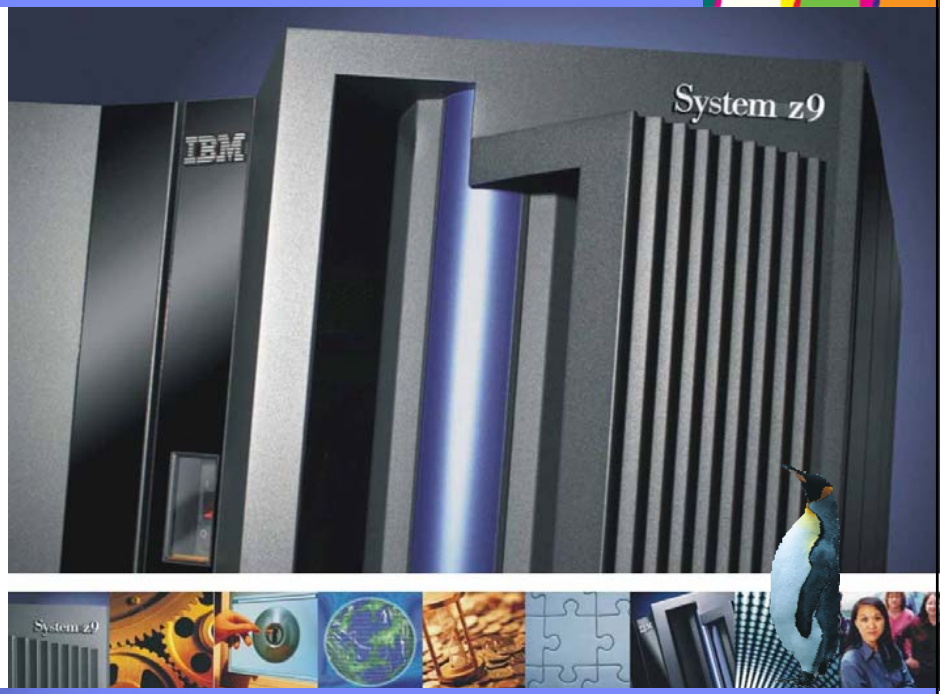
IBM System z

Reducing Your Software Costs Through Server Consolidation with Linux on System z



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IBM Systems
Simplify your IT.

1825 – Reducing Your Software Costs Through Server Consolidation with Linux on System z

- **Reducing Your Software Costs Through Server Consolidation with Linux on System z**
  - Consolidating UNIX and Windows servers onto Linux on System z can dramatically reduce your software costs. This presentation will provide an overview of how this can be accomplished, along with real customer examples where large savings were obtained.
- **Credits**
  - Marlin Maddy, Executive IT Consultant - Scorpion Consulting in IBM Systems & Technology Group, Infrastructure Solutions
  - David Rhoderick, Mainframe Evangelist in IBM Software Group, Strategy

Have you heard/made these statements?

▪ **“My mainframe cost 2x, 5x, 10x compared to my distributed environment”**	**Mainframe**
▪ **“Mainframe software costs are expensive and are driving me off the platform”**	**Mainframe**
▪ **“We are on a get off the mainframe strategy”**	**Mainframe**
▪ **“We keep adding servers and people”**	**Distributed**
▪ **“Our infrastructure can not support our servers”**	**Distributed**

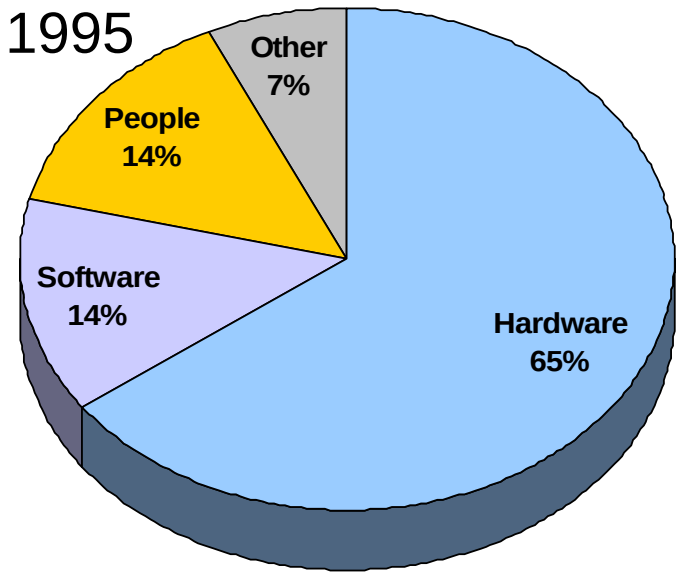
Mainframe inhibitors

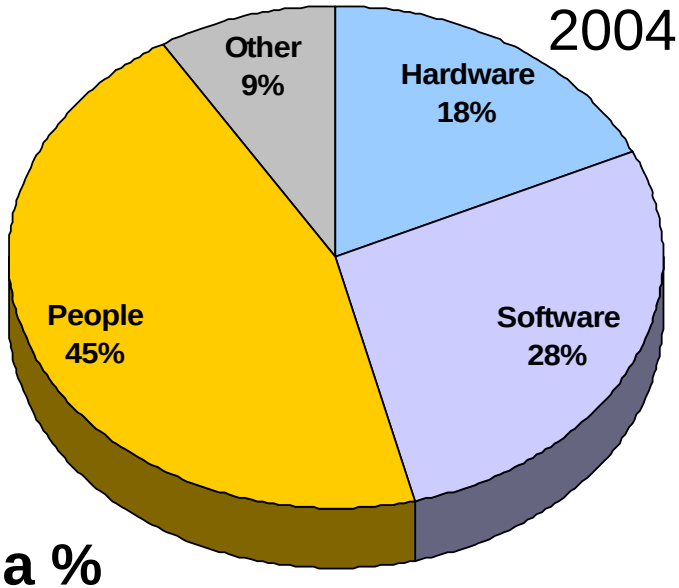
- **Cost due to perception**
  - Chargeback
  - Latest software contract/negotiation
  - Size of the total spending
  - Size of the smallest unit
- **Application availability**
- **Skill Availability**
  - Addressed in IBM's Mainframe Charter

Chargeback

- **Mainframe chargeback pools are typically 50 – 60% overstated**
  - Software contracts
  - People
    - Operations and monitoring
  - Default bucket
- **Chargeback methodology can not be used for comparing the cost of adding or removing a workload**
  - Incremental cost is 20 – 25% of the full chargeback cost
    - Hardware price performance
    - Software flat slope, ISVs?
    - Do you need to hire additional people

