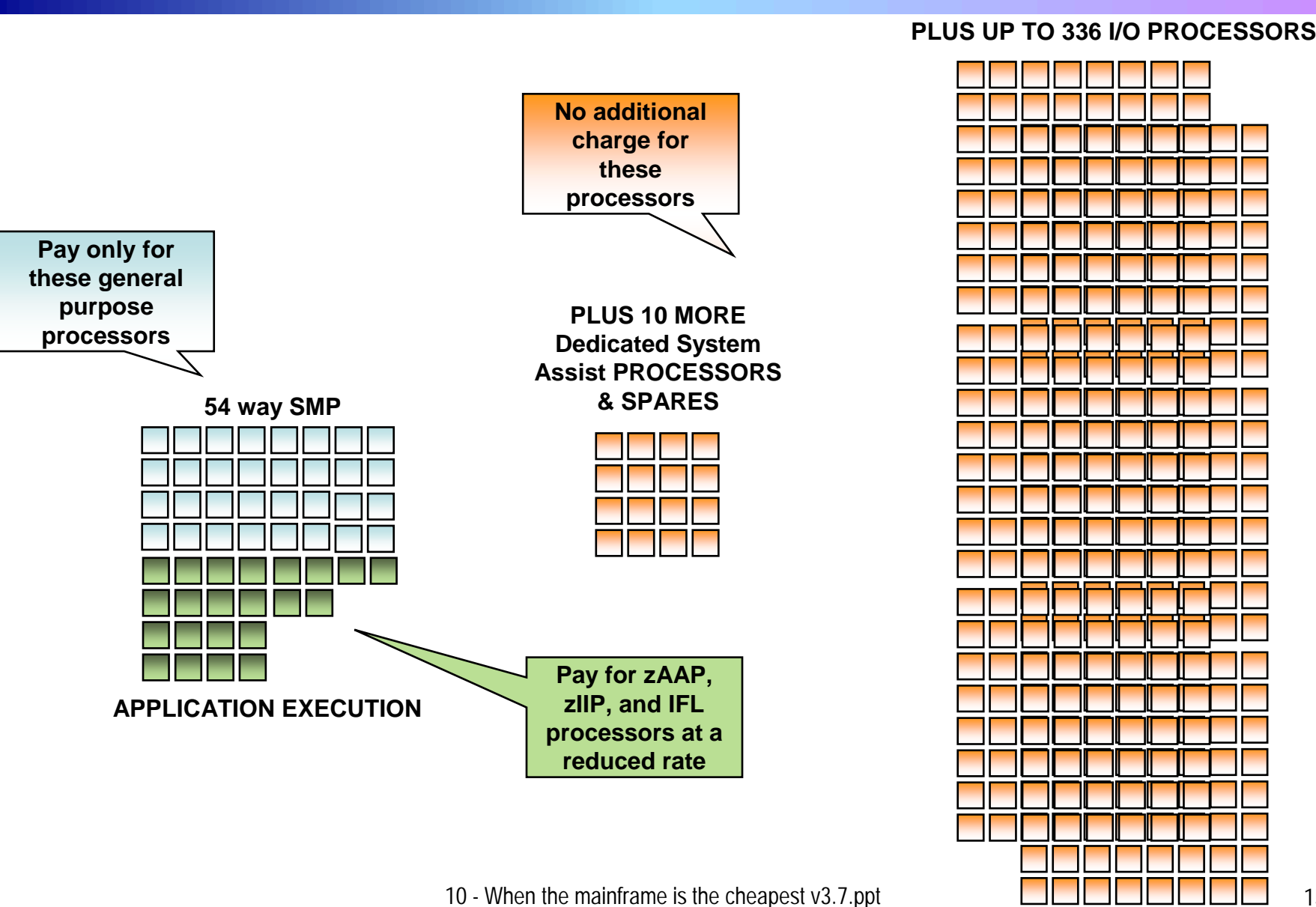
+ required Quality-of-Service

(Availability, Security, Disaster/Recovery...)

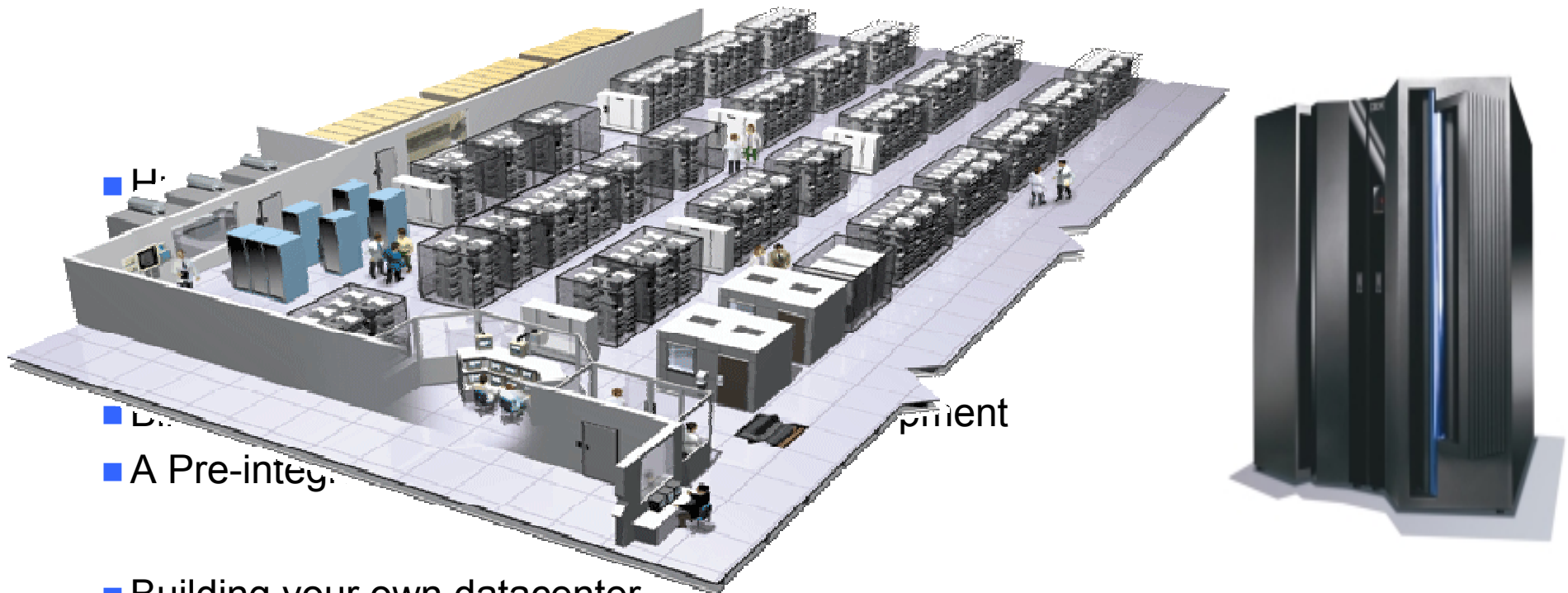
Mainframe Hardware Cost is Decreasing



No Additional Charge For System Assist and I/O Processors



Datacenter in a Box



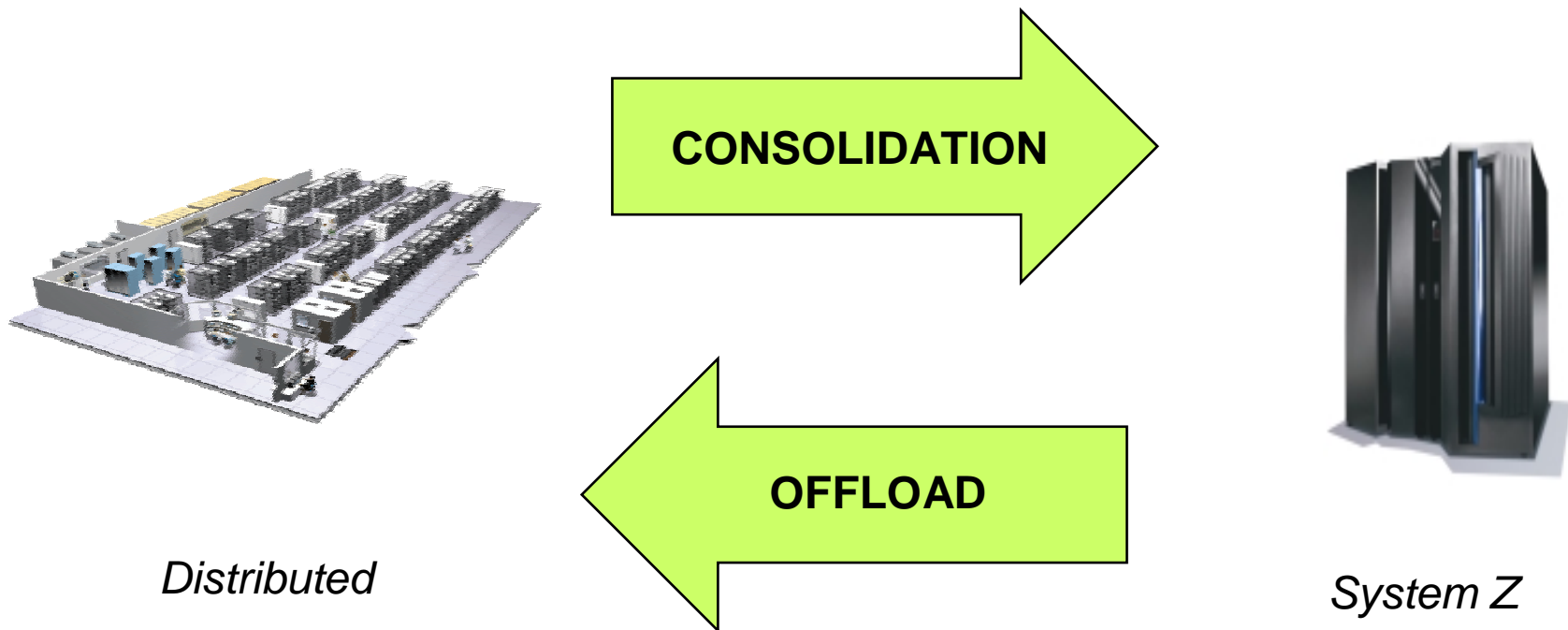
- F.
- D.
- A Pre-integ.

- Building your own datacenter is costly and complex
- Data Silos and Synchronization
- Networking
- Linear Staffing Costs
- Frequent Outages

Resulting in tremendous efficiencies

No extra charge for this deep pre-integration!

