

A Fresh Look at the Mainframe

Mainframe Total Cost of Ownership Issues

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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

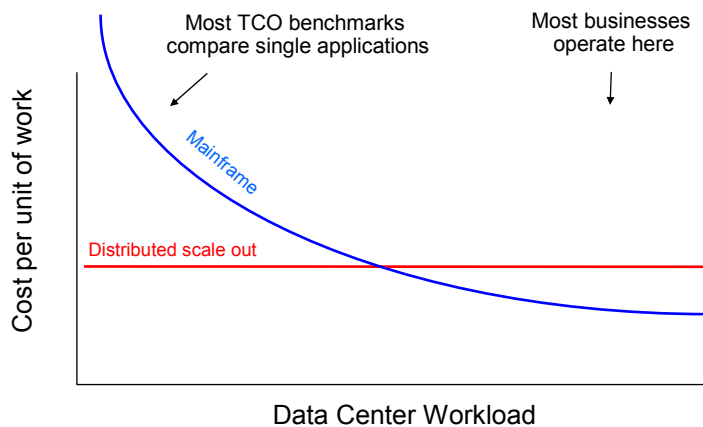
- The cost of running incremental workload on the mainframe goes down as the total workload grows
 - ▶ Labor costs hold steady as workload grows
 - ▶ Mainframe design and pricing policies designed to favor the addition of more workload
 - ▶ Special hardware pricing for new workload types
 - ▶ Lower software 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 throughput 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

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Mainframe Cost Per Unit of Work Goes Down as Workload Increases



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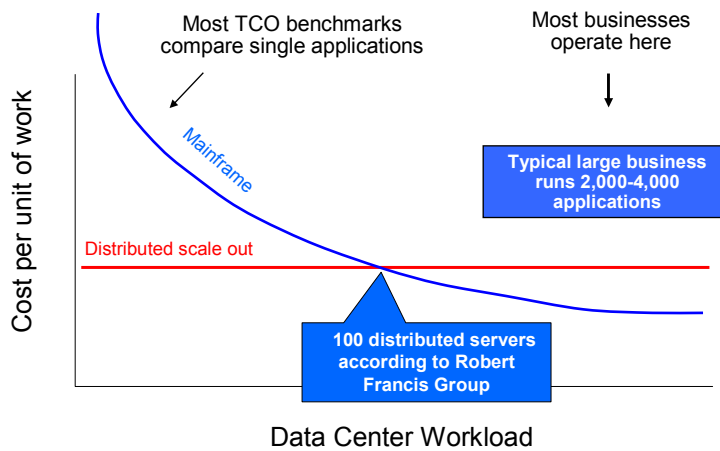
First National Bank of Omaha



	Servers	Reliability	Utilization	Staff
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

Where is the Cross Over Point?

It depends on your environment ...



Here Are Some More Hints

- Growth by Large Customers
 - ▶ 95% of large mainframe customers (average installed MIPS from 13,000 to 15,000 have CAGR of installed MIPS by **21%** to **31%** since 2002

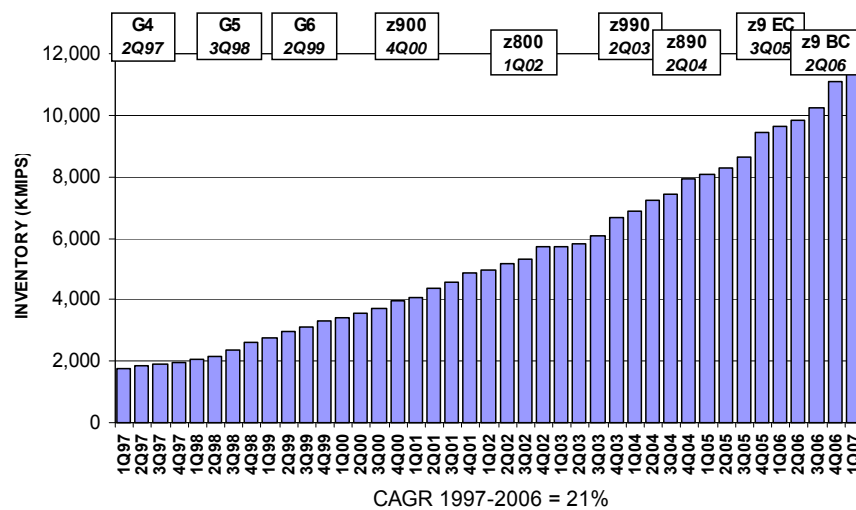
- Growth by mid size customers
 - ▶ 72% of mid size mainframe customers (average installed MIPS 1400) have CAGR of installed MIPS from **25%** to **34%** since 2002

- Growth by small customers
 - ▶ 70% of small mainframe customers (average installed MIPS 400 to 600) have CAGR of installed MIPS from **38%** to **50%** since 2002

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Mainframe Growth of Installed MIPS



Source: IBM STG Finance

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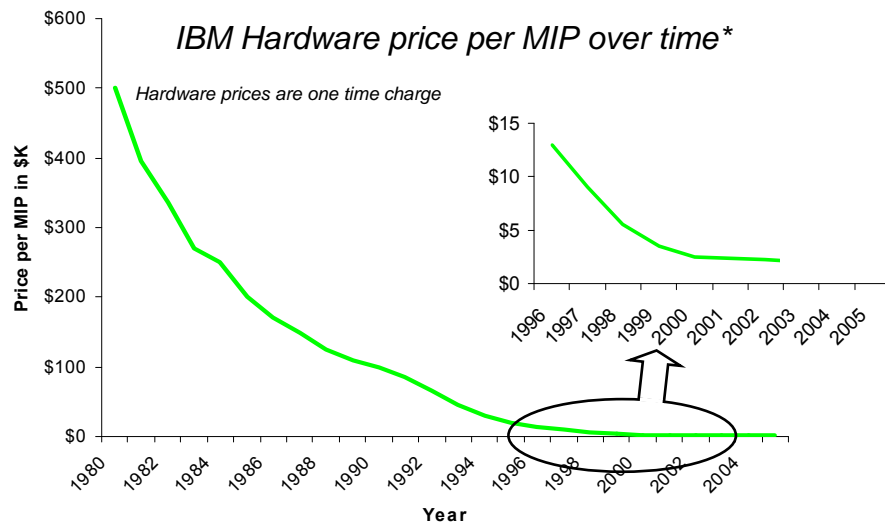
Let's Break Down the Elements of Cost

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

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Mainframe Hardware Cost is Decreasing



* Memory and I/O capacity are additional feature charges

Source: Gartner

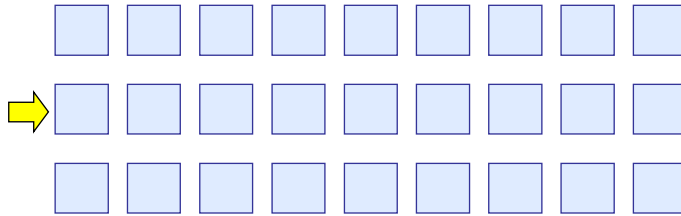
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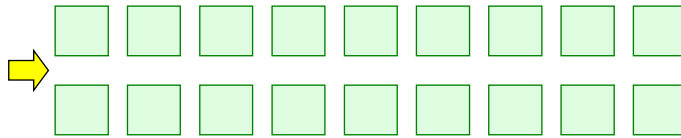
“Price Per MIP” Does Not Tell The Whole Story

54 way SMP

Pay for these general purpose processors
“Price per MIP” →



Pay for zAAP, zIIP, and IFL processors at a reduced rate
(~9% of price per MIP) →



Do not pay for SAPs, spares, pre-installed capacity on demand processors until used →

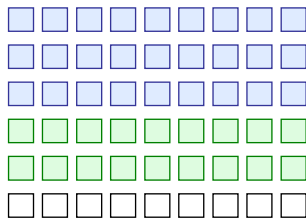


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Disaster Recovery – Fast Failover For Less

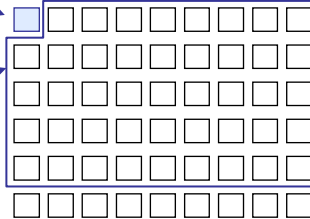
Primary Site
54 way SMP



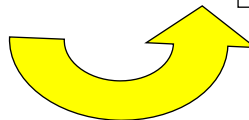
Pay regular price for one active processor to enable fast failover

Pay \$30K for each dormant processor to maintain capacity back up on demand
~2% of price per MIP

Alternative Site
54 way SMP



Pay regular price for frame



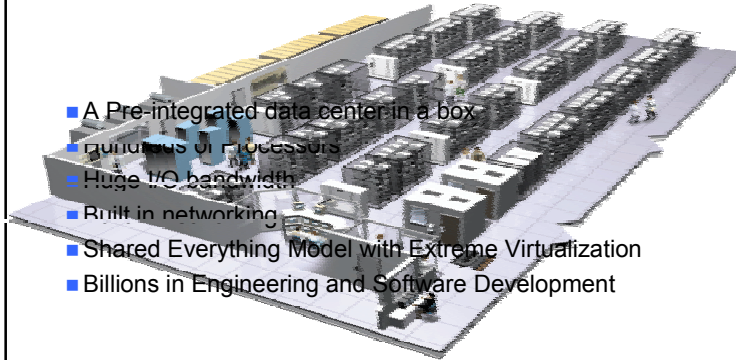
Site Failover With GDPS

Note: other scenarios can reduce the price further

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Datacenter in a Box



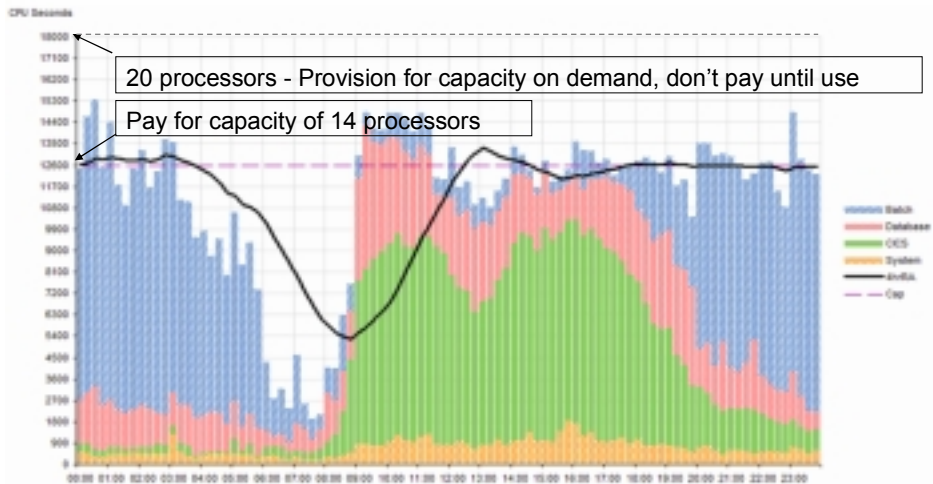
- A Pre-integrated data center in a box
- Hundreds of Processors
- Huge I/O bandwidth
- Built-in networking
- Shared Everything Model with Extreme Virtualization
- Billions in Engineering and Software Development