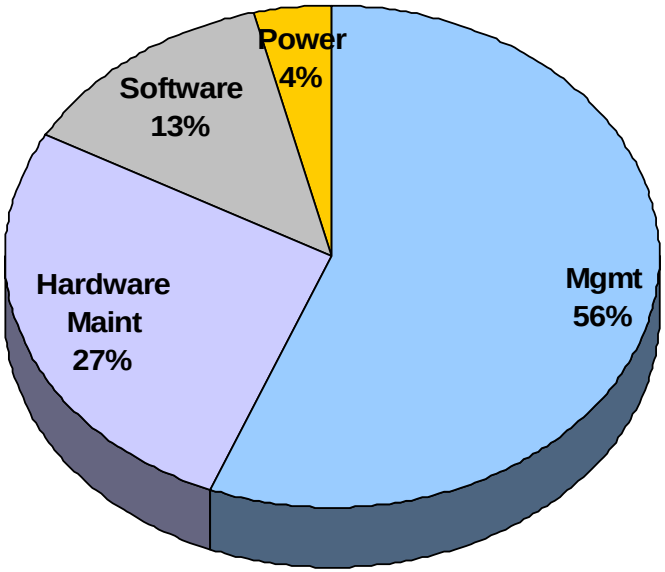
The cost dynamics of supporting corporate IT infrastructures has changed significantly



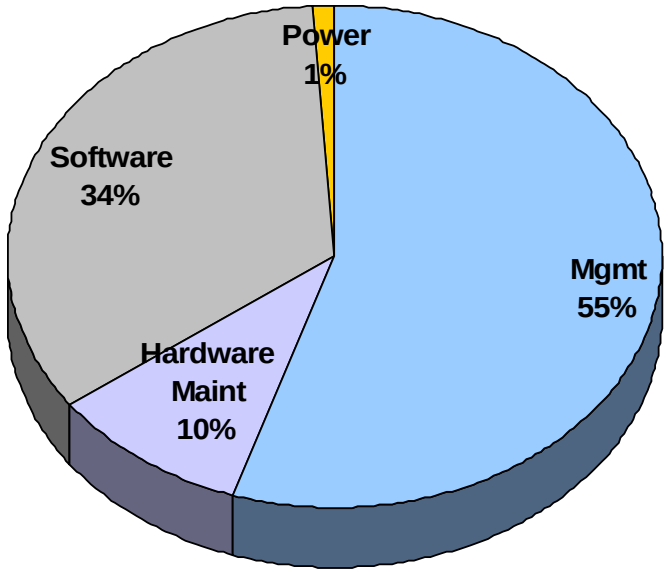


- **People expense has tripled as a %**
- **Software expense has doubled as a %**
- **Hardware is less than 1/3 of its original %**

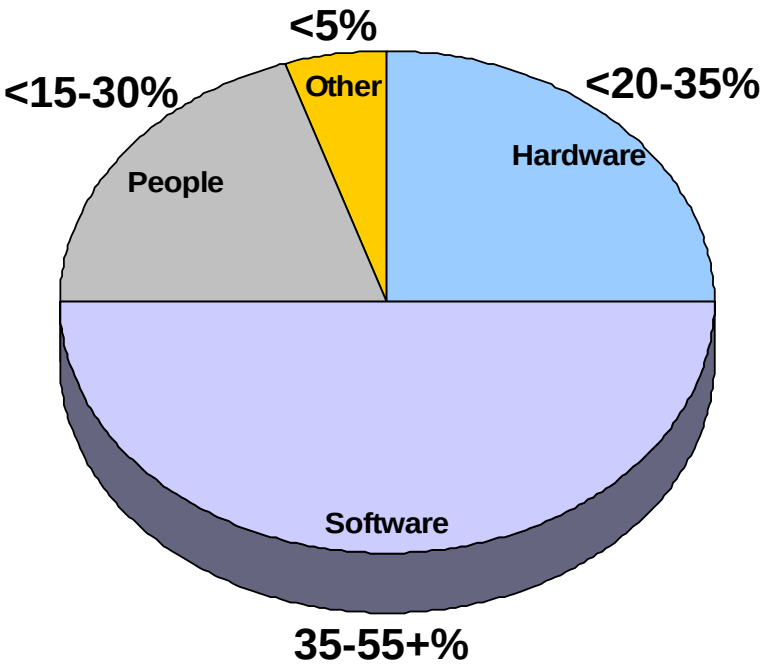
Distributed server annual cost distribution



These are 2 typical customer examples



Traditional mainframe spending distribution



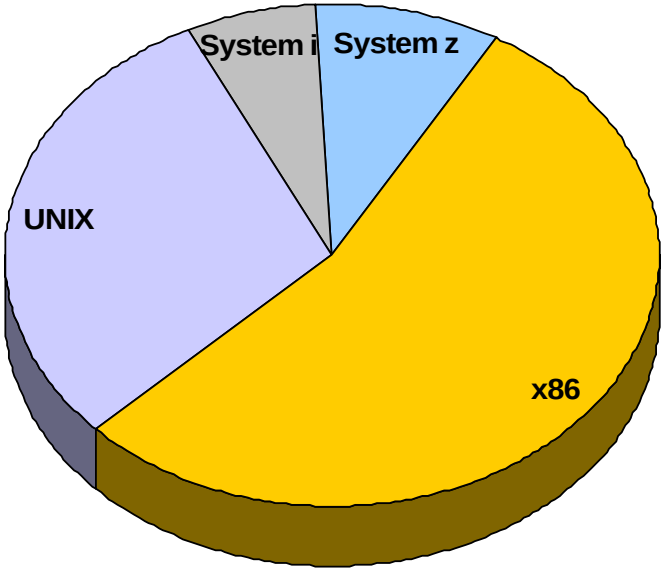
- **Software costs are highly visible**
- **Incremental people costs are minimal**
- **Facility costs are minimal**