TCO Comparisons

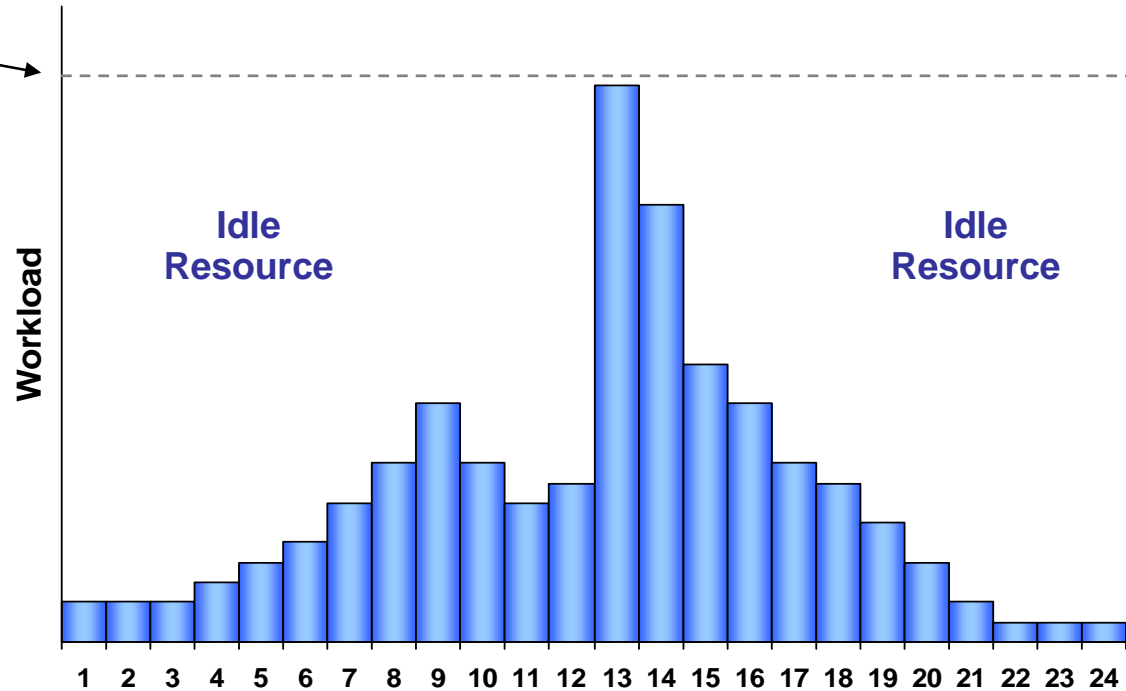


Utilization of Distributed Servers

Provision capacity
for peak workload

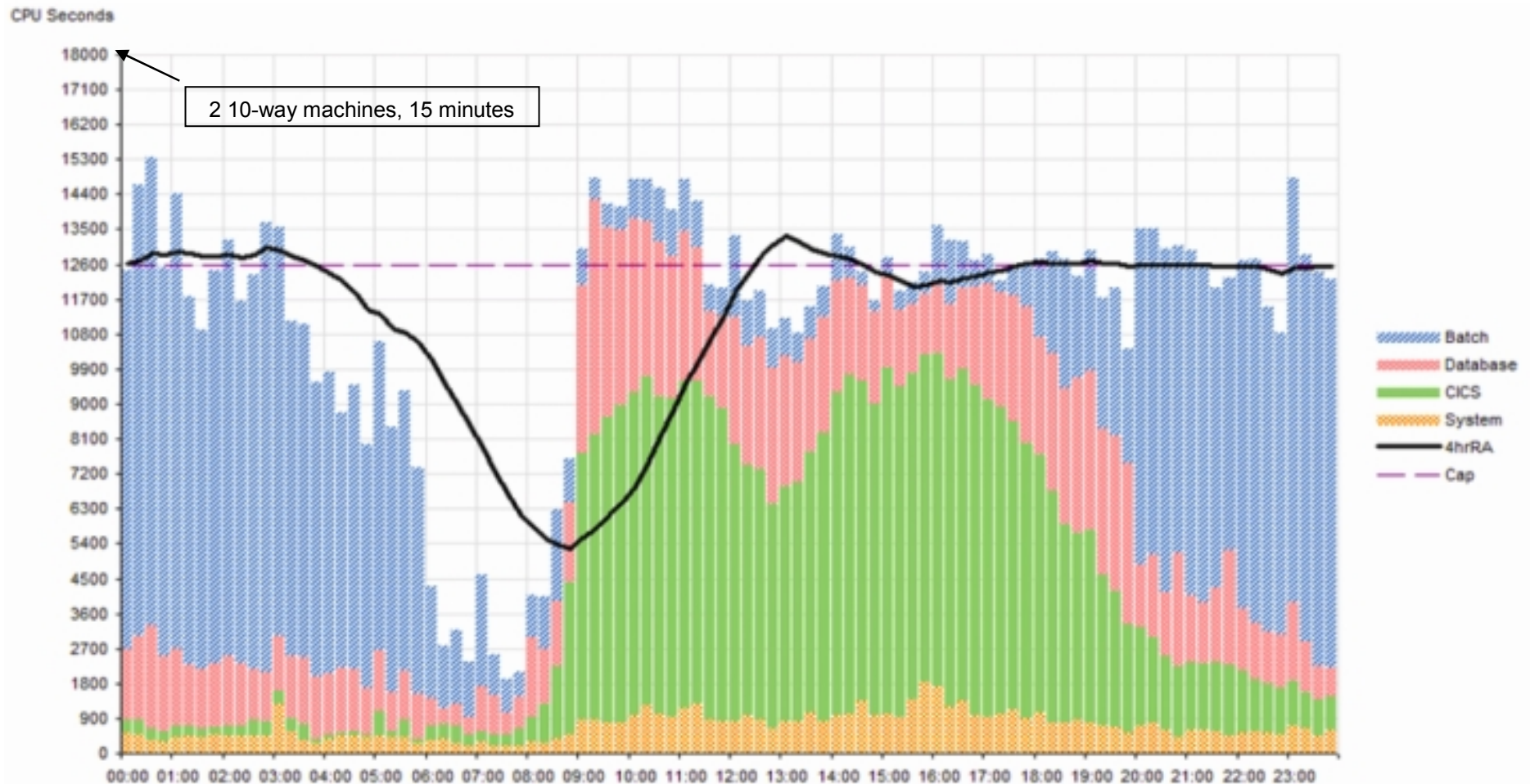


Server dedicated to
one application



- ▶ Typical utilization of Windows Servers 5 – 10%
- ▶ Typical utilization of UNIX Servers 10 – 20%
- ▶ Typical utilization of System z Servers 85 – 100%

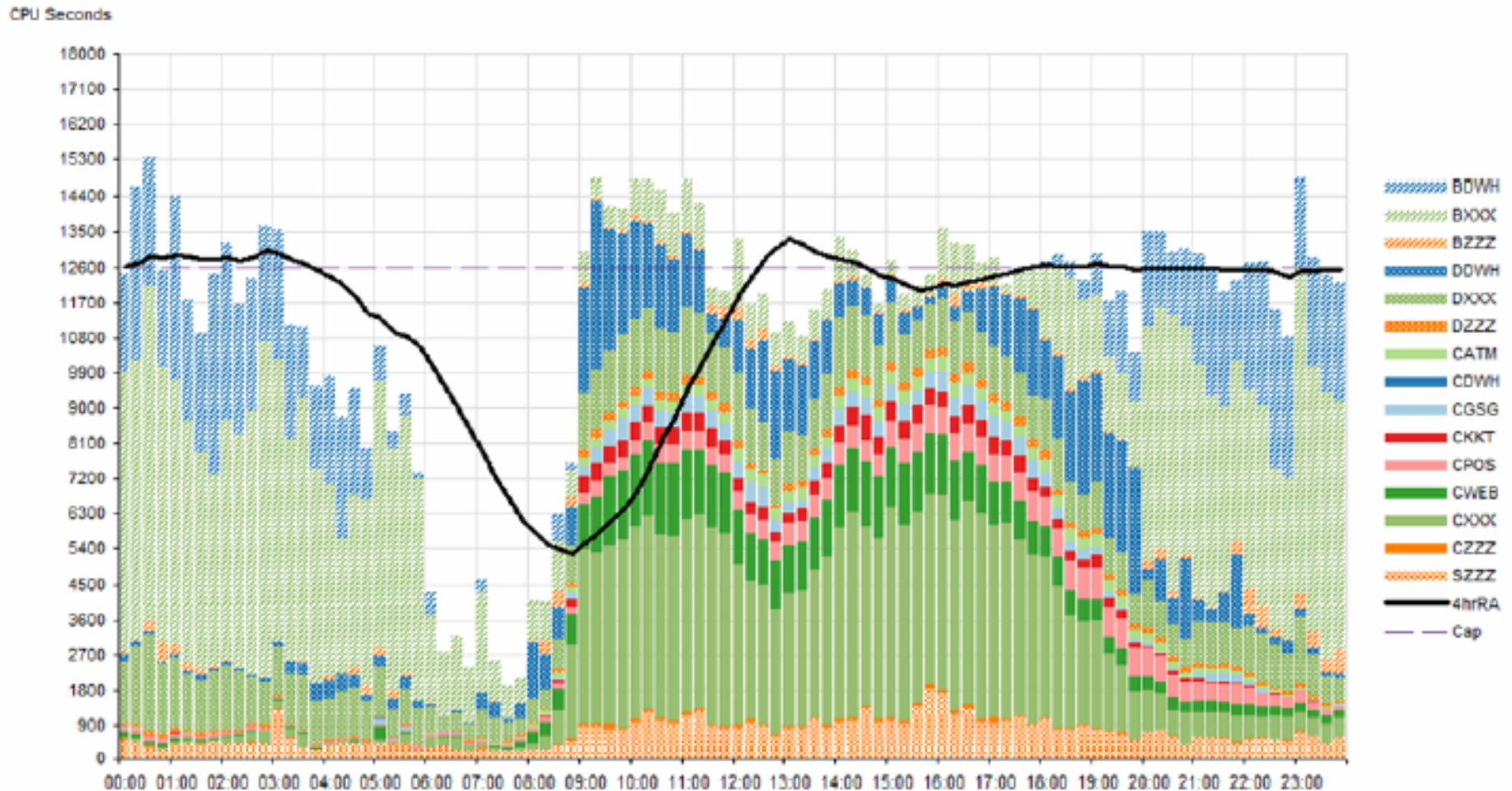
System z Virtualization and Workload Management Achieve High Levels of Utilization



Note:

- Each bar represents the amount of CPU seconds used in 15 minutes (= 900 seconds) with 2 10-way machines
- The way Workload Management controls the workload 4-hour rolling average to the Cap "high-water mark"

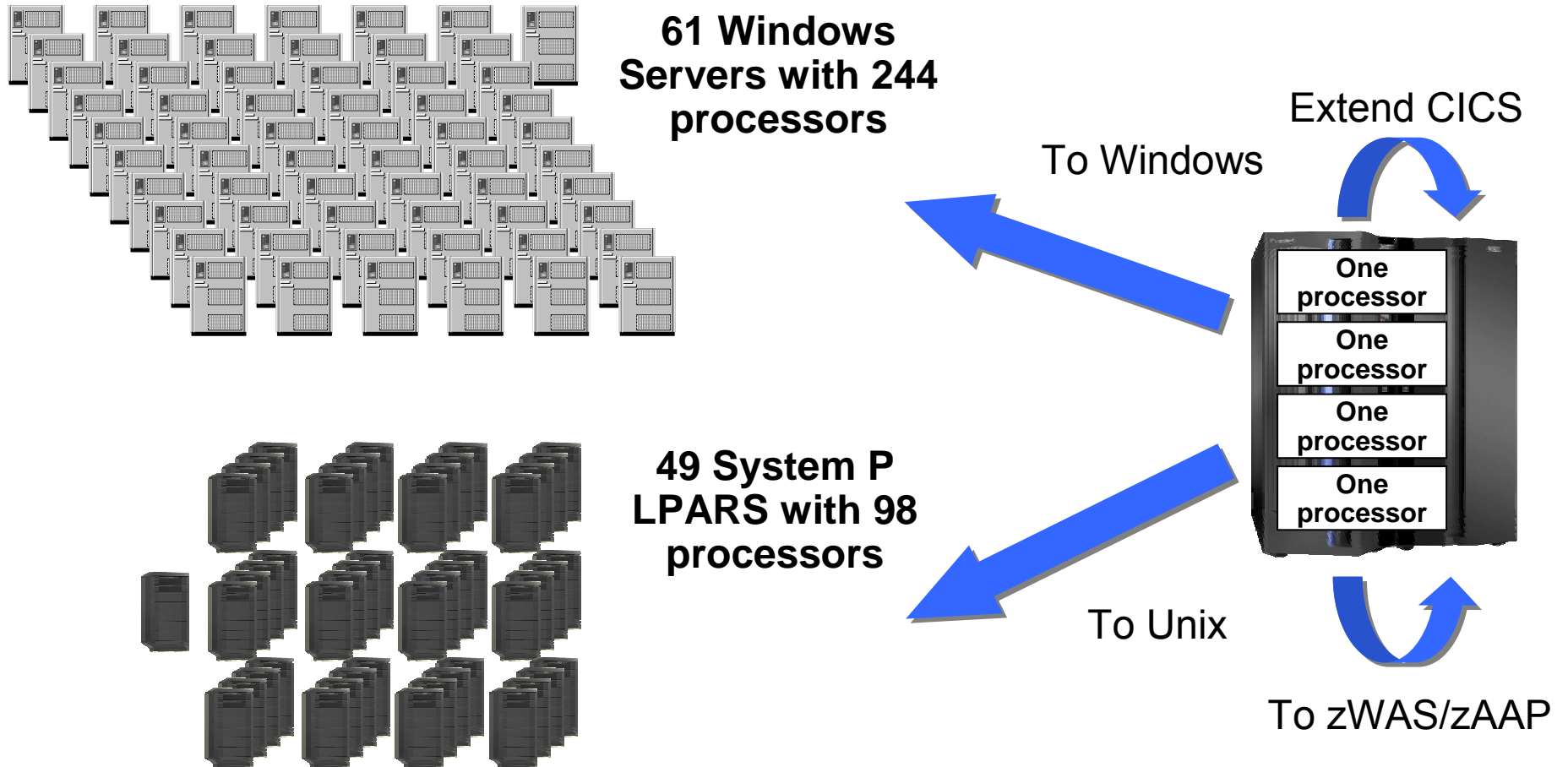
System z Virtualization and Workload Management Achieve High Levels of Utilization



CICS, DB2, Batch Workload Profile – Mon 27 March (15 applications)

European Banking Customer

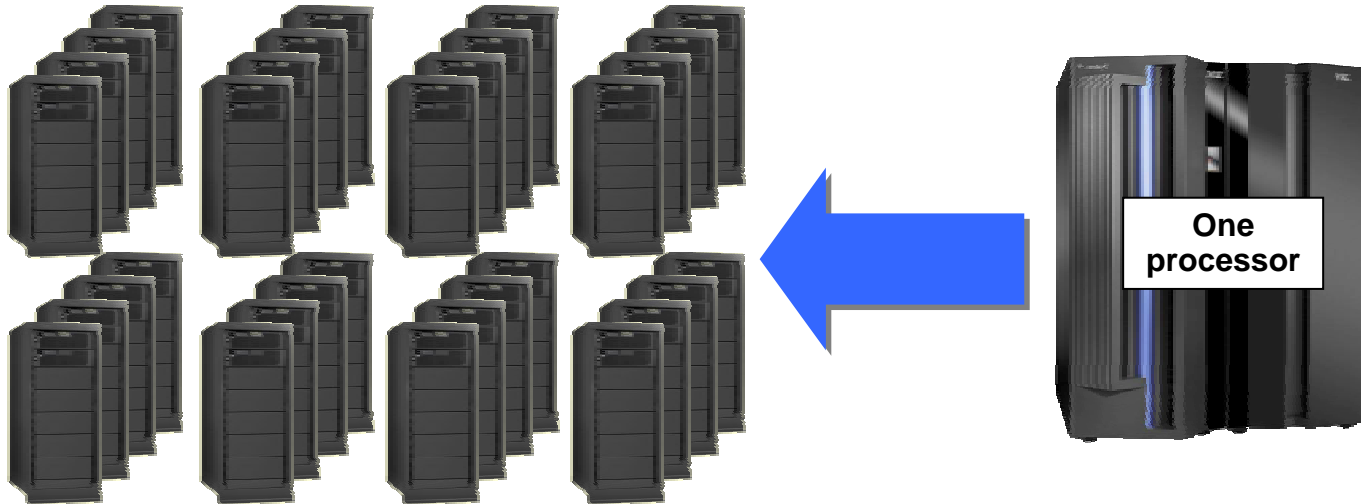
TCO Analysis to Extend CICS Transaction Workload



