IBM System x™ Technology

Introduction to IBM System x

Matthew Fordham – Technical Sales

Topics

IBM System x Introduction / Industry updates

Innovation with System x and Intel/AMD

High Performance EXA X3 / ScaleUp Computing

IBM BladeCenter™ / ScaleOut Computing

IBM Director - Smart Systems Management

Virtualization and Consolidation

Capabilities and Leadership

- **IBM Global Capabilities and Resources**
  - Global presence in 170 countries
  - Global account management / project management
  - Worldwide service/technical support programs
  - Global financing
- **World-class Service and Support**
  - IBM Global Services – world's largest and most versatile services company
  - PricewaterhouseCooper Business Consulting acquisition strengthens business consulting
  - More than 25 years of leadership and innovation
- **Technology Leadership**
  - Most U.S. Patents in 2005 (13 Consecutive Years)
  - More than $5 billion spent annually on research

The IBM Systems family

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

System z™
The flagship for IBM Systems innovation and the heart of a highly secure, resilient and integrated infrastructure.

BladeCenter®
Simplify data center complexity.

IBM Systems

System i™
Complexity is expensive. Simplify your IT. Innovate your business.

System x®
Innovation comes standard.

System Storage™
Connected. Protected. Complete.

System p™
Get the power to do more, spend less.

Delivering business value with innovation at all levels

Infrastructure

Information on Demand

Capacity on Demand

Cool Blue

Grid Computing

Infrastructure Solutions

Supercomputing Capacity on Demand

IBM Virtualization Engine

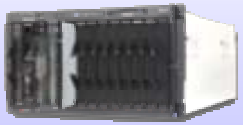
Self-Managing Autonomic Technology

Product Families

Mainframe

UNIX **Midrange**

x86



Blades

Storage

Technology & Packaging

z/OS

AIX 5L

i5/OS

IBM z/Architecture™

Power Architecture™

Cell Broadband Engine™

X-Architecture™

IBM Virtualization Platform

IBM Virtualization Engine

IBM Director *is the common thread across IBM Virtualization Engine, providing consistent platform management*

Virtual Planning Tools

Virtual Access

Programmatic access

Virtual view

VE Console

IBM TotalStorage Productivity Center

Virtual Management

Workload and performance managers
Resource management, modeling, mapping

Enterprise Workload Manager

IBM Director 5.10

Resource Dependency Service 2.1

Virtual Resources

Resource Virtualizers
Micro-Partitioning, Virtual I/O, Partition Load Manager, Dynamic LPAR