Installed vs. used capacity

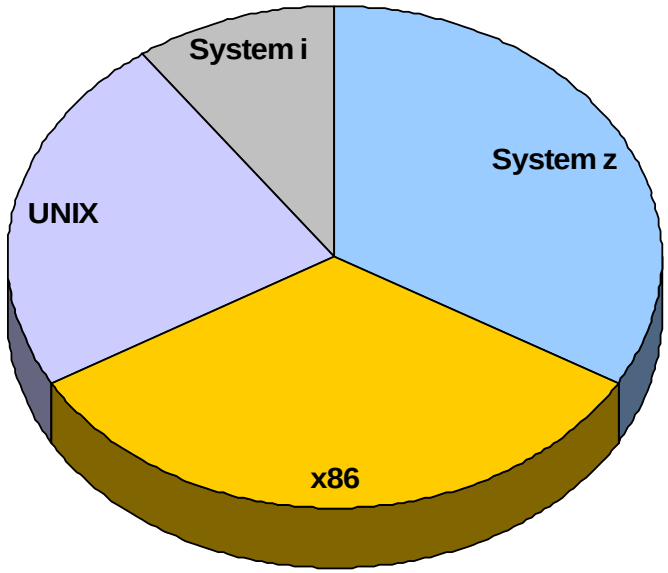
Typical utilization

- **Mainframe 80 – 90%**
- **Unix 10 – 20%**
- **Wintel 5 – 12**

Installed capacity: 33M tpms*



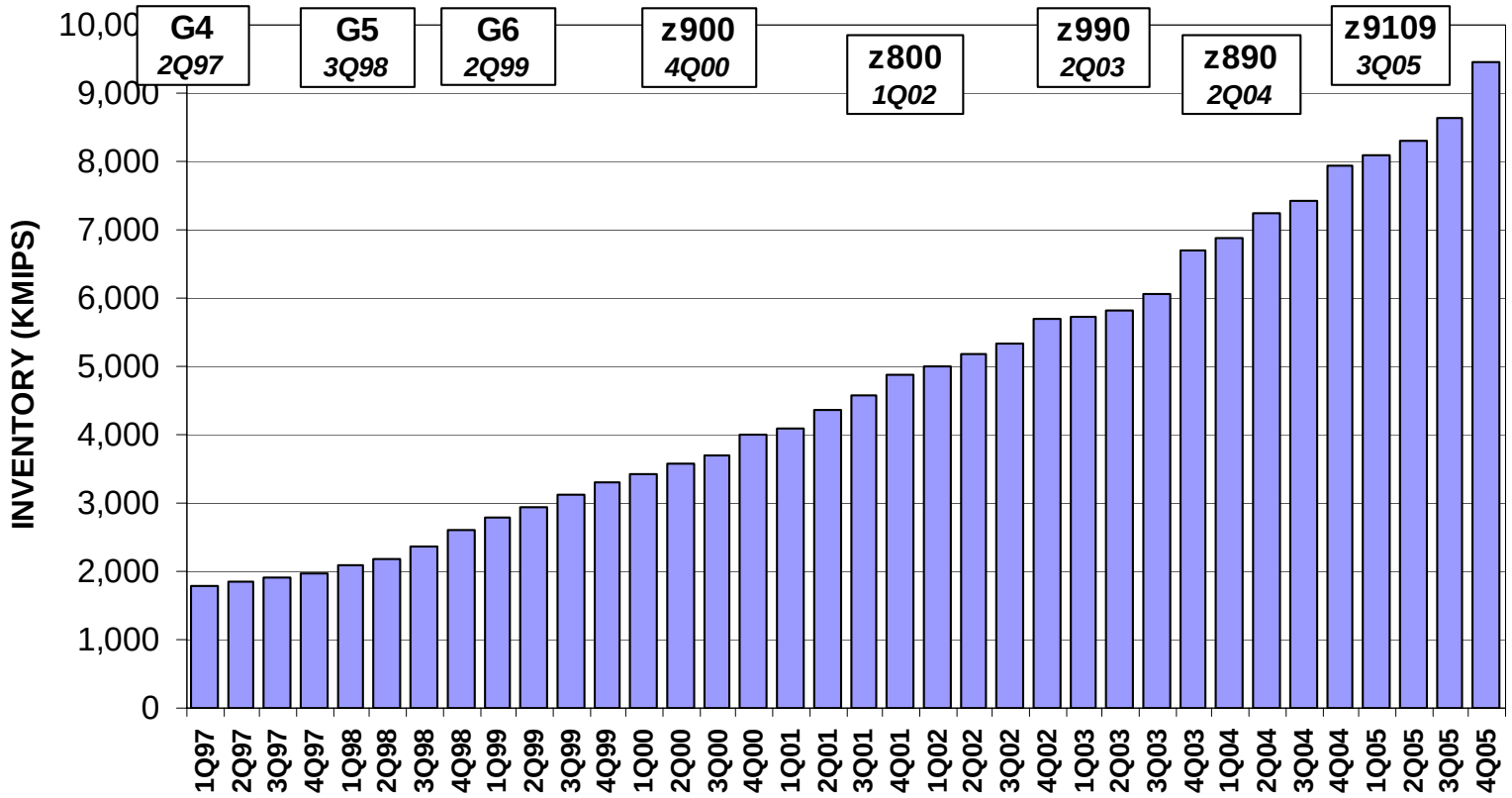
Used capacity: 4M tpms*



* System capacity (tpms) is an approximation of the transaction processing capability of each system. It cannot be compared to other commercial ratings or benchmarks and is invalid outside of the context of this IBM study.

Server utilization varies significantly by platform and that needs to be accounted for in the business case. The mainframe environment is used most efficiently, but is it the most or least expensive?