Conclusion: Same TCO with no benefit from additional migration cost & risk

Asian Financial Services Customer

- 7 workloads using 420 MIPS on a mainframe
- TCO analysis to offload to distributed UNIX Systems



32 Unix Servers with 79 Processors

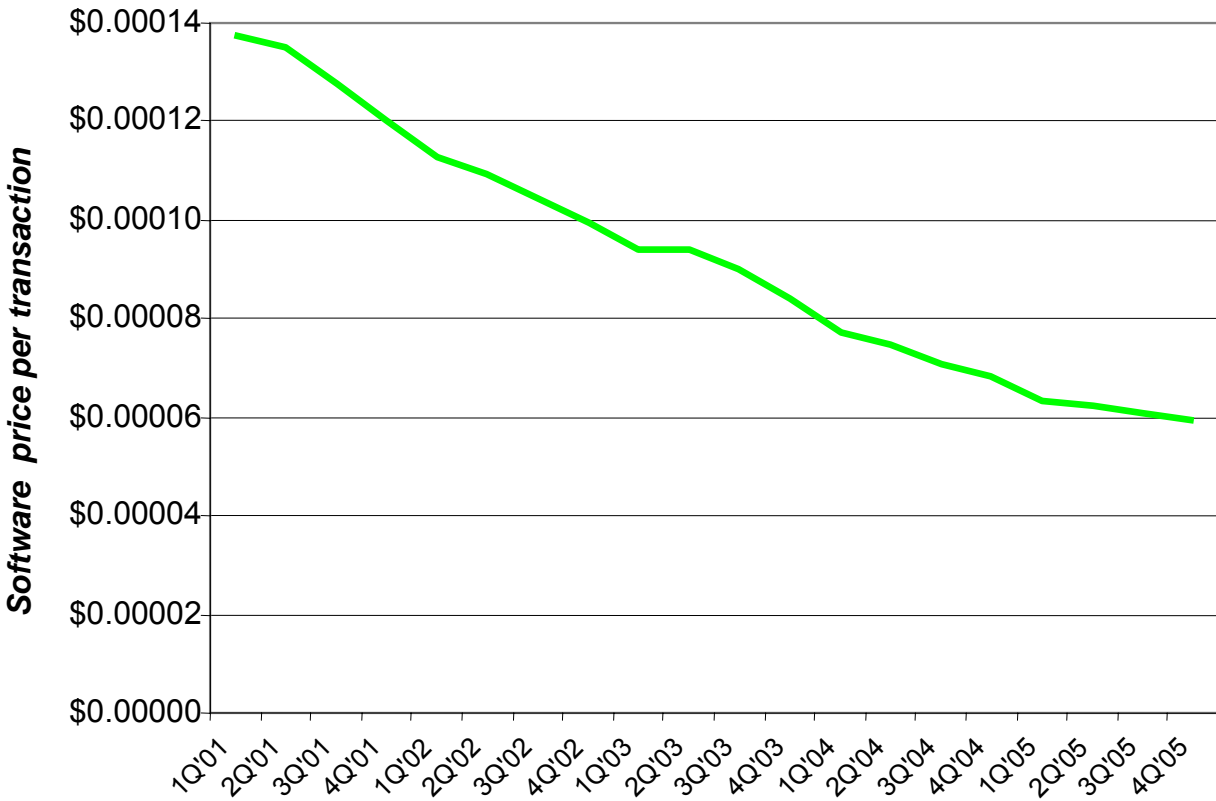
Conclusion: Same TCO with no benefit from additional migration cost & risk

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
 - Peak-to-average provisioning yields low utilization
 - Batch workload conversion to “transaction style”
 - Separate servers for production, failover, development/test
 - Infrastructure servers for systems management
 - ▶ Processing comparisons
 - Language expansion (CICS/COBOL path lengths are highly optimized)
 - Conversion factor (MIPS to TPM-C or RPE) worsens as I/O rates increase

- Other TCO considerations
 - ▶ Provision for continued growth in workload year to year
 - ▶ Dual environments during migration
 - ▶ 3 to 5 year lifetime for distributed servers requires repurchase
 - ▶ Partial offloads eliminate the lowest cost MIPS first

IBM Software Price Per Transaction is Also Going Down



57% decrease in past 60 months

➤ **17% decrease per year**

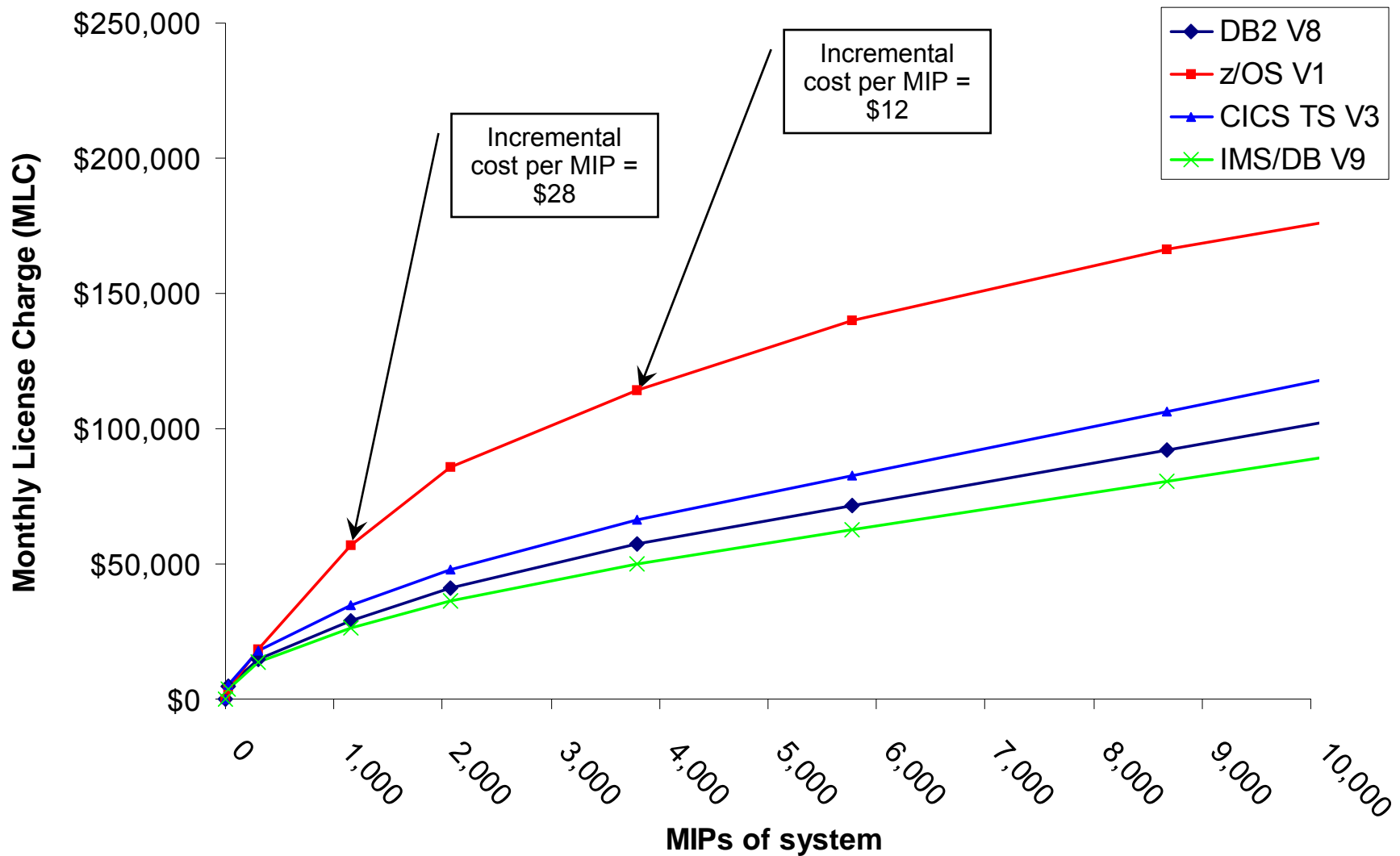
What makes the price go down?

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

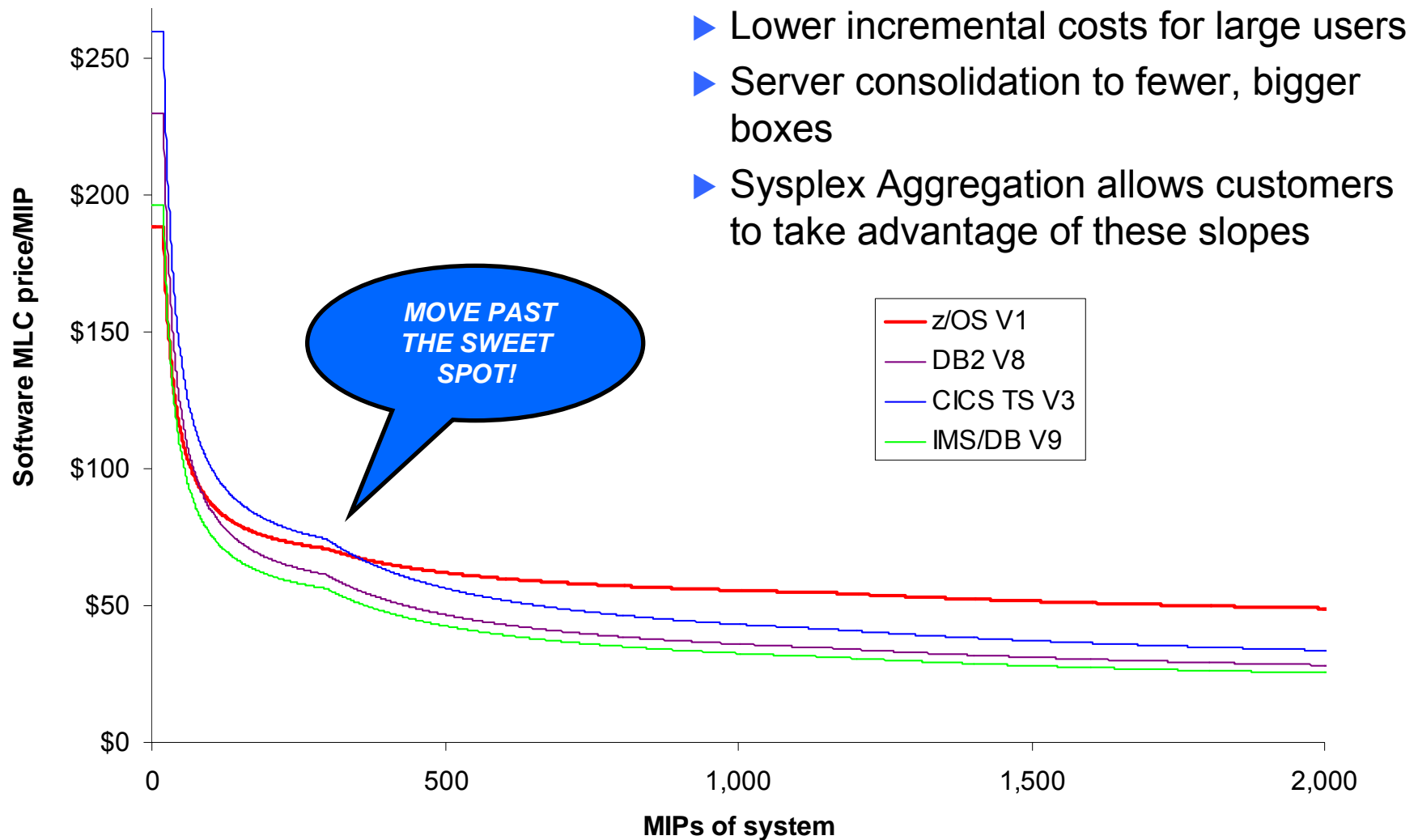
— Inflation-adjusted IBM software price per transaction

