Server Virtualization

Driving ROI and Best Practices

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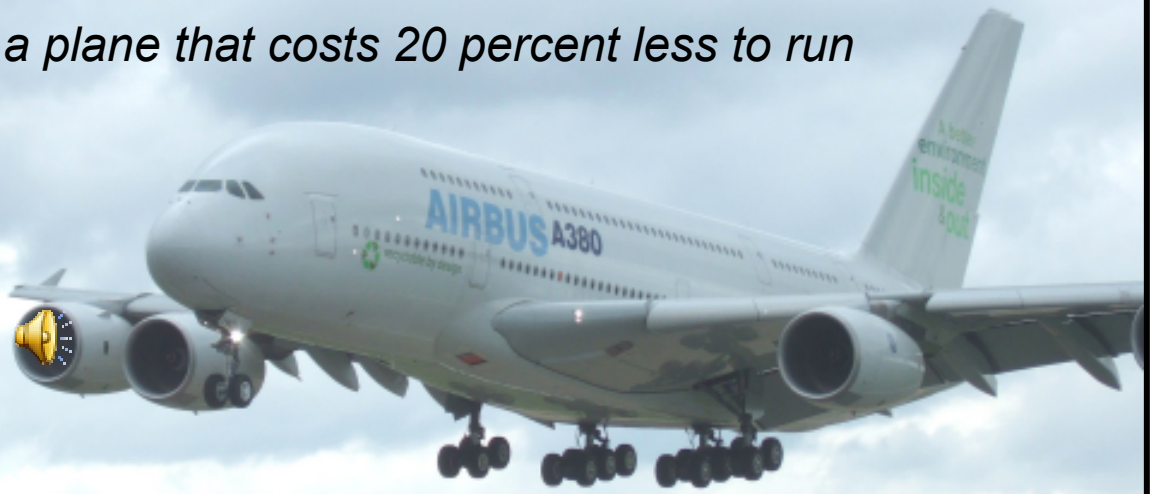
Systems & Technology Group

"*To go to New York, we can remove one Boeing 777-200 and one Airbus A340 and go from five flights a day to four*"

"*We will be able to use a plane that costs 20 percent less to run than the two others*"



"*In other words, we will save 15 million euros a year with an A380*"

Pierre-Henri Gourgeon,
Director, Air France
30 October 2009

Agenda

- **IBM servers and virtualization**
  - Platform Selection
  - Form Factor
- **Some ROI factors**
  - Power and cooling
  - Tools and downloads
- **IBM server consolidation tools & techniques**
  - Types of tools
  - Sizing
  - Business cases
- **Best practices**
  - Project guides
  - Don’t stop when you have finished

- IBM Servers and Virtualization
  - Platform Selection
  - Scale up vs Out

The IBM Systems family

Innovative, proven technology providing platform choice to match unique business needs

System z™

BladeCenter®

System x®

IBM Systems

POWER Systems™

Systems Director™

System Storage™

IBM virtualization across all platforms

- 100 percent of IBM mainframes are delivered **virtualization ready**
- 82 percent of IBM System i5 595 servers **are ordered with logical partitioning**
- Over 40,000 UNIX, mainframe and System i companies exploit **systems-level virtualization**
- IBM System x clients **deploy over 1,000 virtual servers a day**
- IBM is the leading **reseller of VMware**
- 3,000 storage virtualization clients**, adding more than five every day**
- More than 3,400 virtual tape systems **supporting one exabyte of data**
- ServerWatch awarded **IBM Virtualization Manager** Best Virtualization Tool in their annual Product Excellence Awards
- IBM System x3850 M2 won **Best of Show** at the VMware 2007 VM World event
- Hundreds of in-depth **total cost of ownership studies**
- IBM Systems Director V6.1 for **cross-platform physical and virtual systems management**

SearchServerVirtualization.com BEST OF VMWORLD 2007

BEST OF SHOW

"This is the game changer here: an IBM data-class machine with four quad-core processors ... running an embedded hypervisor.
This makes [virtualization] simpler to administer and manage, adding a level of reliability and security"

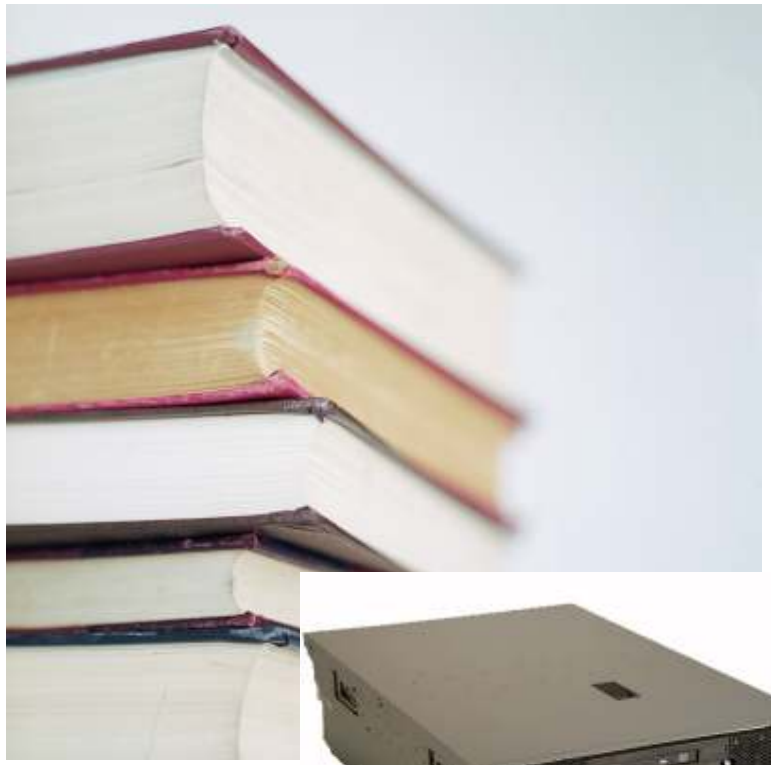
IBM is working with clients to evolve their data centers

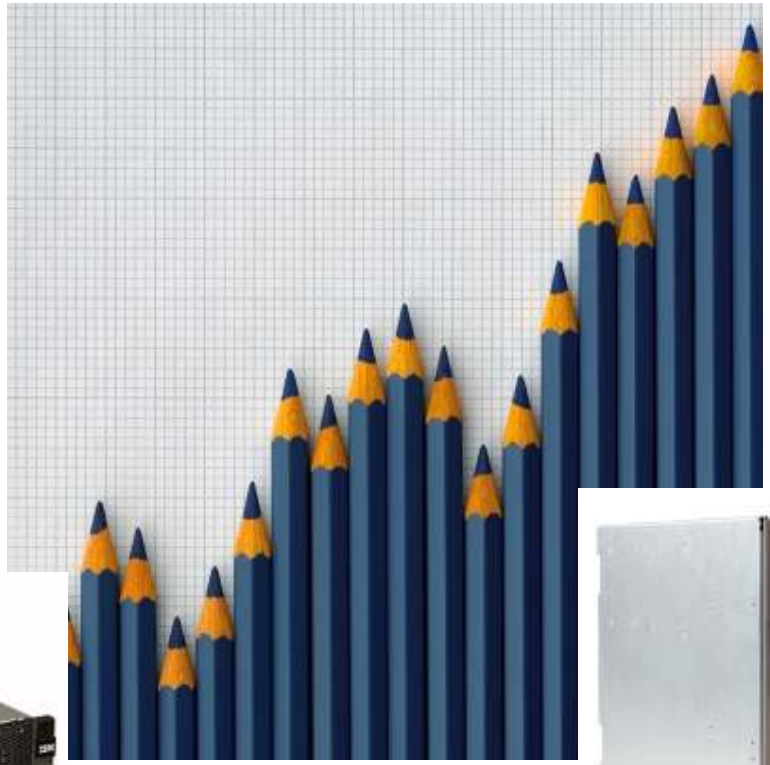
Virtualization enables IT simplification and quick ROI

60 percent reduction in power and cooling costs through virtualization-based data center consolidation		AISO.net
Tiered storage helped **reduce capital costs by $1M** over 18 months		Circuit City
Consolidated & virtualized 89 standalone servers to 5 System x servers and one IBM BladeCenter **–** enabling a **new application to be deployed in minutes rather than weeks**		St. Helens Council
Implemented an IBM Scalable Modular Data Center solution yielding **40 to 50 percent reduction in floorspace**; estimated **30 percent more efficient in power and cooling**		Bryant University

Scale up or Scale out? Brick or Blade?

Selecting a Form Factor





Consolidation Approach – based on IBM scale-up multi-processor servers

- Pros
  - ✓ Industry-leading performance and benchmarks
  - ✓ Unique scalability to 4, 8 , 12 and 16-sockets to grow as the demand grows
  - ✓ Massive amounts of CPU, memory, network and disk resource – unlikely to be a cap
  - ✓ Highest consolidation ratios (Due to highest headroom levels)
  - ✓ Also ideal as high-end scalable database servers
  - ✓ Simpler management (fewer servers)

- Cons
  - – Need to virtualize greater numbers of servers at a time in order to realize ROI

Consolidation Approach – based on IBM Blades

- Pros
  - ✓ More power-efficient than rack-mount servers
  - ✓ Permits migration to consolidation and virtualization at a controlled rate – can be accelerated or slowed as desired
  - ✓ Allows neighbouring blade servers to run natively if required (ie non-virtualized)
  - ✓ Creates a multi-node virtualized server farm – with efficient load-balancing of VMs and separation of applications e.g. cluster pairs
  - ✓ Can be configured as stateless servers – no moving parts – for high reliability and availability
- Cons
  - – Resource ceilings – CPU, memory, network – reached more quickly
  - – Concentration of compute resource may be an issue as regards power and cooling
  - – More servers to manage than scale-up

- Some ROI Factors
  - Capex
  - Opex
    - Power & Cooling – free tools
    - Labour

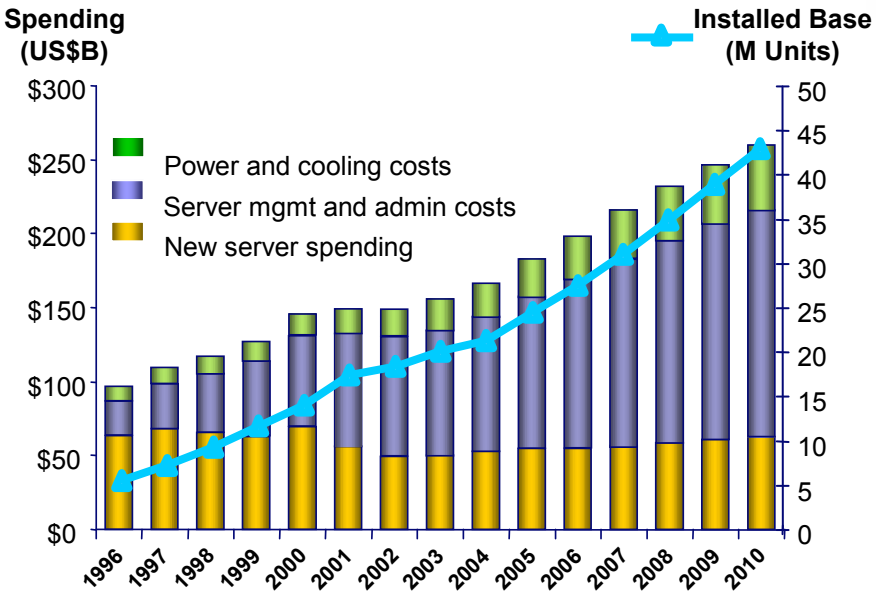
Reality of x86… a Love / Hate Relationship

What we LOVE…

Lower Acquisition Cost

Large Application Base

Readily Available Administration Skills

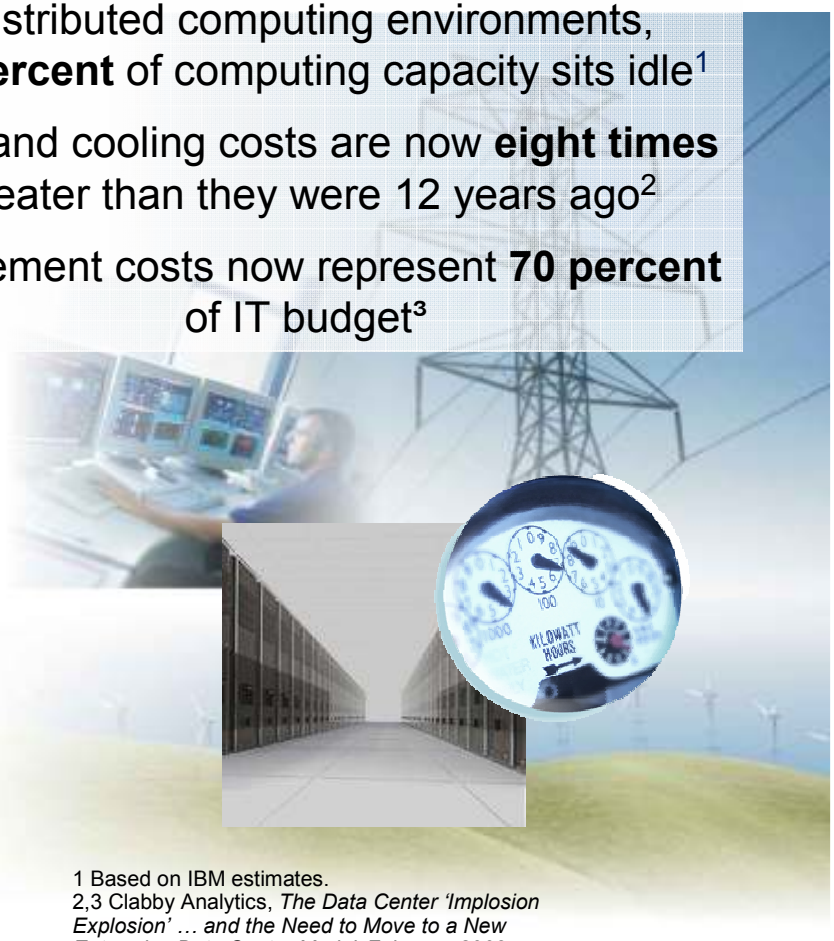


What we HATE…

In distributed computing environments, **85 percent** of computing capacity sits idle[1]

