The Art of the Possible – Linux Workload Consolidation on System z

Increasing Operational Efficiencies and Driving Cost Savings

May 2009

IBM

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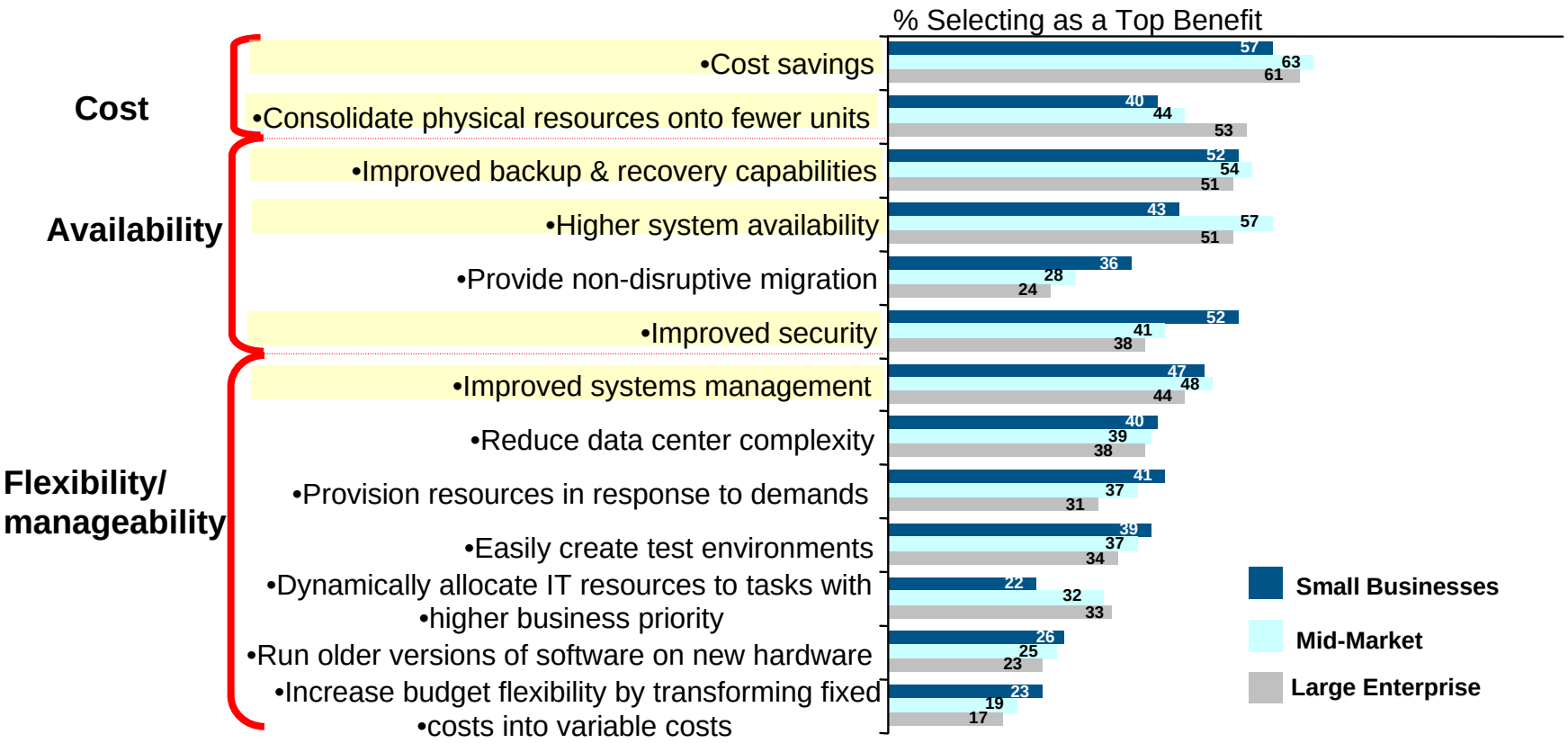
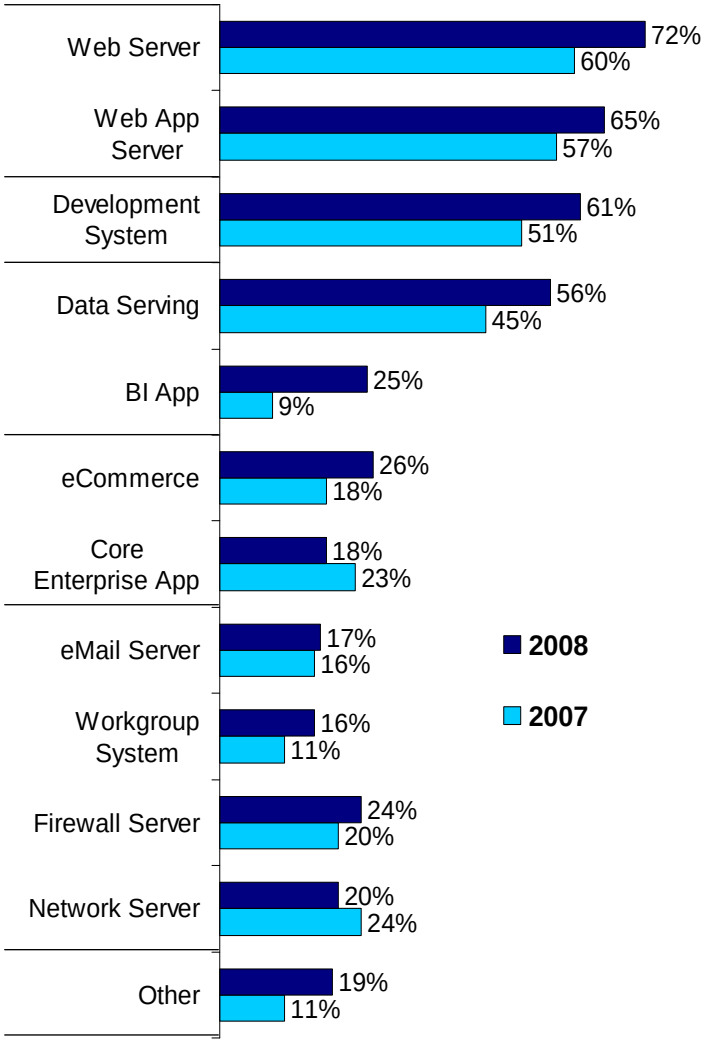
All company sizes identify costs savings as a top benefit of server virtualization followed by availability & flexibility

- **Companies and their IT organizations are almost always under pressure to cut costs**
- **Servers running one or a few applications are typically underutilized**
- **Consolidating servers through virtualization is one easy way to reduce costs**



Consolidate What?