IBM Server and Storage Systems

System z9 zSeries

TotalStorage

xSeries

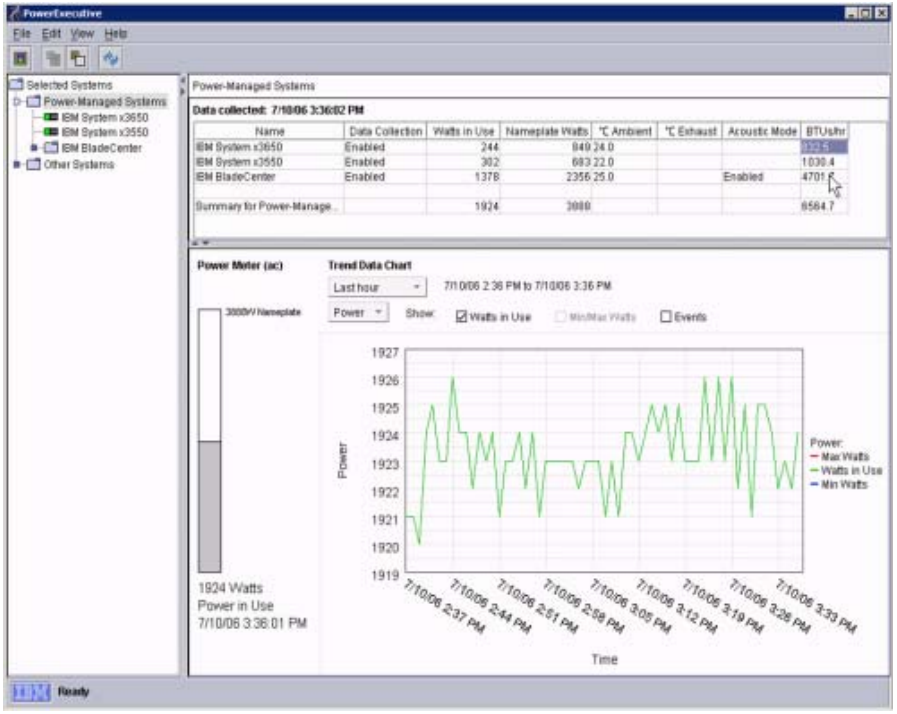
BladeCenter

iSeries

System p5 pSeries

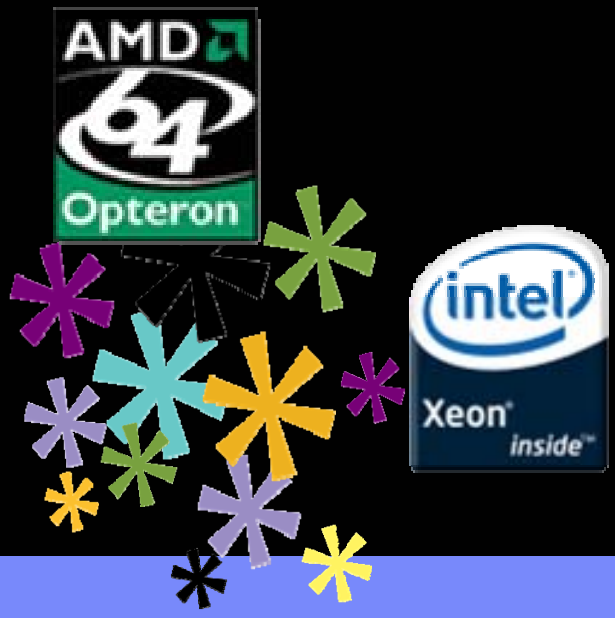
PowerExecutive™
Product Innovation for Customer Value

- **Optimize and manage datacenter power and cooling**
  - Intelligence and control to manage datacenter server power utilization
  - Combination of hardware, system logic, and group management tools
- **Remove datacenter power management guess work**
  - Actual power draw, not conservative “label/spec power” estimates
- **More accurate datacenter planning helps maximize performance**
  - Power control capability ensure datacenter robustness within fixed power envelope (2H 2006)



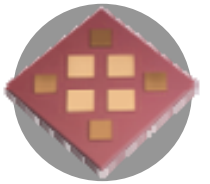
PowerExecutive™ in Action

Industry and Processor Technology



Technology Innovation Opportunities

- Multi-core Processors Multiply
  - 2 cores in 2005-6, 4 cores in 2006-7
  - New opportunities to advance application and solution architecture



Multi Core

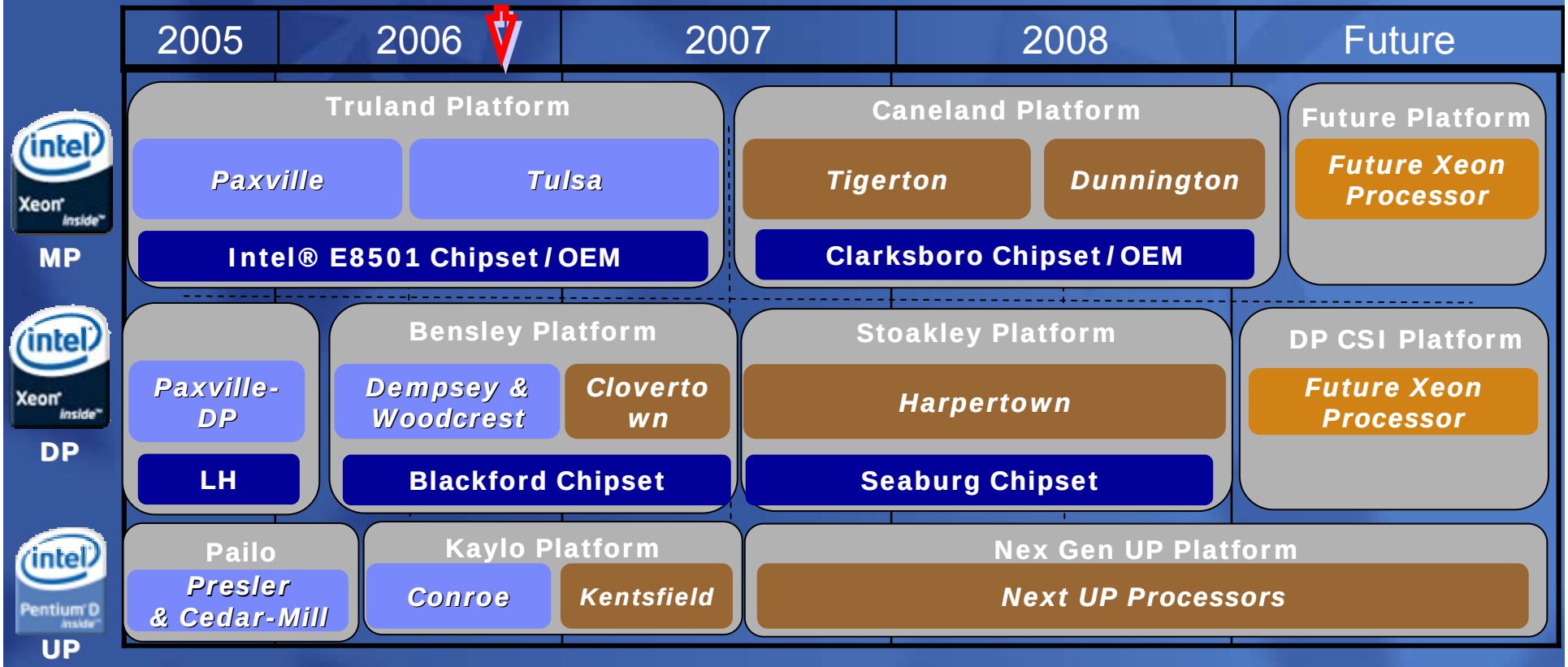
- Virtualized computing will proliferate and move to mainstream solutions
  - Software licensing trends, increased AURs and industry analyst surveys indicate greater use of high volume servers as virtualization platforms
  - Virtualization solutions will enable customers to lower their total cost of operations by improving the utilization of their hardware and labor costs