Power and cooling costs are now **eight times** greater than they were 12 years ago[2]

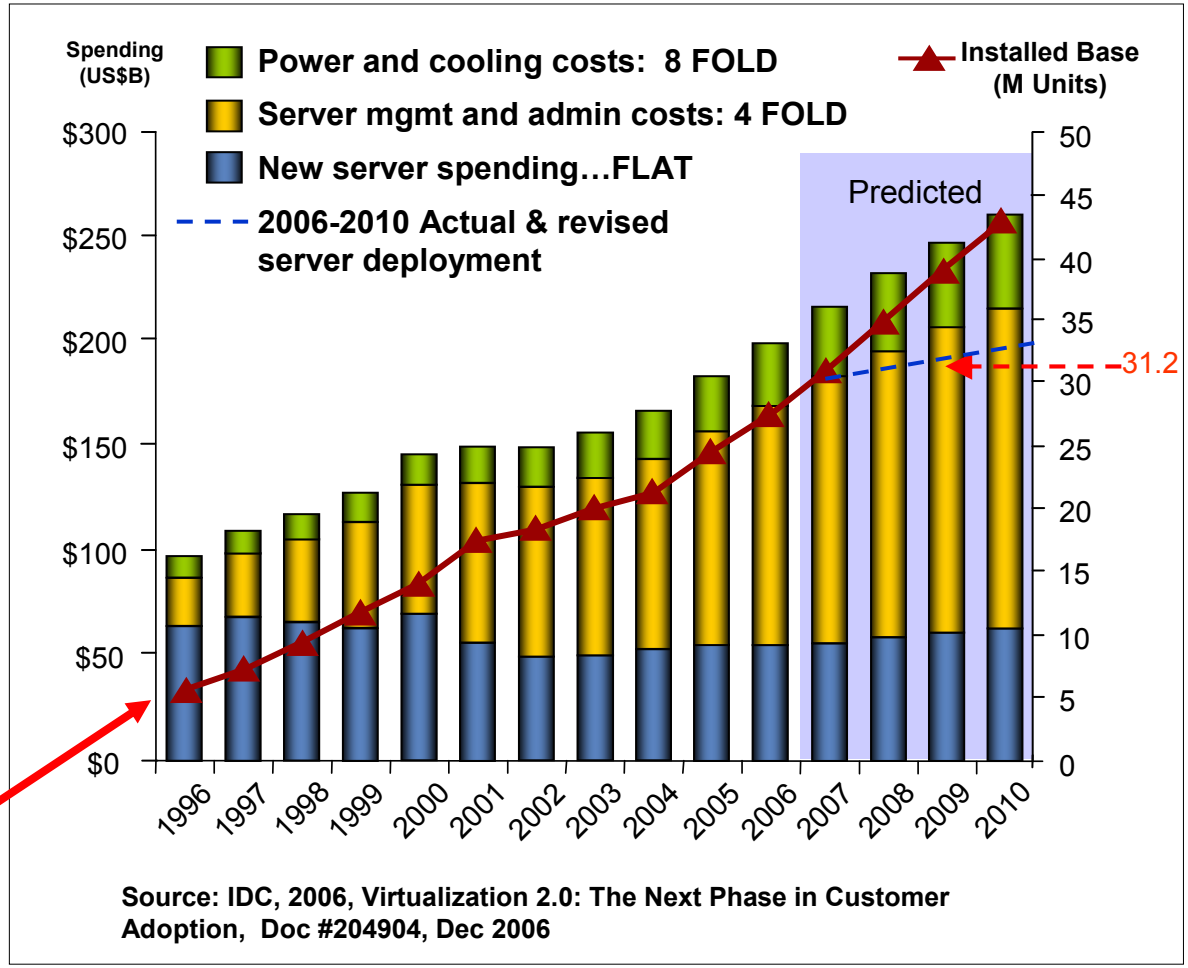
Management costs now represent **70 percent** of IT budget[3]



1 Based on IBM estimates.
2,3 Clabby Analytics, *The Data Center 'Implosion Explosion' … and the Need to Move to a New Enterprise Data Center Model*, February 2008

IDC: Impact of Server Proliferation

- IT energy costs – **Rising**
  - 15% per year over the last 5 years and are forecast to match or exceed server procurement costs within 5 years
- IT operational overhead – **Rising**
  - 70% of the IT labour budget and is growing at 10% CAGR 2003-2008
- Server Procurement Costs – **Flat**
  - 85-95% of capacity is excess – nearly $140B in over-expenditure



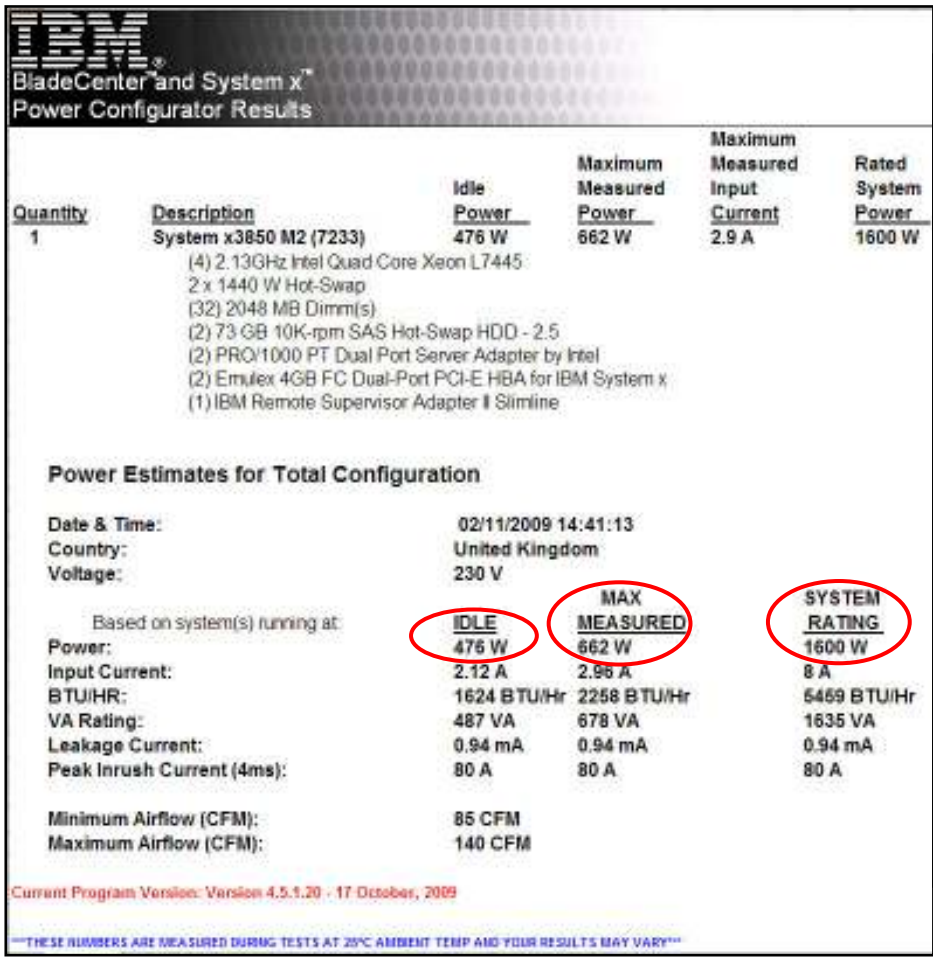
Source: IDC, 2006, Virtualization 2.0: The Next Phase in Customer Adoption, Doc #204904, Dec 2006

(Quantity of) Servers Proliferation…4-FOLD INCREASE

IBM Power Configurator

- Available via the web, free download
- This tool provides power sizing information for configurations of BladeCenter and System x servers
- The following useful information is available
  - Input Power (Watts)
  - PDU Sizing Information (Amps)
  - Heat Output (BTU/Hr)
  - Airflow requirements through chassis (CFM)
  - VA Rating (VA)
  - Leakage Current (milliAmps)
  - Peak Inrush Current (Amps)

  in spreadsheet format



IBM BladeCenter and System x
Power Configurator Results

Quantity	Description	Idle Power	Maximum Measured Power	Maximum Measured Input Current	Rated System Power
1	System x3850 M2 (7233)	476 W	662 W	2.9 A	1600 W
	(4) 2.13GHz Intel Quad Core Xeon L7445				
	2 x 1440 W Hot-Swap				
	(32) 2048 MB Dimm(s)				
	(2) 73 GB 10K-rpm SAS Hot-Swap HDD - 2.5				
	(2) PRO/1000 PT Dual Port Server Adapter by Intel				
	(2) Emulex 4GB FC Dual-Port PCI-E HBA for IBM System x				
	(1) IBM Remote Supervisor Adapter II Slimline				

Power Estimates for Total Configuration

Date & Time:	02/11/2009 14:41:13
Country:	United Kingdom
Voltage:	230 V

Based on system(s) running at:	IDLE	MAX MEASURED	SYSTEM RATING
Power:	476 W	662 W	1600 W
Input Current:	2.12 A	2.96 A	8 A
BTU/HR:	1624 BTU/Hr	2258 BTU/Hr	5469 BTU/Hr
VA Rating:	487 VA	678 VA	1635 VA
Leakage Current:	0.94 mA	0.94 mA	0.94 mA
Peak Inrush Current (4ms):	80 A	80 A	80 A

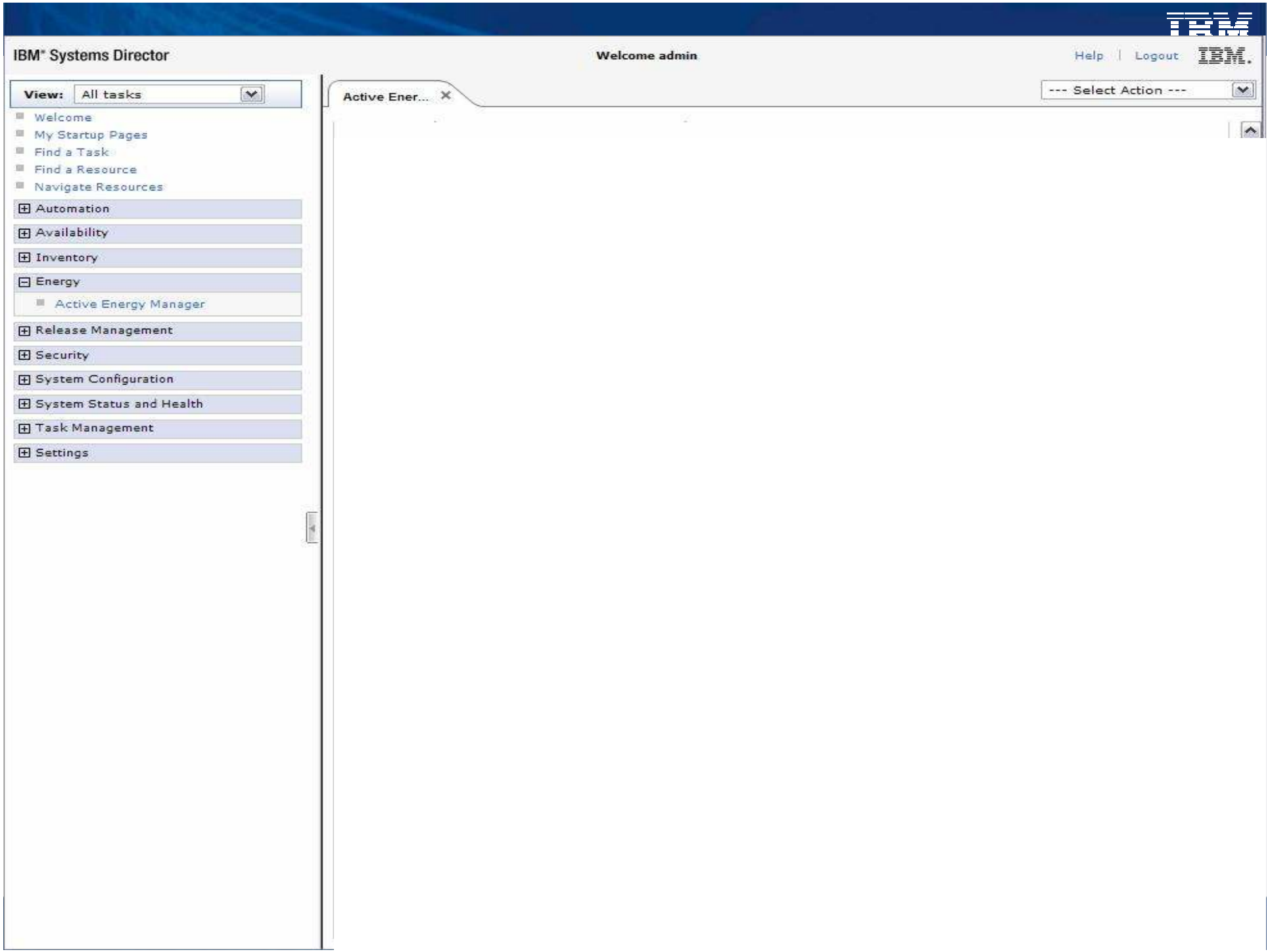
Minimum Airflow (CFM):	85 CFM
Maximum Airflow (CFM):	140 CFM