Surveys indicate IBM System z® customers use Linux® for:

- Web Serving and Web Application Serving
- Data Serving
- Systems Development

"Best Fit" Workloads for Linux on System z:

- **Business connectors**: WebSphere® MQSeries®, DB2® Connect, CICS® Transaction Gateway, IMS™ Connect for Java™
- **Business critical applications**: e.g. SAP
- **Development and test** of WebSphere and Java applications
- **WebSphere Application Server** (WAS)
- **Email & collaboration**: Domino™, Web 2.0
- **Network Infrastructure**: FTP, NFS, DNS, etc. and Comm Server and Communications Controller for Linux, Communigate Pro (VoIP)
- **Data services**: Cognos®, Oracle, Informix®, Information Server, Builders WebFOCUS
- **Applications requiring top end disaster recovery model**
- **Virtualization and Security Services**

Source: IBM Market Intelligence

What Makes A Best Fit Workload for Linux on System z?

- **Leverage classic strengths of the System z**
  - High availability
  - High i/o bandwidth capabilities
  - Flexibility to run disparate workloads concurrently
  - Requirement for excellent disaster recovery capabilities
  - Security
- **Shortening end to end path length for applications**
  - Co-location of applications
  - Consolidation of applications from distributed servers
  - Reduction in network traffic
  - Simplification of support model
- **Consolidation Effect**
  - **Power requirements**
  - **Software costs**
  - **People Costs**
  - **Real Estate**
  - **Workloads requiring EXTREME Flexibility**

System z Achieves High Core-to-Core Ratios When Consolidating from Distributed Environments

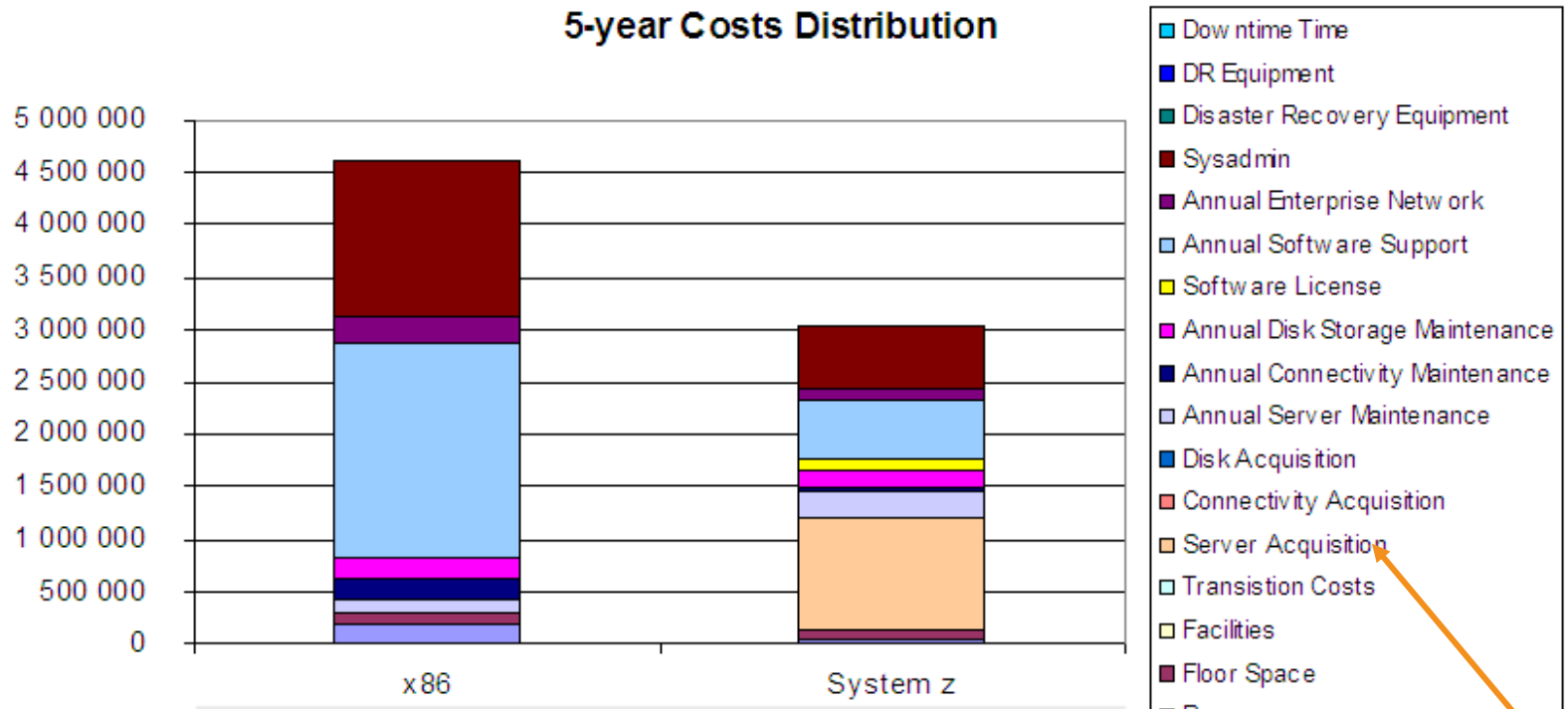
- Demonstrates unique IBM Value Proposition against competitive scale-out solutions
- **Real customers, real workloads!**

Customer	Distributed Cores	IBM System z10™ or IBM System z9® Cores	Ratio of distributed to System z cores*
Nationwide	**450**	**21 cores z9**	**21 to 1**
Pension Fund Agency	**1324**	**36 cores z10**	**36 to 1**
Government Agency	**292**	**5 cores z10**	**58 to 1**

* Client results will vary based on each specific customer environment including types of workloads, utilization levels, target consolidation hardware, and other implementation requirements.