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

Software Pricing Curves Favor Growth



Overall Software Price Per MIP Decreases as System Size Increases



Putting This in Perspective

- For a low-end system of 200 MIPS, MLC software stack costs \$123 per incremental MIP
- If a transaction is 1 million instructions, an incremental MIP can perform >2½ million additional transactions per month for Δ\$123 software cost (21K transactions per dollar)
- **If these are credit card transactions** of average \$100 with a commission of 2%, the business makes \$5.2M per month for a software cost of \$123 per month (42,000 times return)
- **If this is a bank account** averaging 3 transactions a day, the business can do 19 years of account management for a software cost of \$1

Putting This in Perspective

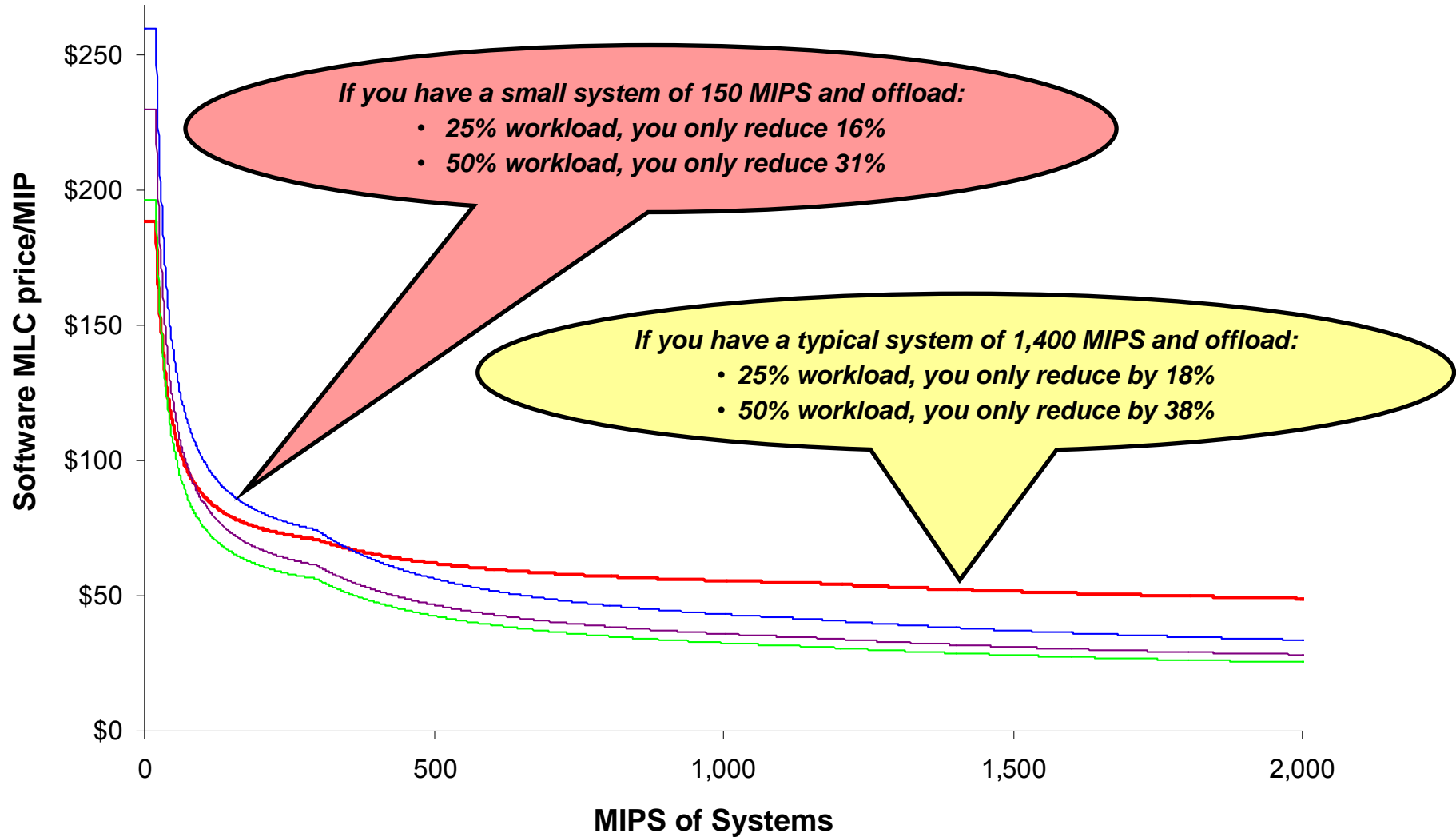
- For a typical system of 1,400 MIPS, MLC software stack costs \$59 per incremental MIP
- If a transaction is 1 million instructions, an incremental MIP can perform >2½ million additional transactions per month for Δ\$59 software cost (44K transactions per dollar)
- **If these are credit card transactions** of average \$100 with a commission of 2%, the business makes \$5.2M per month for a software cost of \$59 per month (88,000 times return)
- **If this is a bank account** averaging 3 transactions a day, the business can do 40 years of account management for a software cost of \$1

Comment on the Mainframe

*“Then we looked at the one million plus transactions every day that 2,000 of our employees generated, and we start to do the math and you realize that the **per transaction cost is really very modest.**”*

Kevin Campbell, Chief Application Architect, Univar USA

Let's Consider How this Works in Reverse ... Lowest Cost MIPS are Offloaded First



IBM Actually Charges on the Basis of MSUs (Millions of Service Units Per Hour)

- 1 MSU currently is equal to about 7.3 MIPS (for a z9 EC)

So...

- Software for a 580 MIPS machine will be charged at a rate of 81 MSU's

Various ratings online at:

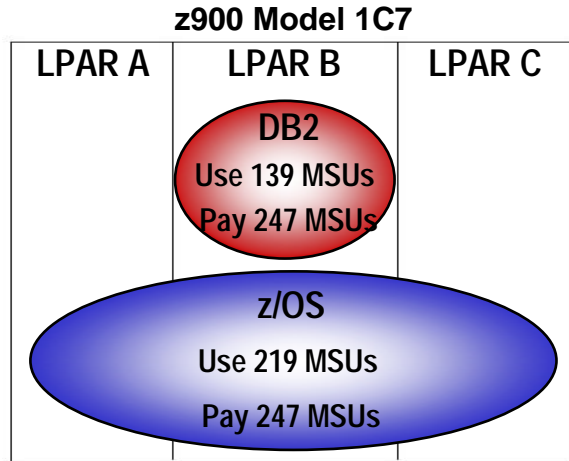
MSUs <http://ibm.com/zseries/library/swpriceinfo/hardware.html>

LSPR MIPS <http://ibm.com/zseries/lspr>

Hardware SRM Constants <http://ibm.com/zseries/srm>

Example of Sub-Capacity Pricing, Saving ~ \$16K MLC

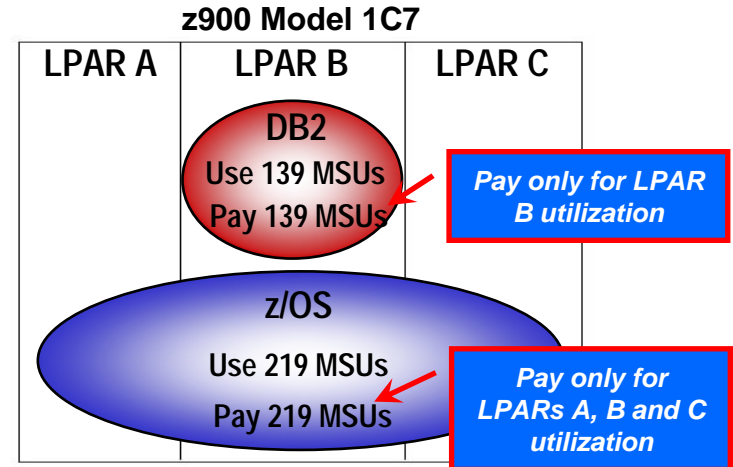
FULL-CAPACITY PRICING



247 MSUs

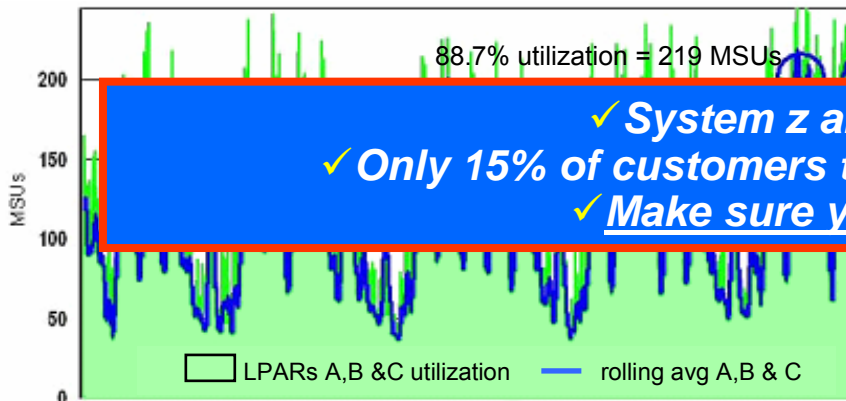
Total cost = \$106,915/mo

SUB-CAPACITY PRICING

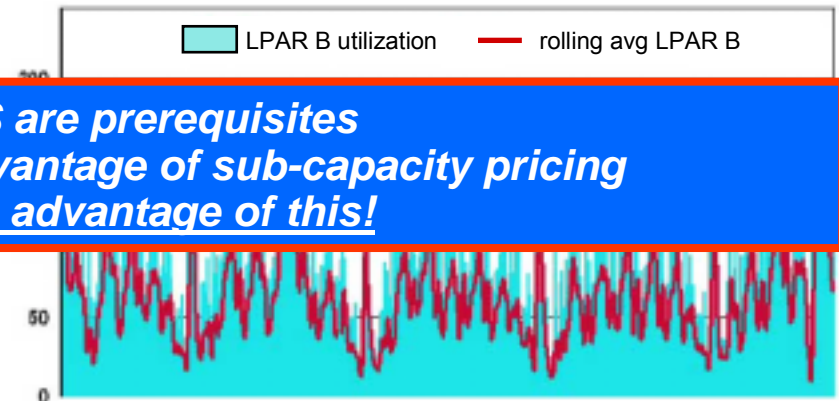


247 MSUs

Total cost = \$91,011/mo



one month



one month

- ✓ System z and z/OS are prerequisites
- ✓ Only 15% of customers take advantage of sub-capacity pricing
- ✓ Make sure you take advantage of this!

Example of Sysplex Aggregation, Saving >\$82K MLC

NO AGGREGATION

z990 Model 305 z900 Model 1C8



302 MSUs

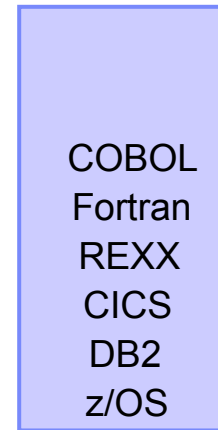
276 MSUs

COBOL	302 MSUs	
Fortran	302 MSUs	
REXX	302 MSUs	
CICS TS	302 MSUs	+ 276 MSUs
DB2	302 MSUs	+ 276 MSUs
z/OS	302 MSUs	+ 276 MSUs

Total cost = \$321,596/mo

AGGREGATION

z990 Model 305 z900 Model 1C8



302 MSUs

276 MSUs

COBOL	302 MSUs
Fortran	302 MSUs
REXX	302 MSUs
CICS TS	578 MSUs
DB2	578 MSUs
z/OS	578 MSUs

Benefit of price slopes

Total cost = \$239,090/mo

Specialty Processors

- Same as general purpose CPU's except limited to specific uses
 - ▶ zAAP runs any Java workload
 - ▶ zIIP runs specified data base workloads
 - ▶ IFL runs Linux (natively or under VM)
- Hardware is \$95K–\$125K one time charge
 - ▶ Approximately 9% of general purpose price
 - ▶ **No charge** for software running on zAAP/zIIP
 - ▶ IBM software running on IFL is priced per IFL processor (not per image)
 - ▶ Free upgrade to next generation!
- **In typical scenarios, zAAP/zIIP can reduce annual (software) and OTC charges (hardware and software) by ~40%**



Up to 85% of WebSphere can be offloaded to zAAPs, saving over \$3M

- Only 2.6% overhead
- HW savings = **\$2.8M**
 - ▶ Savings of 1,914 GP MIPS (425% of a z990)
- SW OTC savings **\$200,000** for WAS
 - ▶ 2,250 MIPS (340 MSUs) = \$258K
 - ▶ 338 MIPS (53 MSUs) = \$58K
 - ▶ Plus **\$40K** p.a. S&S savings
 - ▶ Plus **\$228K** p.a. zNALC savings
 - ▶ Then add in z/OS and DB2 MLC savings ...
- One customer has achieved **92%** Java offload to zAAPs