Virtualization

- Power Management
  - Server power is approaching limits of thermal, acoustic, and power density
  - Active power management is key to managing future power

Manageability

Intel® Xeon® Processor Roadmap



2005 and Prior Platforms:

- Performance (Dual-core, 800Mhz FSB, HT)
- Investment protection & 64 bit headroom (EM64T)
- High bandwidth/flexible I/O (PCI Express*)
- Faster, more reliable, lower power memory (DDR2)
- Power/Thermal management (DBS)
- Improved security (XD)

2006 Platforms:

- Breakthrough '05 technologies (EM64T, DDR2, PCIe, XD)
- Highly scalable (dual-independent bus)
- Improved virtualization (VT)
- High bandwidth (1066FSB) and 4x memory capacity (FBD)
- Manageability (IAMT)
- Improved networking (DPT)
- Flexible Storage (SSB)
- More power efficient cores

All products, dates, comparisons and information are preliminary and subject to change without notice.

Dual Core | Quad Core | Multi Core

Stability, Longevity, Choice

	Today	Q2 '06	2H '06	'07
Performance Optimized ***Best* absolute performance**	135W Paxville DP 64bit dual-core	130W Dempsey 64bit, dual-core	80W Woodcrest 64bit, dual-core	~110W Clovertown 64bit, quad-core
Mainstream Volume ***Balanced performance & power*** ***~80W top to bottom***	110W Irwindale [1] 64bit single-core	95W Dempsey 64bit, dual-core	80W Woodcrest 64bit, dual-core	80W Clovertown 64bit, quad-core
Ultra-Dense Servers ***Optimal performance density***	55W LV Irwindale 64bit single-core	31W Sossaman 32bit dual-core	40W LV Woodcrest 64bit, dual-core	40W LV Woodcrest 64bit, dual-core

Supported in current 64bit Intel® Xeon® processor based servers

Supported in new Dual-Core Intel® Xeon® processor based servers

Dual Core to Quad Core - One Stable Platform

All products, dates, comparisons and information are preliminary and subject to change without notice.

1 also supported are 95W MV Irwindale 64bit, single-core processors

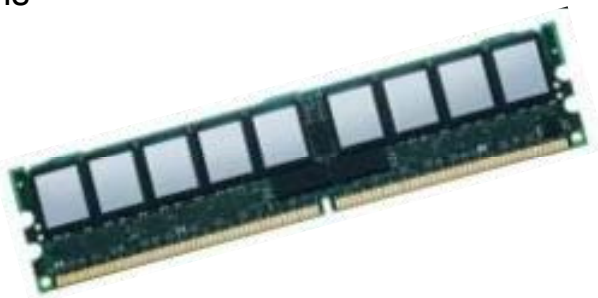
Technologies Roadmap: Server and Workstation

	2006	2007	2008
Processor	Dual-core AMD Virtualization Security Memory RAS DDR2	Next-generation Core Quad-core L3 Cache HyperTransport™ 3.0 Power Management Enhancements 128-bit FPU Increased IPC	Direct Connect Architecture 2.0 Larger Cache Manageability Virtualization+ Enhanced RAS FBDIMM
Chipset and Platform	PCI Express Gigabit Ethernet TCP Offload Serial SCSI Serial ATA II Hardware RAID	HyperTransport 3.0 PCI Express Gigabit Ethernet TCP Offload Serial SCSI Serial ATA II Hardware RAID	I/O Virtualization PCI Express 2 10 Gigabit Ethernet TCP Offload Serial SCSI Serial ATA II Hardware RAID