Source: IBM

Actual Customer Saves $1.5M with Oracle on System z vs. 45 Oracle x86 Servers!



72% reduction in SW maintenance costs
95% reduction in connectivity costs
75% reduction in power/cooling costs
60% reduction in System Admin costs

Note: Upgrade required for mainframe; Dell and HP were existing HW

5-year Cost Comparison	1st Year	2nd Year	3rd Year	4th Year	5th Year
x86	923 625	1 847 250	2 770 874	3 694 499	4 618 124
System z	1 482 559	1 871 822	2 261 085	2 650 348	3 039 611
Delta	558 934	24 572	-509 789	-1 044 151	-1 578 513

Prices are in USD. Prices may vary in other countries.
Data is based on real client opportunity and on internal standardized costing tools and methodologies.
Client results will vary by types of workloads, technology level of consolidated servers, utilization factor, and other implementation requirements. Savings will vary by client.

Large Bank Reduces Space, Energy Requirements and Saves $1.5M + (Details for Previous Chart)

	FROM …	TO …
Current hardware infrastructure	45x86 (HP + Dell)	IBM System z10 Enterprise Class (z10™ EC)
Footprints	45	1
Cores	111	4 IFLs
Avg utilization	Less than 10%	60%
Peak utilization	35%	85%
# DBs, size of DB	111 Oracle DB	111 Oracle DB
Application	Oracle 10G databases	Oracle 10G databases
OS	Linux	Linux + z/VM®
Energy usage		75% less
Floor Space usage		28% less
TCO: 5 years	$4.62M	$3.04M / savings: $1.58M

Summary of Benefits:

- 111 to 1 core reduction, 27:1 footprint reduction
- Up to 72% software maintenance cost reduction
- Improved application reliability, and efficient Disaster Recovery capabilities

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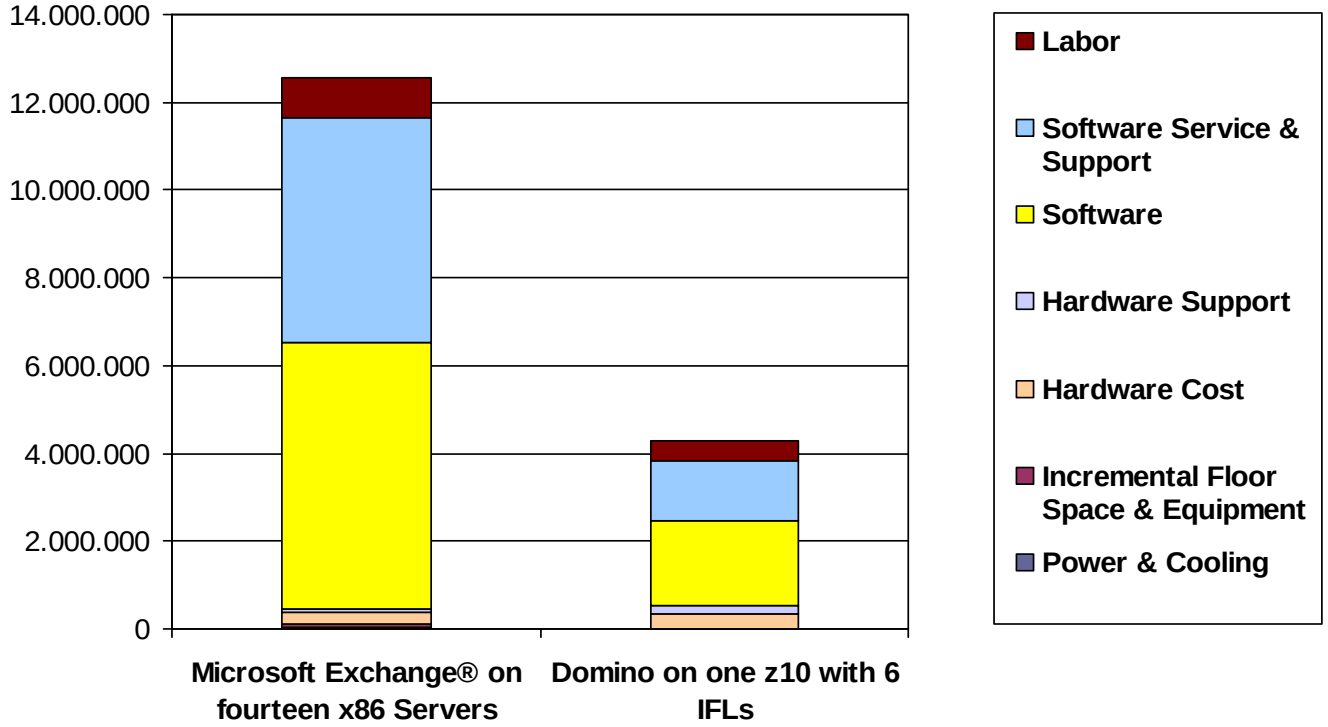
Email, Calendaring, and Collaborative Application on System z is 1/3 the Cost of x86 and Saves $8M+ over 3 years



	TCO: 3 Years	Per User Cost
Microsoft® Exchange on fourteen x86 Servers	$ 12,557,473	$ 1,046
Domino on one z10 with 6 IFLs	$ 4,286,997	$ 357
Savings with Domino on System z Linux	$ 8,270,476	$ 689

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Email, Calendaring, and Collaborative Application on System z is 1/3 the Cost of x86 (Details for Previous Chart)