Customers are installing more capacity

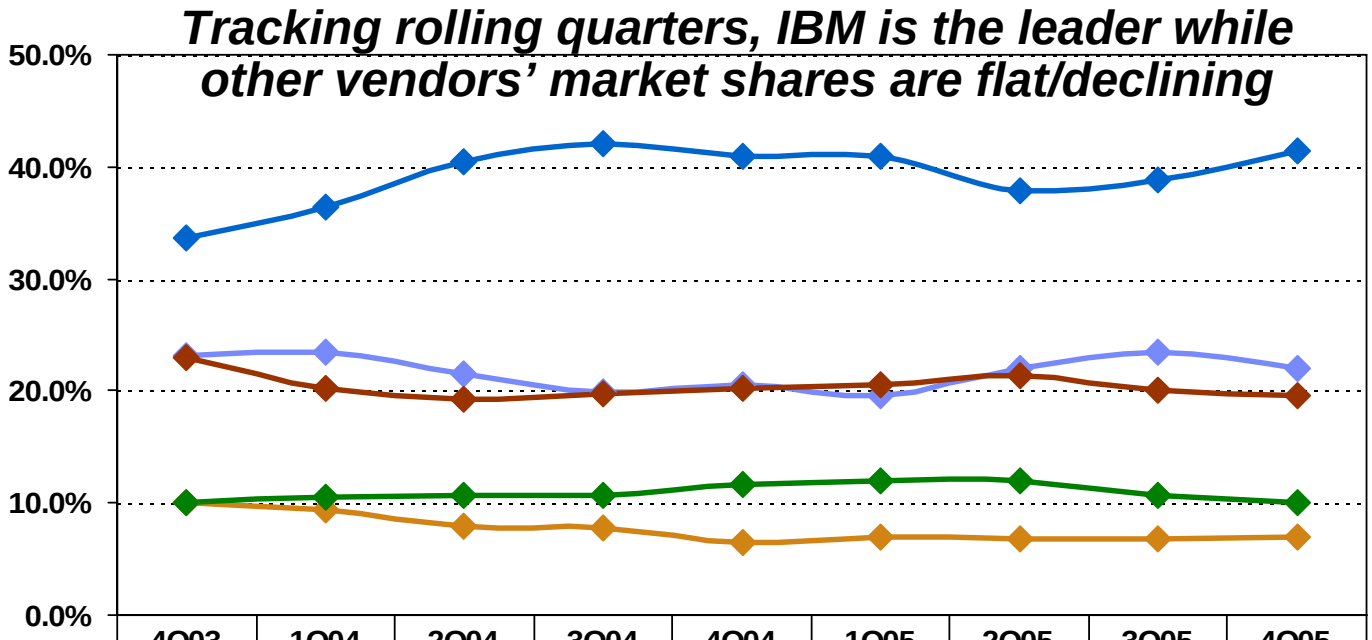


CAGR 1997-2000 = 26%

CAGR 2000-2005 = 19%

Source: IBM STG Finance

System z retains market share



	4Q03	1Q04	2Q04	3Q04	4Q04	1Q05	2Q05	3Q05	4Q05
IBM System z	33.7%	36.4%	40.4%	42.0%	40.9%	41.0%	37.9%	38.9%	41.4%
IBM other $250K+	23.1%	23.4%	21.5%	19.9%	20.6%	19.5%	22.0%	23.4%	22.0%
HP	23.0%	20.3%	19.3%	19.7%	20.3%	20.6%	21.3%	20.1%	19.6%
Sun	10.1%	9.4%	8.0%	7.8%	6.5%	7.0%	6.8%	6.8%	6.9%
Other	10.0%	10.5%	10.7%	10.7%	11.7%	11.9%	11.9%	10.7%	10.0%

Source: IDC 4Q05 Server Tracker – servers at $250K+

System z business value

- **Lowest outage costs:**
  - Highest reliability 99.999%+
  - Highest, availability, recoverability, data integrity
  - Strongest disaster recovery
- **Highest scalability & capacity:**
  - On big commercial workloads
  - Now low entry, small steps
  - Non-disruptive growth
- **Reuse/modernization of mainframe application assets:**
  - $TB customer SW assets on mainframe
  - Excellent tools for modernization, integration, reuse
- **Lowest security breach risks/costs:**
  - Never broken security
  - Highest security ratings
  - Dramatic SSL performance
- **Lowest total cost of ownership and cost/user:**
  - For mid-large workloads / user populations
  - <50% TCO/TCU of UNIX or Windows
- **Highest performance & quality of service:**
  - Fastest response times
  - Business policy driven QoS
  - Highest commercial workload throughput, I/O capacity
- **Highest resource use efficiency/utilization:**
  - Best mixed workloads
  - Complete resource virtualization
  - Highest automation
- **Low risk via world-class support:**
  - For hardware & software
  - Stable environment
  - Dependable, global, long-term
  - Preserves customer investment
- **Much-improved system costs:**
  - Dramatically lower hardware prices
  - Improved software price / performance and “pay for use”
  - Dedicated System z engines slash new workload costs

** Source: Software Strategies “PR” White Paper, April 2005 analysis. Based on Mercer Survey data.*

+ Relative to other computing platforms

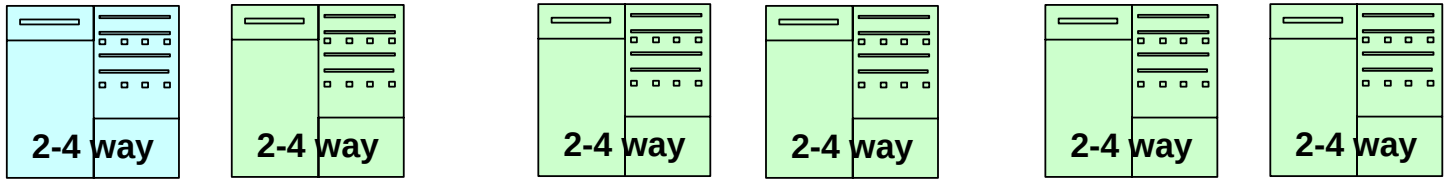
Datacenter reality

- **Mainframe**
  - Well managed
  - Rock solid QoS
  - Expensive (perception)
  - Lowest TCO (reality)
- **UNIX and x86**
  - Proliferation of servers
  - Lower systems utilization
  - Staffing growth
  - Inexpensive hardware (perception)

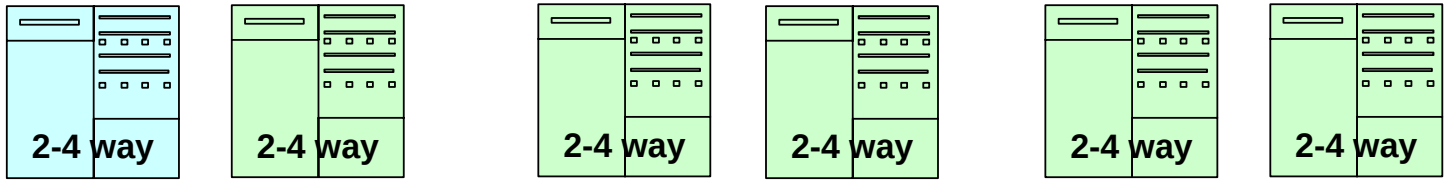
Server proliferation

- **Describe a current application environment**
  - Production
    - Database server? How many?
    - Application server? How many?
    - Messaging server? How many?
    - Failover servers? For each?
  - Disaster Recovery
    - Do you have a DR site?
  - Additional Servers
    - Development servers? Multiple levels?
    - Test servers? Multiple levels?
    - Systems test? Multiple levels?
    - Quality Assurance servers?
    - Education servers?
- **How many applications/types of workload do you have?**