Technologies Trends Impacting High Volume

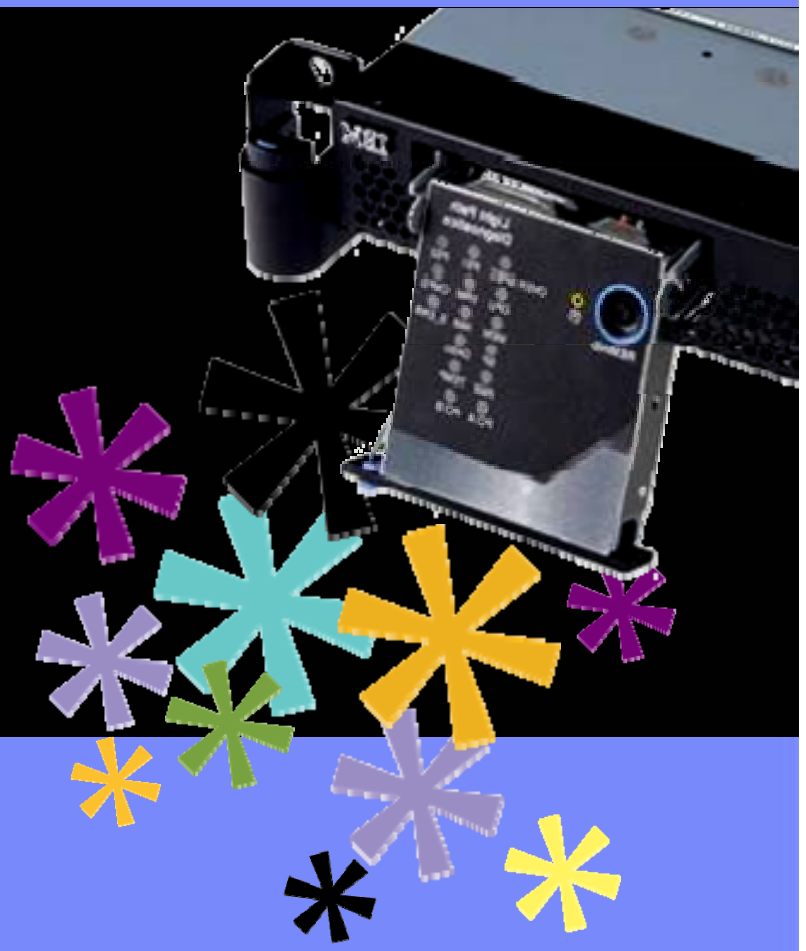
- **RAID**
  - Wide requirement for Standard RAID - top to bottom of portfolio
  - Solution requirements vary from very Basic to Fully Featured
- **HDD**
  - Serial Attached SCSI (SAS) replaces parallel SCSI
  - Compatible with SATA - unifies drive attachment interface
  - 2.5-inch drives grow dramatically in 2006/2007

- **Network Offload Technologies**
  - Broadcom TOE or Intel IOAT
  - Offloads protocol processing from CPU to a separate engine, improves processor efficiency
- Fully Buffered DIMMS will become standard on two-socket systems
  - Faster speeds, higher peak bandwidth than DDR2
- PCI-Express
  - Adoption rate will increase in 2006-2007



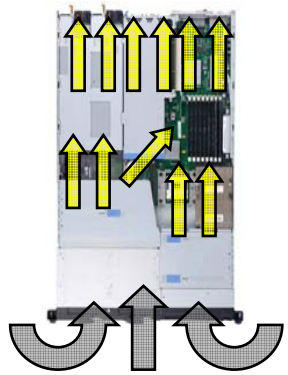
IBM System x Innovation

Built on Industry Standards



Leveraging industry standards, IBM adds innovation

- Predictive Failure Analysis® — Helps alert IT to potential failures *before* they happen – on additional components beyond Dell and HP
- Simple-swap SATA interfaces — Makes it easier to add or replace than fixed drives and at a lower cost than hot-swap drives