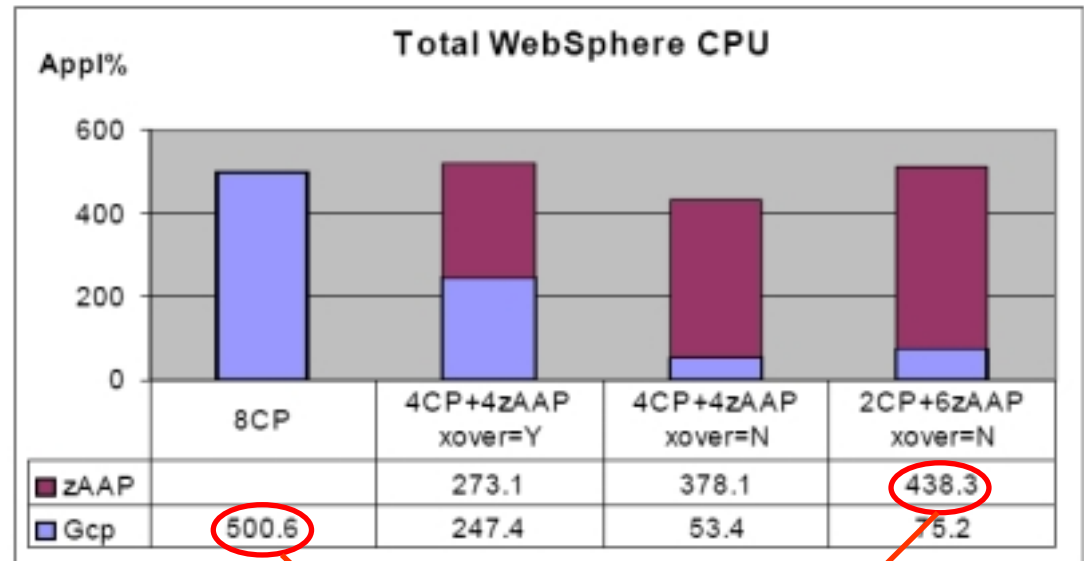


Figure 4-36 Total WebSphere CPU consumption for zAAPs and CPs

New in 2007
85%

From the Redbook *Implementing an SOA on the IBM zSeries Platform* (ZG24-6752)

Comparison of local vs remote I/O performance

From



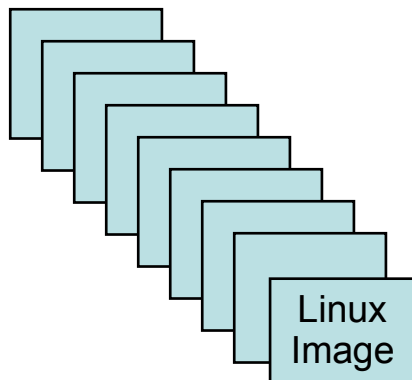
<i>Benchmark configuration (relative to SQL access)</i>	<i>Average CPU time per EJB</i>	<i>Amount of data transferred per EJB transaction</i>
<i>Remote (Distributed) z/OS Business Logic Environment</i>	11.73 mS ↓ 77%	54.4 KB ↓ 99%
<i>Local z/OS Business Logic Environment</i>	2.64 mS	0.5 KB

Also, in a different study comparing a Type 4 JDBC connector and a Type 2 (Local) JDBC connector, the Type 2 connector showed

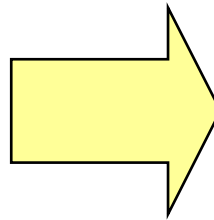
50% reduction in end-user response time and CPU used

The Economics of Workload Consolidation

- Distributed servers typically run at utilization levels in the range of 5% to 20%
 - ▶ Production servers, development servers, test servers
- Virtualization and workload management enable consolidation on the mainframe
 - ▶ Run multiple images on fewer processors
 - ▶ Achieve utilization levels of 85% or more



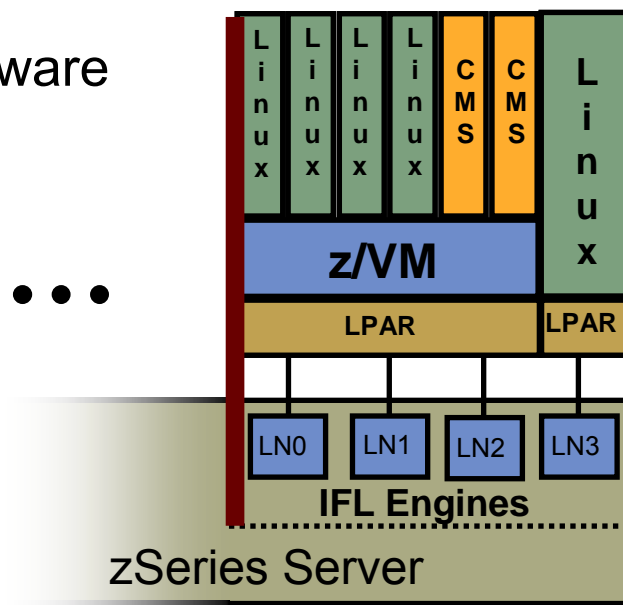
5% to 20% utilization



Full utilization

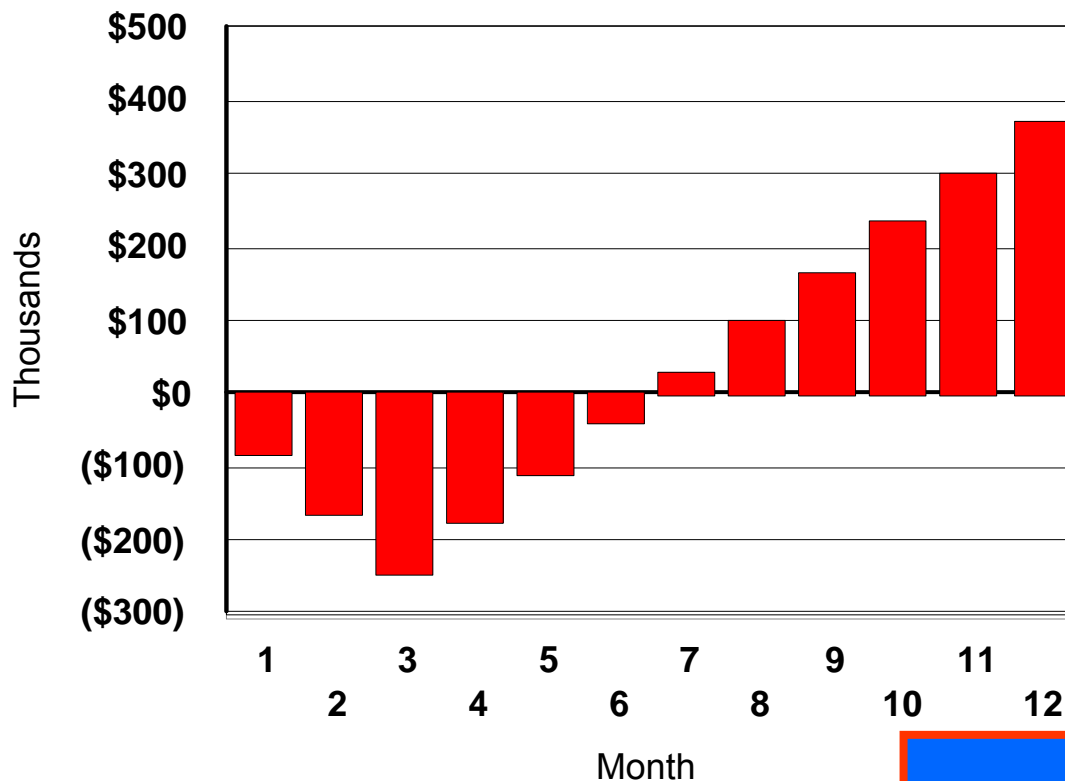
Integrated Facility for Linux (IFL) Makes Linux Consolidation Even More Attractive

- Linux Consolidation
 - ▶ Port multiple Linux systems to run as separate images under z/VM
 - ▶ Good economics due to typically low utilization of distributed servers
- Use of IFL engine reduces the price further
 - ▶ IFL specifically limited to Linux workloads
- IFL Requirements
 - ▶ z9-109, z990, z900, z890 or z800 hardware platform
 - ▶ No z/OS requirements
 - ▶ No limit on the number of IFLs



Example: IGS US Consolidated 62 Distributed Images to zLinux Images on an IFL

UNIX to zLinux Cost Savings

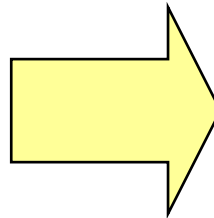
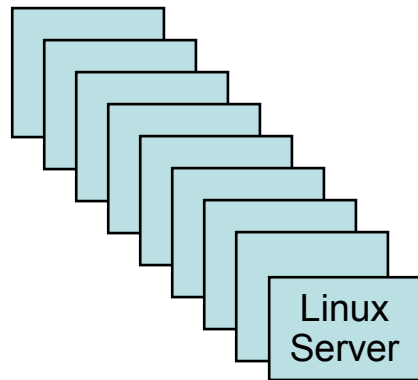


(Costs Savings are driven primarily by \$89K monthly labor savings)

■ Cost Differential

- ✓ Broke-even after 6 months
- ✓ >\$2.5M saved in 3 years
- ✓ In Europe, €524K headcount saved in Year 1

The Economics of Workload Consolidation



62 Linux servers with low utilization

62 @ \$5,000 = \$310,000

Plus 62 middleware licenses

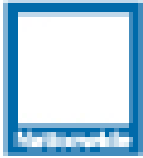
Plus \$6,500 x 62 = \$403,000/yr labor

One IFL processor with high utilization

1 @ \$125,000 = \$125,000

Plus one middleware license

Little additional labor



Nationwide® Saves \$16+ Million with Linux on On Your Side™ System z

■ **Problems:**

- ▶ High TCO including data center power and floor space scarcity (new facility would cost \$10M+)
- ▶ Long server provisioning process

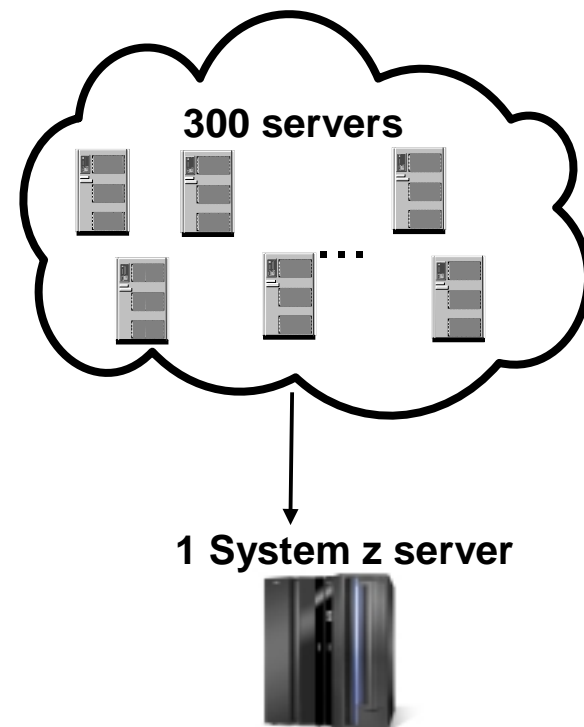
▶ **Solution:**

- ▶ 350 servers virtualized with 15 z990 IFLs, supported by 3 staff
 - ▶ 12 mission critical applications with 100,000+ users/day
- ▶ 50% reduction in Web hosting monthly costs, 80% reduction in floor space & power conservation
- ▶ 50% reduction in hardware & OS support efforts; significant savings on middleware costs
- ▶ Fast deployment (4 months)
- ▶ Significantly faster provisioning speed (months → days)
- ▶ Dynamic allocation of compute power eliminates need to “over-provision”
- ▶ Simple, robust mainframe high availability & disaster recovery

Vastly improved TCO, Speed & Simplification

Hannaford Supermarket Chain Goes Real Time with Linux on System z

- North-eastern United States supermarket chain
- Consolidated 300 Linux store servers on to a single mainframe
 - ▶ Running 62 virtual servers instead
 - ▶ Orders now direct from the aisles, just-in-time inventory management
 - ▶ Introduced new web portal for business partners
- Reduced costs while improving customer and partner satisfaction
 - ▶ Significant labor savings across the IT organization
- See <http://biz.yahoo.com/iw/051205/0103015.html>



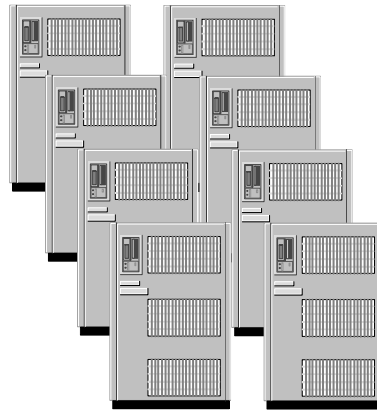
“The only way we'd consider consolidating critical data from hundreds of servers onto one system was by choosing an IBM mainframe for its legendary reliability and availability,”