e-business servers – complexity and cost

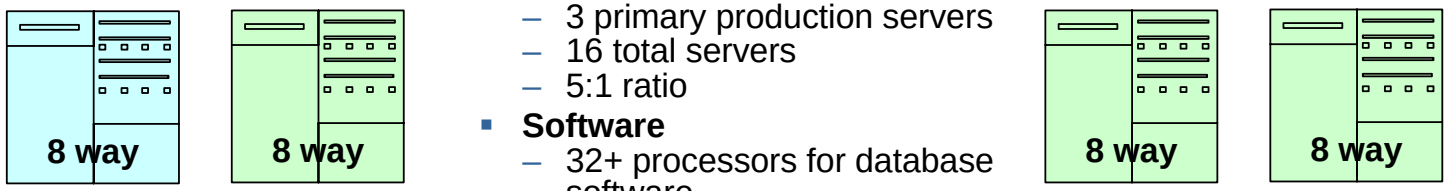


Web/App | Web/App failover | Development | Test | Web/App DR & QA | Web/APP DR failover



Messaging | Messaging failover | Test/Education | Integration | Messaging DR & QA | Messaging DR failover

- **Hardware**
  - 3 primary production servers
  - 16 total servers
  - 5:1 ratio
- **Software**
  - 32+ processors for database software
    - ~ $1.8M over 3 years
  - 15+ processors for application software



Database | Database failover | Database DR & QA | Database DR failover

Summary of server scorecard metrics

Example

	Mainframe	UNIX	x86
People efficiency	**Very good**	**Average to low**	**Very good** – Tend to be cloned – Infrastructure applications
Prime shift utilization	**Very high** – 65-85%	**Fair/good** – 10-20%	**Very low** – 1-8%
Online availability	**Excellent** – 99.9-99.95%	**Fair/good** – 98.5-99.7%	**Not known** – 97.0-99.0%
Usual incremental cost ratio to mainframe	**1.0**	**1.0 – 1.5x**	**<1.0 – 4.0x**
Typical incremental current cost ratio	**20 – 25%**	**50 – 60%**	**50 – 60%**

Why is utilization low on “distributed” servers?

- **Use of response time as a measure of capacity**
  - Buy rather than tune
- **Backup, development, test, training and integration servers**
- **Peaked, spiky workloads on dedicated rather than shared hardware**
- **I/O bound workloads, contention**
- **Utilization controlled to avoid system stress and outages**
- **Incompatible release levels**
- **Incompatible maintenance windows**

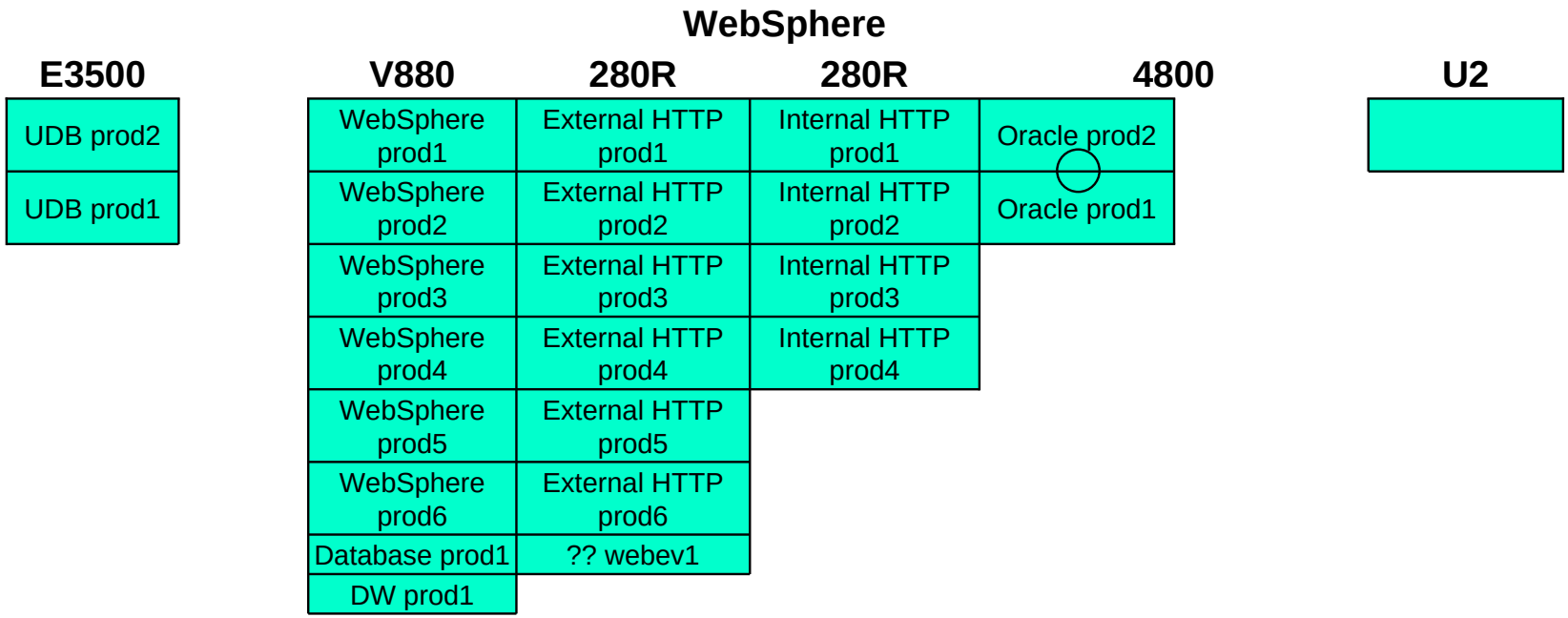
Customer studies

- **WebSphere customer**
- **Hardware**
  - 5000+ MIPS
  - 1000+ servers (25% UNIX)
- **Software**
  - WebSphere currently on Solaris
  - Oracle and DB2

Customer perception:

Solaris environment is 1/5 the cost of the mainframe

Production Sun server architecture



Source: Scorpion Study 1999 - 2004

Production Sun server reality

E3500	V880	V880	WebSphere 280R	280R	4800		U2
UDB prod2	DR	WebSphere prod1	External HTTP prod1	Internal HTTP prod1	Oracle prod2	Test	
UDB prod1	DR	WebSphere prod2	External HTTP prod2	Internal HTTP prod2	Oracle prod1	Test	Development
Test	DR	WebSphere prod3	External HTTP prod3	Internal HTTP prod3			Development
Test	DR	WebSphere prod4	External HTTP prod4	Internal HTTP prod4			Development
	DR	WebSphere prod5	External HTTP prod5	Test			Development
	DR	WebSphere prod6	External HTTP prod6	Test			Development
	DR	Database prod1	?? webev1	DR			Development
		DW prod1	Test	DR			Development
		Test	Test	DR			Development
		Test	DR	DR	Development	Development	Development
		Test	DR	DR	Development	Development	Development
		Test			Development	Development	
		Test			Development	Development	
		Test			Development	Development	