Current Program Version: Version 4.5.1.20 - 17 October, 2009

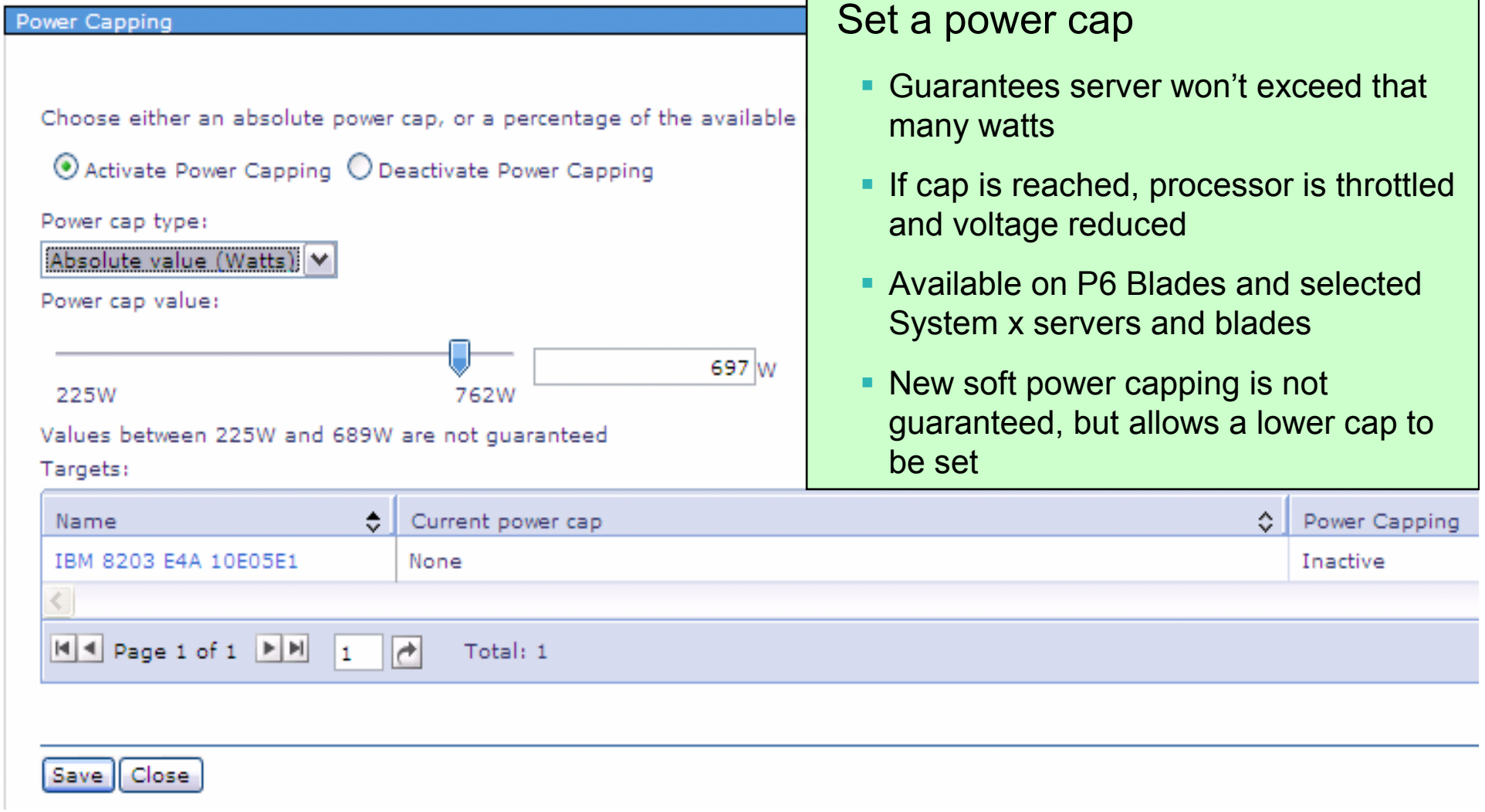
THESE NUMBERS ARE MEASURED DURING TESTS AT 25°C AMBIENT TEMP AND YOUR RESULTS MAY VARY

http://www.ibm.com/systems/bladecenter/resources/powerconfig/index.html

IBM BladeCenter and System x
Power Configurator Results


IBM® Systems Director
Welcome admin
Help | Logout
IBM.
View: All tasks
Welcome
My Startup Pages
Find a Task
Find a Resource
Navigate Resources
Automation
Availability
Inventory
Energy
Active Energy Manager
Release Management
Security
System Configuration
System Status and Health
Task Management
Settings
Active Ener...
--- Select Action ---

Configure Power Capping

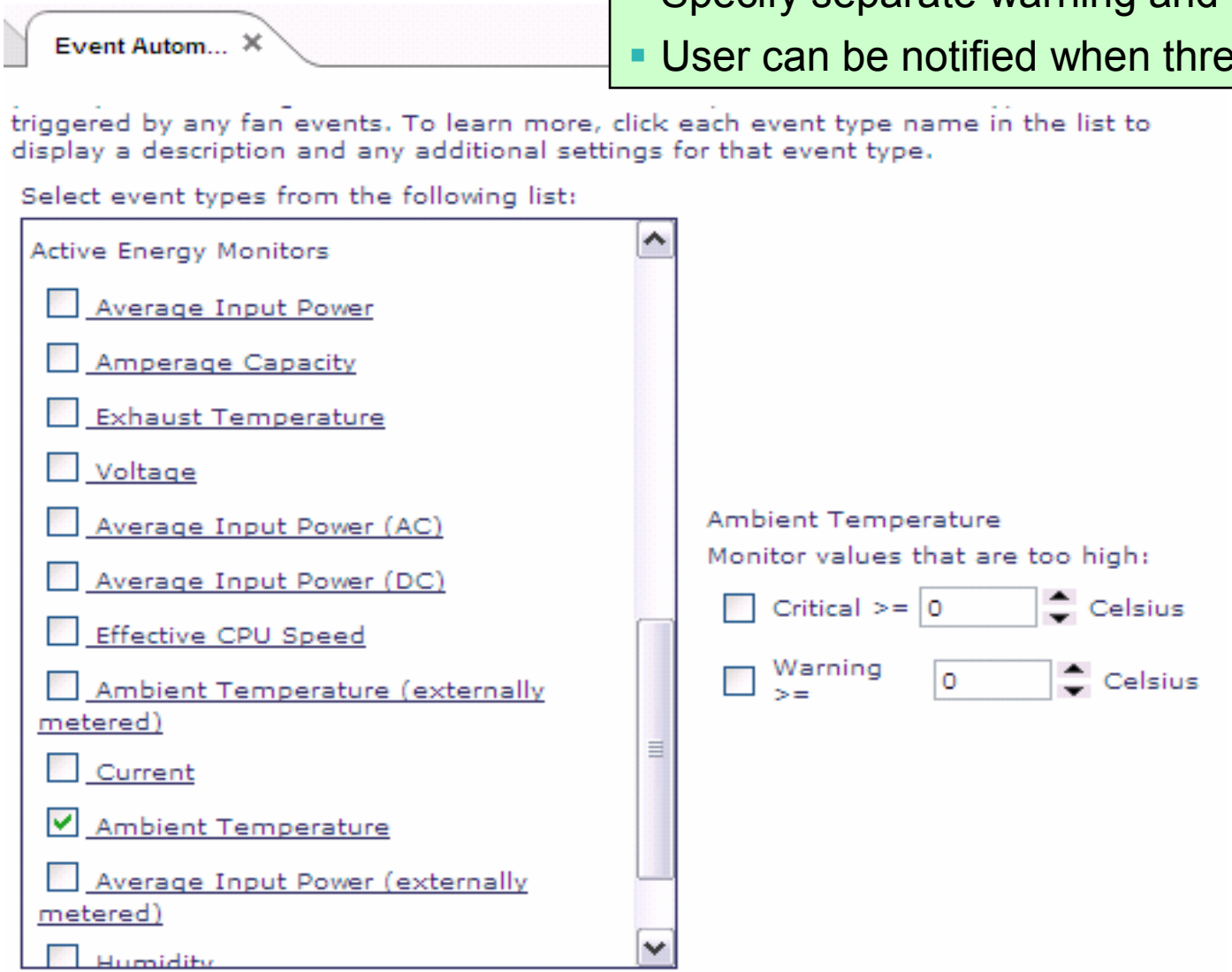


Set a power cap

- Guarantees server won't exceed that many watts
- If cap is reached, processor is throttled and voltage reduced
- Available on P6 Blades and selected System x servers and blades
- New soft power capping is not guaranteed, but allows a lower cap to be set

Set Automation Plans

- Set thresholds for energy attributes
- Specify separate warning and critical levels
- User can be notified when thresholds are reached



IBM Server Consolidation Tools and Techniques

Some Server Consolidation tools and methodologies

- ZODIAC
  - IBM global method to produce a business case for: Consolidation, Virtualization, ….
- COBRA
  - Much-reduced version of above, using industry-standard data (Same tool, different approach)
- CDAT
  - Consolidation, Discovery and Analysis Toolset
  - AIX, HP-UX, Solaris, Windows, Linux
- SWIFT
  - Sizing/Capacity Planning Web-Based Interactive Solution Fitting & TCO Model
- VISIAN
  - Virtualization Sizing Analysis
  - “best-fit” of VMs
  - VMware, MS VS, Virtual Iron (Xen), System p hypervisor
- WASFO
  - Workload Analysis for Server Farm Optimization
  - “collection and analysis”
  - x86 only
- VMware Capacity Planner
  - Basic Consolidation Estimate (CE)
  - Consolidation Assessment (CA)
  - x86 only, mainly Windows

IDC Analyze the Future | ALINEAN

COBRA

VMware® Capacity Planner Dashboard

VISIAN
VIRTUALIZATION SIZING ANALYSIS

WASFO

Zodiac

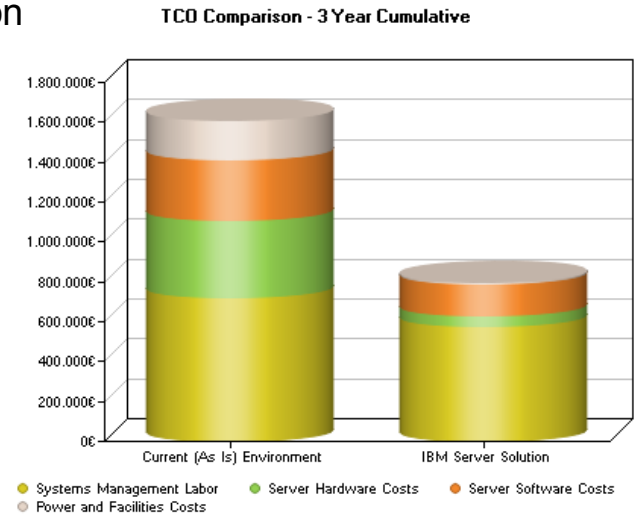
The IBM Systems Consolidation Evaluation Tool for IBM System x and BladeCenter

→ Register to access the tool

www.ibm.com/systems/3months

- The Business case for moving to IBM System x servers can be substantiated by using the IBM Systems Consolidation Evaluation Tool (Alinean)
- The tool will demonstrate quantifiable TCO and ROI results in 15 mins or so for a Customer on why they should consider moving to an IBM System x or BladeCenter solution
- The tool provides a professional report in MS Word or Power Point format that can be shared with the Customer
- If needed, the tool can be used by the Customer or dynamically shared.