- 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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System z Virtualization, Workload Management, and Storage Bandwidth 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"

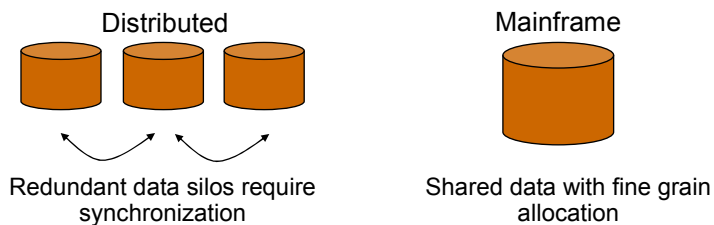
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Storage Costs Are Different

► The Total Cost of Storage is Typically Three Times More in Distributed Environments

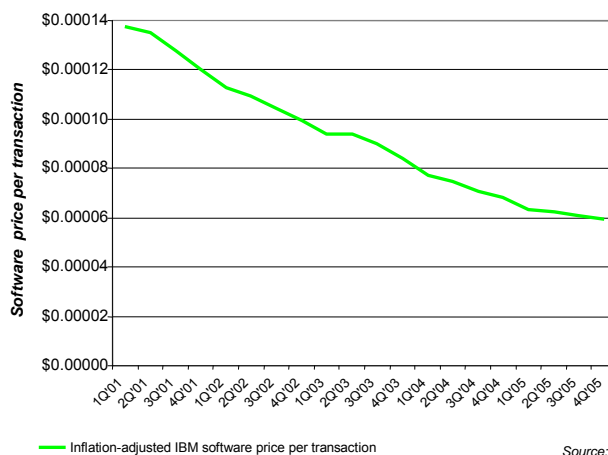
- Application specific data silos create redundant data
- Data copies are often used to separate “batch” style workloads from online
- Storage utilization of 25-30% or less is typical in distributed environments
- Mainframe fine grained allocation and data sharing yield typical storage utilizations of 80% +
- Cheap disks cannot be used by high RAS workloads in distributed environments



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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

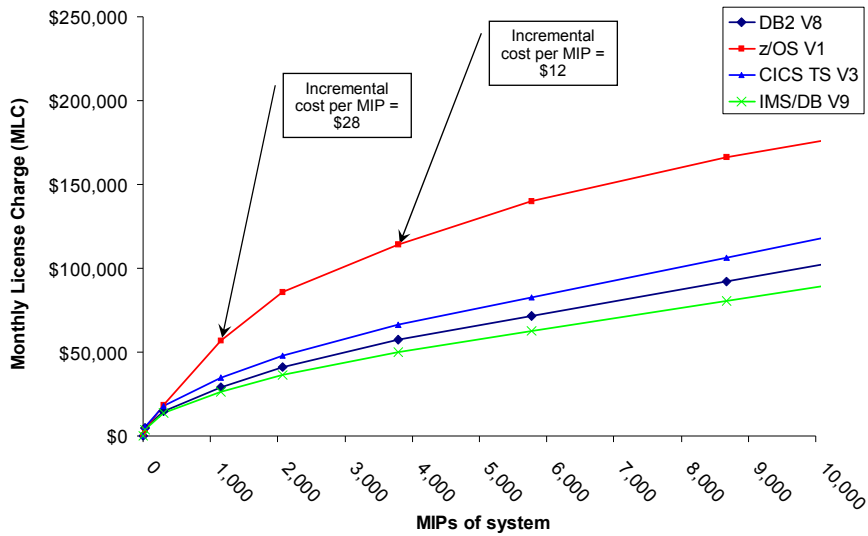
— Inflation-adjusted IBM software price per transaction

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

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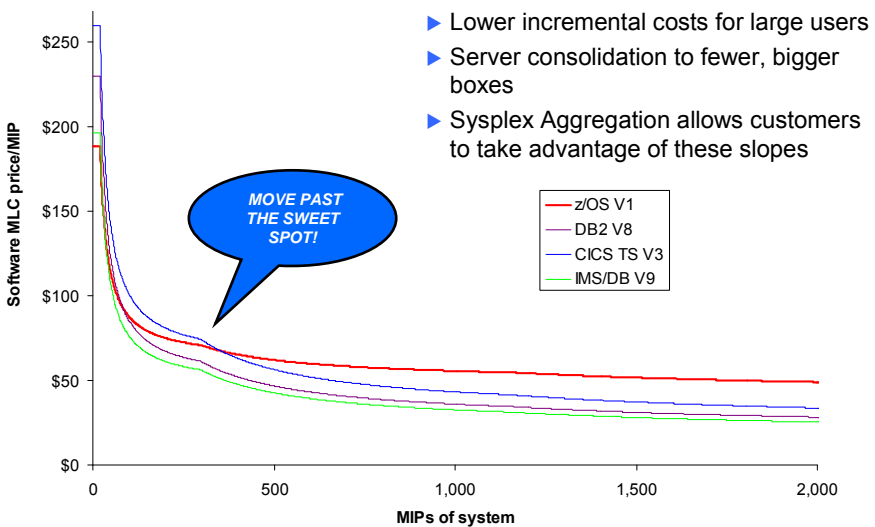
Software Pricing Curves Favor Growth



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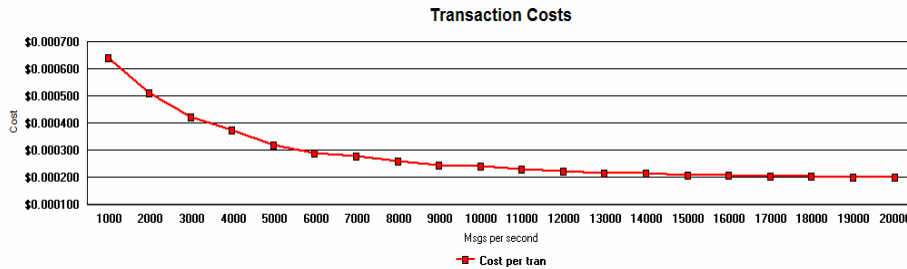
Overall Software Price Per MIP Decreases as System Size Increases



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z/TPF Cost per Transaction



- Workload based on banking authorization profile
- z/TPF WLC (workload charging) used
- HPO feature for high availability
- CPU configurations such that a loss of a single box never causes an outage
- Cost includes z/TPF license, HW costs spread over three years and full time equivalents (FTEs) for operations staff (DASD & Tape not included)

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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>

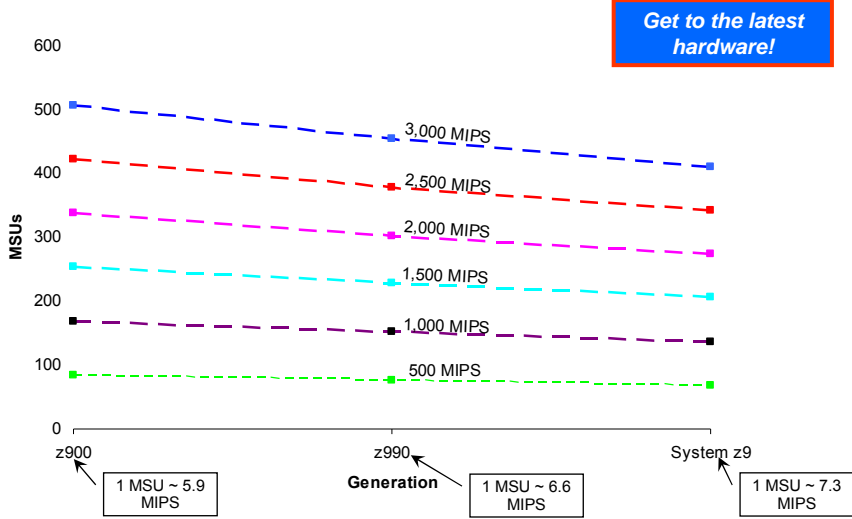
LSPR MIPS <http://ibm.com/zseries/lspr>

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

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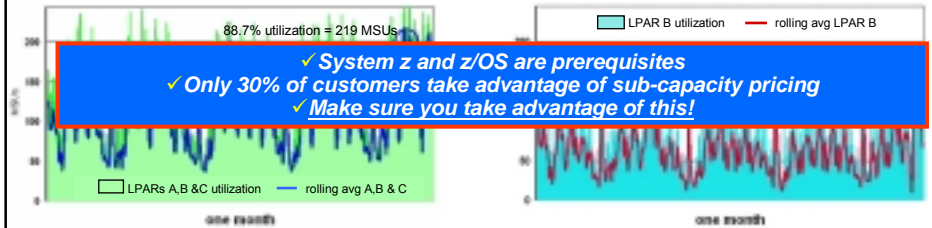
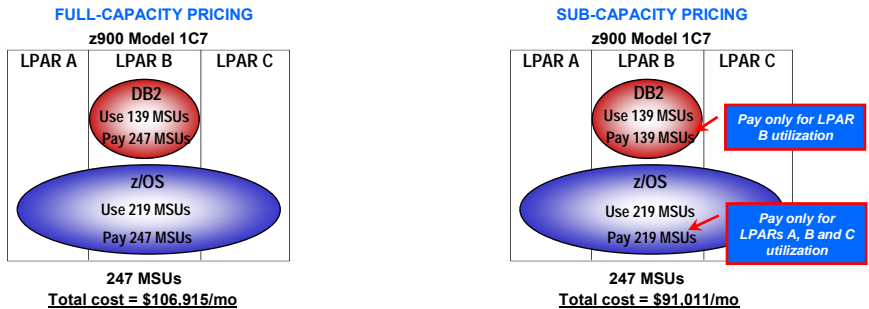
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“Technology Dividend” = ~10% MSU Reduction Each Generation



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

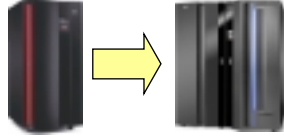


✓ System z and z/OS are prerequisites
 ✓ Only 30% of customers take advantage of sub-capacity pricing
 ✓ Make sure you take advantage of this!