Bill Homa, senior vice president and CIO of Hannaford

ODI Will Save with Linux Consolidation

\$1.1M saving over 3 years

60 Linux Servers



1 IFL

	<i>Distributed Linux/Intel @ low utilization</i>				<i>Mainframe IFL @ high utilization</i>			
	<i>Unit cost</i>	<i>Quantity</i>	<i>Sub Total</i>	<i>3 year total</i>	<i>Unit cost</i>	<i>Quantity</i>	<i>Sub Total</i>	<i>3 year total</i>
Hardware & OS - every 3 years	\$4,000	60	\$240,000	\$240,000	\$125,000	1	\$125,000	\$125,000
HW Maintenance		Included			\$19,944	1	\$19,944	\$39,888
VM virtualization		N/A			\$22,500	1	\$22,500	\$22,500
VM S&S (25%)		N/A			\$5,625	1	\$5,625	\$16,875
Annual Linux support	\$1,000	60	\$60,000	\$180,000	\$14,000	1	\$14,000	\$42,000
OTC Software license – WAS*	\$4,000	60	\$240,000	\$240,000	\$4,000	1	\$4,000	\$4,000
WAS S&S for 2 years	\$800	60	\$48,000	\$96,000	\$800	1	\$800	\$1,600
Annual labor for support	\$3,333	60	\$200,000	\$600,000	\$60,000	1	\$60,000	\$180,000
Annual power & cooling	\$920	60	\$55,188	\$165,564	\$920	1	\$920	\$2,759
Grand Total				<u>\$1,521,564</u>				<u>\$434,622</u>

* IBM WebSphere Application Server for Linux

Distributed Power Costs Have Become a Major Issue

- According to the Wall Street Journal, distributed server farms can generate as much as **3,800** watts per square foot
 - ▶ In 1992 it was 250 watts/sq foot
- *“Power-related problems in 2005 will cause 4 of the 20 major failures, up from 2 of 20 last year”* (The Uptime Institute)
- By comparison, a System z9 consumes **107-312** watts per square foot – *one tenth or less the amount*
 - ▶ Switching on an IFL processor consumes only 60-75 watts

Downtime and Security are Significant Unexpected Costs

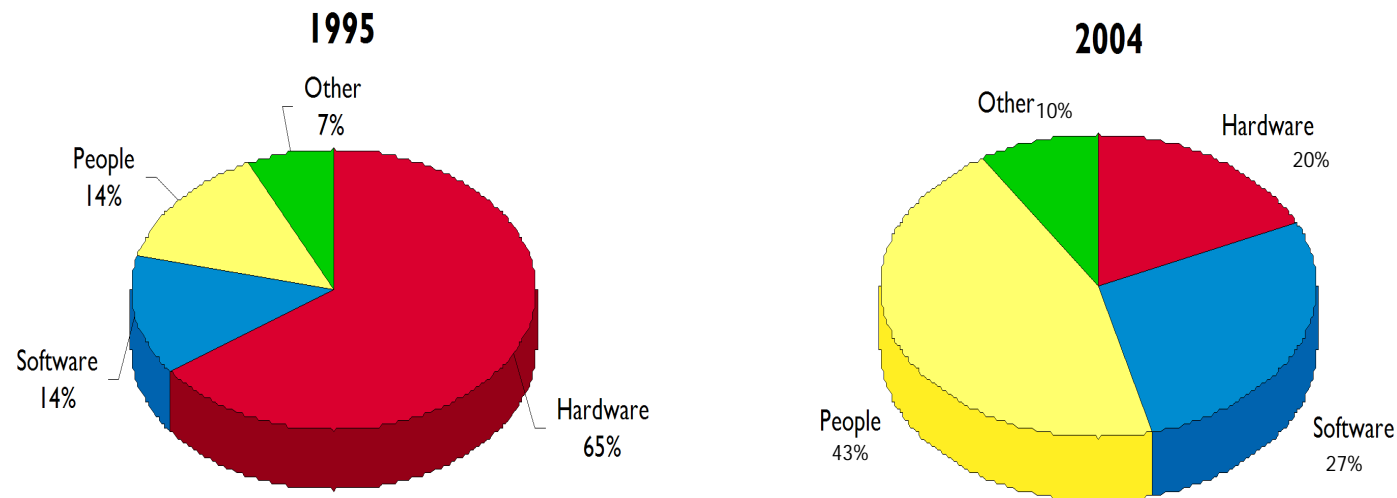
- Mainframes run at 99.999% availability
 - ▶ average unplanned downtime ~ 5 minutes/year
- Downtime and security issues can mean more than economic loss
 - ▶ Regulatory compliance
 - Fines
 - Other penalties
 - ▶ Market competitiveness
 - ▶ Customer loyalty
 - ▶ Business image & reputation

Financial Impact of Downtime Per Hour

<i>Industry segment</i>	<i>Cost</i>
Energy	\$2,818K
Telecommunications	\$2,066K
Manufacturing	\$1,611K
Financial	\$1,495K
Information Technology	\$1,345K
Insurance	\$1,202K
Retail	\$1,107K
Pharmaceuticals	\$1,082K
Banking	\$997K
Consumer Products	\$786K
Chemicals	\$704K
Transportation	\$669K

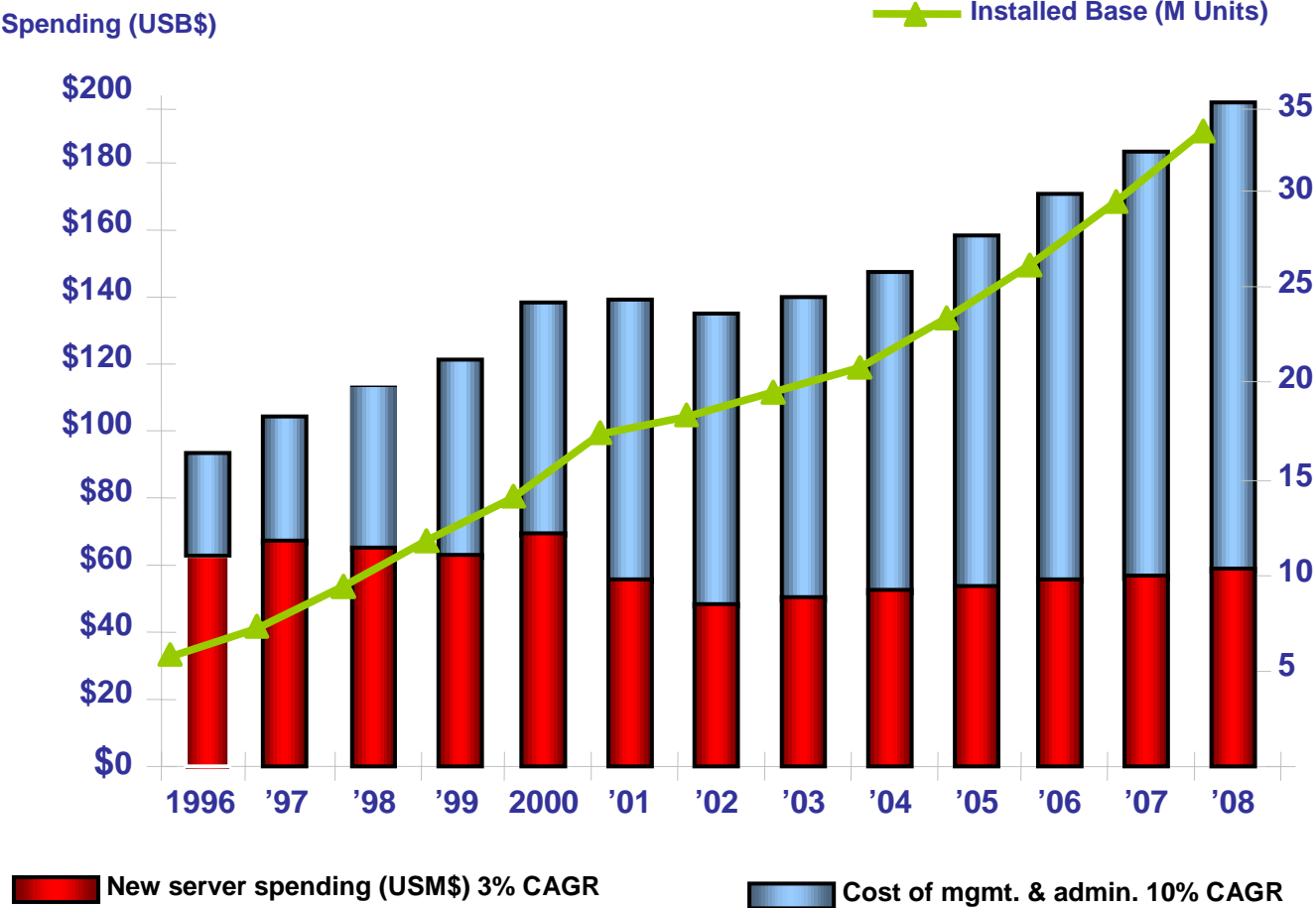
Source: Robert Frances Group 2005

People Expense has Become the Dominant Component of TCO



Based on IBM Scorpion customer analyses

Since 2000, Labor Costs Have Exceeded the Cost of All Servers ... and are *Still* Growing

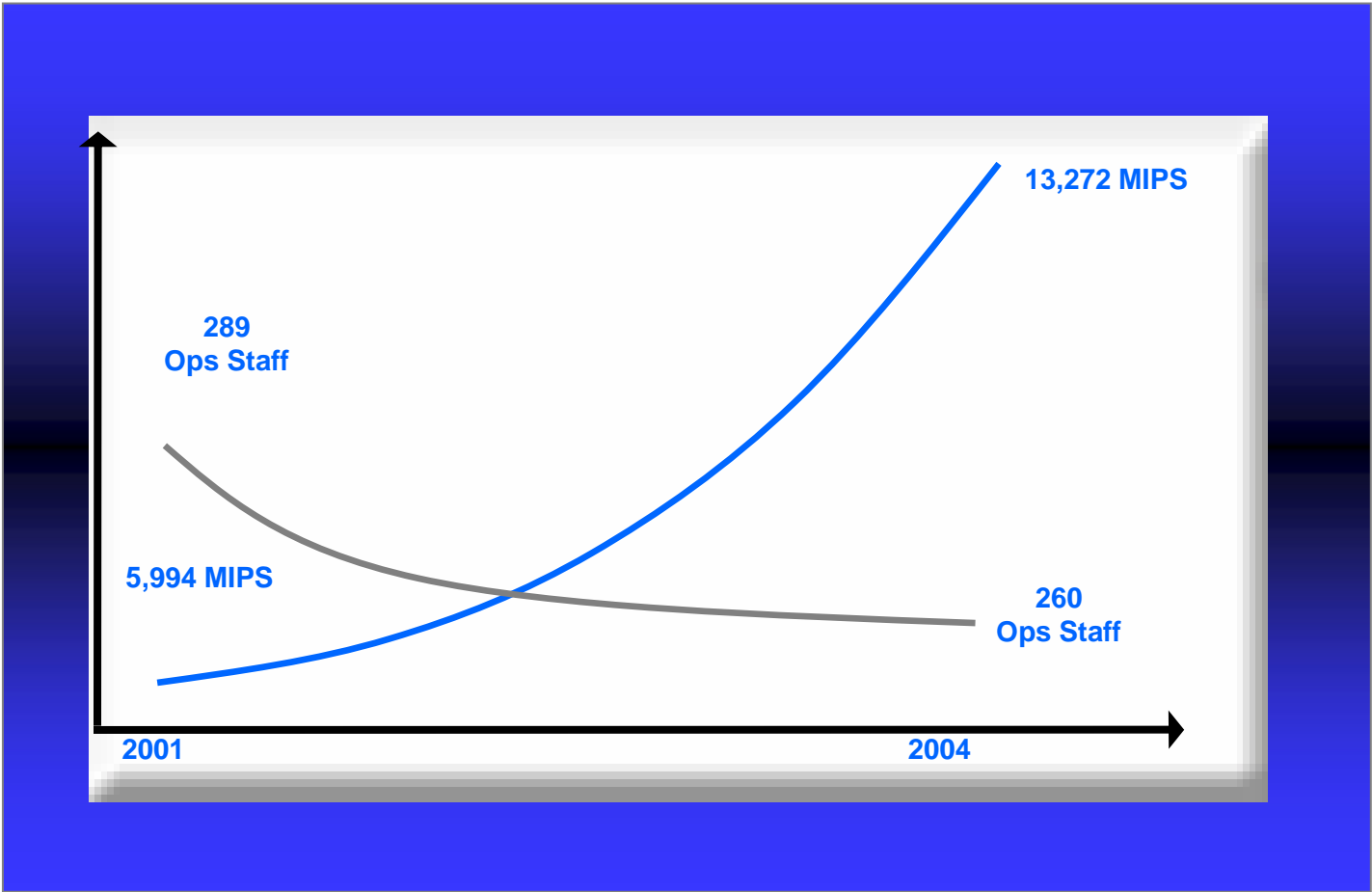


The cost of labor scales linearly with the number of distributed servers

Distributed scale-out is costly!