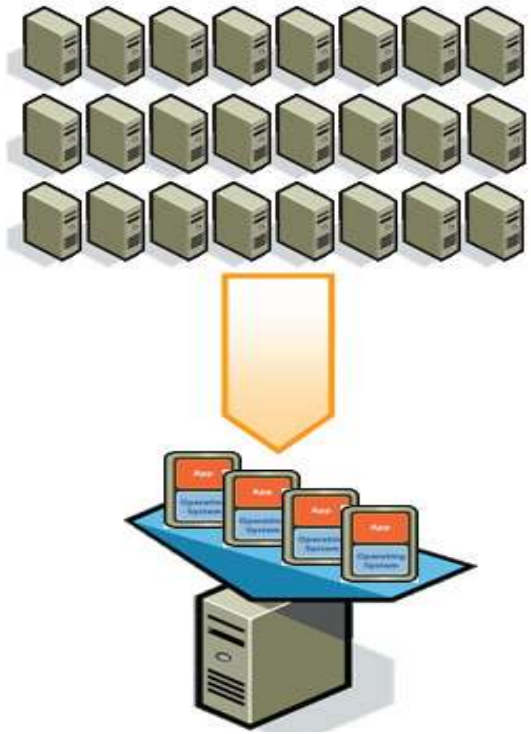
www.ibm.com/systems/90percent



Some data collection and sizing tools

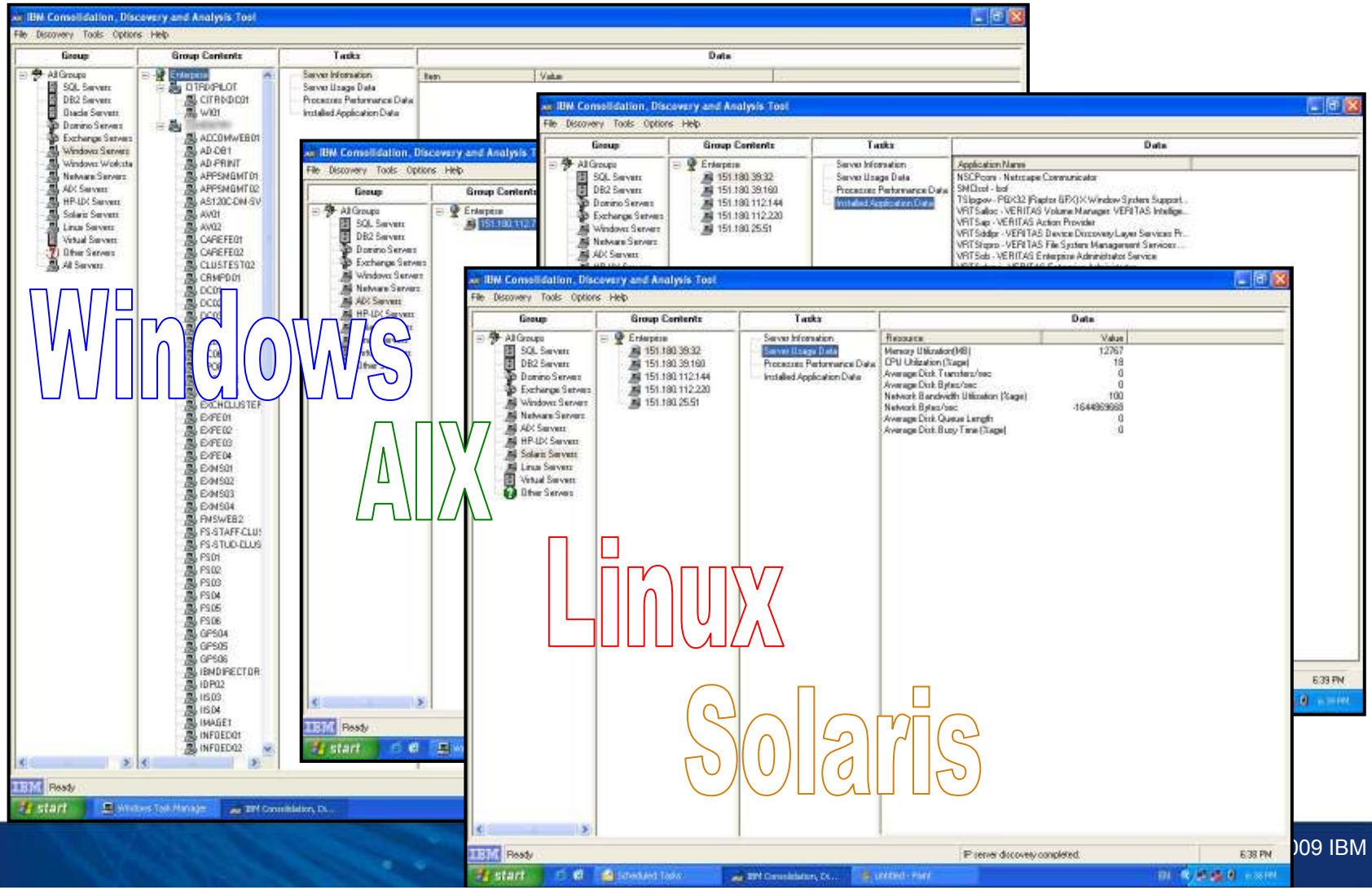
- VMware Capacity Planner
  - Collect server and storage data
  - Analyze data for best-fit onto virtualized environment
  - Can only be used by VMware accredited partners – including IBM – under a services engagement
- IBM CDAT
  - Consolidation Discovery and Analysis Tool
  - Can only be used by IBM and IBM business partners
  - Multi-platform server data collection

    -Windows, Linux, Solaris, HP-UX, Netware



IBM Consolidated Discovery and Analysis Tool

- Multi-platform server data collection tool
- Windows, Linux, Solaris, AIX, HP-UX, Netware

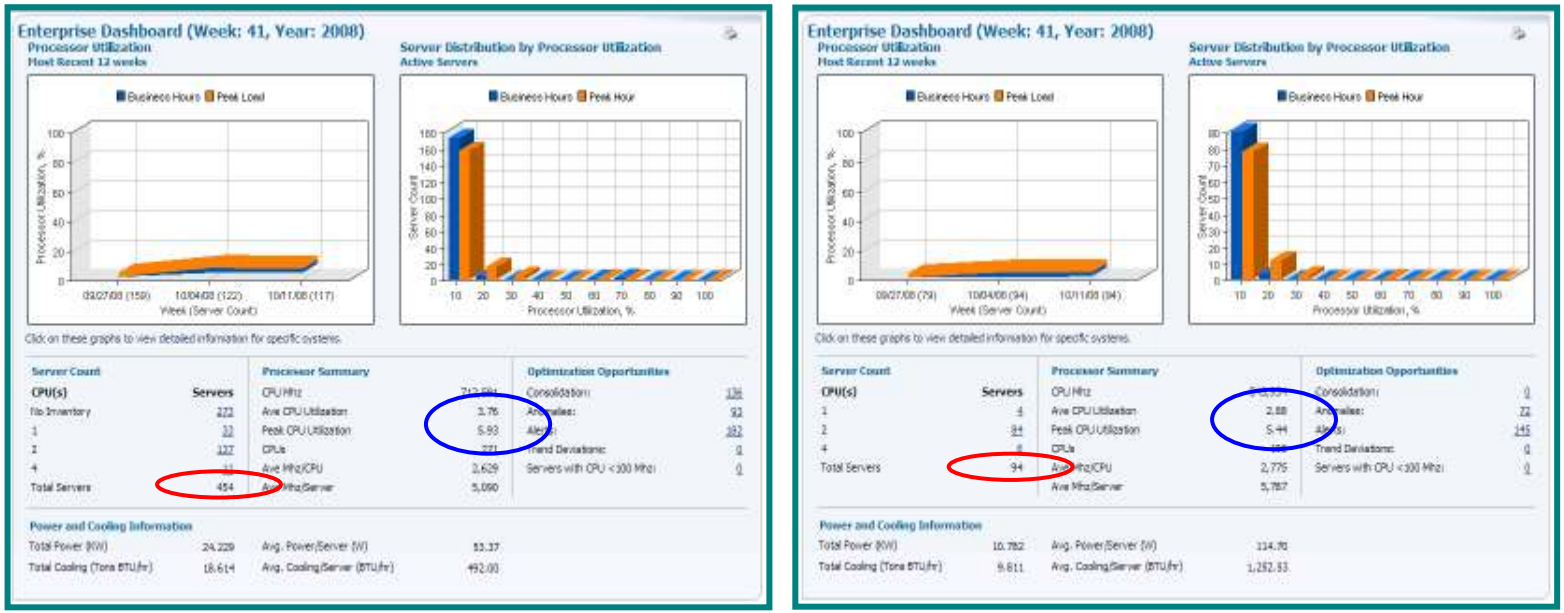


Average Utilisation compared with Industry norms

Anon ->

Group	% CPU Utilization	CPU Queue	Disk Utilization		Pages Per Second	Network BytesPer Second
			% Busy	Disk Queue		
Industry Average						
All Systems Group						

Performance - Average Processor Utilisation



- Charts show all-discovered servers (left chart) vs servers at a selected location (right chart)
- Slightly lower utilization for second location – probably because of use of newer hardware
- "Peak CPU utilization" = *The hour of the day that has the highest load based on a 24-hour day, where 1 is 1am and 20 is 8pm. When summarized weekly, this is the busiest hour across all the days of the week.*
  i.e. this figure represents the average CPU utilization during the busiest hour.

Benefit of Dual and Quad Core on Power / Cooling

Assumption: Install of two servers with both processors included

2005

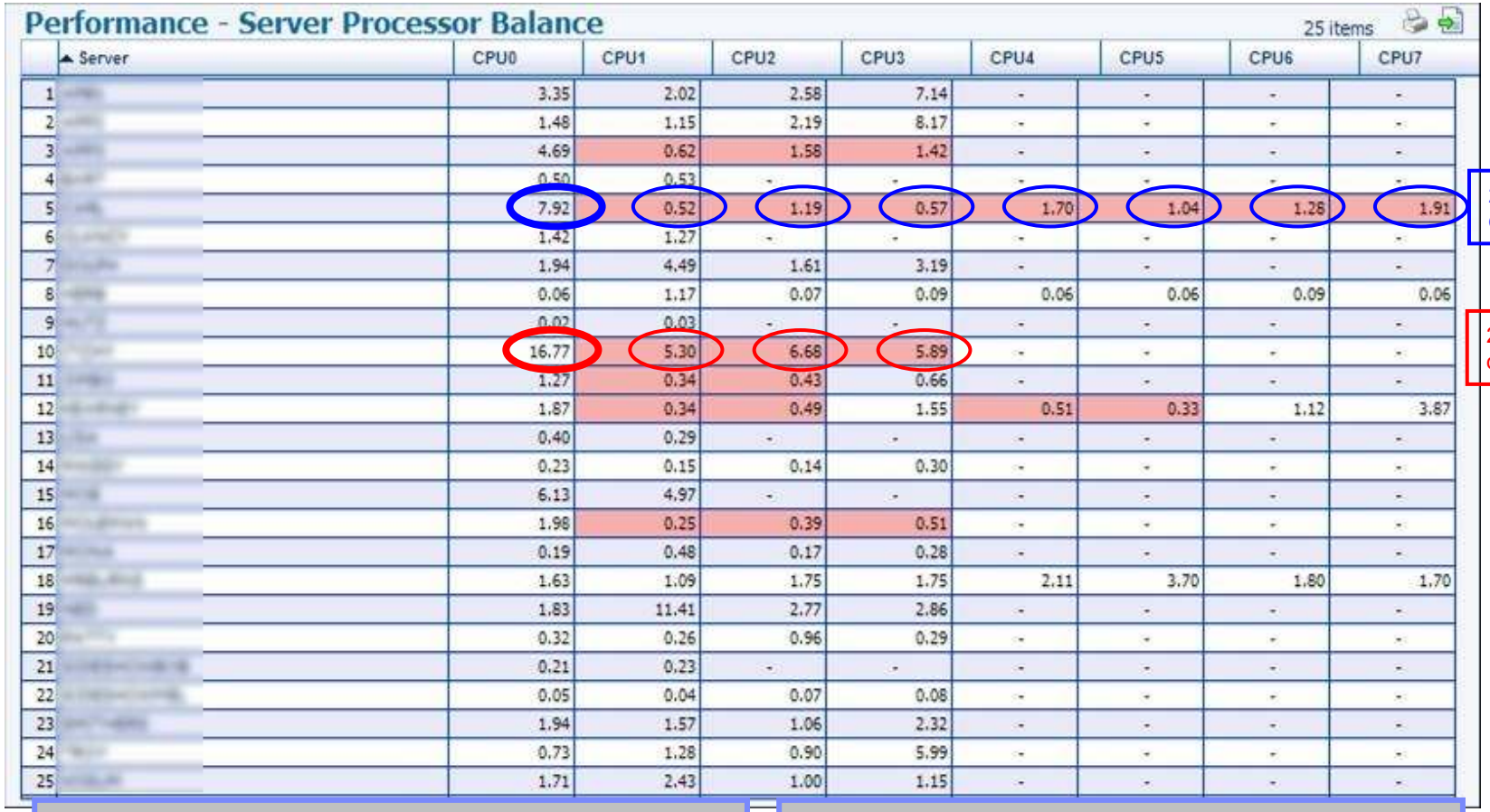
	FSB Speed	**800MHz**
Server 1	Processor 1	**1 core = 120w**
	Processor 2	**1 core = 120w**
Server 2	Processor 1	**1 core = 120w**
	Processor 2	**1 core = 120w**
	Total	**480W**

4 cores

120W per core

Delta of 60W (average domestic light bulb) 2006-9 for our 2-server farm. 50x this for a 100-server farm: 3kW difference

Performance - Server Processor Balance



Performance - Server Processor Balance

25 items

	Server	CPU0	CPU1	CPU2	CPU3	CPU4	CPU5	CPU6	CPU7
1		3.35	2.02	2.58	7.14	-	-	-	-
2		1.48	1.15	2.19	8.17	-	-	-	-
3		4.69	0.62	1.58	1.42	-	-	-	-
4		0.50	0.53	-	-	-	-	-	-
5		7.92	0.52	1.19	0.57	1.70	1.04	1.28	1.91
6		1.42	1.27	-	-	-	-	-	-
7		1.94	4.49	1.61	3.19	-	-	-	-
8		0.06	1.17	0.07	0.09	0.06	0.06	0.09	0.06
9		0.02	0.03	-	-	-	-	-	-
10		16.77	5.30	6.68	5.89	-	-	-	-
11		1.27	0.34	0.43	0.66	-	-	-	-
12		1.87	0.34	0.49	1.55	0.51	0.33	1.12	3.87
13		0.40	0.29	-	-	-	-	-	-
14		0.23	0.15	0.14	0.30	-	-	-	-
15		6.13	4.97	-	-	-	-	-	-
16		1.98	0.25	0.39	0.51	-	-	-	-
17		0.19	0.48	0.17	0.28	-	-	-	-
18		1.63	1.09	1.75	1.75	2.11	3.70	1.80	1.70
19		1.83	11.41	2.77	2.86	-	-	-	-
20		0.32	0.26	0.96	0.29	-	-	-	-
21		0.21	0.23	-	-	-	-	-	-
22		0.05	0.04	0.07	0.08	-	-	-	-
23		1.94	1.57	1.06	2.32	-	-	-	-
24		0.73	1.28	0.90	5.99	-	-	-	-
25		1.71	2.43	1.00	1.15	-	-	-	-

2-way quad-core

2-way dual-core

This table shows the average CPU utilisation for up to eight physical CPU cores
Eight cores could be a 2w quad-core or 4w dual-core server

Where a value differs significantly from its neighbours, it is highlighted in red
This probably indicates a single and/or poorly-threaded application on the server

1. For this configuration of target server…

Target Systems

New Hardware Configuration

		Capacity											
		Processors			Memory	Disk			Network		Physical			
	Make/Model	Count	Speed (MHz)	Word Length	Size (MB)	Size (GB)	I/O (MB/sec)	I/O (Trans/sec)	Count	Speed (MB/sec)	Rack Units	Weight (lbs)	Power (W)	Thermal (BTU/hr)
★	IBM/x3850 M2	16	2,100	64	32,768	146	50	4,000	6	1,000	4	90	701	2,389

Scenario Recommendations

Number of Systems Out: 3
Scenario Group 1
Operating Systems: All OSes Architectures: x86, IA64 and AMD64 Architectures
Function: All Functions Location: All Locations Department: All Departments Environment: All Environments