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Technology Dividend Helps Offset Software Upgrade Increases

G5 S/390 processor
9672-R56
Purchased in 3Q98
Back level 4 generations
540 MIPS (5 CPU's)
93 MSU's



Upgrade to
current generation
z9 Enterprise Class
2094-701

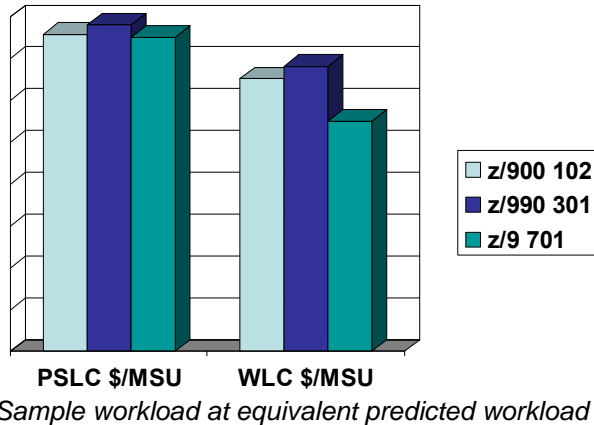
	MLC (PSLC)			Tech Div and sub capacity	If No Tech Div
Database (-3 Generations)	\$15,378	DB2 UDB V6	→	DB2 9	540 MIPS (<1CPU) 76 MSU's MLC (VWLC)
Transaction Processing (-3 Generations)	\$14,733	CICS ESA V4	→	CICS TS V3.1	540 MIPS (<1CPU) 93 MSU's MLC (VWLC)
Operating System (-2 Generations)	\$46,485	OS/390 Base	→	z/OS VI Base	
	\$76,596			\$69,562	\$78,810

* PSLC – Parallel Sysplex Licensing Charge, VWLC – Variable Workload Licensing Charge (newer)

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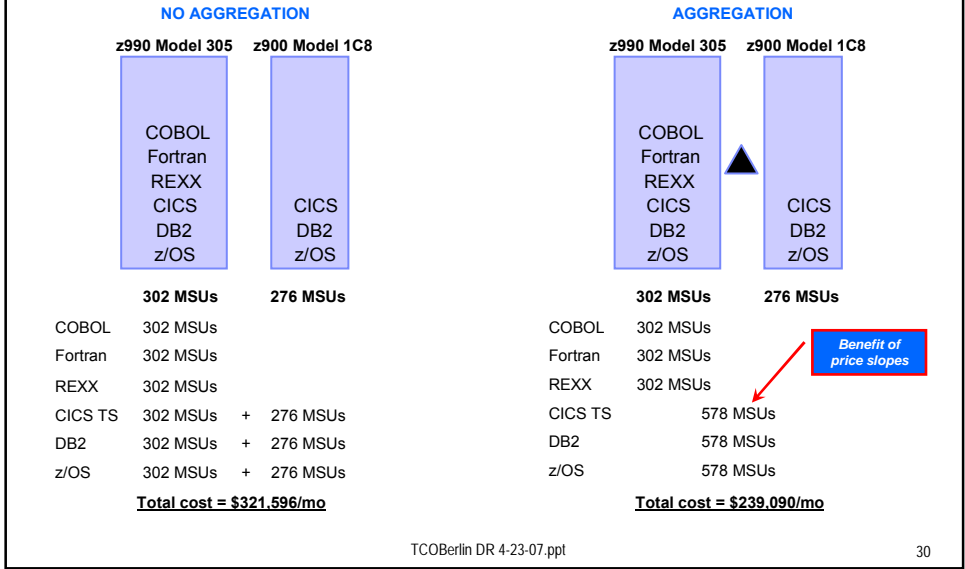
z/TPF + z/TPFDF Relative Price/MSU



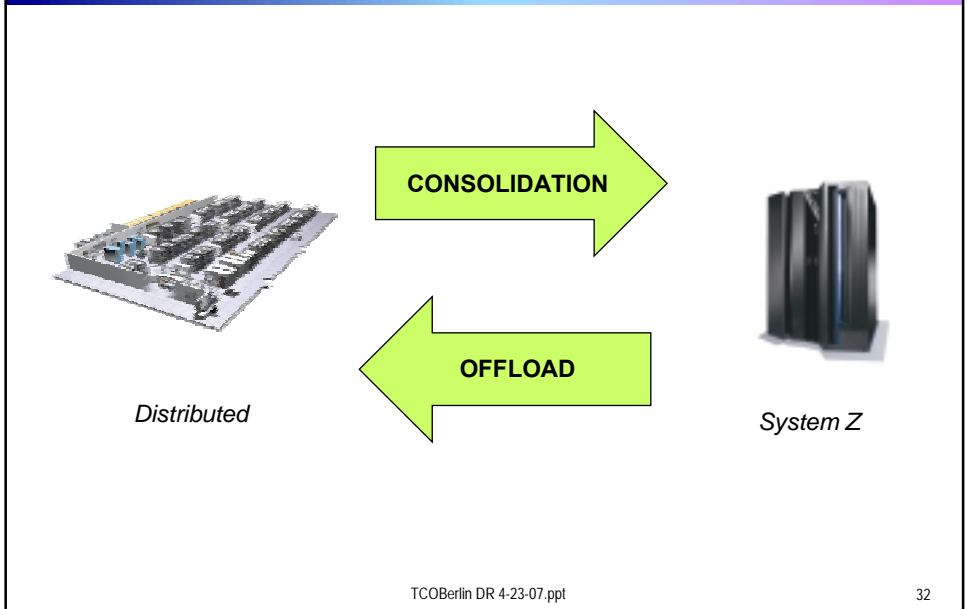
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Example of Sysplex Aggregation, Saving >\$82K MLC



TCO Comparisons



Economics of Consolidation

- Consolidating workload means running multiple workloads on the mainframe at the same time
- Consolidation achieves greater utilization of assets which minimizes cost per unit of work
- Same principal was applied by Henry Ford at the dawn of the industry era
 - ▶ It still applies today
- Workload consolidation on a mainframe squeezes out cost to achieve maximum efficiency
 - ▶ And return on investment

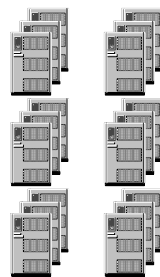


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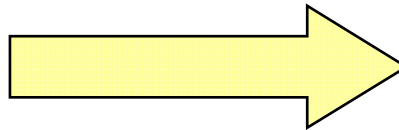
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Two Kinds of Workload Consolidation

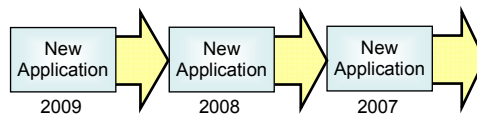


Roll-up
Migrate to achieve lower costs



Programmers

Strategic Hosting
Incremental growth on System z



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“Specialty Engines” Make Consolidation Even More Attractive

- Special assist processors for System z
 - ▶ For Java workloads (zAAP)
 - ▶ For selected DB2 workloads (zIIP)
 - ▶ For Linux workloads (IFL)
- Attractive pricing
 - ▶ Hardware is \$125K per processor one time charge
 - \$125K for a 580 MIP processor
 - ~ 9% of the normal price
 - ▶ No charge for IBM software running on zAAP/zIIP
 - IBM software running on IFL pays 100 PVU's (same as Intel dual core)
 - ▶ Free upgrade to next generation!
- Requirements
 - ▶ Max number of zAAP =< number of general purpose processors
 - ▶ Max number of zIIP =< number of general purpose processors
 - ▶ No Limit on the number of IFL's



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How Much Workload is zAAP or zIIP- able?

- **How much DB2 workload can typically be run on a zIIP?**
 - ▶ Parallel queries (Data Warehouse scenario)
 - Up to 40%
 - ▶ Queries received via DRDA Remote Access Protocol (Database Server scenarios)
 - Up to 80%
 - ▶ Some of index maintenance utilities
- **How much Java workload can typically be run on a zAAP?**
 - ▶ WebSphere scenario
 - Up to 85% of a WebSphere workload
- **How much Linux workload can typically be run on an IFL?**
 - 100% of Linux workload
- **Offloads to specialty processors reduce software load and charges on general purpose processors**
 - ▶ For sub capacity pricing, the offload must occur at a time that will reduce billable rolling average

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Example: Consolidate Data Server For SAP On Mainframe

Existing Mainframe



Existing processors:
9 general purpose
4000 MIPS of
existing DB2
workload

Add 1 LPAR for New SAP Data Server w 42 TB Storage



**966 MIPS
additional
workload**

*3 year
cost of
acquisition
\$3.40 M*

Add two processors:
1 zIIP
386 MIPS (40%)
1 General purpose
580 MIPS (60%)

Or add HP Integrity rx8640 Server w 75 TB storage



84,042 *
RPE's

*3 year
cost of
acquisition
\$5.45 M*

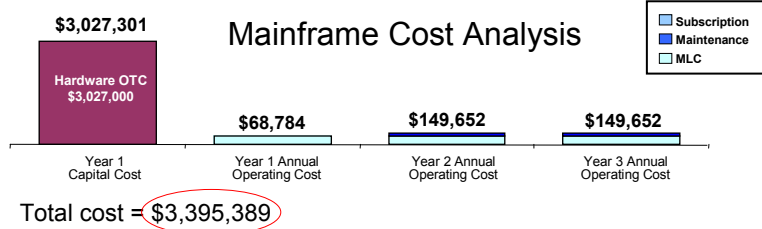
* Production RPE's required = 966 x 87 = 84,042

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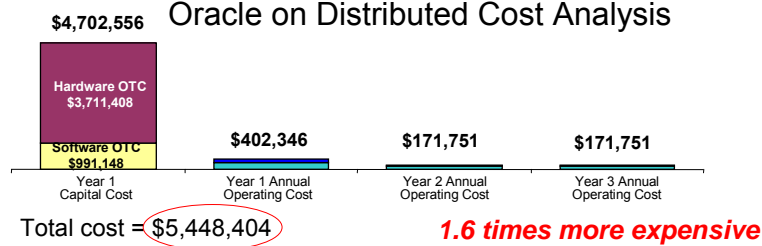
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zIIP Processor and Storage Compression Lowers the Cost of Acquisition

Mainframe Cost Analysis



Oracle on Distributed Cost Analysis



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SAP Data Server Incremental Cost Breakdown

Mainframe Hardware				Mainframe Software			
OTC		ANNUAL		OTC		ANNUAL	
1 General Processor	\$1,452,500	Processor Maintenance	\$80,868	Utilities	\$0	DB2 MLC	\$33,840
1 zIIP Processor	\$125,000					zOS MLC	\$34,944
IBM Storage (42TB)	\$1,449,801	Storage Maintenance	0				
TOTAL	\$3,027,301	TOTAL	\$80,868	TOTAL	\$0	TOTAL	\$68,784

Distributed Hardware				Distributed Software			
OTC		ANNUAL		OTC		ANNUAL	
HP Processors	\$603,939	Processor Maintenance	\$123,139	Oracle EE	\$640,000	Oracle S&S	\$297,440
HP storage (75TB)	\$3,107,469	Storage Maintenance	\$30,951	Unix	\$126,048	Unix S&S	\$107,456
						(Prepaid in year 1 for 3 years)	
TOTAL	\$3,711,408	TOTAL	\$154,090	TOTAL	\$991,148	TOTAL	\$248,256 (year 1)
							\$140,800 (year 2, 3)

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DB2 – Better Compression Ratio Than Oracle