	Microsoft Exchange on fourteen x86 servers	**Domino** on one IBM System z10 Business Class™ (z10 BC™) with 6 IFLs
Hardware cost	$ 267,000	$ 339,000
Software	$ 6,067,986 Office (includes Outlook), Exchange 2007, CAL Enterprise	$1,931,790 Domino for Linux on System z: z/VM, Linux, Domino, Lotus® Notes®
Hardware Support	$ 93,450	$ 201,312
Software Service & Support	$ 5,125,551	$ 1,364,601
Power and Cooling	$ 40,366	$ 294
Labor	$ 900,000	$ 450,000
Incremental floor space & equipment	$ 63,120	$ 0
TCO: 3 years	**$12,557,473**	**$ 4,286,997**
Per user cost	**$ 1,046**	**$ 357**

Summary of Benefits:

The per-user cost is 1/3 of x86 MS Exchange solution due to significant savings on labor, power and cooling, floor space, HW /SW support

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Insurance Customer Moves From x86 and Uses 60% Less Energy

	FROM …	TO …
Current hardware infrastructure	4x86 (IBM)	z10 EC™
Footprints	4	1
Cores	7	1 IFL
Avg utilization	Less than 3%	11 %
Peak utilization	12 %	16 %
# DBs, size of DB	4 Oracle DB	4 Oracle DB
Application	Oracle databases	Oracle databases
OS	Windows®	Linux + z/VM
Energy usage		60 % less

Summary of Benefits:

- Application integration with current System z applications
- Backup and Disaster Recovery capabilities
- Better utilization with smaller footprint and less energy requirements

Data is based on real client opportunity and on internal standardized costing tools and methodologies. Client results will vary by types of workloads, technology level of consolidated servers, utilization factor, and other implementation requirements. Savings will vary by client.

Financial Client Consolidates 61 Sun and HP Servers to a System z10 and Saves 96% on Power and Cooling

	FROM …	TO …
Current hardware infrastructure	Sun and HP servers	z10 EC
Footprints	61	1
Cores/Memory	442 cores / 1440 GB	16 IFLs / 82GB
Avg Utilization	13.3%	40%
Peak Utilization	28.7%	92%
# DBs, size of DB	61	61
Application	Oracle databases	Oracle databases
OS	Sun Solaris	Linux + z/VM
Energy usage: Power & cooling (Whr) Heat (BTUs/hr)	 345,618 Whr 737,030 BTUs/hr	 14,766 Whr -> 95% less 39,648 BTUs/hr -> 94% less

Summary of Benefits: Software savings, energy requirements reduced, better utilization

Data is based on real client opportunity and on internal standardized costing tools and methodologies. Client results will vary by types of workloads, technology level of consolidated servers, utilization factor, and other implementation requirements. Savings will vary by client.

Government Client Consolidates Sun Servers to System z to Save on Software, Energy, and Space

	FROM …	TO …
Current hardware infrastructure	Sun	IBM System z9 Business Class (z9® BC)
Footprints	5	1
Cores/Memory	9	1 IFL
Peak Utilization	48%	89%
# DBs, size of DB	5	5
Application	Oracle databases	Oracle databases
OS	Sun Solaris	Linux + z/VM
Energy usage: Power & cooling (Whr) Heat (kBTUs/hr)	 4,803 Whr 10,243 BTUs/hr	 2,986 Whr -> 37% less 8,016 BTUs/hr -> 21% less

Summary of Benefits: Software, energy, space savings

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Banking client solves environment, space and cost issues - an expected 20 % cost reduction

	FROM …	TO …
Current hardware infrastructure	Sun SPARC	z10 (+ z9 for use as a disaster recovery machine)
Footprints	131 (v440s, v280Rs, E10Ks)	1
Cores		3 IFLs
Application	Customer facing banking systems, including Internet banking and teller platforms (IBM WebSphere application and IBM Process server, along with customised Java applications)	Customer facing banking systems, including Internet banking and teller platforms (IBM WebSphere application and IBM Process server, along with customised Java applications)
OS	Solaris	Linux + z/VM
Energy and Space Power (kWhr) Heat (kBTUs/hr) Space (Racks) CO2 (Tonnes)	 36 kWhr 110 kBTUs/hr 6,5 racks 66 tonnes	 22 kWhr -> 38% less 74 kBTUs/hr -> 33% less 4,5 racks -> 31% less 40 tonnes -> 39% less

Summary of Benefits:

- Maximize space, keep costs down and reduce carbon footprint
- Boost the speed and simplicity of new deployments

Source: Red Hat, http://customers.redhat.com/2009/02/03/bank-of-new-zealand-reduces-carbon-footprint-with-red-hat-on-the-mainframe