			Capacity										Estimated New Utilization								
			Processors		Memory	Disk	Network		Physical				Processor		Memory				Disk		Network
	Target System Name	Source System Name(s)	Count	Speed (MHz)	Size (MB)	Size (GB)	Count	Speed (MB/sec)	Rack Units	Weight (lbs)	Power (W)	Thermal (BTU/hr)	% Used	Queue per CPU	% Used	File Sys Cache (MB)	Page File %	Paging (Pg/sec)	I/O (Trans/sec)	I/O (MB/sec)	Speed (MB/sec)
	Systems with Exceptions - None																				
	Reused Systems - None																				
	New Systems																				
★	Phantom1-1	(Totals)	16	2,100	32,768	146.00	6	6,000.00	4	90	701	2,389	38.09	0.10	22.17	2,407.94	4.12	300.00	332.83	9.50	9.63
★			2	2,100	1,536			10.00					5.91	0.01	3.48	253.17	0.43	1.19	8.65	0.07	0.00
★			1	400	1,280			10.00					0.58	0.01	2.57	267.48	0.74	0.09	2.12	0.02	0.00
★			1	100	1,024			10.00					0.11	0.00	2.34	227.13	0.18	0.05	1.28	0.01	0.00
★			1	600	2,560			10.00					1.72	0.00	5.88	434.96	1.47	0.01	3.53	0.03	0.00
★			5	8,600	1,280			10.00					35.26	0.06	2.91	350.26	0.03	0.07	4.24	0.03	0.01
★			1	200	1,024			10.00					0.33	0.00	2.15	568.04	1.23	2.60	5.34	0.01	0.29
★			1	1,400	1,280			10.00					4.16	0.00	2.84	310.81	0.04	295.99	209.66	9.21	9.34
★	Phantom2-1	(	16	2,100	32,768	146.00	6	6,000.00	4	90	701	2,389	12.52	0.14	38.31	2,428.94	5.18	207.60	280.00	6.89	0.21
★			1	100	1,280			10.00					0.11	0.00	3.09	248.68	0.16	0.67	2.04	0.01	0.00
★			1	200	768			10.00					0.46	0.14	1.85	246.48	0.05	70.52	16.37	0.17	0.00
★			1	1,700	3,072			10.00					4.74	0.00	7.22	268.23	1.09	0.06	14.56	1.76	0.00
★			1	300	512			10.00					0.21	0.00	1.22	242.18	0.51	75.28	13.44	0.23	0.15
★			1	700	1,024			10.00					1.79	0.00	2.28	162.16	0.20	14.36	2.44	0.05	0.05
★			1	1,100	2,304			10.00					2.73	0.00	6.79	322.93	3.87	24.21	5.36	0.07	0.00
★			1	300	768			10.00					0.46	0.01	2.36	239.65	0.04	10.69	1.02	0.01	0.00
★			1	500	3,072			10.00					1.36	0.00	7.44	307.10	0.17	4.01	2.95	0.06	0.00
★			1	900	2,560			10.00					0.64	0.00	5.96	361.54	2.96	7.10	220.81	4.61	0.00
★	Phantom3-1	(	16	2,100	32,768	146.00	6	6,000.00	4	90	701	2,389	4.40	0.43	34.33	1,765.64	5.51	31.39	1,432.00	6.16	0.43
★			1	300	1,024			10.00					0.48	0.13	2.20	207.16	0.12	5.26	3.63	0.04	0.00
★			1	300	2,560			10.00					0.08	0.00	5.88	128.96	0.41	0.03	1.90	0.02	0.00
★			1	100	768			10.00					0.21	0.06	1.43	122.65	0.06	3.38	1.16	0.01	0.00
★			1	300	1,024			10.00					0.12	0.00	2.27	162.19	1.06	0.11	1.30	0.01	0.27
★			1	600	1,280			10.00					1.19	0.15	2.71	158.10	0.59	19.06	22.76	0.15	0.01
★			1	200	1,024			10.00					0.12	0.00	1.93	201.80	0.13	0.29	6.38	0.04	0.00
★			1	700	2,304			10.00					1.97	0.00	6.80	213.84	2.56	1.76	1,406.26	5.85	0.00
★			1	100	768			10.00					0.01	0.00	1.28	101.65	0.04	0.09	2.70	0.02	0.13
★			1	100	2,560			10.00					0.02	0.00	5.89	112.28	0.26	0.00	0.15	0.00	0.00
★			1	300	512			10.00					0.06	0.09	1.18	93.78	0.04	0.06	3.61	0.02	0.00
★		ay1	1	100	1,280			10.00					0.06	0.00	2.65	158.90	0.11	0.00	1.06	0.01	0.00
★			1	100	768			10.00					0.05	0.00	1.42	107.34	0.02	1.64	0.05	0.00	0.00
	All Systems		31.3 GHz	98.3 GB	458.00	18	18.0 GB		12	270	2.1 kW	0.6 Tons	18.33	0.23	31.61	6,606.52	6.27	339.19	2,064.88	22.54	10.29

3. We get this distribution and quantity of virtual machines to physical host ESX servers

7 servers re-defined as virtual machines (VMs) on an ESX host (“Phantom1-1”)

Next host contains a similar number (9) VMs

Next host contains a similar number (12) VMs

2. And for this workload of the target server…

Max Load Thresholds

Utilization Limits								
Processor		Memory				Disk		Network
% Used	Queue per CPU	% Used	File Sys Cache (MB)	Page File %	Paging (Pg/sec)	I/O (Trans/sec)	I/O (MB/sec)	Speed (MB/sec)
75	4	80	572	70	300	1,500	50	1,000

Please note that the indicated server placement is used only for illustration purposes, in practice DRS would be used to continuously define and re-define the placement of servers.

Consolidation ratios on IBM x3850 M2 servers

11 x IBM x3850 M2 servers, to host 185 server VMs
(16.8 VMs per host)

4 x quad-core 2.4GHz

64GB RAM

Windows XP desktop VMs:

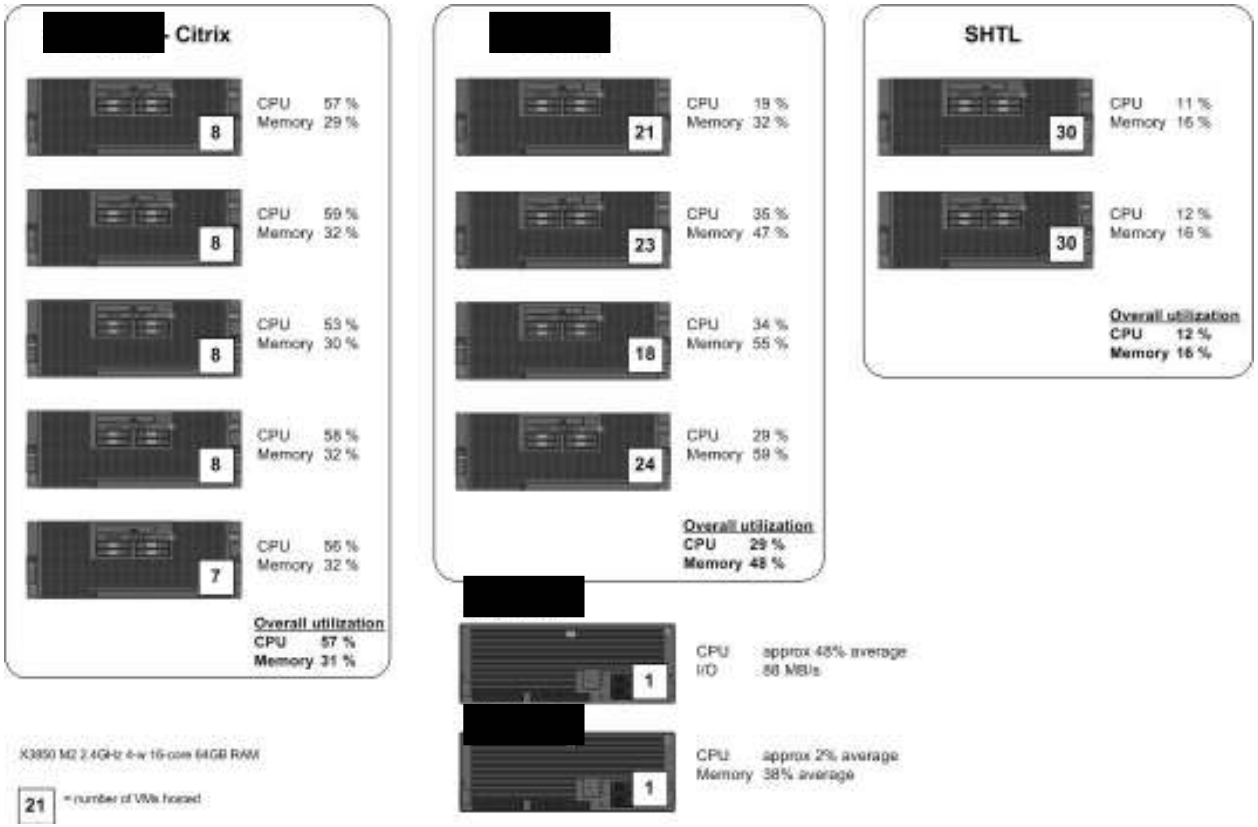
CPU: 41% max

Memory: 81% max

Dual-core (8 cores)

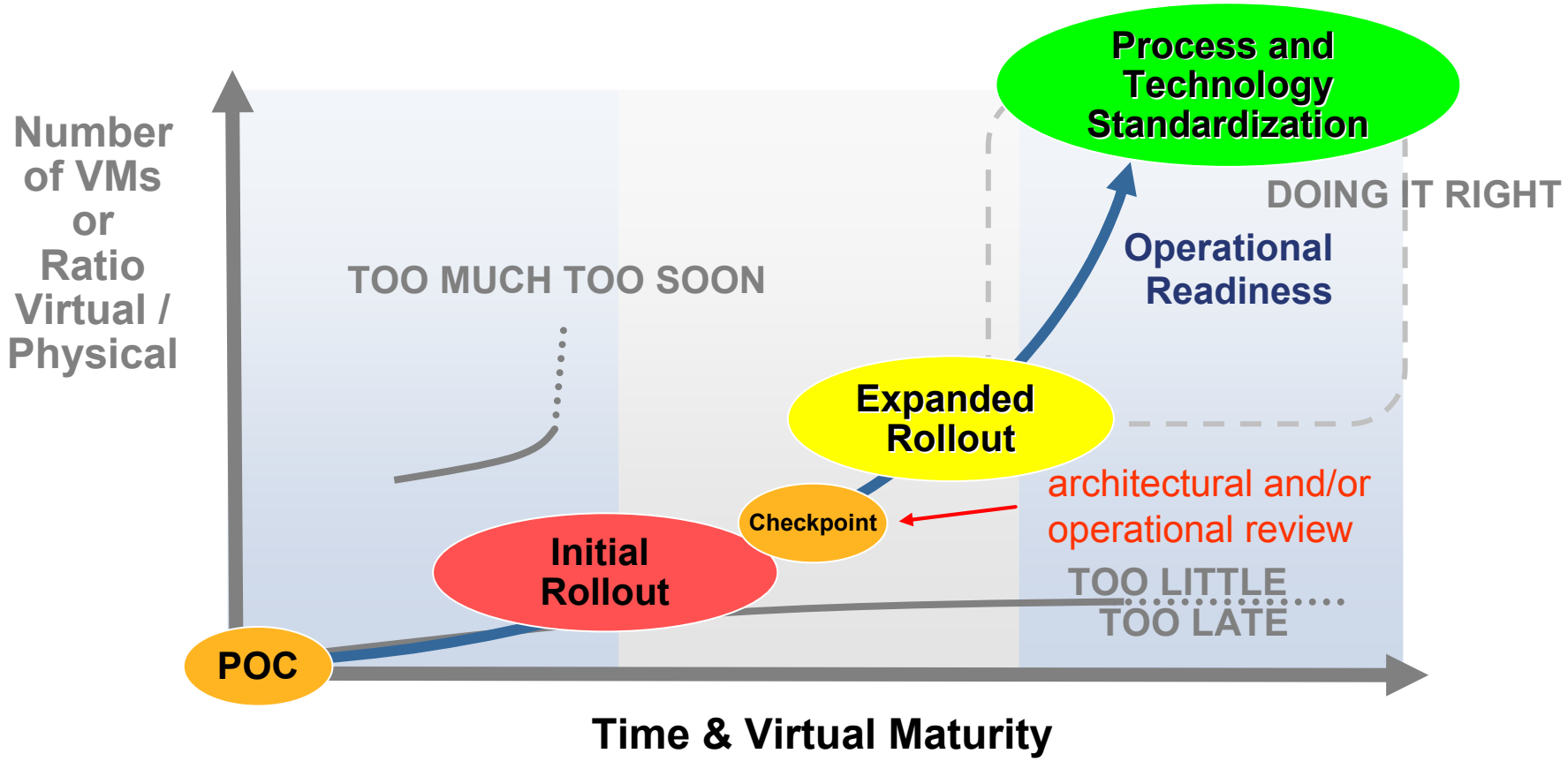
Quad-core (16 cores)

Six-core (24 cores)



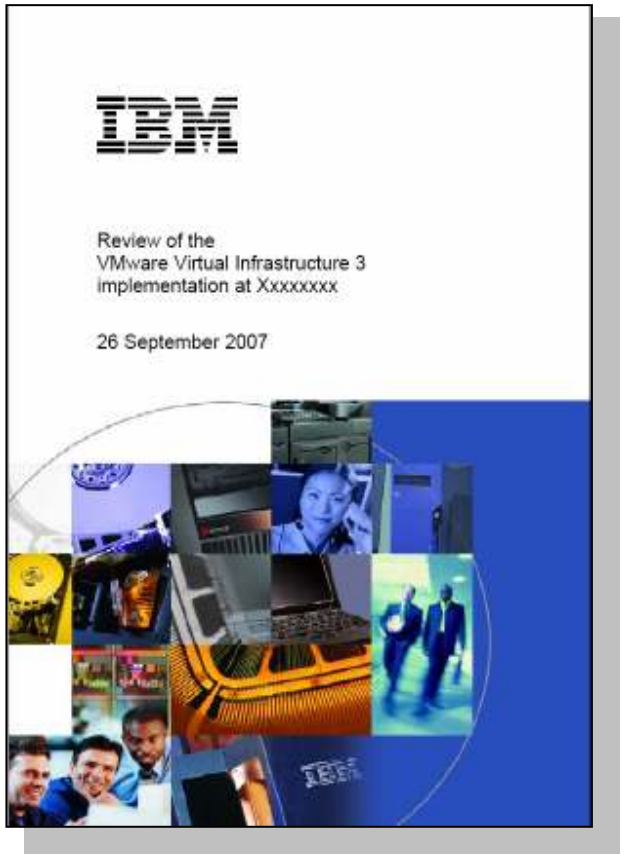
- Best Practices
  - Consultancy
  - Sizing
  - Systems Management

Getting the adoption curve right



After VMware

Examples of recent work – checkpoint review



The VI3 estate is in good shape at the present time.