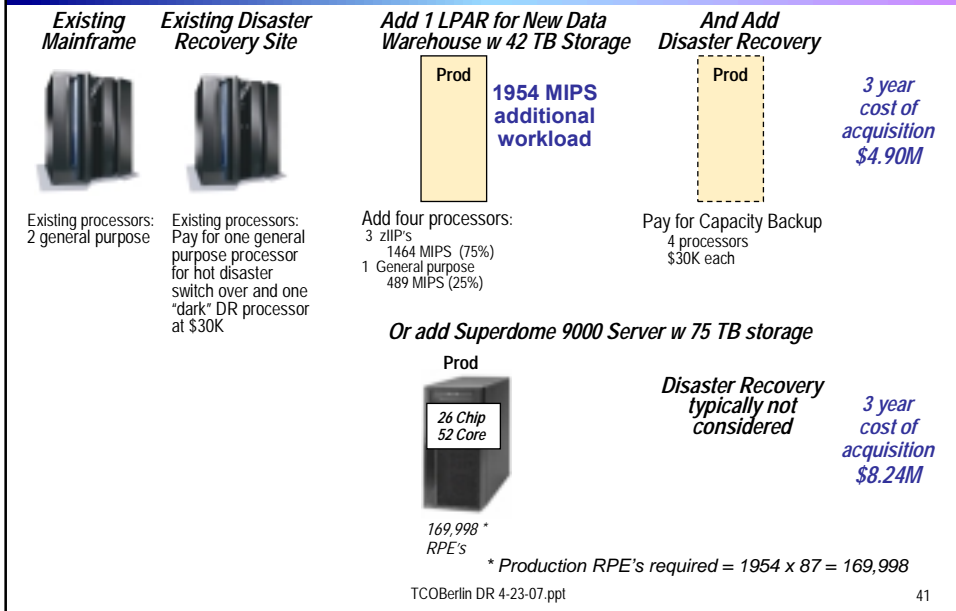
- TPC-H is a well known data warehouse benchmark
 - ▶ Each vendor uses the same tables and same data
 - ▶ Oracle published their compression rates for TPC-H tables at the VLDB conference in 2003
 - ▶ IBM ran the same tests on the same tables
- Test results

Table	Compression Ratio	
	Oracle	DB2
LINEITEM	38%	58% (1.5x better)
ORDERS	18%	60% (3x better)
Entire Database	29%	59% (2x better)

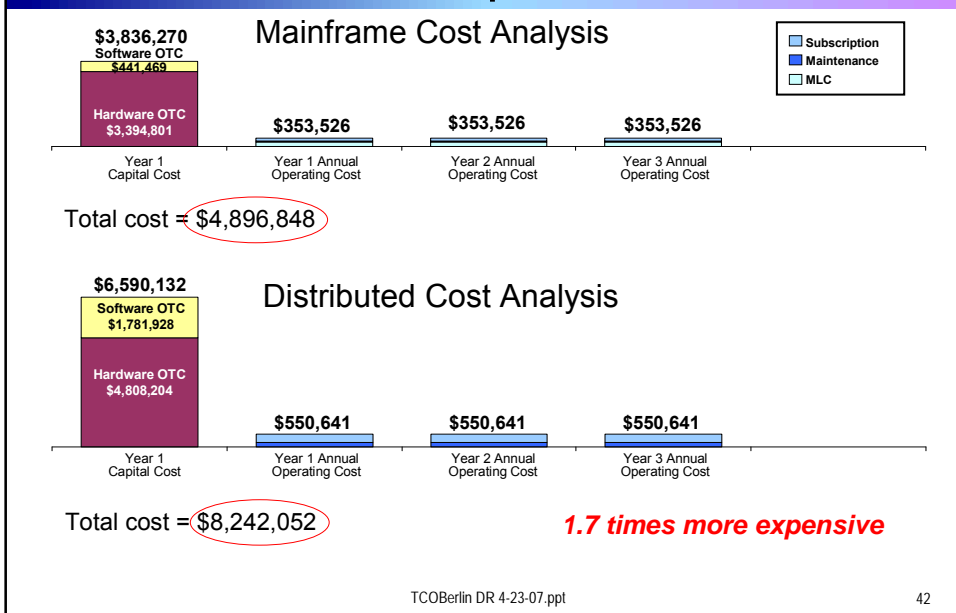
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Example: Consolidate New Data Warehouse Application on Mainframe



zIIP Processors and Storage Compression Lower the Cost of Acquisition



Data Warehouse Incremental Cost Breakdown

Mainframe Hardware				Mainframe Software			
OTC		ANNUAL		OTC		ANNUAL	
Z Processors	\$1,825,000	Processor Maintenance	\$123,540	Utilities	\$441,469	Utilities S&S	\$44,454
4 DR Processors	\$120,000					DB2 MLC	\$72,240
IBM Storage (42TB)	\$1,449,801	Storage Maintenance	0			QMF MLC	\$34,716
						zOS MLC	\$78,576
						SubTotal MLC	\$185,532
TOTAL	\$3,394,801	TOTAL	\$123,540	TOTAL	\$441,469	TOTAL	\$229,986

Distributed Hardware				Distributed Software			
OTC		ANNUAL		OTC		ANNUAL	
HP Processors	\$1,700,735	Processor Maintenance	\$164,044	Oracle EE & Utilities	\$1,352,000	Oracle S&S	\$297,440
HP storage (75TB)	\$3,107,469	Storage Maintenance	\$30,951	Unix	\$204,828	Unix S&S	\$58,205
				HP Storage SW	\$225,100		
TOTAL	\$4,808,204	TOTAL	\$194,995	TOTAL	\$1,781,928	TOTAL	\$355,645

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85%+ of WebSphere is zAAP-able, saving \$Ms

- Only 2.6% overhead
- HW savings = **\$2.8M**
 - Savings of 1,914 GP MIPS (425% of a z990)
- WAS OTC savings **\$200K**
 - 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 DB2 MLC savings ...

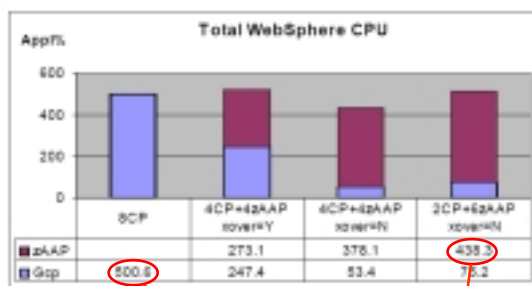


Figure 4-28 Total WebSphere CPU consumption for zAAPs and zCPs

New in 2007

85%

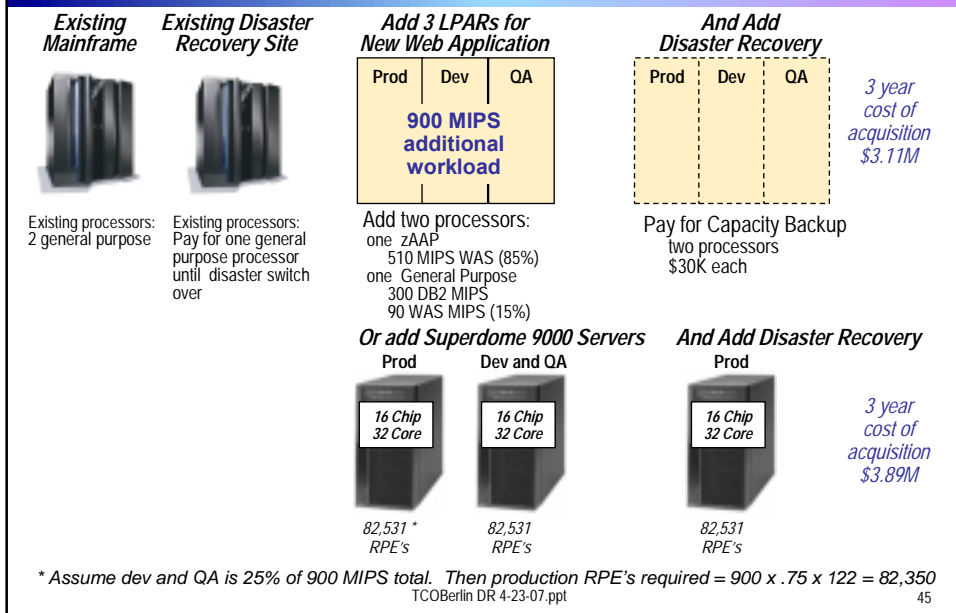
One customer has achieved 92% Java offload to zAAPs!

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

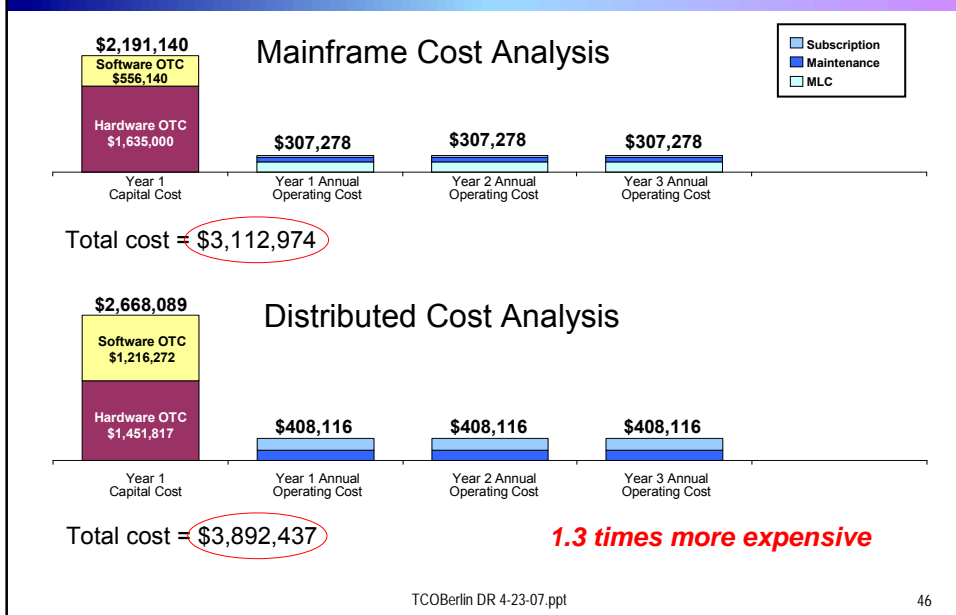
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Example: Consolidate New WebSphere Application on Mainframe



zAAP Processor Lowers the Cost of Acquisition



WebSphere Application Server Incremental Cost Breakdown

Mainframe Hardware				Mainframe Software			
OTC		ANNUAL		OTC		ANNUAL	
1 GP Processor	\$1,450,000	Processor Maintenance	\$88,500	Utilities + WAS	\$556,140	Utilities S&S	\$44,454
zAAP	\$125,000			DB2 MLC	\$72,240	QMF MLC	\$34,716
2 DR Processors	\$60,000			zOS MLC	\$67,368	SubTotal MLC	\$174,324
TOTAL	\$1,635,000	TOTAL	\$88,500	TOTAL	\$556,140	TOTAL	\$218,778