E250

Development

E1000 Domains

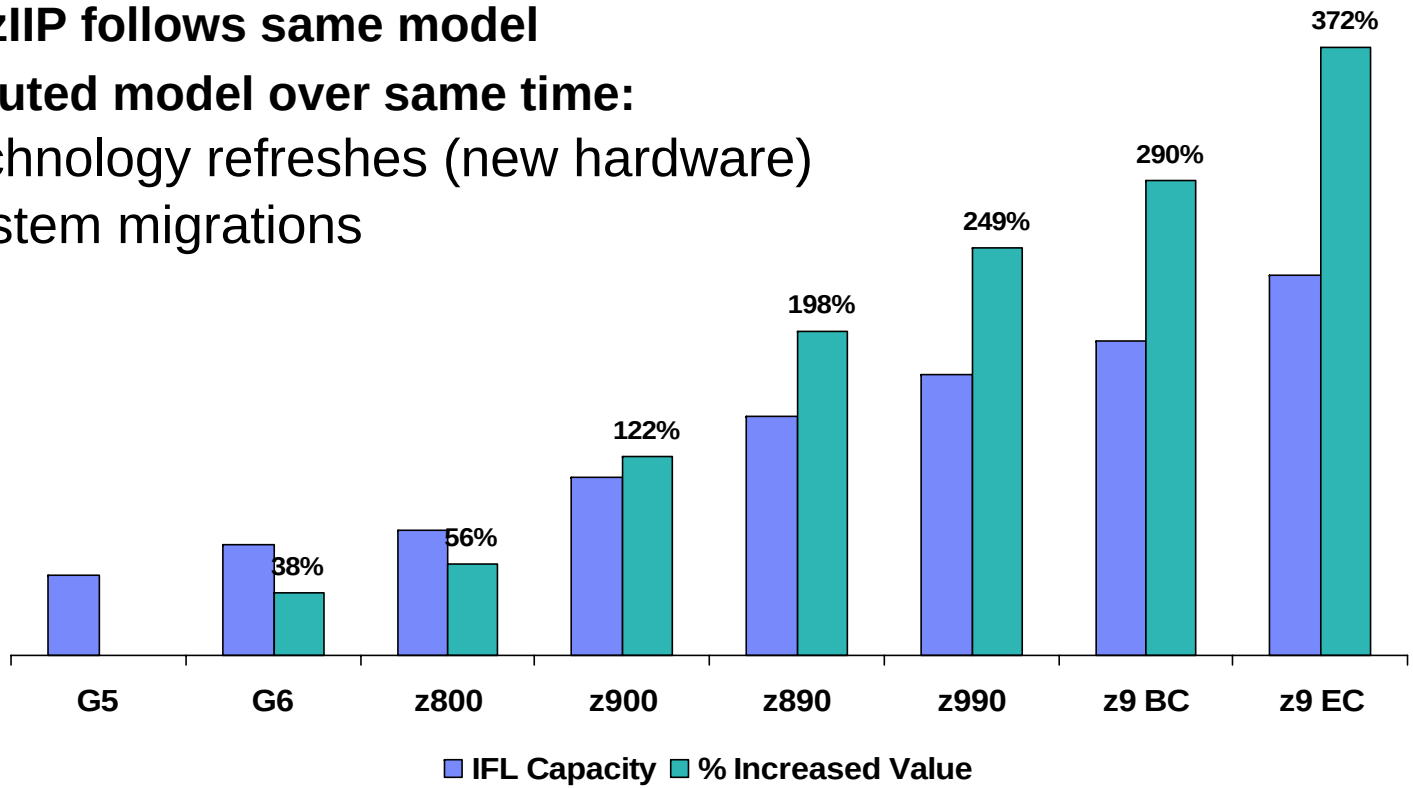
Source: Scorpion Study 1999 - 2004

Integrated Facility for Linux (IFL) makes Linux consolidation even more attractive

- **Same as general purpose processor**
  - Specifically limited to Linux workloads
- **Attractive pricing**
  - Hardware is much lower than general purpose price
  - IBM Linux middleware is charged one license per IFL
    - The same rate as a distributed processor
- **IFL capacity increases “just happen” when you do a mainframe hardware upgrade**
  - zAAPs and zIIPs also
- **Requirements**
  - z9 EC, z9 BC, z990, z900, z890 or z800 server
  - No z/OS requirements
  - No limit on the number of IFLs

Unique value of Integrated Facility for Linux (IFL)

- **IFL price has remained constant (or dropped!)**
- **IFLs move with upgrades**
- **zAAP/zIIP follows same model**
- **Distributed model over same time:**
  - 2 technology refreshes (new hardware)
  - 2 system migrations