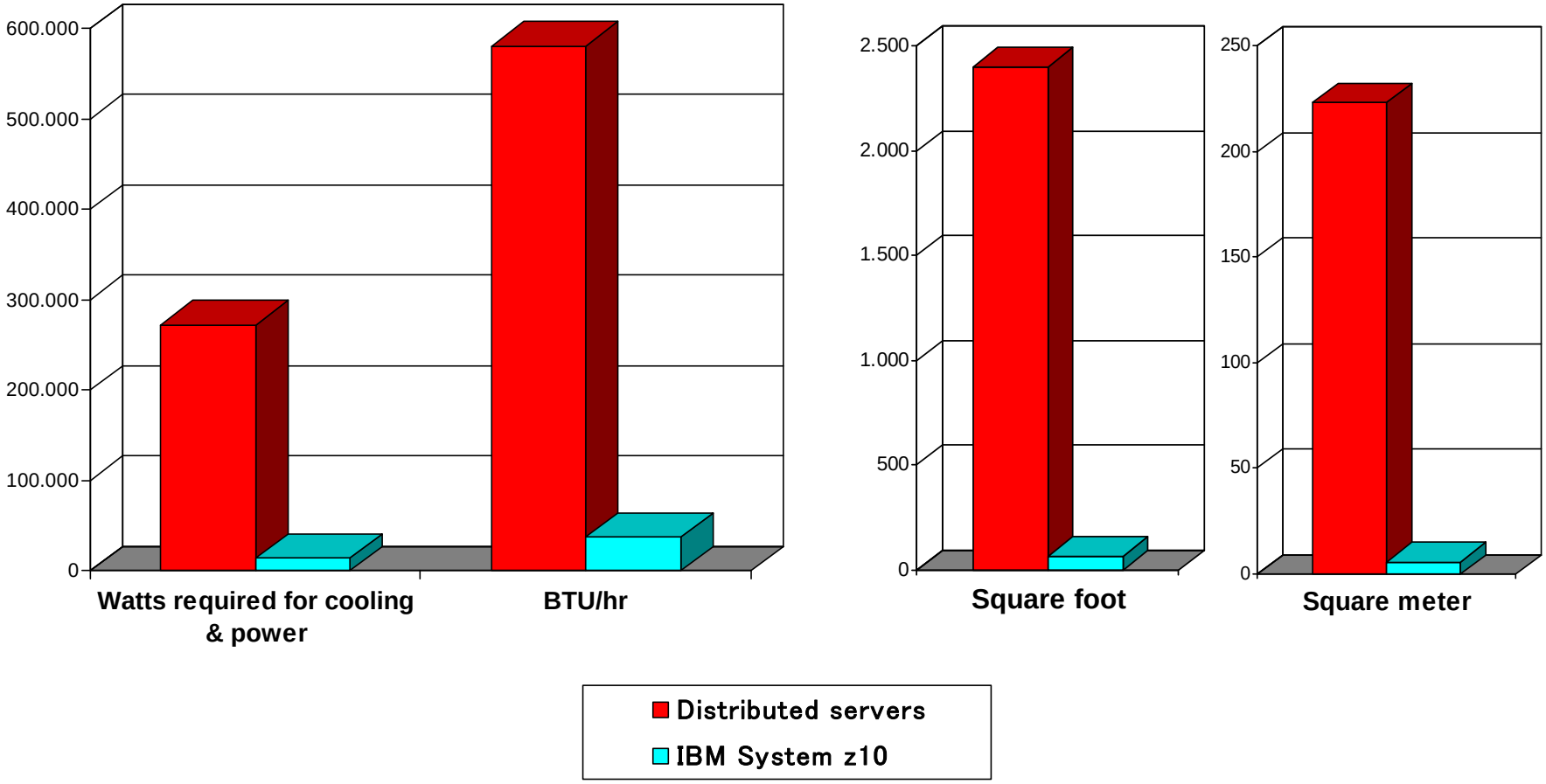
Insurance Company Reduced Energy Requirements 95% by Consolidating 292 Servers to a z10 (1 of 3)

	FROM …	TO …
Current hardware infrastructure	Sun (Fire, Netra, Enterprise servers)	z10 EC
Footprints	292	1
Cores/Memory	500+ cores	22 IFLs
Avg Utilization	30 %	90 %
Application	Mainly Web services	Mainly Web services
OS	Solaris	Linux + z/VM
Energy / Space savings		Energy reduction: 95% Heat reduction: 93.6% Floor space reduction: 97%

Summary of Benefits: Improved utilization, reductions in energy, heat
Floor space savings with 292 footprints to 1 reduction

Data is based on real client opportunity and on internal standardized costing tools and methodologies.
Client results will vary by types of workloads, technology level of consolidated servers, utilization factor, and other implementation requirements. Savings will vary by client.

Insurance Company Reduced Energy Requirements 95% by Consolidating 292 Servers to a z10 (2 of 3)



OEM Server environmentals are derived from IDEAS International.

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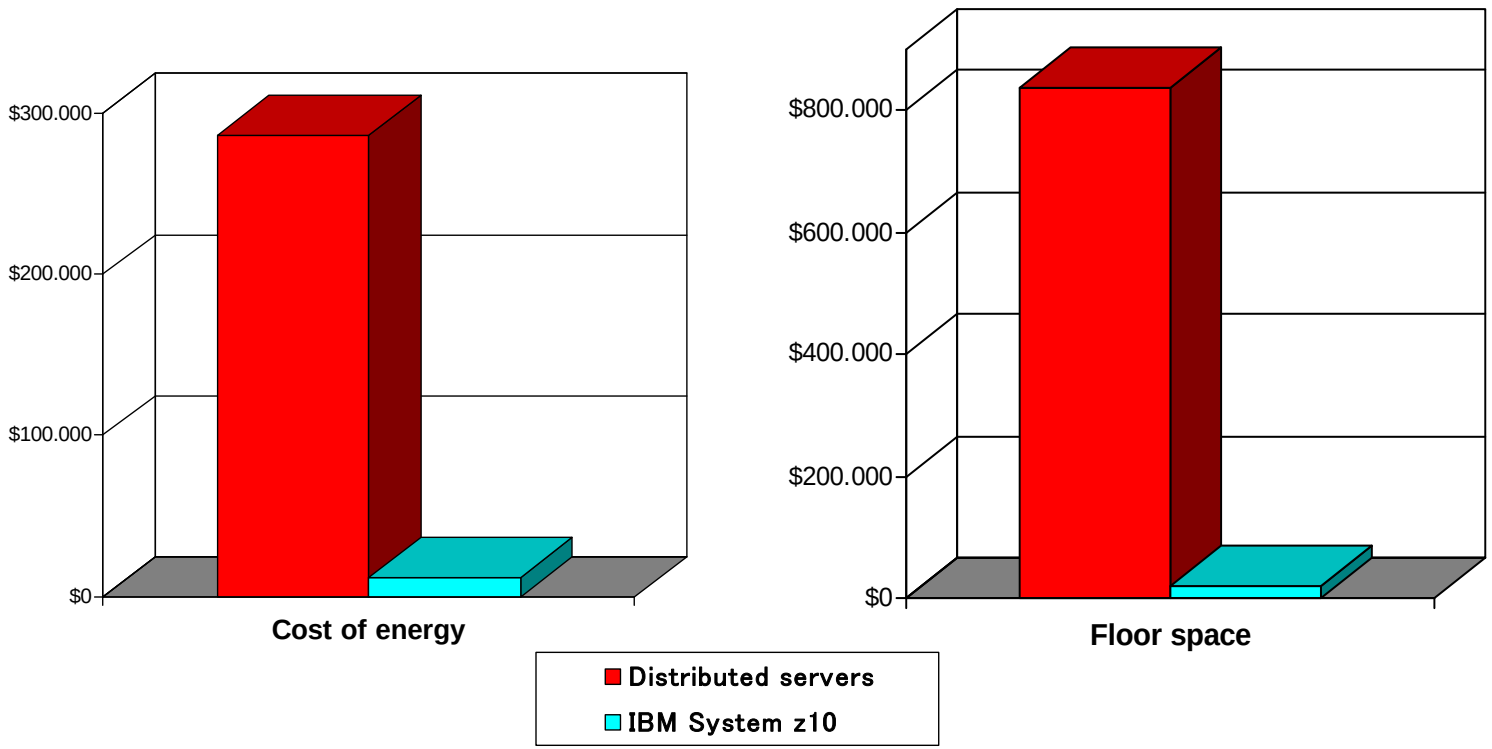
Insurance Company Reduced Energy Requirements 95% by Consolidating 292 Servers to a z10 (3 of 3)