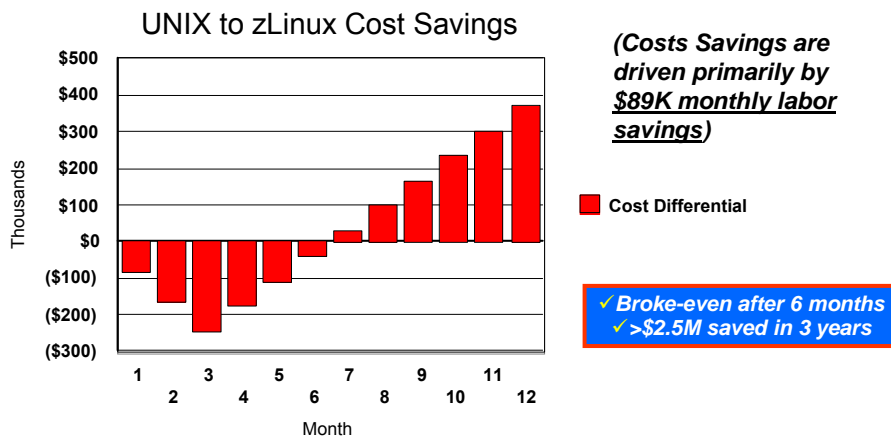
Distributed Hardware				Distributed Software			
OTC		ANNUAL		OTC		ANNUAL	
3 16x32 Itanium Superdome Servers	\$1,451,817	Servers Maintenance	\$123,139	Oracle EE & Utilities	\$858,000	Oracle S&S	\$188,760
				WebSphere	\$259,875	WS Maint	\$51,975
				Unix	\$98,397	Unix S&S	\$44,242
TOTAL	\$1,451,817	TOTAL	\$123,139	TOTAL	\$1,216,272	TOTAL	\$284,977

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Linux Consolidation

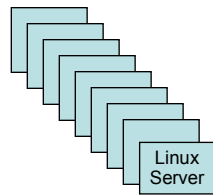
IBM Global Services Consolidated 62 Linux Servers onto one IFL



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The Economics of Linux Workload Consolidation



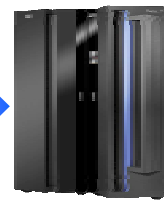
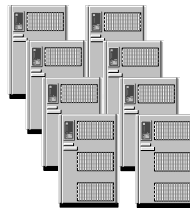
62 Linux servers with low utilization
 62 @ \$5,000 = \$310,000
 Plus 62 middleware licenses
 Plus \$6,500 x 62 = \$403,000/yr labor

One IFL processor with high utilization
 1 @ \$125,000 = \$125,000
 Plus one middleware license
 Little additional labor

Example Analysis of Linux Consolidation TCO Savings

\$1M saving over 3 years

60 Linux Servers



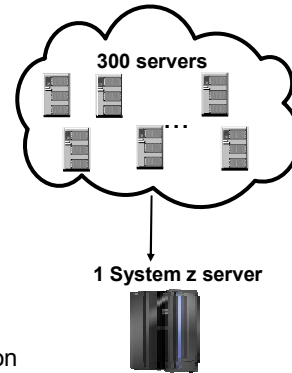
+1 IFL

	Distributed Linux/Intel @ low utilization				Mainframe IFL @ high utilization			
	Unit cost	Quantity	Sub Total	3 year total	Unit cost	Quantity	Sub Total	3 year total
Hardware & OS - every 3 years	\$4,000	60	\$240,000	\$240,000	\$125,000	1	\$125,000	\$125,000
Additional Memory		Included			\$8,000	10	\$80,000	\$80,000
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				\$1,521,564				\$514,622

* IBM WebSphere Application Server for Linux

Hannaford Supermarket Chain Goes Real Time with Linux on System z

- North-eastern United States supermarket chain
- Reduced costs while improving customer and partner satisfaction using Linux on System z
- Consolidated **300** store servers onto 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
 - ▶ Significant labor savings across the IT organisation



"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

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Nationwide® Saves \$16+ Million with Linux on System z

On Your Side™

- **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** IFLs (z990)
 - 12 mission critical applications with 100,000+ users/day
 - supported by 3 staff
 - ▶ 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)
 - ▶ Simple, robust mainframe high availability & disaster recovery

Vastly improved TCO, Speed & Simplification

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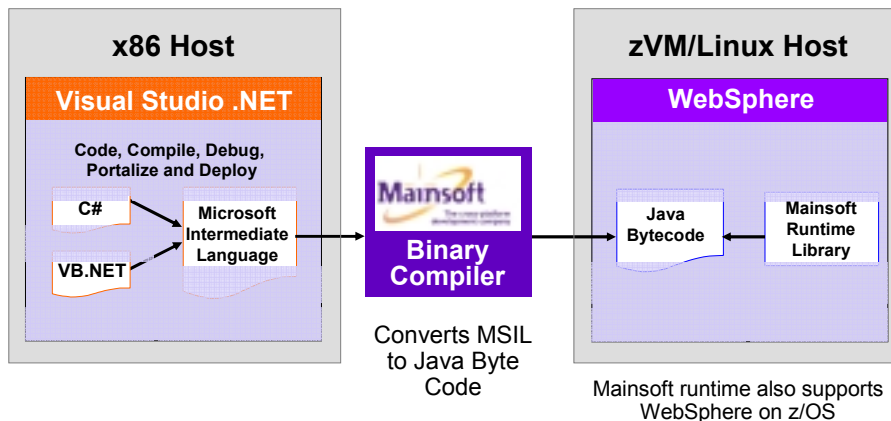
Québec Government Runs Oracle at IFL Prices

- Consolidated 190 Oracle Databases (9i and 10g) onto a z9-EC with IFL's
 - ▶ Reduced cost of hardware and software by 30%
 - ▶ Better database loading performance due to higher I/O bandwidth
 - ▶ Each administrator could manage 100 database instances
 - ▶ Easy migration
 - One migration per day
 - Create new Linux server in 30 min (vs 1 week – 3 months)
 - Clone Oracle DB instance in 30-45 min (vs 10 – 14 hours)
 - Unload/load
 - ▶ Inherit benefits of z platform – workload management, availability, disaster recovery
 - ▶ Expect to migrate 200 more Oracle databases per year

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NEW! Execute .NET Code on the Mainframe at IFL Prices Visual MainWin for J2EE



Contact: Ron Johnsen – VP WW Sales, ronj@mainsoft.com USA 408 200 4023

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Replace Third Party Tools to Reduce Costs

- LabCorp
 - ▶ 35 products replaced - includes RMM, TWS, SCLM and DB tools and AD tools
 - ▶ About 700 MIPS
 - ▶ \$12M saved
- Putnam Investments
 - ▶ Over 20 products replaced at 2 sites - includes RACF, RMM, TWS, SCLM, SA390, GRS and DB2 Suite of tools
 - ▶ About 1500 MIPS
 - ▶ \$Millions saved
- Hennepin County
 - ▶ Products replaced - includes RACF, TWS, SA390, DB2PM, TDS
 - ▶ About 1100 MIPS
 - ▶ \$3M in savings
- Major automotive manufacturer
 - ▶ Doubled MIPS from 600 to 1200
 - ▶ Annual savings of \$1.8M
- Typically 30-50% lower run-rate after initial ROI period

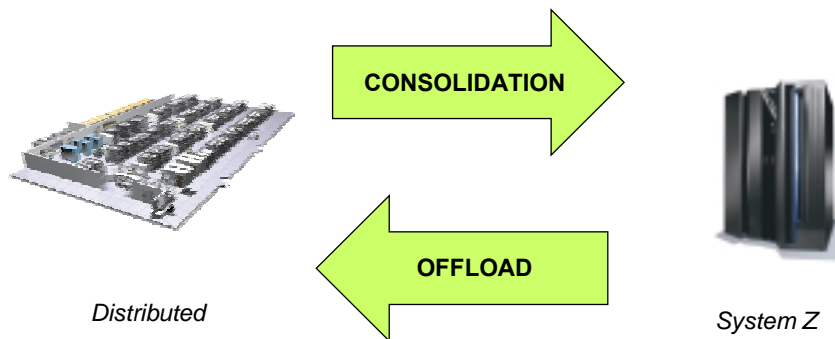
A typical customer engagement replacing BMC tools

Original Product	IBM Replacement
Mainview for z/OS	IBM Tivoli OMEGAMON XE for z/OS
Mainview Stop X37	IBM Tivoli Allocation Optimizer
Mainview Explorer and Alarm Manager	IBM Tivoli OMEGAMON DE on z/OS
Mainview EasyHSM and StorageGuard	IBM Tivoli Storage Optimizer
Control-M & R	IBM Tivoli Workload Scheduler
Auto Operator	IBM Tivoli System Automation
Mainview for CICS	IBM Tivoli OMEGAMON XE for CICS / CICS PA
Mainview for DB2	IBM Tivoli OMEGAMON XE for DB2
Mainview for IMS	IBM Tivoli OMEGAMON XE for IMS
UltraOpt for IMS	IMS NETWORK COMPRESS FACILITY V1
Image Copy Plus for IMS	IMS HIGH PERFORMANCE IMAGE COPY
Unload Plus for IMS	IMS HIGH PERFORMANCE UNLOAD V1
Prefix Resolution Plus for IMS	IMS HIGH PERFORMANCE PREFIX RESOLUTION V3
Load Plus for IMS	IMS HIGH PERFORMANCE LOAD
Secondary Index Utility / EP	IMS INDEX BUILDER V2.3

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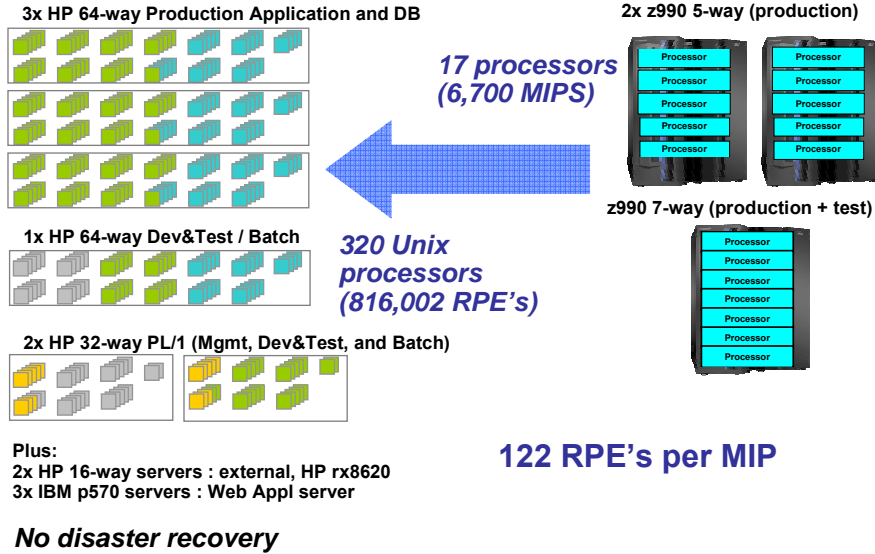
TCO Comparisons