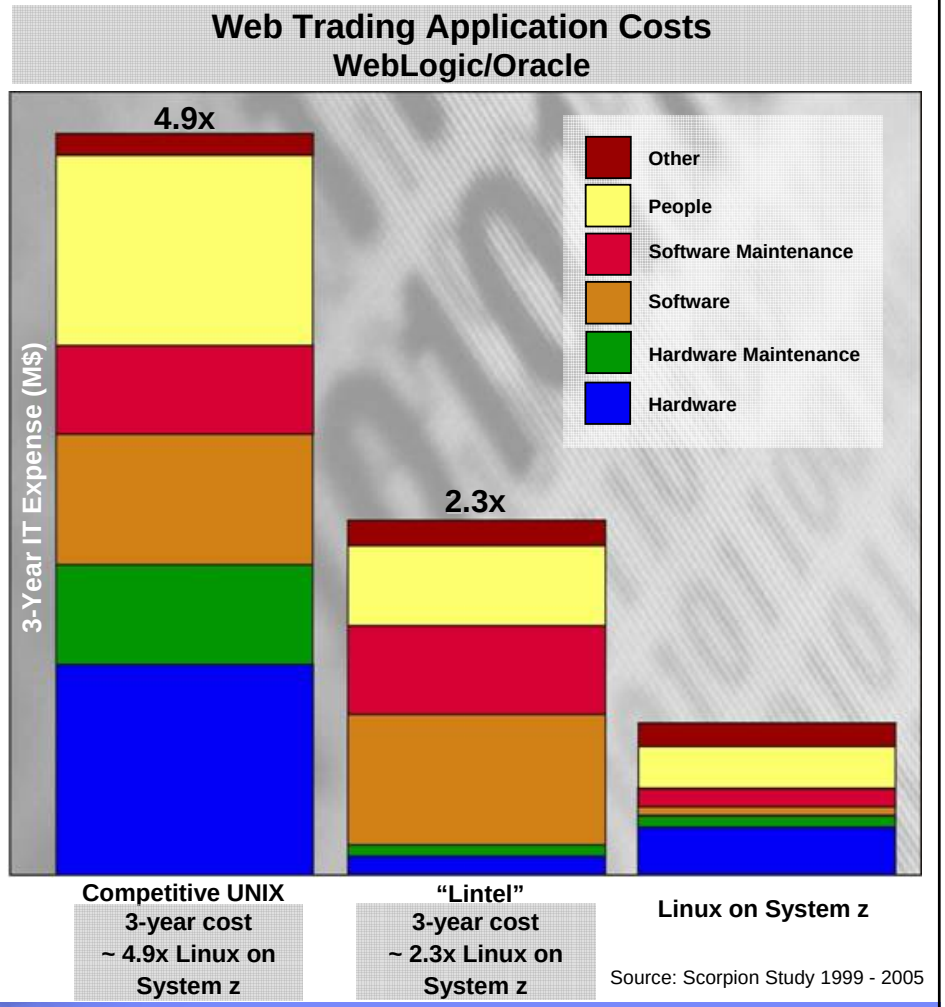


TCO impact of mainframe consolidations

- **TCO impact of Mainframe consolidations**
  - Sun engines lag in capacity
  - 50% reduction in power and cooling costs typical
  - How many Person Years are spent fighting fires?
  - Reliability Matters: z9 30 yr MTBF - others are 10 - 20years
- **Per engine software costs on under utilized engines**
- **Intel engines saturate at low utilization**

Source: Capricorn whitepaper

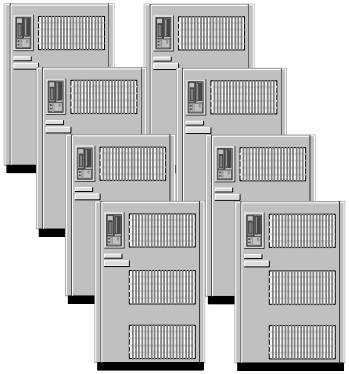
Workload consolidation using Linux on a mainframe can result in significant TCO savings, up to 80%!



Source: Scorpion Study 1999 - 2005

Savings from Linux consolidation on System z

60 Linux Servers



1 IFL

$1.8M saving over 3 years

	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**
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	**$6,500**	**60**	**$390,000**	**$1,170,000**	**$6,500**	**1**	**$6,500**	**$19,500**
Annual power & cooling	**$920**	**60**	**$55,188**	**$165,564**	**$920**	**1**	**$920**	**$2,759**
Grand Total				$2,091,564				$274,122

** IBM WebSphere Application Server for Linux*

Background to Linux financial case study

- **Approach**
  - Compared the costs of 60 distributed Lintel servers doing Web (including some J2EE), File and Print Serving and one IFL
    - 60 distributed servers to 1 IFL is a typical ratio according to customer studies
  - Included hardware maintenance and software support
- **Assumptions**
  - PC service included in the price
  - Base WAS used, 1st year's service included in license
  - Used z/VM to optimize virtualization
  - 24 by 7 hour operation
  - PC servers consume 400W each, 15¢/kWh
    - Cooling costs ~ power costs
  - Cost of capital/inflation ignored

Facility costs

- **"The data center utility bill exceeds the cost of acquiring new computers for some companies"**
  - Annual electric bill for a high-end server is $8760 - IDC
- **"The cost of datacenter floor space is inconsequential compared with the cost of operating and cooling a datacenter"**
  - "Modern computing hardware requires 3 sq ft of cooling infrastructure for every sq ft of floor space"
  - For example, $20/sq ft for space and $60/sq ft for cooling
  - That is 6x the ratio of 10 years ago
- **"The average annual utility cost for a 100,000 sq ft datacenter has reached $5.9M"**
- **"You pay once to power the systems and again to cool them"**
  - And again and again for redundancy
- **"Businesses paid about 20% more last year than in 2004, with rates jumping as much as 40% is some parts of the country"**

Source: Information Week 2/27/06

Distributed power costs now a major issue

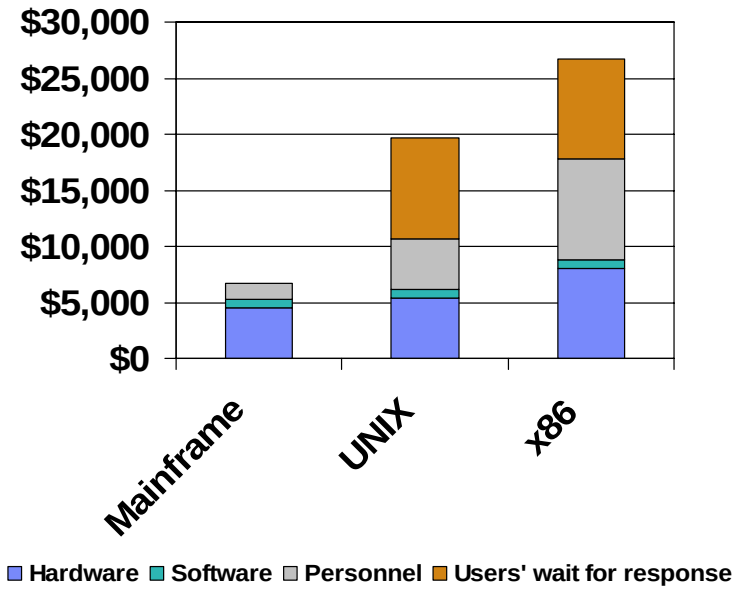
- **According to the Wall Street Journal, distributed servers generate 10x more heat than System z**
  - 3,800 watts per square foot in 2005
    - In 1992 was 250 watts/sq foot
  - z9 heat output is 107 – 312 watts per square foot
    - Switching on an IFL processor consumes only 60-75 watts
- **"*Power-related problems in 2005 will cause 4 of the 20 major failures, up from 2 of 20 last year*" (The Uptime Institute)**
  Costly outcomes:
  - 4 – 5 times increase in power utility bills
    - "*Big businesses can spend up to 17% of their IT operating expenses on power and cooling*" says John Humphreys of IDC
  - Major reconstructions and electrical/air-conditioning upgrades
    - Sometimes building new facilities
  - Erratic machine behavior from high room temperatures (92ºF +)
    - Reducing raised-floor occupancy