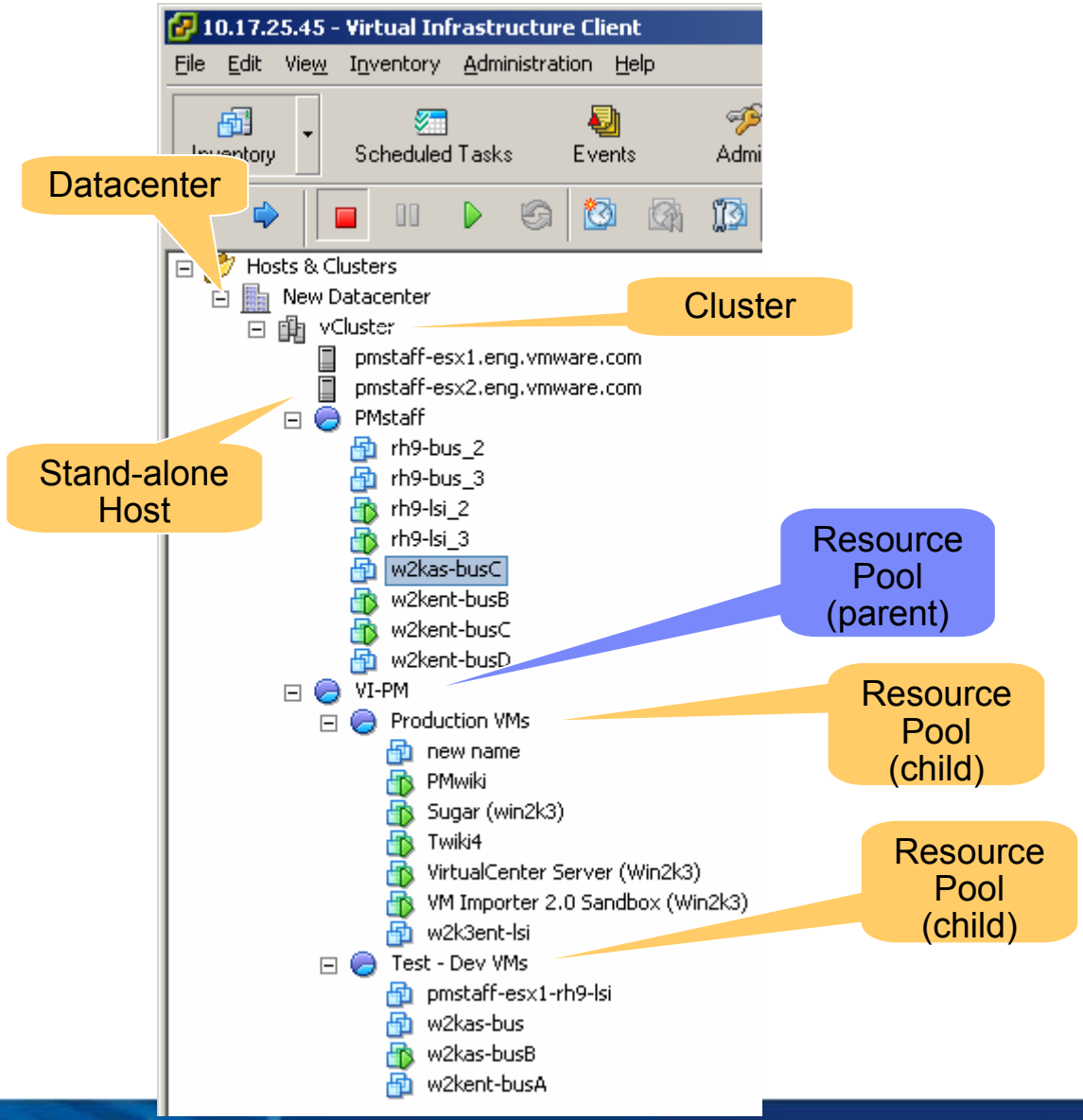
However there is potential for the successful consolidation and virtualization of several hundred servers to itself proliferate into an estate of hundreds and even thousands of virtual servers, together with an increasing number of high-dependence host servers. If the estate does grow further, it will require strong processes to manage the new environment.

The host servers are well-utilized in some areas but could be much improved in other areas. This is a consequence of … not yet utilizing the more advanced features of VI3.

… average virtual machine consolidation ratio is exactly in line with that calculated from IBM world-wide studies. However, this is an average, and the overall utilization achievable through virtualization could be substantially higher.

There do not appear to be procedures relating to the sizing, configuration, operation and availability of virtual machines which can be related back to the original business needs.

Resource Pools



Business cases for server consolidation

Zodiac

101: win-all x86 servers Actual

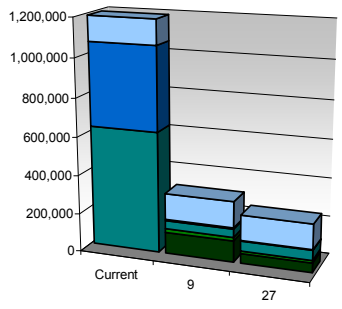
Sizing	Current	AltCase2 9:1	AltCase1 27:1
server type		b.HS21XM(1)L5310&BCH	B x3850.M2(4)7350QC
total #CPU	464.0	96.0	64.0
used #CPU		96.0	64.0
#Log.Servers	213.0	213.0	213.0
#Phys.Servers	213.0	24.0	8.0
avg.Log.srv RIP	429.5	210.9	208.3
total capacity RIP	91,479.9	44,912.7	44,360.0
total workload RIP	4,574.0	4,574.0	4,574.0
average utilization	5.00%	10.18%	10.31%

AOC: Annual Operating Costs			
Staff cost code	Win	0	0
SW cost code	win	win.VMENTA	win.VMENTA
SW cost /CPU /yr	0.00	41.91	41.91
SW cost /Lsrv /yr	145.24	142.13	142.13
SW cost /Psrv /yr	7.01	0.00	0.00
SW maint.pa	32,429.85	34,295.83	32,954.76
maint.pa	108,200.00	5,944.89	2,321.12
space & power pa	157,820.08	10,690.49	13,130.57
staff cost pa	0.00	0.00	0.00
	0.00	0.00	0.00
total pa	**298,449.93**	**50,931.21**	**48,406.45**

OTC: One Time Costs			
SW purchase		20,378.16	13,585.44
HW purchase		110,503.73	50,465.76
total OTC	**0.00**	**130,881.89**	
write off		0.00	

4 Year Projection		
OTC + 4x AOC	**1,085,599.72**	**316,772.06**

4 Year Projection



250,043 est.potential saving /yr

100.0 :100 SCON ratio Log
2,662.5 :100 SCON ratio Phy

Energy and Climate	Current	Alt.Case.2	Alt.Case	Difference
avg RackU / Serve	3.6	1.0	4.0	-0.4
Total RackU	757.0	24.0	32.0	725.0
42U Racks	18.0	0.6	0.8	17.3
Total kW	79.9	5.0	7.7	72.2
Adjusted kWh/y	1,049,527	65,500	101,420	948,108
Heat BTU/h	182,640	11,398	17,649	164,991
CO2 tonnes /y	449	28	44	405
Carbon tonnes /y	123	8	12	111
RIPs /m2	2,537.8	39,298.6	29,111.3	-26,573
RIPs /W	1.1	9.0	5.7	5
RIPs /BTU/h	0.501	3.940	2.513	2.013
RIPS / tonne CO	204	1,595	1,017	813
W /m2	2,216	4,362	5,065	-2,849

energy&climate

Power saving equates to 405 tonnes CO2/yr or 1,341 Trees; or 162 cars

IBM's own smart transformation has delivered results

IBM IT Transformation

- From 2002 through 2007, IBM's own IT investments delivered a cumulative benefit yield of approximately $4 billion. For every dollar invested, we saw a $4 cumulative benefit.

	1997	Today
CIOs	128	1
Host data centers	155	7
Web hosting centers	80	5
Network	31	1
Applications	15,000	4,700

Data Center Efficiencies Achieved

- Consolidation and virtualization - thousands of servers onto approximately 30 IBM System z™ mainframes.
- Additional virtualization leveraging System p, System x and storage across enterprise.
- Substantial savings being achieved in multiple dimensions: energy, software and system management and support costs.

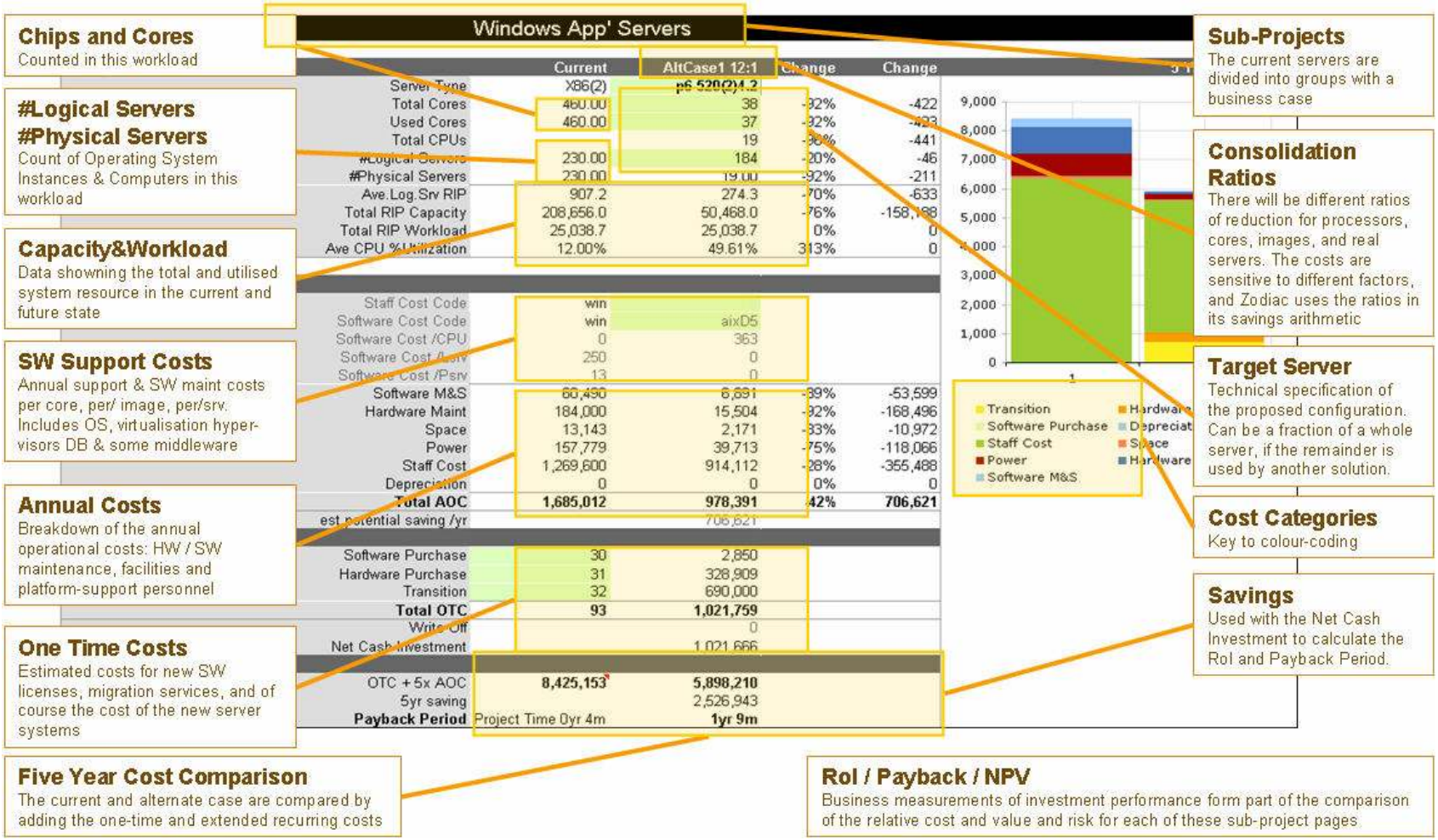
Project Big Green

- The virtualized environment will use 80% less energy and 85% less floor space.
- 2X existing capacity, no increase in consumption or impact by 2010.

Cloud-enabled on demand IT delivery solution

- Self-service for 3,000 IBM researchers across 8 countries.
- Real time integration of information and business services.

Key to Zodiac business cases



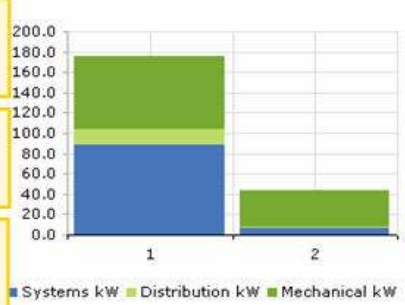
Key to energy efficiency analysis

This analysis compares the energy needed to power servers in current and alternate cases.
We show the Typical Watts drawn, and derive the distribution and mechanicals overhead depending on the Data Center's Power Usage Effectiveness (PUE = total load / IT load)

Power & Cooling
In kiloWatts (kW)
The total is made up of the IT Systems and the overheads for distribution and Mechanicals.

Space Efficiency
The average server footprint is shown together with an estimate of Racks needed taking into account the optimal rack utilisation level in the Data Centre

Power & Space	Current	Alt.Case	Change	Difference
Total RackU	438.1	76.0	-83%	-362.1
Racks (30 RackU)	14.6	2.5	-83%	-12.1
Systems kW	**87.9**	**7.0**		
Distribution kW	15.8	1.3		
Mechanical kW	72.0	36.0		
Total kW	**175.7**	**44.2**	-75%	-131
Energy Efficiency				
Relative RIPs /Watt	1.0	12.6	1163%	11.6
Watts/Log.Srv	2896.2	1401.0	-52%	-1495.2
USD Power Cost per Logical Server	686	216	-69%	-470



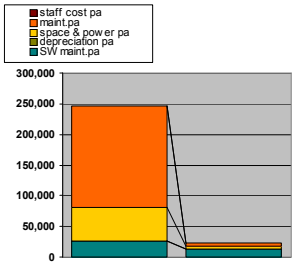
Energy Efficiency
With the advent of virtualisation it makes sense to examine the amount of shareable capacity delivered in comparison to the environmental limits of your data centre:
Space, Power & Cooling

Environmental Cost
Heat and greenhouse gases are created in the process of electricity generation, depending on the country and its energy technology.
This can be shown separately.