Annual cost calculation

- Energy cost calculated with a rate of $0.12 per Kilowatt
- Floor space cost calculated with a rate of $29 per square foot per month

Medium Size Health Care Company Consolidates 31 HP Servers to System z and Reduces Energy Requirements 72% (1 of 3)

	FROM …	TO …
Current hardware infrastructure	HP	IBM System z9 Enterprise Class (z9 EC)
Footprints	31	1
Cores/Memory	144	14 IFLs
Avg Utilization	30 %	87 %
Application	Mix workload	Mixed workload
OS	Solaris	Linux + z/VM
Energy /Space/Other		Energy Reduction: 72% Heat Reduction: 64.6% Floor Space Reduction: 80.4%

Summary of Benefits: Software licenses, Energy and Floor space savings

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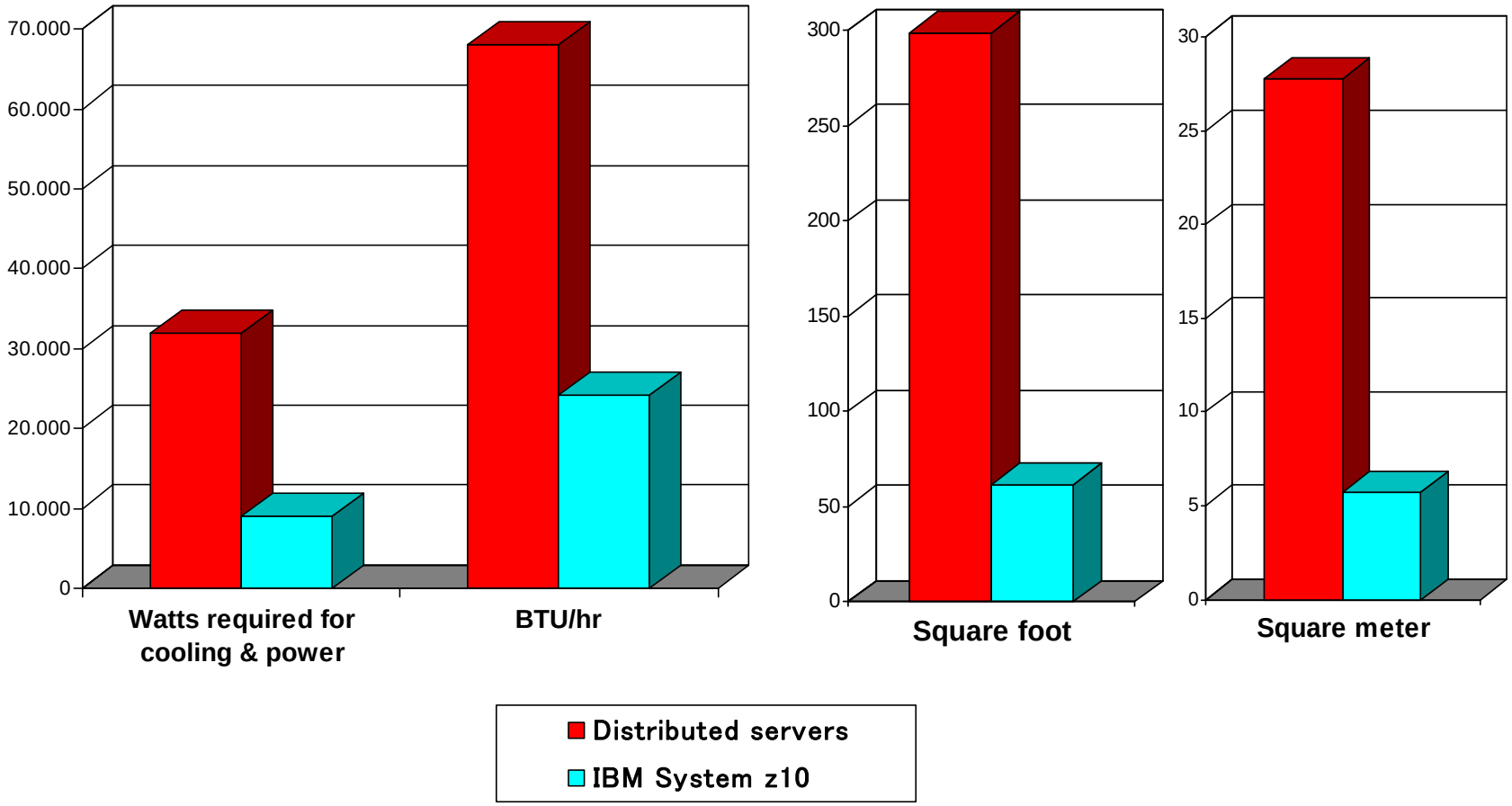
Medium Size Health Care Company Consolidates 31 HP Servers to System z and Reduces Energy Requirements 72% (2 of 3)