Putting this in perspective

- **An average distributed system consumes about 400W**
- **1,000 servers cost about $840K annually to power and cool**
  - >$35K electric power per month
  - Another $21K - $35K in cooling capacity of 400kW

Arcati: Much lower mainframe staff costs compared with UNIX or x86 servers

- **Mainframes have dropped in support costs (10-fold in 7 years)**
  - Will halve again in the next 5 years
  - Major advances in self-healing, self-managing, self-protecting, autonomic technologies
- **Distributed requires much more hardware and software than System z**
  - 2.5 – 3 times more staff for similar workloads



Current Total Cost per User

Arcati Research Note 'Dinosaur Myth 2004 Update' can be found at ftp.software.ibm.com/s390/audio/pdfs/newdino.pdf

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 and reputation

Financial impact of downtime per hour

Industry segment	Cost
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

First National Bank of Omaha

First National Bank Omaha

- **Although core banking and credit-card operations were running on a z900, other processes and applications, such as Web-based banking and back-office software, were assigned various standalone boxes, including more than 30 Sun machines and more than 560 Intel technology-based servers.**
- **This disparate computing environment was becoming extremely expensive, requiring FNBO to hire more people as more boxes were brought online.**
- **First National Bank Omaha (FNBO) is using the onboard Linux capabilities of an IBM zSeries server and the dense computing capabilities of the IBM BladeCenter to replace approximately 600 standalone Intel and UNIX technology-based servers. As a result, FNBO is now poised to save $1.8 million in operating expenses this year alone.**

Source: eServer magazine, May 2005

First National Bank of Omaha

First National Bank Omaha

	Servers	***Reliability***	***Utilization***	***Staff***
First move: Implemented distributed computing architecture that became **too difficult to monitor, maintain, upgrade and scale**	▪ 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 software licensing, labor, power, and air conditioning costs accordingly**

System z – Can help modernize and integrate applications quickly and at a low cost

BALDOR MOTORS, DRIVES & GENERATORS

- **Challenge**
  - Improve Customer responsive and reduce business costs.
  - Provide scalability, enhance flexibility and eliminate single points of failure in the SAP environment.
  - Provide rock solid availability.
- **Solution**
  - Baldor Electric consolidated several UNIX-based servers onto one IBM System z9
  - Deployed all of its SAP Enterprise Portal, Supply Chain and Business Warehouse solutions on System z9 and Linux
  - The company relies on SAP solutions running on System z9 to power its entire business – including sales and distribution, manufacturing, payroll and finance – supporting the work of 3,800 employees worldwide.
- **Benefits**
  - According to Mark Shackleford, director of Information Systems, this has allowed Baldor to increase application performance by 40% and cut IT expenditures from 1.7% of total sales to less than 1% versus the manufacturing industry norm of 4%.

A 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*"

What makes the best fit for System z

- **Leverage classic strengths of the mainframe**
  - High availability
  - High i/o bandwidth capabilities
  - Flexibility to run disparate workloads concurrently
  - Requirement for excellent disaster recovery capabilities
  - Security
  - Facilities – 15 yrs ago did you think facilities would be a mainframe strength?
- **Shortening end to end path length for applications**
  - Collocation of applications
  - Consolidation of applications from distributed servers
  - Reduction in network traffic
  - Simplification of support model

- **IBM middleware**
  - WebSphere MQ Series
  - DB2 Connect
  - CICS Transaction Gateway
  - IMS Connect for Java
  - WebSphere
- **Applications requiring top end disaster recovery model**
- **LDAP security services**
- **IBI Web Focus**
- **Oracle DB**

Full range of TCO factors considerations – often ignored

- **Availability**
  - –High availability
  - –Hours of operation
- **Backup / Restore / Site Recovery**
  - –Backup / Restore
  - –Disaster Scenario
  - –Effort for Complete Site Recovery
  - –SAN effort
- **Infrastructure Cost**
  - –Space and Power
  - –Network Infrastructure
  - –Storage Infrastructure
- **Additional development and implementation**
  - –Investment for one platform – reproduction for others
- **Controlling and Accounting**
  - –Analyzing the systems
  - –Cost
- **Operations Effort**
  - –Monitoring, Operating
  - –Problem Determination
  - –Server Management Tools
  - –Integrated Server Management – Enterprise Wide
- **Security**
  - –Authentication / Authorization
  - –User Administration
  - –Data Security
  - –Server and OS Security
  - –RACF vs. other solutions
- **Deployment and Support**
  - –System Programming
  - –Middleware
  - –Application
- **Operating Concept**
  - –Development of an operating procedure
  - –Feasibility of the developed procedure
  - –Automation
- **Resource Utilization and Performance**
  - –Mixed Workload / Batch
  - –Resource Sharing
  - –Parallel Sysplex vs. Other Concepts
  - –Response Time
  - –Performance Management
  - –Peak handling / scalability
- **Integration**
  - –Integrated Functionality vs. Functionality to be implemented (possibly with 3rd party tools)
  - –Balanced System
  - –Integration of / into Standards
- **Further Availability Aspects**
  - –Planned outages
  - –Unplanned outages
  - –Automated Take Over
  - –Uninterrupted Take Over (especially for DB)
  - –Workload Management across physical borders
  - –Business continuity
  - –Availability effects for other applications / projects
  - –End User Service
  - –End User Productivity
  - –Virtualization
- **Skills and Resources**
  - –Personnel Education
  - –Availability of Resources

Reducing TCO with System z

- **Chargeback methodology works against the mainframe**
  - It feeds the “expensive” perception
- **Specialty engines can significantly lower the total cost of the mainframe**
- **The typical total server to production server ratio is between 3:1 or 5:1 for a distributed app.**
- **The incremental cost of capacity on a zSeries is less expensive than distributed servers**
  - UNIX – 1.0 – 1.5 x compared to mainframes
  - Windows – <1.0 - 4.0 x compared to mainframes
- **System z (z/OS) has a significant business case advantage in people, availability, and utilization**
- **System z (Linux on System z with z/VM) has a significant business case advantage in people, software, utilization, and failover**

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**

Thank you

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