Business Case summary

Total: Business Case

Sizing	Current	Alt.Case
server type		
total #CPU	643	91
used #CPU		
#Log.Servers	169	167
#Phys.Servers	169	5.69
avg.Log.srv RIP	1,606.8	357.4
total capacity RIP	271,546.4	59,690.3
total workload RIP	12,762.7	12,762.7
average utilization	5%	21%



AOC: Annual Operating Costs		
Staff cost code		
SW cost code		
SW cost /CPU /yr		
SW cost /Lsrv /yr		
SW cost /Psrv /yr		
SW maint.pa	25,268	12,831
maint.pa	165,149	5,820
space & power pa	56,601	4,231
staff cost pa	0	0
depreciation pa	0	0
total pa	247,018.47	22,881.34

1.0 :1 Log.SCON ratio
29.7 :1 Phy.SCON ratio
224,137 est.potential saving /yr

OTC: One Time Costs		
SW purchase	0	10,926
HW purchase	0	121,687
transition	0	0
total OTC	0.00	132,612.76
write off	0	0

132,613 Net Cash Investment
0yr 0m Project Time
0yr 7m Payback Period

5 Year Projection		
OTC + 5x AOC	1,235,092	241,199

993,893 5yr saving

Energy and Climate	Current	Alt.Case
avg RackU / Server	2.5	4.0
Total RackU	417	23
30U Racks	13.9	0.8
Total kW	68	5
Adjusted kWh/yr	594,744	48,309
Heat BTU/hr	154,525	12,552
CO2 tonnes /yr	256	21
Carbon tonnes /yr	70	6
RIPs /m2	9,768	39,356
RIPs /kW	4,020	10,878
RIPs /BTU/hr	1.757	4.756
RIPS / tonne CO2	1,062	2,873
W /m2	2,430	3,618

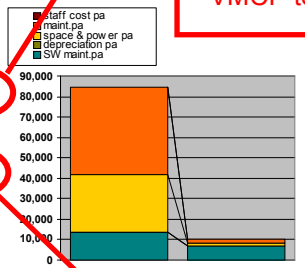
energy&climate

Saving 235 tonnes CO2/yr
or 777 Trees; or 94 cars

July

Total: Business Case

Sizing	Current	Alt.Case
server type		
total #CPU	300	60.7
used #CPU		
#Log.Servers	90	89
#Phys.Servers	90	7.59
avg.Log.srv RIP	1,498.7	
total capacity RIP	134,880.3	32,497.4
total workload RIP	6,386.8	
average utilization	5%	20%



AOC: Annual Operating Costs		
Staff cost code		
SW cost code		
SW cost /CPU /yr		
SW cost /Lsrv /yr		
SW cost /Psrv /yr		
SW maint.pa	13,456	6,573
maint.pa	42,751	1,879
space & power pa	28,557	1,646
staff cost pa	0	0
depreciation pa	0	0
total pa	84,764.81	10,098.11

1.0 :1 Log.SCON ratio
1.9 :1 Phy.SCON ratio
74,667 est.p

OTC: One Time Costs		
SW purchase	0	6,129
HW purchase	0	47,272
transition	0	0
total OTC	0.00	53,401.01
write off	0	0

53,401 Net C
0yr 0m Proje
0yr 9m Payb

5 Year Projection		
OTC + 5x AOC	423,824	102,012

321,812 5yr s

Energy and Climate	Current	Alt.Case
avg RackU / Server	2.4	1.0
Total RackU	217	8
30U Racks	7.2	0.3
Total kW	36	2
Adjusted kWh/yr	319,076	18,439
Heat BTU/hr	82,901	4,791
CO2 tonnes /yr	137	8
Carbon tonnes /yr	37	2
RIPs /m2	9,324	64,245
RIPs /kW	3,722	15,516
RIPs /BTU/hr	1.627	6.783
RIPS / tonne CO2	983	4,099
W /m2	2,505	4,141

energy&climate

Saving 129 tonnes CO2/yr
or 428 Trees; or 52 cars

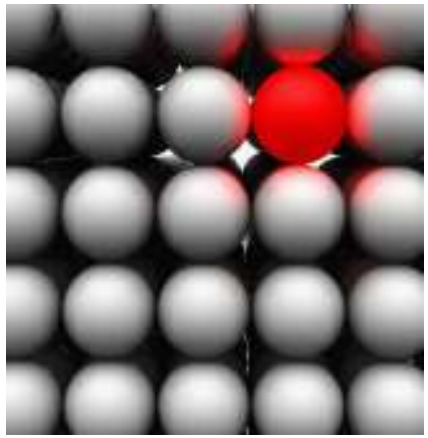
October

Matches the 7 to 8 blade servers forecast using the VMCP tool

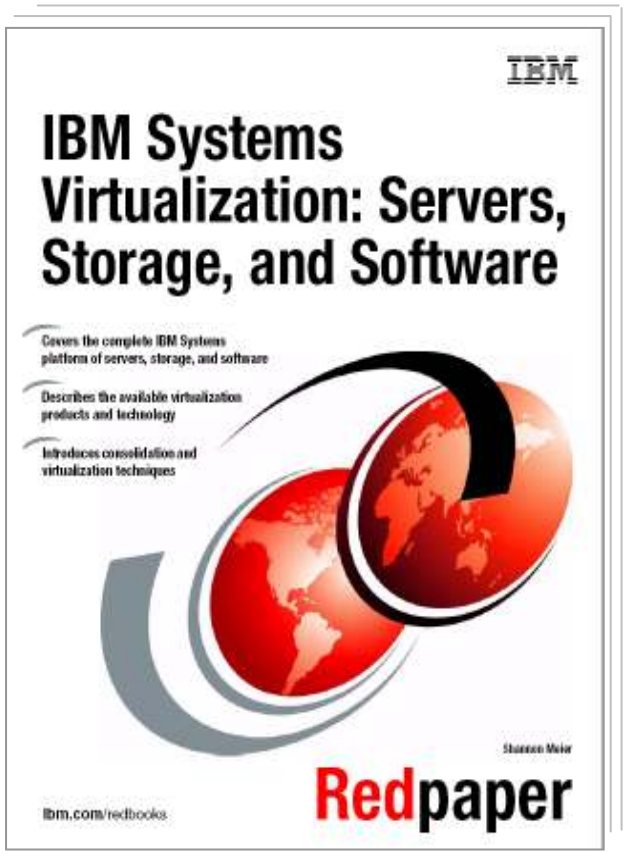
Matches the 19% average CPU utilization forecast using the VMCP tool

Example summary of a business case comparison

- Systems and sizing comparison
  - Physical servers reduced from 26 down to 2
  - Cores reduced by 115 with consequent opportunity for software cost savings (*126 down to 11*)
  - Upgrade capability within both new systems to accommodate some growth (*additional 31% more processing power available via upgrades*)
  - Increased capacity available for disaster recovery
  - “Fine tuning” of capacity to better meet processing requirements
- Potential financial differences
  - Overall financial savings of £2.37 Million over 5 years (45% less)
  - Annual Operating Costs reduced by £0.65 Million or 62% vs current
  - Software charges lowered by 90%
  - Hardware maintenance costs reduced by 81%
  - Space costs reduced by 88%
  - Power costs reduced by 64%
  - Estimated Return on Investment of approximately 1 Year 8 Months
- The estimated environmental comparison is…
  - Space savings of ~ 163 standard rack units (~ 5 x 42U racks)
  - Power savings of 43.0 kWh
  - Reduced carbon dioxide (CO^2) emissions of 161.9 metric tonnes p.a. (64% less)



IBM Systems Virtualization: Servers, Storage and Software



- *This paper serves as both an introduction to virtualization, as well as an overview of pertinent IBM hardware and software virtualization offerings*
- *We first introduce the concepts of virtualization and the benefits of virtualizing your systems*
- *We then describe virtualization options for each of the IBM Systems platforms as well as software and storage technologies that are used to implement virtualization*
- *This paper is suitable for people who want to expand their knowledge of virtualization and what IBM can offer with its systems and software*

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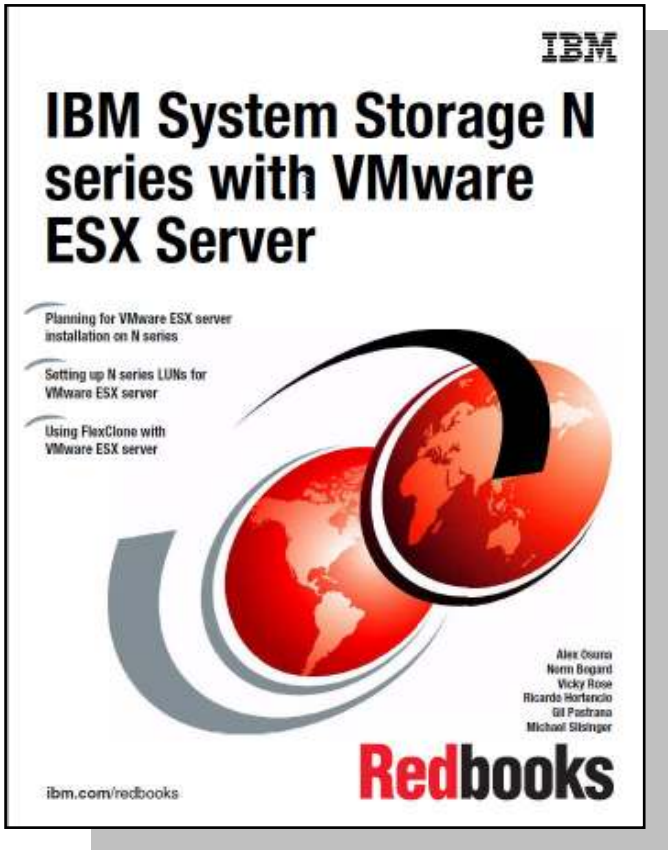
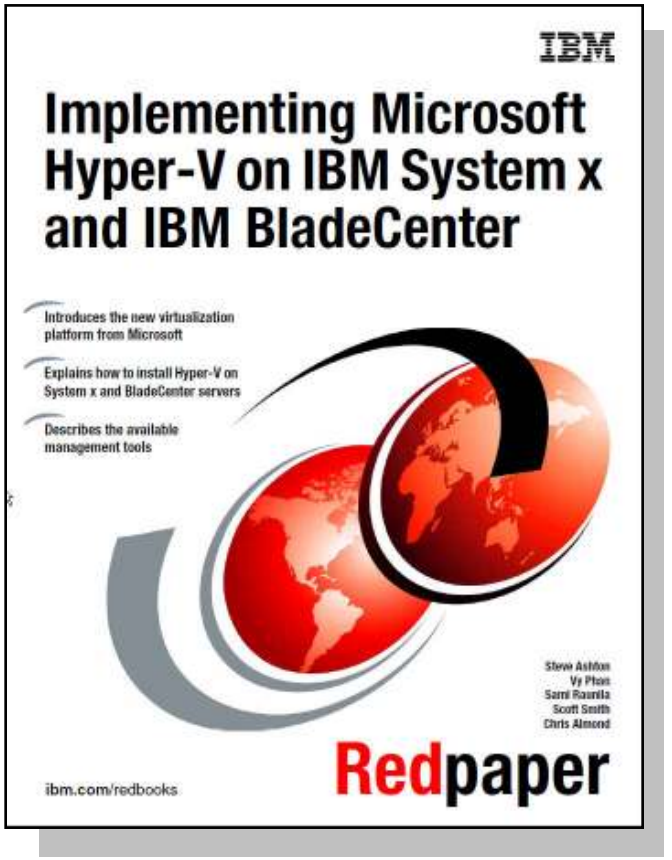
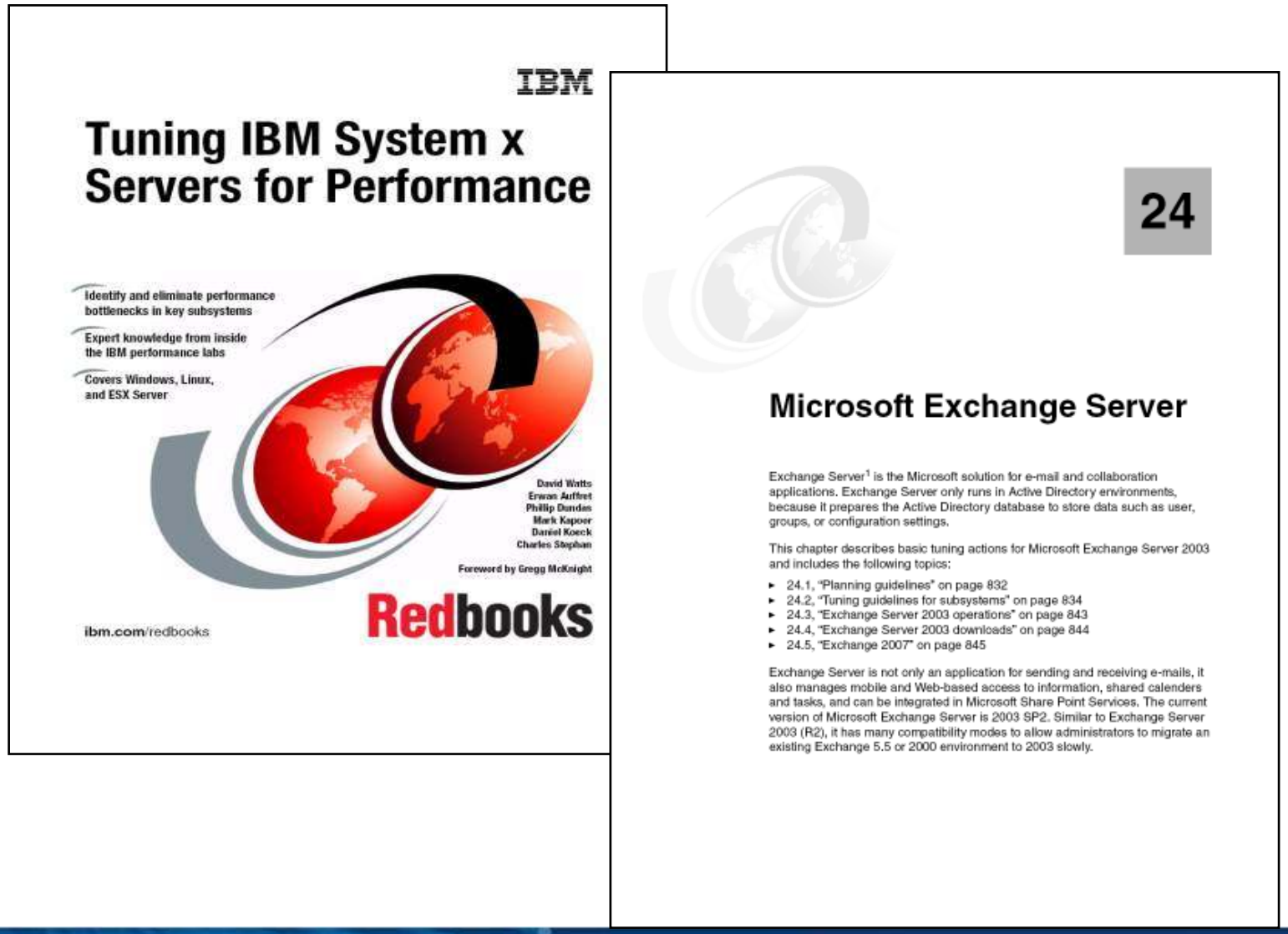
No just servers, not just VMware