Source: IDC

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

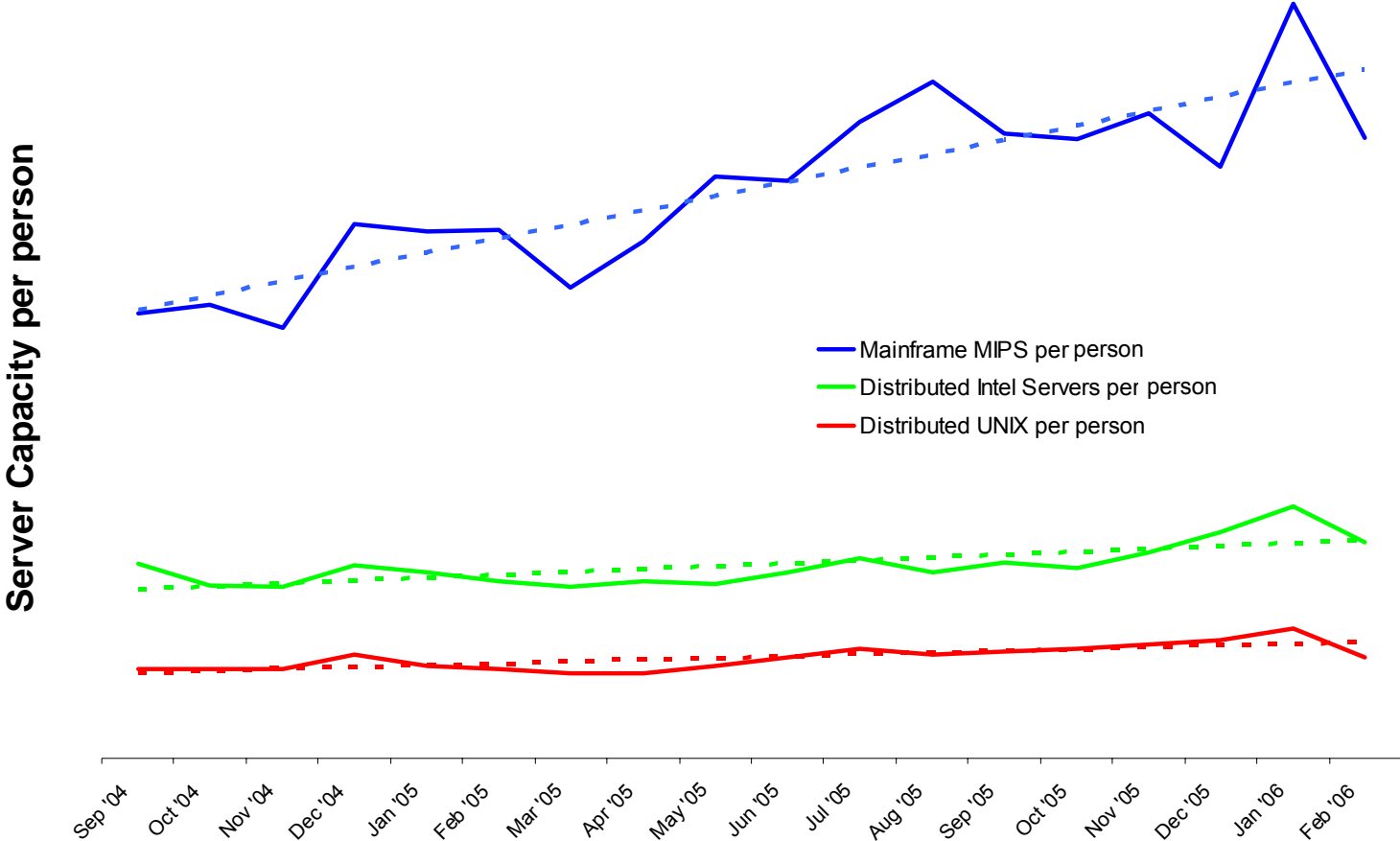


$$\frac{5,994}{289} = 21 \text{ MIPS/HC}$$

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

Source: Gartner

Hardware Managed Per Person



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

Topic	System z – 3,192 MIPS	900 Distributed Servers
Operations	\$105K10% 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>

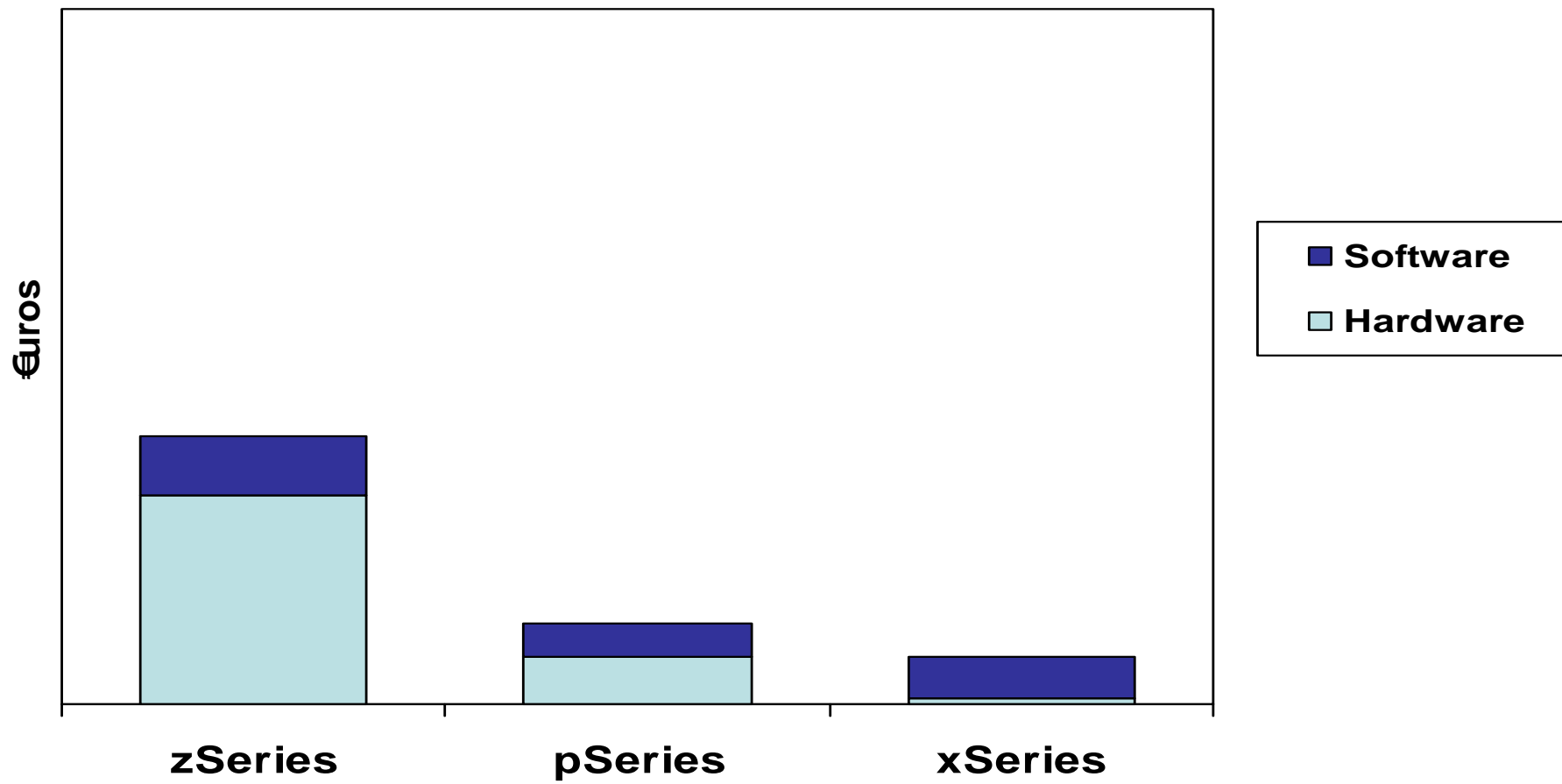
In this case, System z requires 1/8 the labor costs of the distributed environment

Source: IBM SWG Data Center

A Customer Example: Taking Only TCA Into Consideration

*German financial institution
running WebSphere*

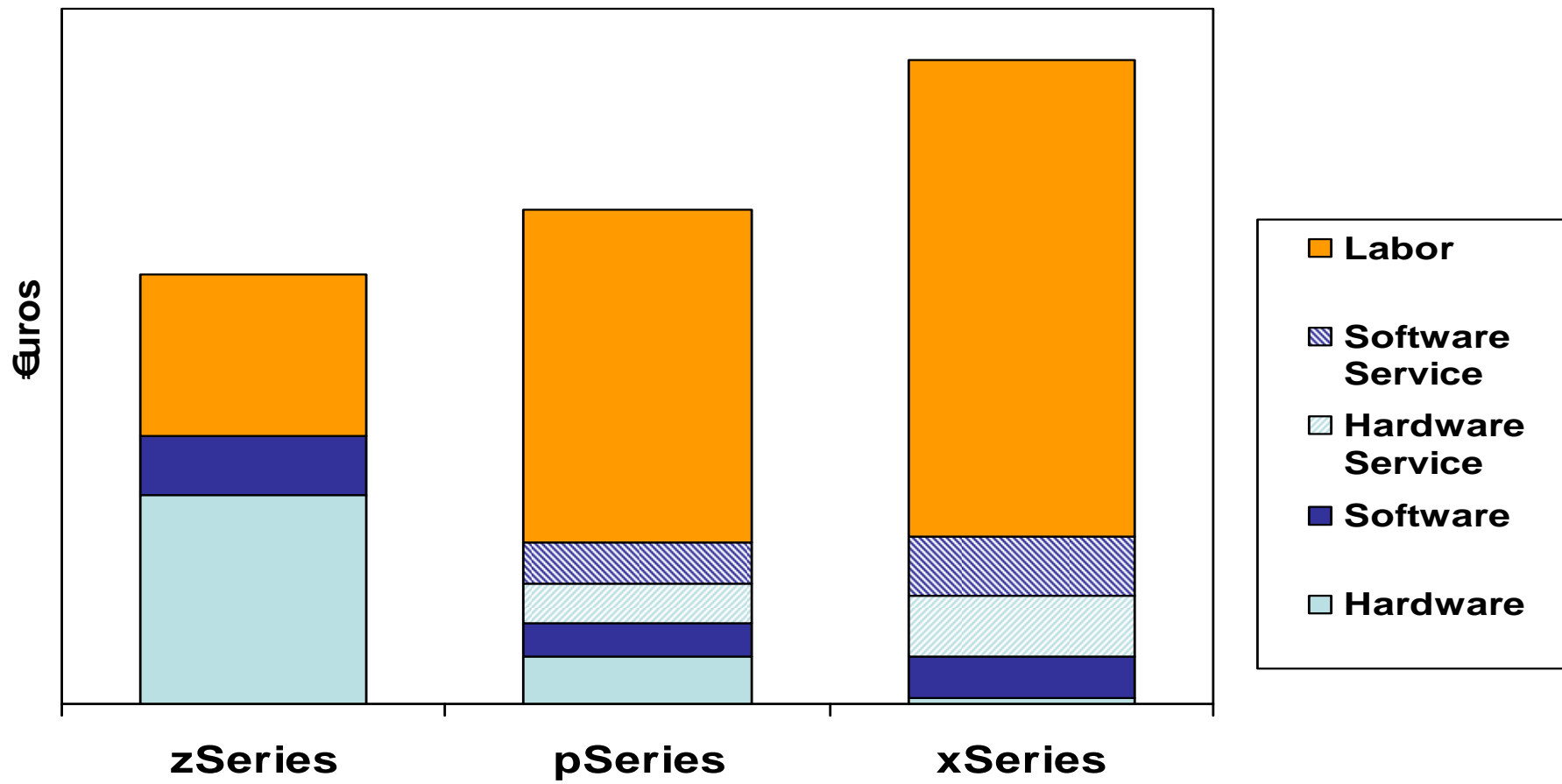
Acquisition cost over 4 Years



Plus the People & Service Costs

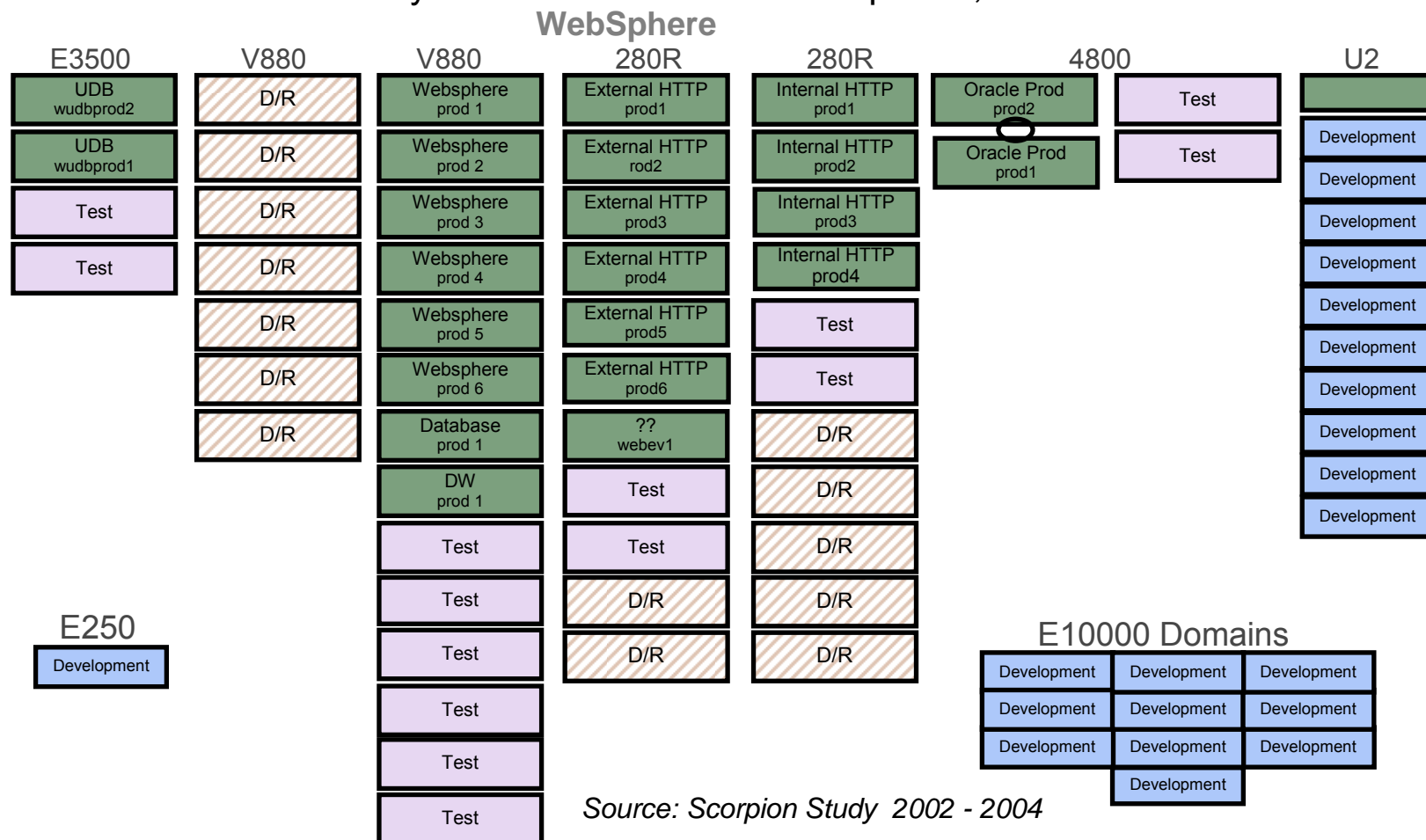
Distributed servers have higher service, monitoring and support costs – and cost more to deploy!