Calibrated Vectored Cooling

Light path diagnostics

tended Design Architecture

r

Xtended Design Architecture

Multiple DIMM slots

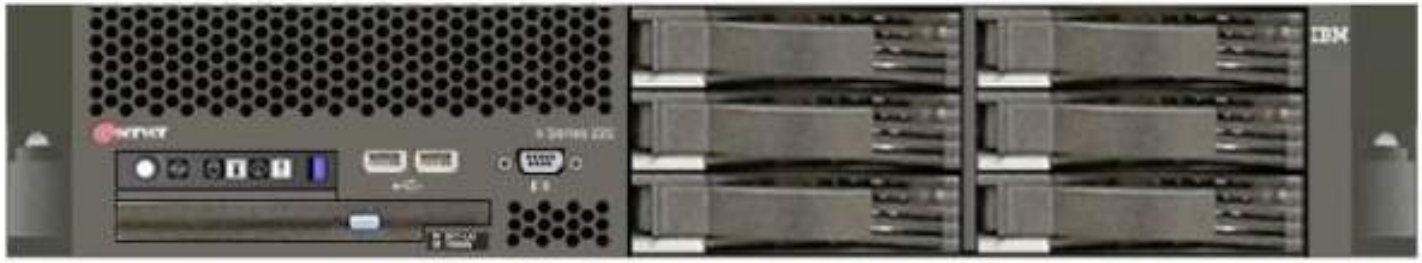
RSA II SlimLine

Light Path Diagnostics

Efficient Cooling design

2U Internal Storage Options

Up to 6 3.5" HDD's



Up to 4 3.5" HDD's and tape

Up to 8 2.5" HDD's and tape

x3550 and x3650 Calibrated Vectored Cooling

Cooling Fans accessible via easy-access panels

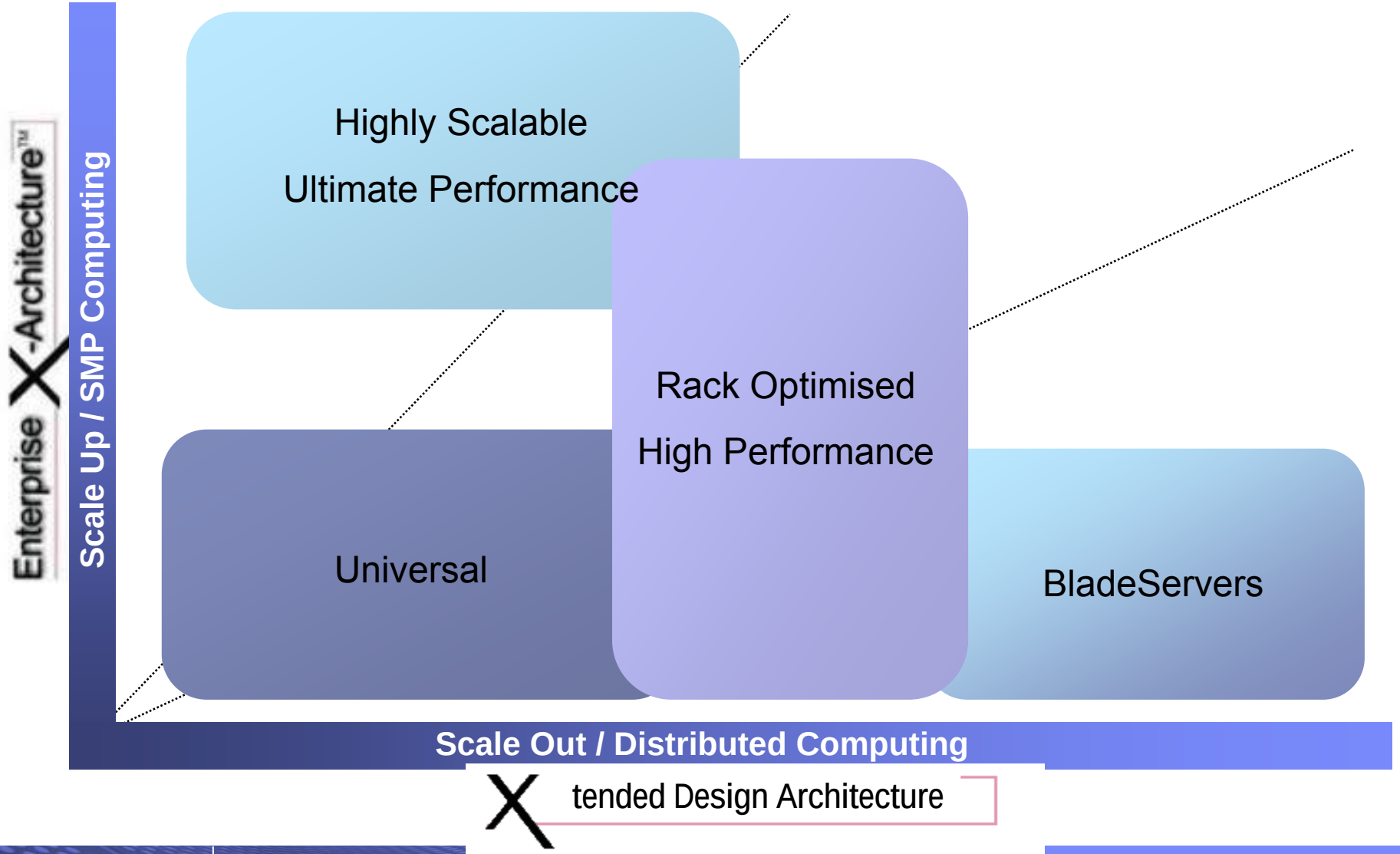
Hot-swap and Redundant

Counter-rotating highly efficient fan assembly

IBM System x

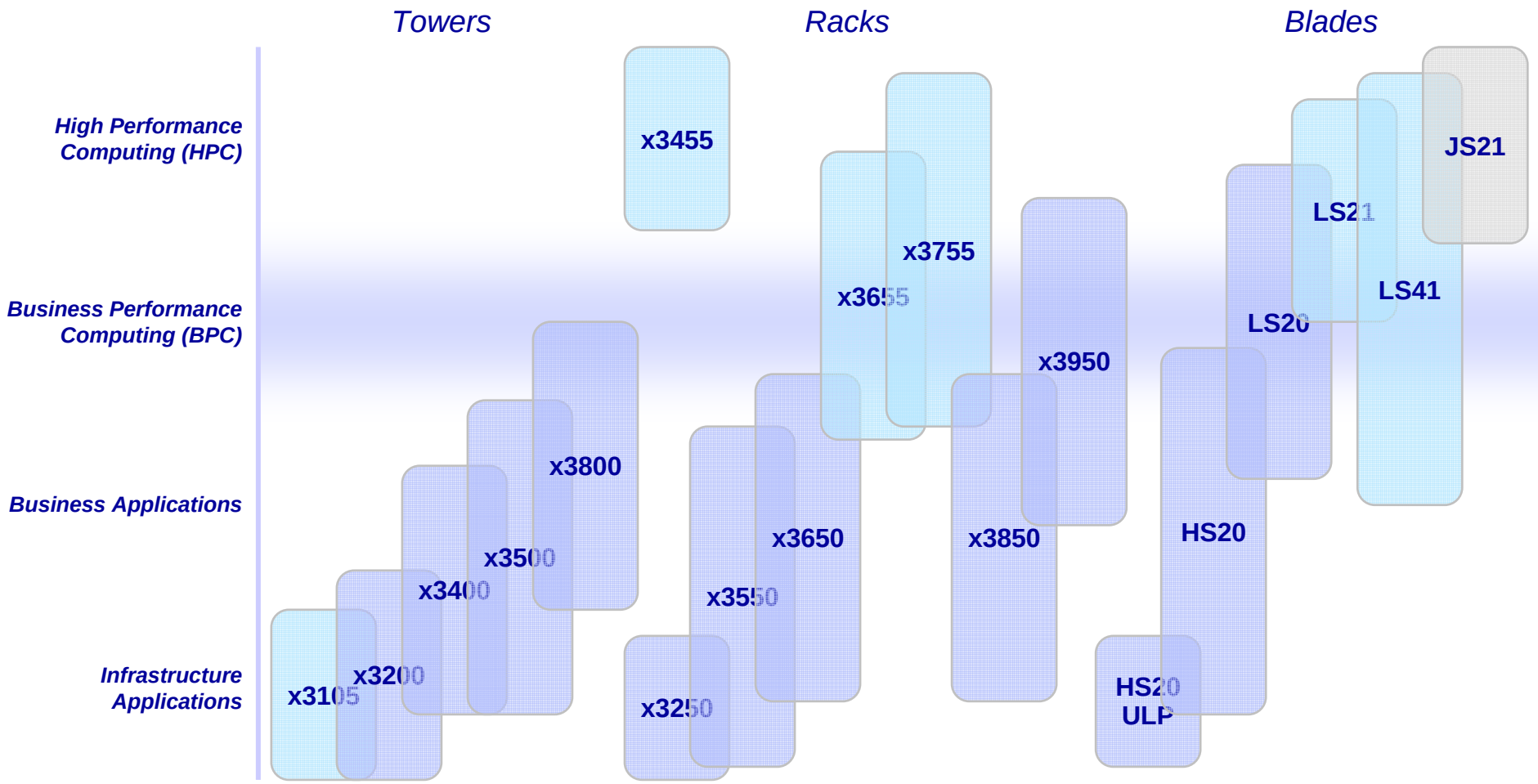
Creation of a complete Portfolio

IBM System x Portfolio



Creation of a Complete Portfolio

A System x and BladeCenter product line from Infrastructure to HPC



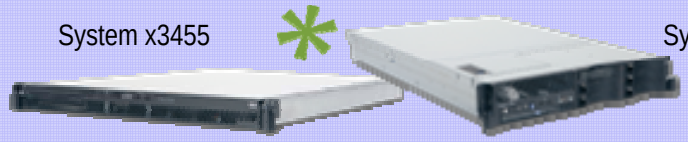
IBM System x Portfolio

Ultimate Performance

System x 3950 System x3755

Rack Optimised