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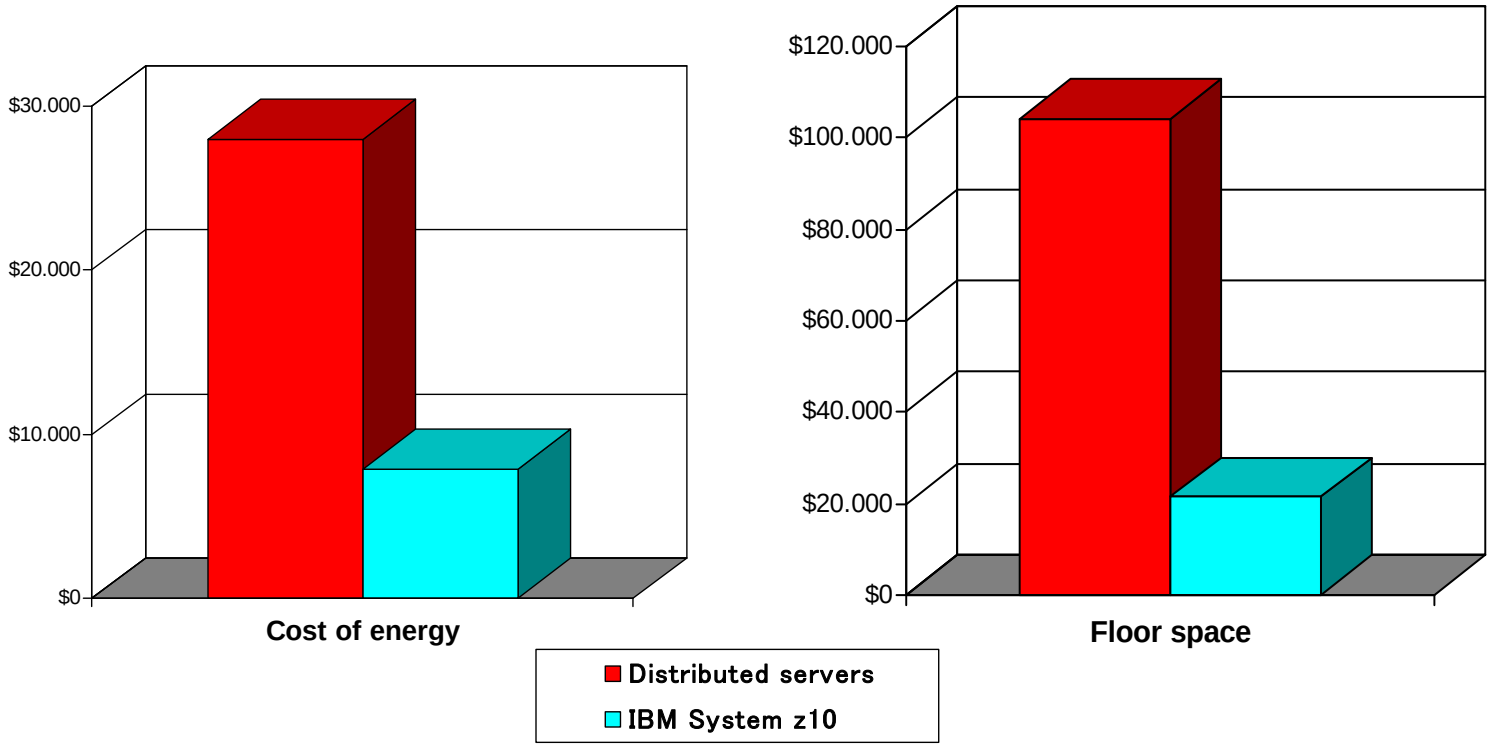

Annual cost calculation

- Energy cost calculated with a rate of $0.12 per Kilowatt
- Floor space cost calculated with a rate of $29 per square foot per month

Medium Size Bank Saves on Software Licensing Moving to Linux on System z

	FROM …	TO …
Current hardware infrastructure	Sun (Fire, Ent 10K), IBM eServer™ pSeries®	z9 EC
Footprints	15	1
Cores/Memory	47 cores	2 IFLs
Avg Utilization	30 %	76 %
Application	DB, WebSphere Application Server with little Java content	DB, WebSphere Application Server with little Java content
OS	Solaris, AIX®	Linux + z/VM

Summary of Benefits:

- Software licenses savings by consolidating 47 cores to 2 IFLs

Data is based on real client opportunity and on internal standardized costing tools and methodologies. Client results will vary by types of workloads, technology level of consolidated servers, utilization factor, and other implementation requirements. Savings will vary by client.

Legal and Financial Company Saves Energy and Floor Space Doing Data Mining on System z vs. HP

	FROM …	TO …
Current hardware infrastructure	HP Proliant ; Sun Fire	z10 EC
Footprints	155 (HP: 45, Sun: 106)	4 (desired separate sites)
Cores/Memory	854 / 676,512 MB	51 IFLs
Peak Utilization	6% to 54% SURF data	90%
Application	Mix of servers used for certification, development, production Oracle DBs and additional workload	Mix of servers used for certification, development, production Oracle DBs and additional workload
OS	HP-UX, Windows	Linux + z/VM

Additional Benefits:

- Avoid HP and Sun server refresh
- Gain disaster recovery in addition to energy savings

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Large Bank Consolidates From HP and Sun Saving Power Costs and Gaining Disaster Recovery Protection

	FROM …	TO …
Current hardware infrastructure	HP Proliant; Sun Fire, pSeries	z10 EC
Footprints	18	2 (2 separate sites)
Cores/Memory	63	3 IFLs
Peak Utilization	3% to 15% SURF data	74%
# DBs, size of DB	Oracle	Oracle
OS	HP-UX, Windows	Linux + z/VM
Energy and floor space savings		$28,000 per year

Summary of Benefits:

- Energy savings
- Disaster recovery capability
- Better utilization

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Transportation Company Moves 42 Servers to a System z

	FROM …	TO …
Current hardware infrastructure	Old IBM eServer xSeries®, IBM System x™	z9 EC
Footprints	42	1
Cores/Memory	84	9 IFLs
Peak Utilization	0.46% - 75.34% (0% – 20% = 34 Servers) (20%- 76% = 8 Servers)	83%
# DBs, size of DB	N/A	N/A
Application	File / print serving	File / print serving
OS	Windows	Linux + z/VM

Summary of Benefits:

- Space savings
- Technology refresh

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Summary of Benefits

Companies, from all sizes across the industries, identify costs savings as a top benefit of server virtualization and consolidation to Linux on System z

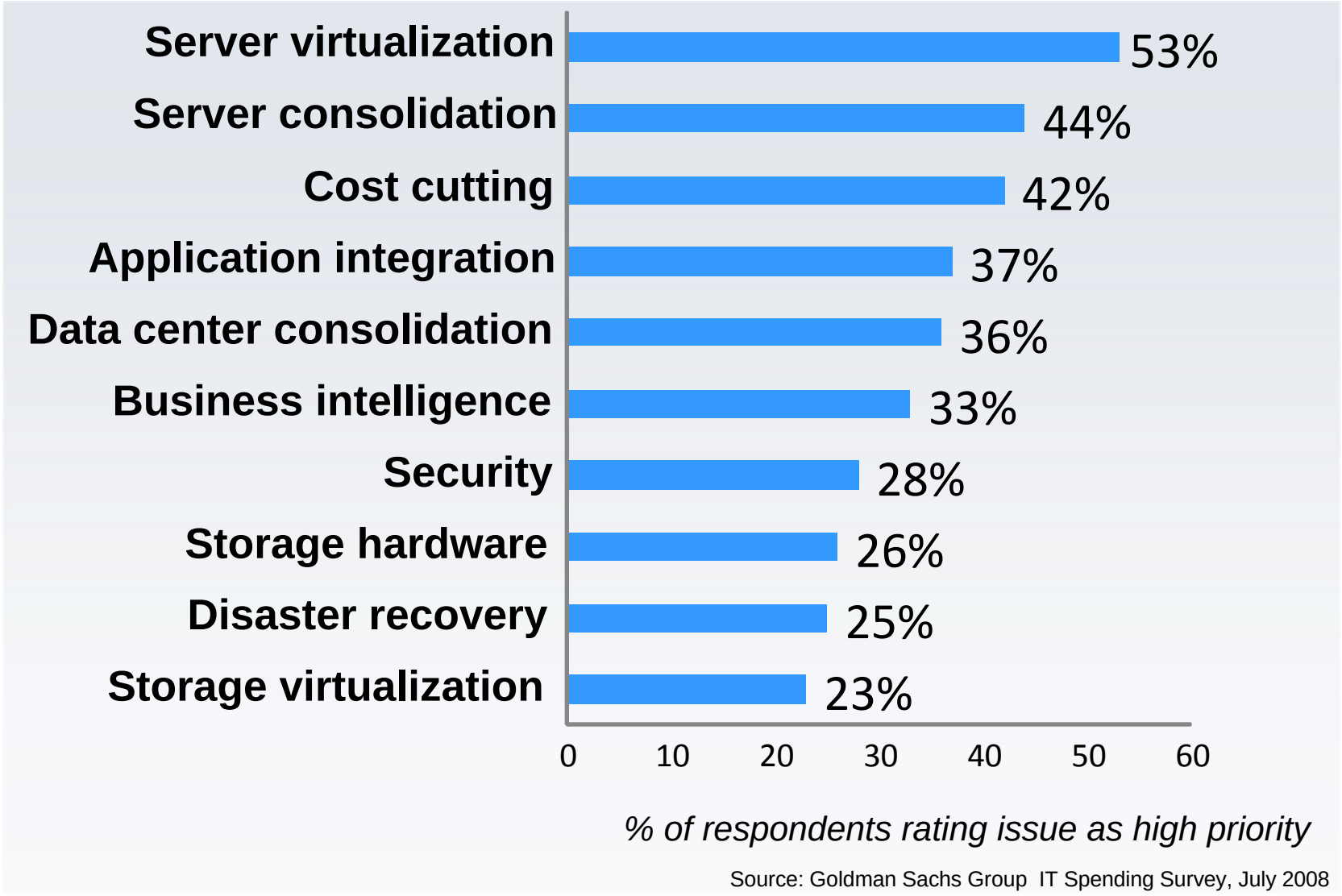
But there are even more benefits:

- **Improved application reliability**
- **Efficient Disaster Recovery capabilities**
- **Application integration with current System z applications**
- **Speed and simplicity of new deployments**
- **Avoided server refresh**

Linux on System z provides a great opportunity for server consolidation and IT simplification

Backup Slides from dynamic infrastructure Presentation with External Proof Points

CIO Key Spending Initiatives for 2008



Source: Goldman Sachs Group IT Spending Survey, July 2008

Dynamic Infrastructure

Smart is: Reducing Cost

SMART IS
Consolidating hundreds of servers to maximize space, reduce power consumption and operating costs

Bank of New Zealand: Consolidates its front-end systems data center reducing its footprint by 30 percent; power consumption by nearly 40 percent; heat output by 33 percent; and carbon dioxide emissions by 39 percent. BNZ is also expecting 20 percent ROI over the life of the platform, deploys new environments in minutes vs. days and, with just one administrator needed per 100 virtual servers, is saving on resources used to manage the platform.

SMART IS
Growing your business confidently in a rapidly changing economy

Transzap: Consolidates to System z to provide the stability and scalability needed to accommodate triple digit volume growth and 100% YTY growth-plan to production. The System z infrastructure securely and rapidly services more than 44,000 users across 4,200 companies with tens of billions in transaction details flowing through the company's systems each year.

Linux on System z customer case stories: ibm.com/systems/z/os/linux/success

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