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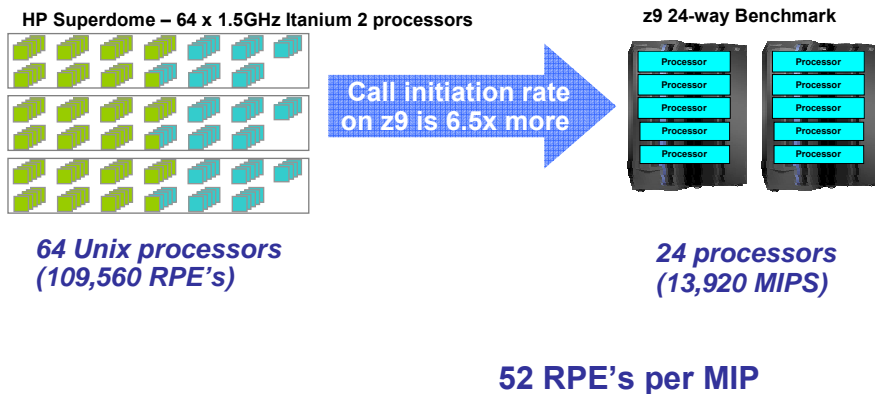
Asian Financial Services Customer Offload Project - Overall



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Telco Industry VOIP Benchmark (CommuniGate) Comparison



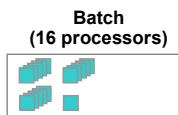
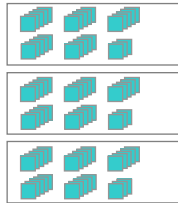
Sources: *CommuniGate-Superdome-VoIP-Benchmark.pdf* & *IBM-CommuniGate-z9.pdf* from <http://www.communiGate.com/Papers>

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Asia Pacific Financial Services Customer Offload Project – Database

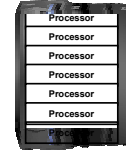
Production Oracle RAC cluster of 3 HP Superdome nodes (28 processors per node)



7 processors (2,680 MIPS*)



z990 Processors for DB2 (production and development)



100 Unix processors Oracle RAC (233,510 RPE's)

87 RPE's per MIP

No disaster recovery

* DB2 is estimated to be 40% of total workload

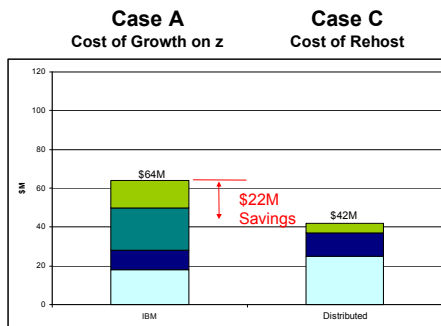
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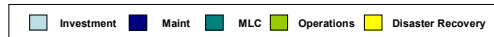
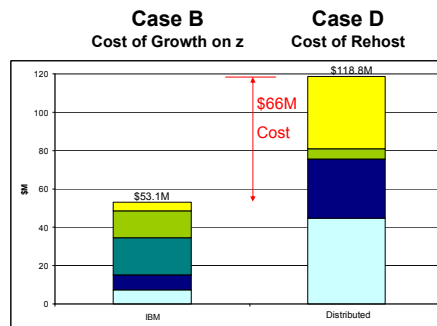
Did They Save Money by Offloading?

- 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



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Lessons Learned About the Promises Made by the Competitors

- They **over-estimated** the mainframe costs
 - ▶ Over-provisioned too early Δ\$3.6M
 - ▶ Used highest hardware purchase & maintenance list prices Δ\$9.4M
 - ▶ Continued using older software; no sub-cap pricing Δ\$2.7M
 - OVERESTIMATED BY Δ\$15.7M**

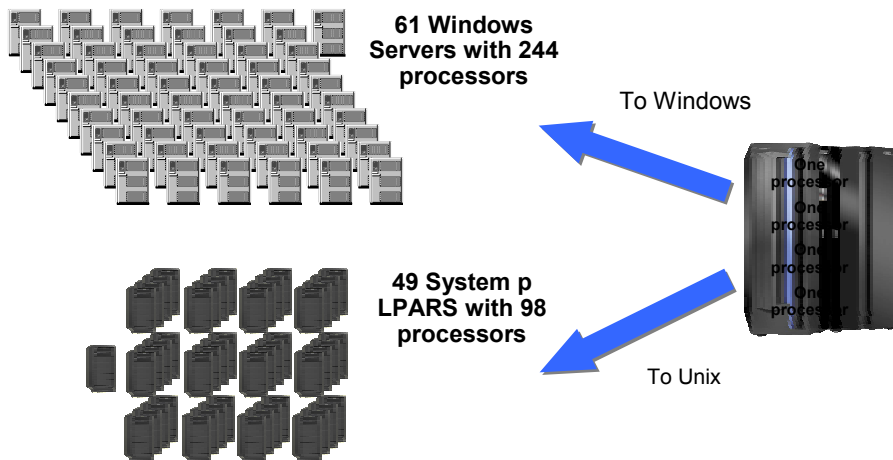
- They **under-estimated** the offload costs
 - ▶ Forgot about mainframe coexistence during migration Δ\$9.5M
 - ▶ Forgot about high cost of power & cooling Δ\$1.1M
 - ▶ Forgot about the financing charges Δ\$2.5M
 - ▶ Added a test server Δ\$2.1M
 - ▶ Under-provisioned batch processing (15 % growth case) Δ\$6.3M
 - ▶ Failed to take into account technology updates Δ\$14.6M
 - ▶ Did not provide Disaster Recovery Δ\$40.6M
 - UNDERESTIMATED BY Δ\$76.7M**

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European Banking Customer Study

TCO Analysis to Offload CICS Transaction Workload



Conclusion: Same TCO with no benefit from additional migration cost

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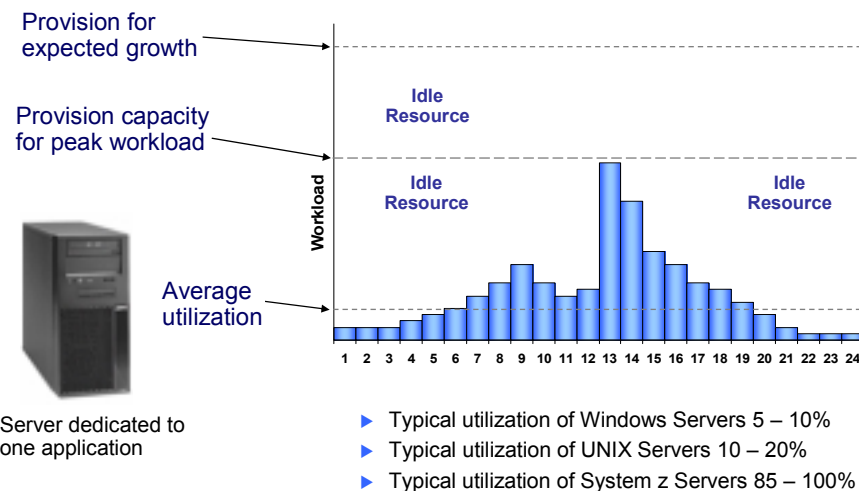
Why Do Servers Proliferate in Offload Scenarios?

- 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
 - Additional provision for expected growth in out years (no capacity on demand)
 - Batch workload may stress I/O capabilities
 - Separate servers for production, failover, development/test, disaster recovery
 - 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
 - Oracle RAC inefficiencies compared to DB2
- Other TCO considerations
 - ▶ 3 to 5 year lifetime for distributed servers requires repurchase
 - ▶ Dual environments during migration
 - ▶ Partial offloads eliminate the lowest cost MIPS first

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Utilization of Distributed Servers



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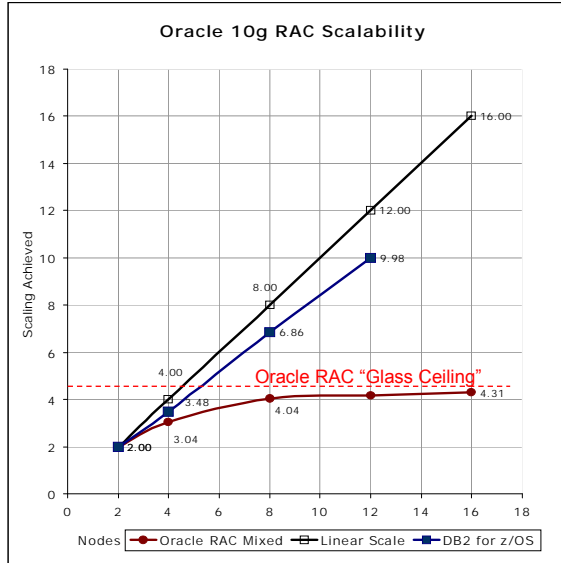
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Oracle RAC Inefficiencies Compared to DB2

- DB2 for z/OS provides near-linear scalability with relatively little overhead as nodes are added
- With Oracle RAC, overhead increases rapidly as additional nodes are added and performance degrades after only 4 to 6 nodes

Oracle RAC source: "Scale-up versus scale-out using Oracle 10g with HP StorageWorks", Hewlett-Packard, 2005

DB2 for z/OS source: "Enterprise Data Base Clustering Solutions" ITG, October 2003



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Let's Consider The Other Elements of Cost

Total Cost of Ownership =

- Cost of hardware +
- Cost of software +
- Environmentals +
- Cost of labor +
- Financial terms

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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 (up from 250 in 1992)
 - ▶ By comparison, a System z9 consumes **107-312** watts per square foot – *one tenth or less the amount*
 - ▶ Turning on an IFL processor consumes **75** additional watts
 - ▶ Cooling cost is roughly an additional 60% of the power cost

- More than half of all serious outages are now caused by power problems*
 - ▶ Room temperatures averaging 92°F lead to erratic machine behavior

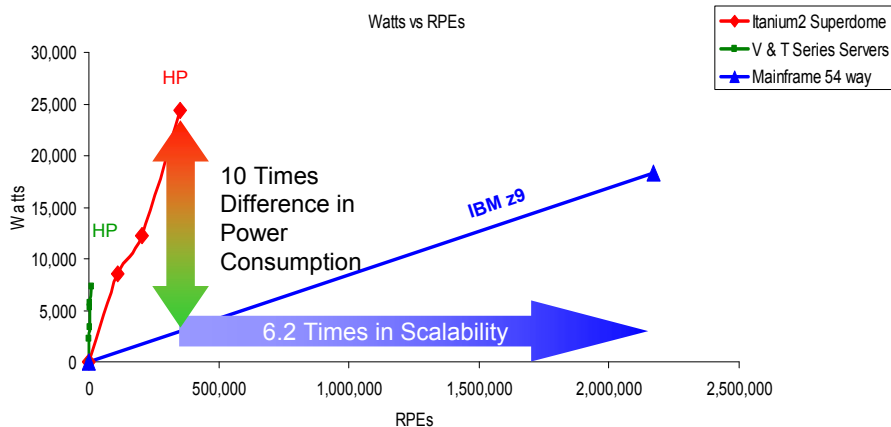
- Aside from cost, some data centers can't obtain additional power from their providers