System x3455 System x3655



System x3250 System x3550 System x 3650 System x3850

Universal

System x3200 System x3400 System x3500 System x3800

IBM BladeCenter
IBM BladeCenter H

AMD, PowerPC and Intel

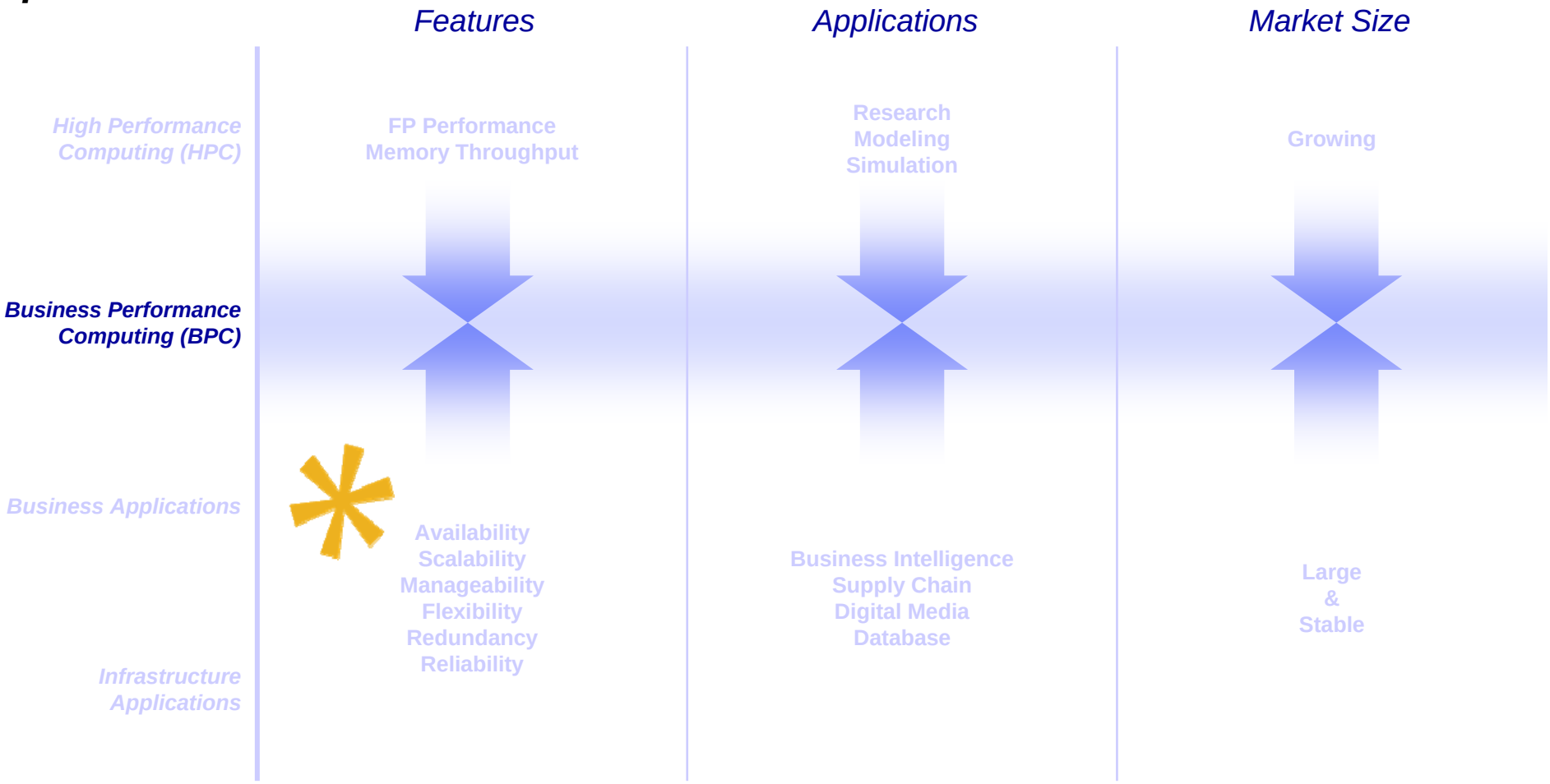
IBM System x AMD Innovation

AMD Portfolio Strengthens

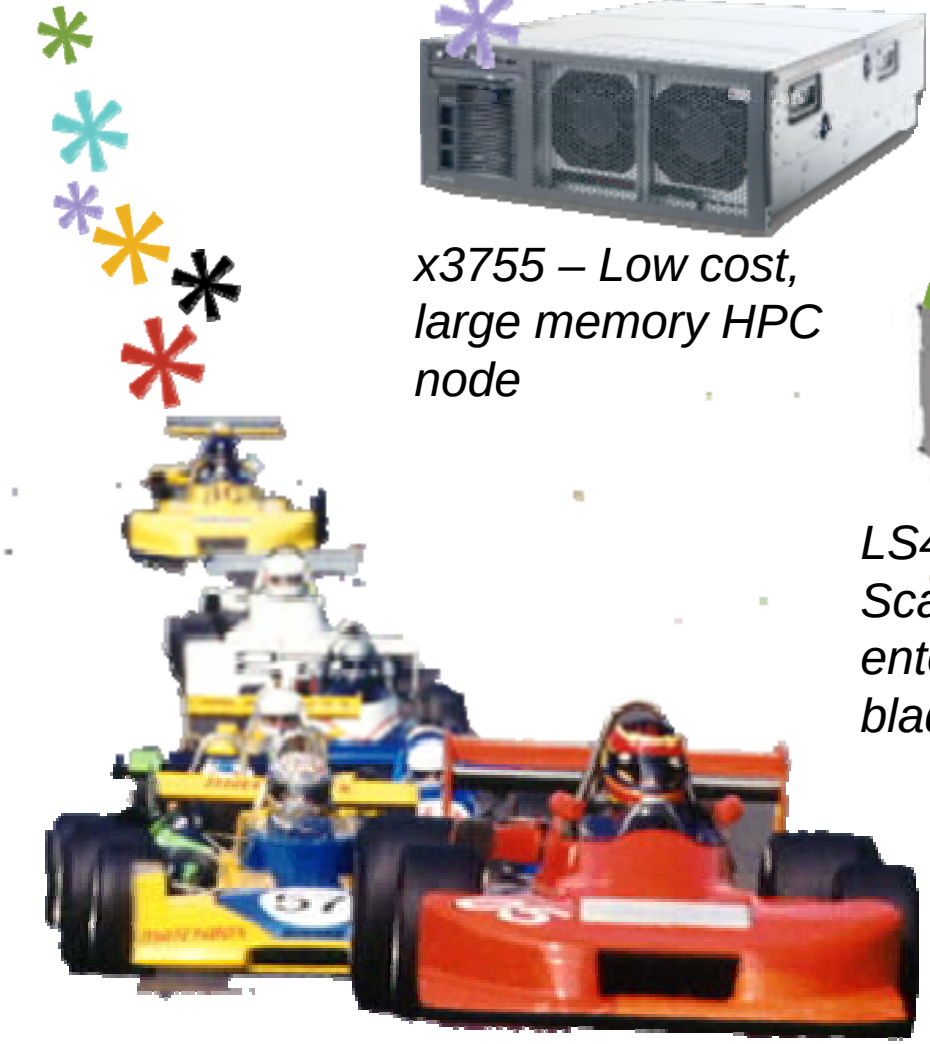
High Performance Computing

The Emergence of Business Performance Computing

HPC apps move into mainstream, and business applications require more performance to meet customer demands



A whole new fleet of high performance systems



x3755 – Low cost, large memory HPC node

LS41 - Scalable enterprise blade server

IBM System x3455 - High Performance Compute Node

x3655 - Business Performance Server

LS21- High performance blade server

With IBM, Customers Gain Stellar Advantage

Industry-leading Performance, Reliability and Control

High Performance Compute Node