For the technicians…



IBM

Tuning IBM System x Servers for Performance

Identify and eliminate performance bottlenecks in key subsystems

Expert knowledge from inside the IBM performance labs

Covers Windows, Linux, and ESX Server

David Watts
Erwan Auffret
Phillip Dundas
Mark Kapoor
Daniel Koeck
Charles Stephan

Foreword by Gregg McKnight

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Microsoft Exchange Server

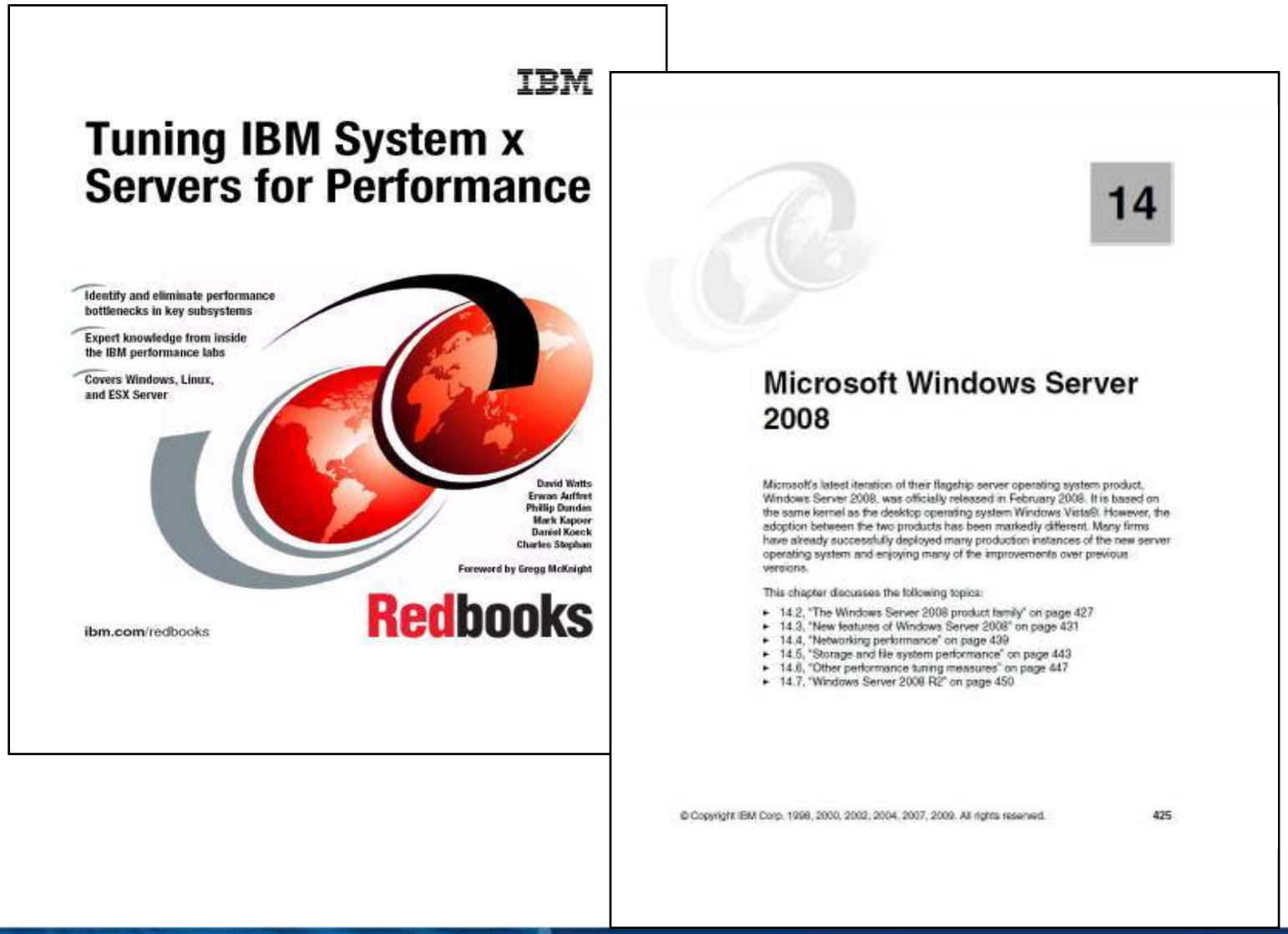
Exchange Server[1] is the Microsoft solution for e-mail and collaboration applications. Exchange Server only runs in Active Directory environments, because it prepares the Active Directory database to store data such as user, groups, or configuration settings.

This chapter describes basic tuning actions for Microsoft Exchange Server 2003 and includes the following topics:

- 24.1, "Planning guidelines" on page 832
- 24.2, "Tuning guidelines for subsystems" on page 834
- 24.3, "Exchange Server 2003 operations" on page 843
- 24.4, "Exchange Server 2003 downloads" on page 844
- 24.5, "Exchange 2007" on page 845

Exchange Server is not only an application for sending and receiving e-mails, it also manages mobile and Web-based access to information, shared calenders and tasks, and can be integrated in Microsoft Share Point Services. The current version of Microsoft Exchange Server is 2003 SP2. Similar to Exchange Server 2003 (R2), it has many compatibility modes to allow administrators to migrate an existing Exchange 5.5 or 2000 environment to 2003 slowly.

For the technicians…



IBM

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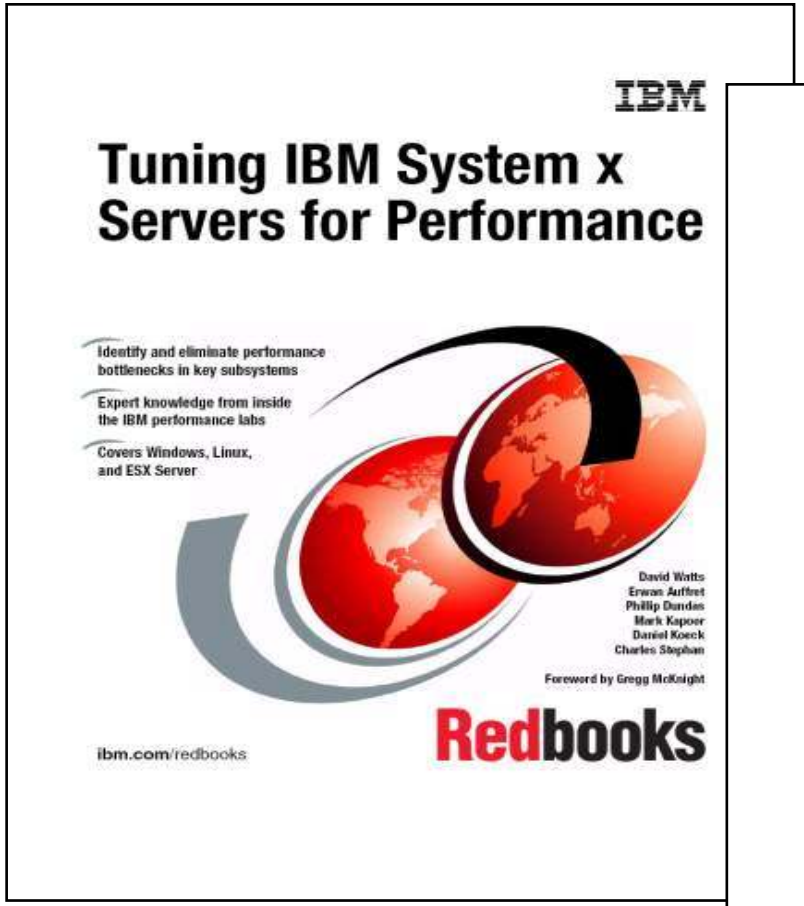
Microsoft Windows Server 2008

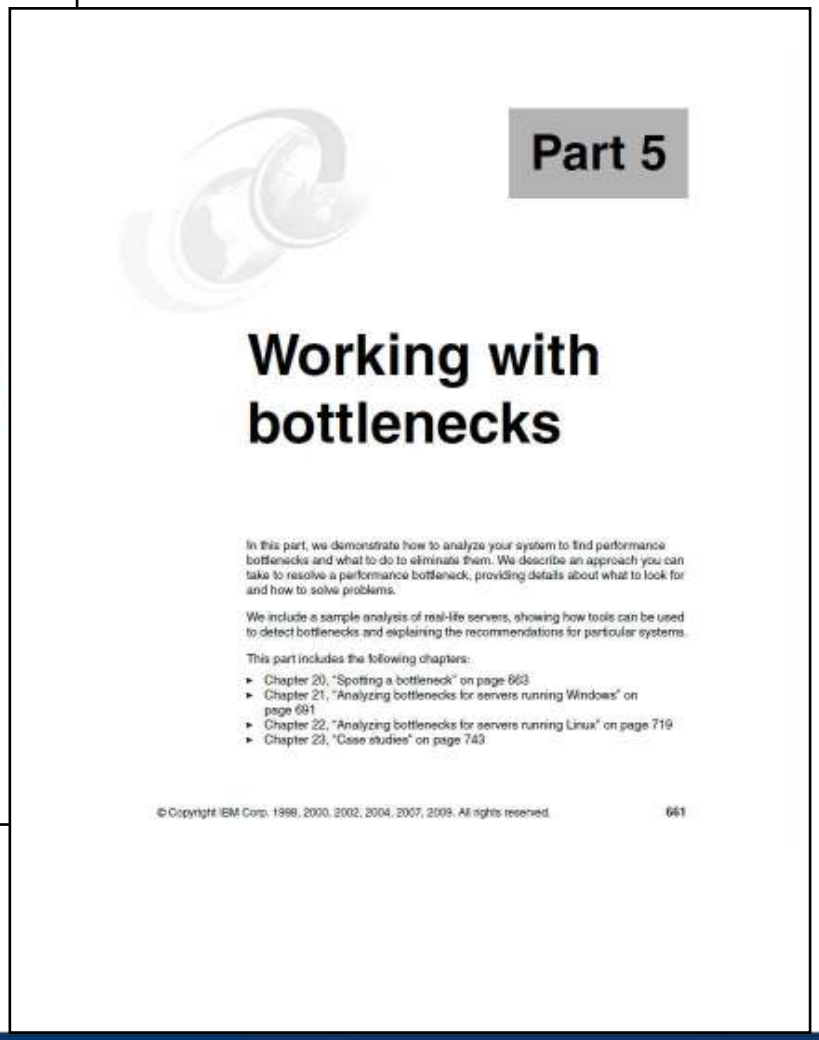
Microsoft's latest iteration of their flagship server operating system product, Windows Server 2008, was officially released in February 2008. It is based on the same kernel as the desktop operating system Windows Vista®. However, the adoption between the two products has been markedly different. Many firms have already successfully deployed many production instances of the new server operating system and enjoying many of the improvements over previous versions.

This chapter discusses the following topics:

- 14.2, "The Windows Server 2008 product family" on page 427
- 14.3, "New features of Windows Server 2008" on page 431
- 14.4, "Networking performance" on page 439
- 14.5, "Storage and file system performance" on page 443
- 14.6, "Other performance tuning measures" on page 447
- 14.7, "Windows Server 2008 R2" on page 450

For the technicians…





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30-second Business Case

Why IBM?

In today's market of apparently-commoditized x86 servers, IBM System x servers stand apart for several reasons.

In the high-end x86 server marketplace our rack-mount servers have market leadership, enterprise-class reliability and unmatched scalability. They can be uniquely expanded or upgraded to match the growth of your business.

In our blades portfolio, we have the widest range of blade servers, chassis and switches yet offer compatibility between them all.

We have hundreds of no.1 performance benchmarks, delivered consistently over several years.

Our x86 systems management can uniquely extend into other platforms such as POWER and mainframe servers, manage both physical and virtual environments and provide enhancements for enterprise-level management suites such as our Tivoli offerings or even those of another vendor.

How to virtualize your servers with IBM

Use the free tools for estimating power consumption of new servers, and for the monitoring of existing servers.

Run a simple review using IBM's server consolidation evaluation tool to estimate the ROI and TCO of a virtualized environment.
Engage IBM to produce a free or low-cost sizing study to size the new environment.
Follow this up with a consultancy study and report from IBM's experienced practitioners to give you the financial case.

Use best practices procedures and documentation to create your virtualized environment.

And – when you have completed all this – don't stop. A Dynamic Infrastructure doesn't stop moving. Deliver a better service for your business.

End of presentation

Simon Hodkin
Senior IT Specialist
IBM UK Ltd