Total cost over 4 Years



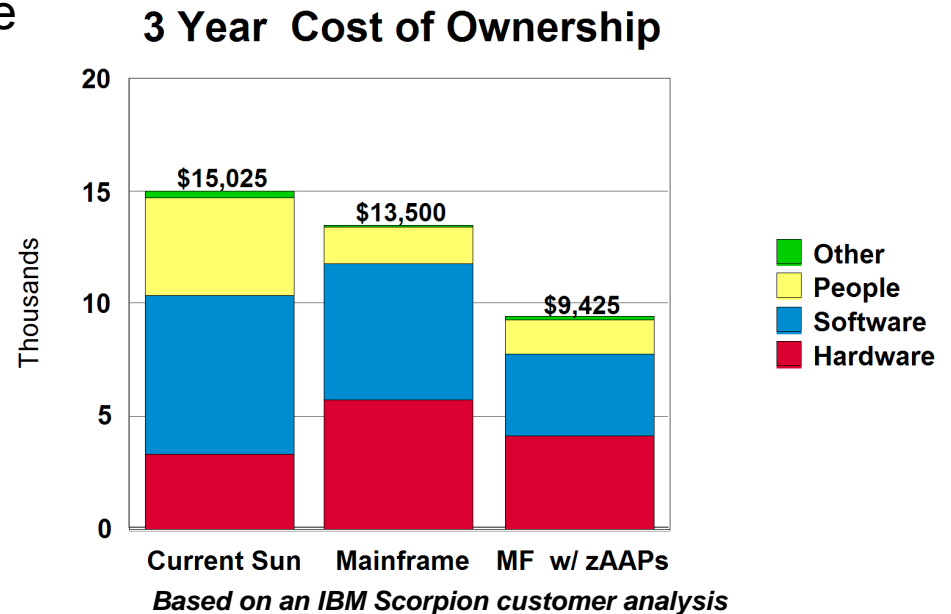
Example: A Customer Thought SUN Was 1/5th the Cost of the Mainframe, but Perception... Isn't Always Reality!

- US Finance customer thought they only had 24 UNIX servers
 - ▶ But these were just the PRODUCTION servers
 - ▶ In addition they had 49 servers for Development, Test and Disaster Recovery



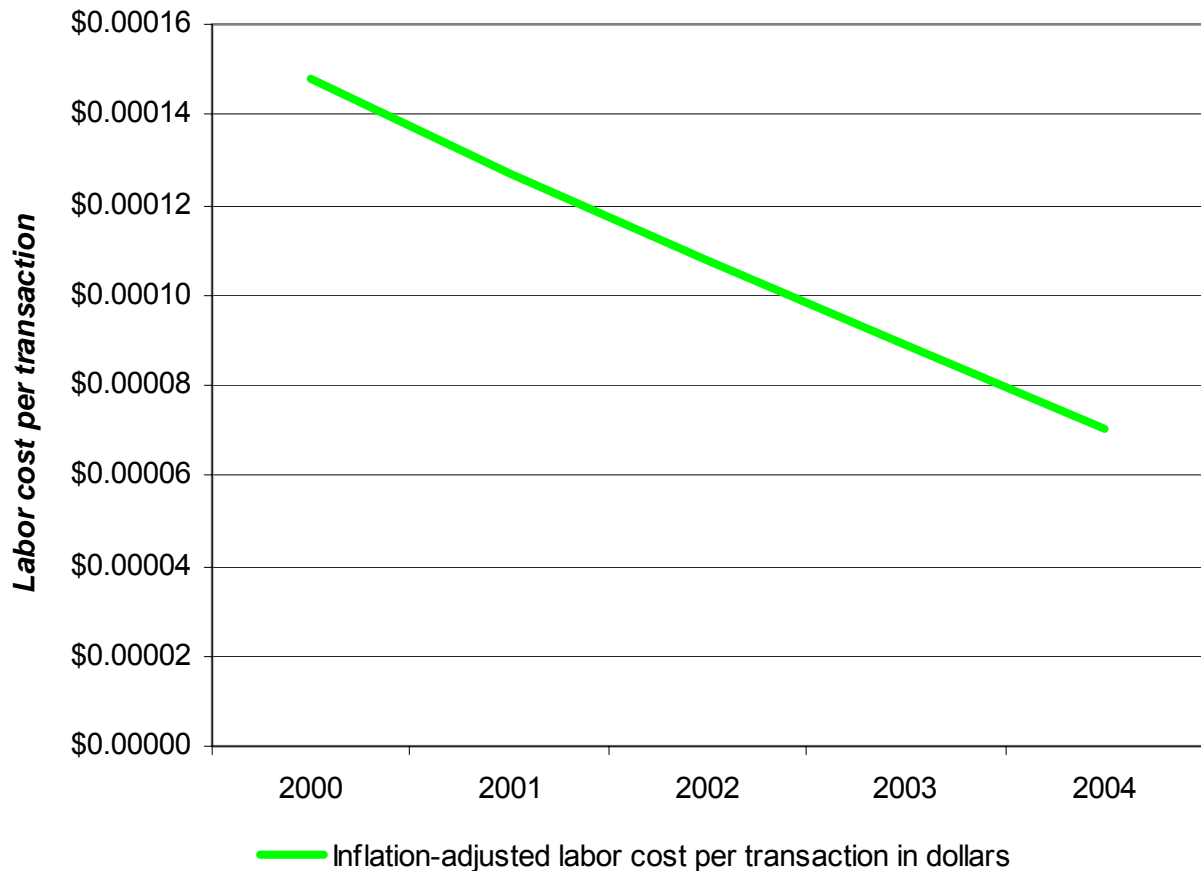
People Costs are Often *Hidden* in Distributed Implementations

- They needed 14 people to support these 73 servers
 - ▶ At only 20% utilization
 - ▶ Each server cost \$20K per annum to support
- A comparable z- implementation would have required just 20 processors
 - ▶ 5 people to support



- The customer thought the Solaris environment was 1/5 the cost of the mainframe...
...but in fact the **z-TCO was 37% less**

Labor Cost Per Transaction on System z is Decreasing



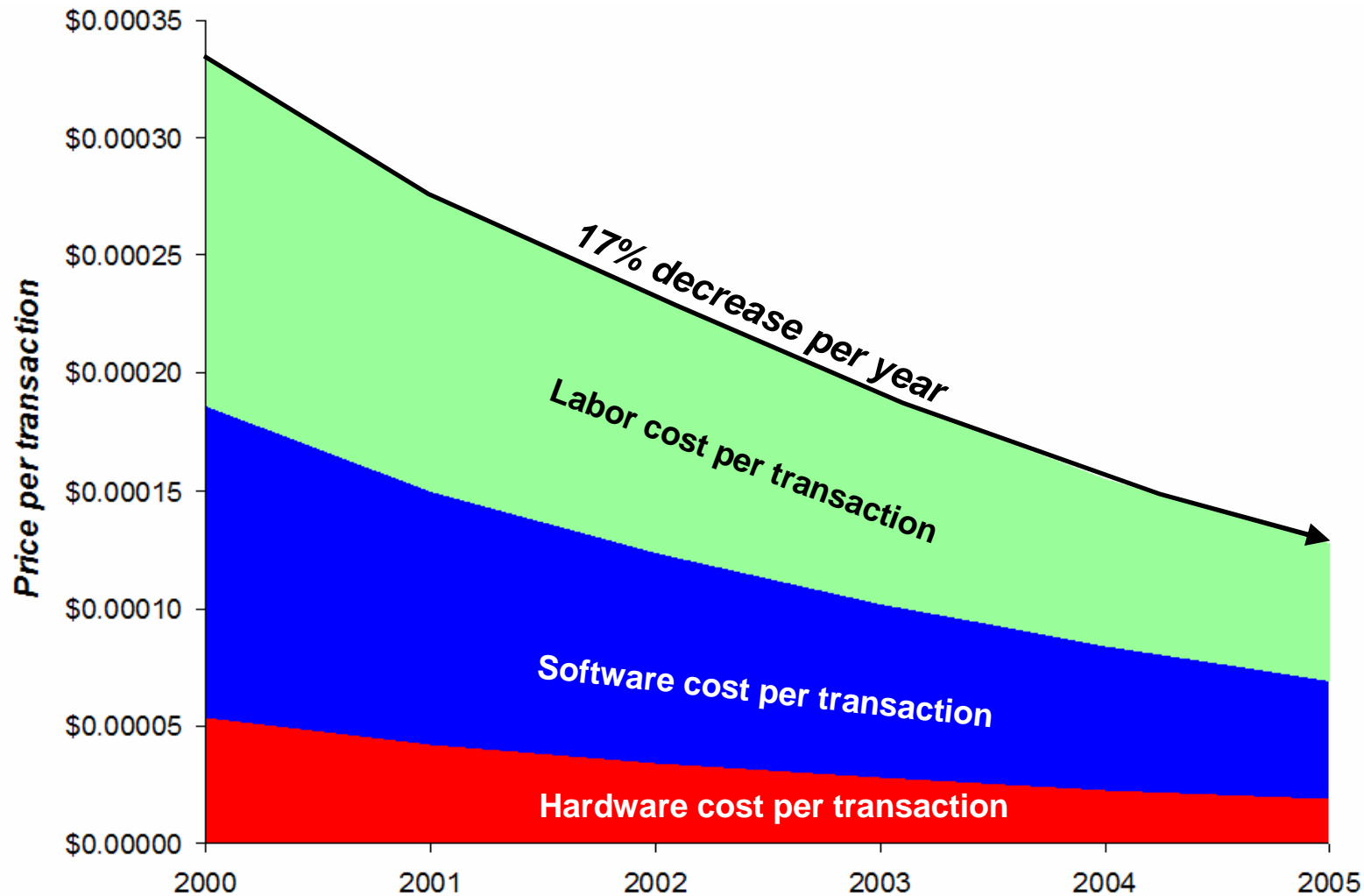
16.9% decrease per year

What makes the price go down?

- Increasing workloads
- Data-center-in-a-box design reduces need for labor
- Scalability of the mainframe
- Ease of incremental upgrade
- Inherent reliability of the mainframe
- Fewer repairs and patches
- Intelligent Workload Management Including CICSplexSM
- Minimal security risks & breaches
- IBM integration, testing & support

Source: IBM Global Services UK

Total Mainframe Hardware, Software & Labor Costs Have Reduced by 62% in 5 Years



Summary

- The proper comparison between mainframe and distributed is not a single application benchmark
- The proper comparison is a distributed data center versus a mainframe, running high volume mixed workloads
- Under this comparison, mainframes have significant cost advantages

How Customers Can Get the Lowest TCO on the Mainframe

1. Move past the “sweet-spot” to realize lower prices
 - ▶ Grow core-business MIPS
2. Use the latest technology and pricing models
 - ▶ Upgrade to System z
 - ▶ Utilize specialty processors
 - ▶ Utilize sysplex aggregation
 - ▶ Exploit sub-capacity pricing
 - ▶ Execute an ELA
3. Maximize utilization
 - ▶ Drive mainframes at 90+% utilization, 24 hours by 7 days
 - ▶ Consolidate workload onto System z
4. Minimize other costs
 - ▶ Minimize software tool costs
 - ▶ Minimize outages and security breaches...
5. Stop spiraling labor costs



Thank
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