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*Source: recent AFCOM survey of 200

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Mainframe Power and Scale Efficiency



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

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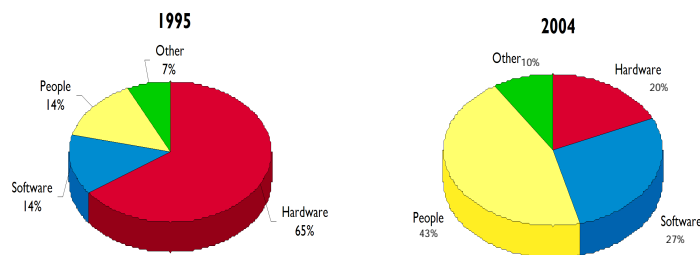
Do the Math

- HP Itanium 2 Superdome 9050 (64ch/128co) consumes a maximum of 24,382 watts
 - ▶ $24,382 \times .08 \times 24 \times 365 = \$17,087$ per year for electricity
- Mainframe with similar computing capacity consumes 2,500 watts
 - ▶ **\$1,752** per year for electricity
 - ▶ Power cost is \$15,335 per year less
- Similar savings on cooling capacity
 - ▶ Cost of cooling is 60% to 80% the cost of power
 - ▶ Superdome total **\$27,339** per year vs Mainframe **\$2,803**

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People Expense has Become the Dominant Component of TCO

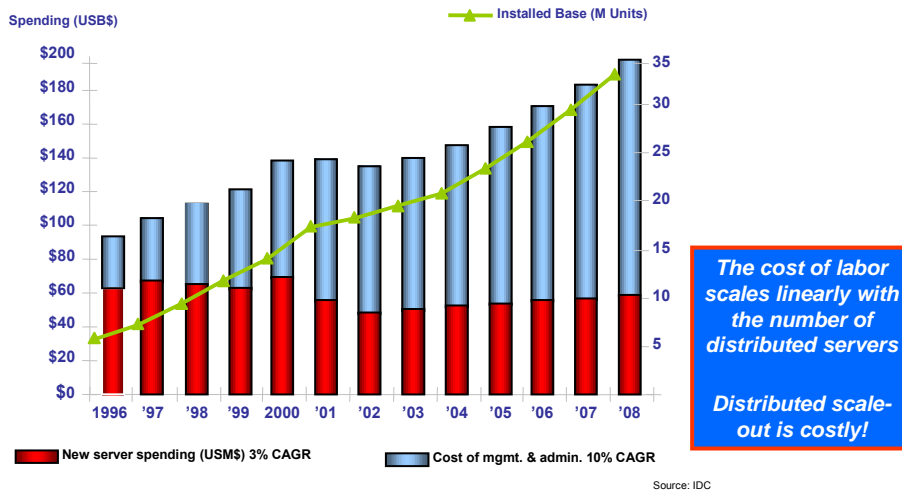


Based on IBM Scorpion customer analyses

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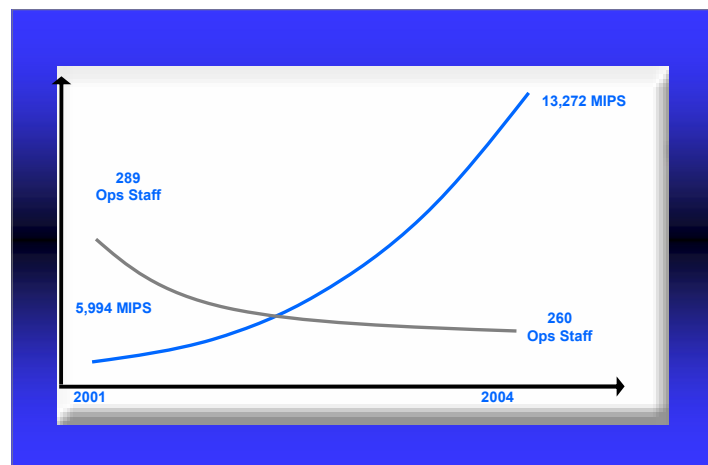
Since 2000, Labor Costs Have Exceeded the Cost of All Servers ... and are *Still* Growing



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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

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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>

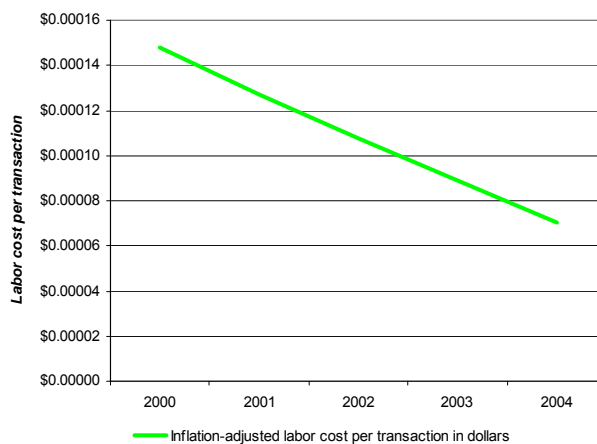
In this case, System z requires 1/8 the labor costs of the distributed environment

Source: IBM SWG Data Center

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Labor Cost Per Transaction on System z is Decreasing



16.9% decrease per year

What makes the price go down?

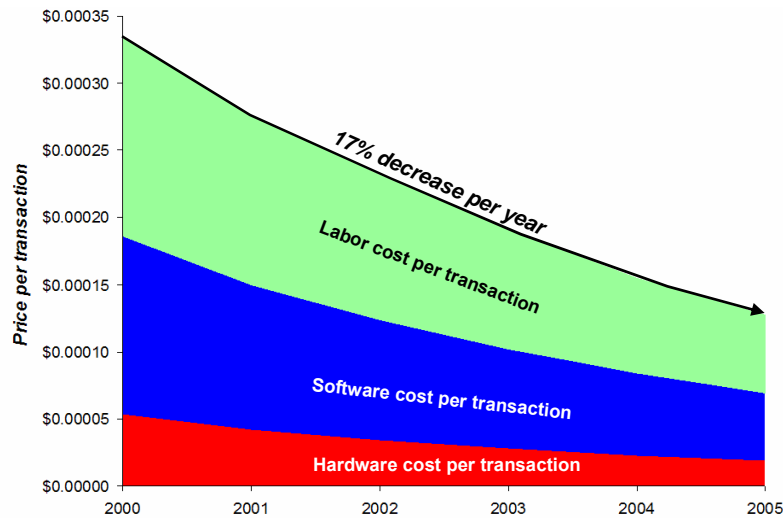
- Increasing workloads
- Data-center-in-a-box design reduces need for labor
- Scalability of the mainframe
- Ease of incremental upgrade
- Inherent reliability of the mainframe
- Fewer repairs and patches
- Intelligent Workload Management including CICSplexSM
- Minimal security risks & breaches
- IBM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

Source: IBM Global Services UK

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



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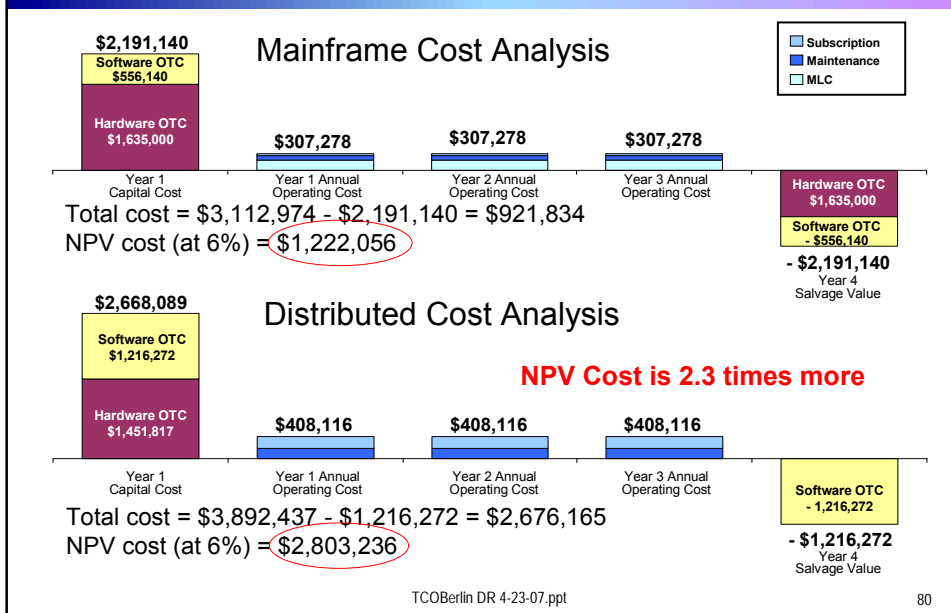
Trade-In Value Reduces Mainframe Net Present Value Costs

- 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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Java Application Example Considering 100% Trade in on Processors



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 Study Summary

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

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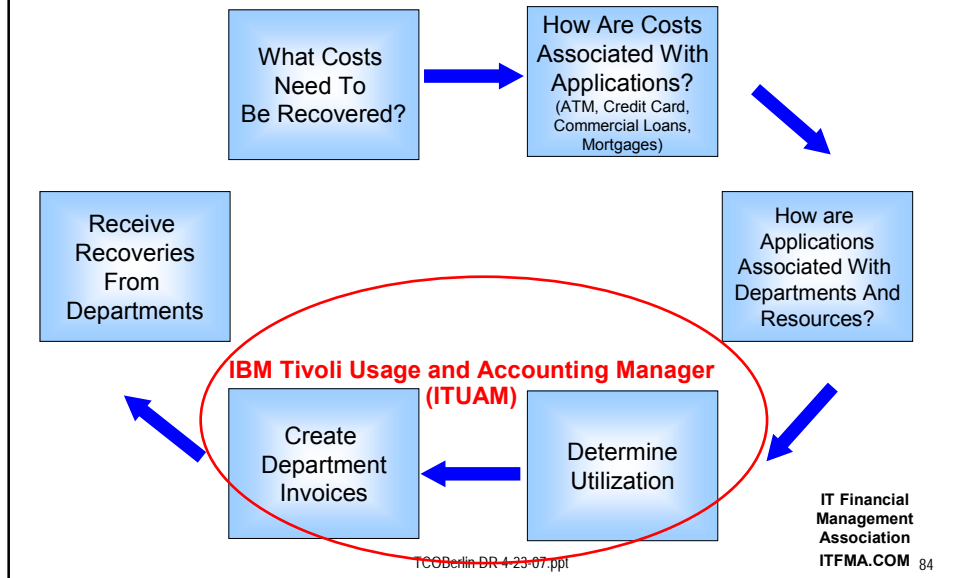
Inaccurate Charge Back Policies Can Distort User's View of Cost

Bad	Better	Good
All Costs Allocated to the Mainframe	Fixed Allocation by Consensus (mainframe vs distributed)	Actual Usage of Each Resource (mainframe or distributed)
Incremental Mainframe Application Costs Calculated as if Standalone (e.g. New Footprint)	All Incremental Mainframe Costs Extrapolated from Current Costs	Calculate Actual Incremental Mainframe Costs Considering Specialty Engines, Pricing Curves, On Demand Capacity, Disaster Recovery, Environmentals, and Labor
Incremental Distributed Application Costs Include Only Production Hardware and Software	Calculations Also Include Development, Test, and Disaster Recovery Hardware and Software	Calculations Also Include Incremental Environmentals and Labor

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Data Center Cost Recovery Model Based on Usage



IBM Tivoli Usage and Accounting Manager (ITUAM)

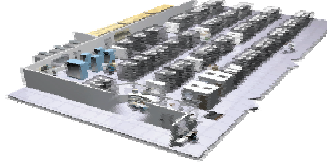
- A cross-platform tool that determines and allocates the cost of providing IT system services
- Helps manage IT costs by appropriating costs to an organization's products, services and business functions
- Measures, analyzes, reports, and bills the utilization and costs of different computing resources
 - ▶ servers, storage, networks, databases, virtualized environments, messaging, print servers, and sub-systems
 - ▶ tracks mainframe and distributed platforms
- Internet enabled
 - ▶ Web-Based Reporting and Drill-Down

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Example: Typical Data Center – A Mix of Mainframe and Distributed Servers

- 105 HP Integrity rx4640 (4U) Itanium2 servers
- 70 servers are running WebSphere
- 35 servers are running Oracle EE
- Two (2) Mainframes (7,000 MIPS)**
- 8 general processors
- 5 zAAP
- 1 zIIP
- WAS and DB2



What are the recoverable costs?

	OTC – Distributed (Annual Depreciation – 3 Year Straight Line)	OTC – Mainframe (Annual Depreciation 5 Year Straight Line)	Annual Distributed	Annual Mainframe
Hardware	\$2,213,219	\$2,763,960	\$445,806	\$527,448
Software	\$2,594,333	\$78,210	\$2,174,900	\$1,875,902
Labor			\$2,520,000	\$1,680,000
Floor space			\$75,600	\$63,840
Power			\$143,000	\$38,000
Network	\$57,100			
Total per year	\$4,864,652	\$2,842,170	\$5,359,306	\$4,185,190

Total Recoverable Costs Annual: \$17,251,318 Monthly: \$1,437,610

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Allocation of Monthly Recoverable Costs

	Old Allocation - Consensus				New Allocation - Usage			
	Distributed	%	MF	%	Distributed	%	MF	%
Power Cost	0	0	\$15,084	100	\$11,917	79	\$3,167	21
Labor Cost	0	0	\$350,000	100	\$210,000	60	\$140,000	40
Floor space	0	0	\$11,620	100	\$6,300	54	\$5,320	46
Software OTC depreciation	\$120,240	60	\$102,472	40	\$216,194	97	\$6518	3
Software S&S and MLC	\$168,783	50	\$168,783	50	\$181,242	54	\$156,325	46
Hardware OTC depreciation	\$103,691	25	\$311,074	75	\$184,435	44	\$230,330	56
Hardware Maintenance	\$20,276	25	\$60,829	75	\$37,151	46	\$43,953	54
Network	0	0	\$4,758	100	\$4,758	100	\$0	0
Total	\$412,990	29	\$1,024,620	71	\$851,997	60	\$585,613	40

Total \$1,437,610

Total \$1,437,610

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IBM Charge-back Service Offerings

- IBM has standard service offerings that can help you implement best practices for charge-back using ITUAM
 - ▶ IT Accounting/Chargeback Assessment & Readiness Review (2 to 6 weeks)
 - ▶ IT Accounting/Chargeback System Design (1 to 3 months)
 - ▶ IT Accounting/Chargeback System Development & Implementation (4 to 12 months)
 - ▶ IT Accounting/Chargeback Planning & Consultation Assistance (As needed)
 - ▶ IT Accounting/Chargeback Migration Assistance from neuMICS, MXG, and SAS IT Charge Management

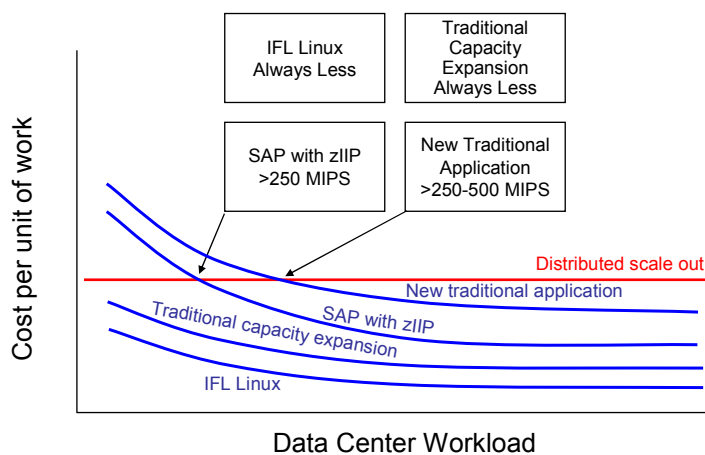
- Contact
 - ▶ US: Russ Egeland, Phone:1-301-260-7546, E-mail: egeland@us.ibm.com
 - ▶ Europe: Richard Jarrett in UK, Phone: 44-1926-465027, E-mail: richard-j-jarrett@uk.ibm.com

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When Does 30% Incremental Workload Growth Cost Less?

3 Year TCO with HI-RAS requirement



Source: Eric Kutcher, McKinsey Analysis

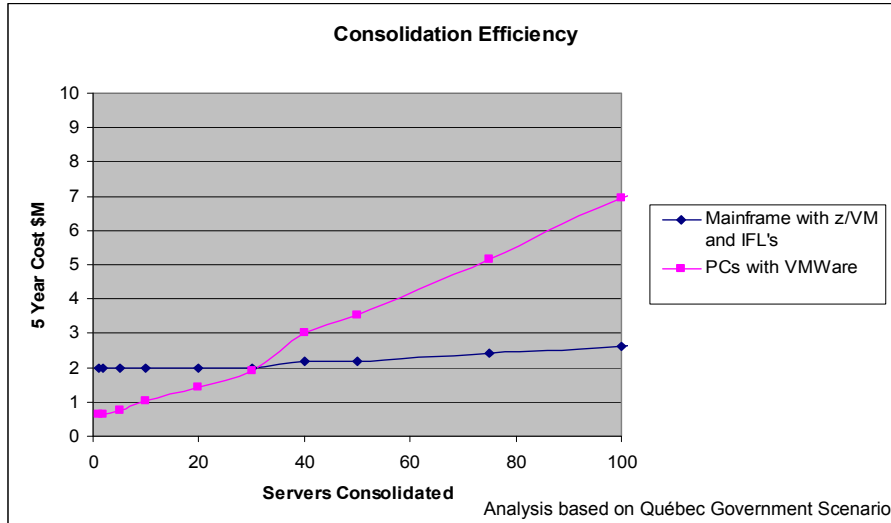
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Back Up Charts

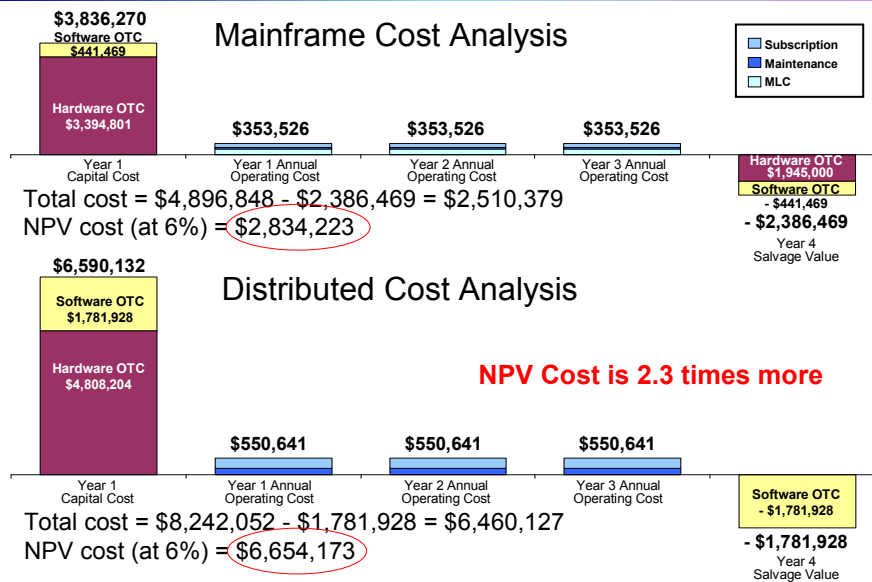
System z Delivers Cost Advantage as You Consolidate More



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Data Warehouse Example Considering 100% Trade in Value on Mainframe Processors

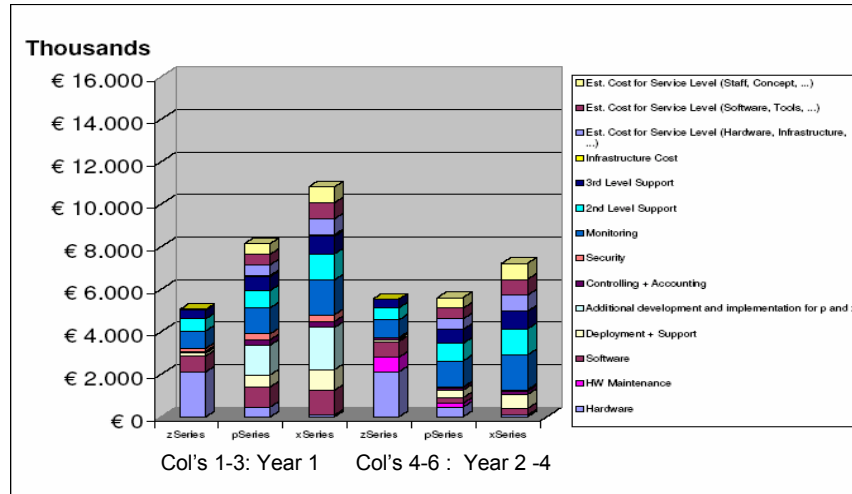


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GAD TCO Study – a WebSphere Banking Example

Distributed servers have higher service, monitoring and support costs and cost more to develop and implement

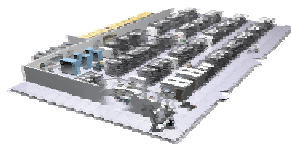


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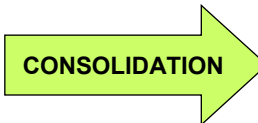
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The Economics of Workload Consolidation

- 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
- Mainframe “specialty engines” further improve consolidation economics
 - ▶ WebSphere, Database, Linux



5% to 20% utilization



Full utilization

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