- Fastest, leanest compute node on the planet
- Ideally suited for HPC clusters, Linux or MSFT

Business Performance Server

- Perfect mix of IBM mainframe inspired reliability and application performance
- Leadership I/O and large memory capacity

Ultra HPC Performance Compute Node

- Unmatched price/performance and leadership design
- Maximum configurable I/O slots
- Fastest, largest memory capacity

2-socket High Performance Computing

- Outstanding performance/watt for HPC and scalable enterprise workloads
- Innovative “snap-in” scalable design allows “pay as you grow” flexibility
- Compatible with existing and future chassis

Scalable 4-socket Performance Computing

PowerExecutive™: Power Management at Your Control

AMD-based IBM System x and BladeCenter Portfolio

Positioning

1U

x3455

Low cost HPC compute node

2U

x3655

Highly Available Application Server

4U

x3755

Mid-Market, Large Enterprise HPC

7U

LS21

LS41

Enterprise class scalable 2-4 socket blade for front and mid tier applications

Typical Use:

- **Scientific and Industrial Applications**
- **Large DB and Linux Clusters**
- **Microsoft Clusters for SMB**
- **Web Serving**
- **Database/ERP**
- **Virtualization**
- **IPTV; VoD**
- **Scientific Computing**
- **Weather Simulations, CAE**
- **Crash Analysis**
- **Financial Services**
- **Scientific/University/ HPC**
- **SQL Databases**
- **ERP**
- **Data marts, Data warehouses, SQL Databases**
- **HPC cluster**

Key Features

- Dual socket Opteron processors
- 48GB of DDR2 memory
- 3.5” SATA or SAS
- Leadership I/O with PCI-E, and HTx
- eXtended I/O

- Dual socket Opteron processors
- 64GB of DDR2 memory
- 2.5”and 3.5” internal storage and tape
- Ready RAID and Ready RSA
- Trusted Platform Module
- Standard TOE

- Four socket Opteron processors
- 128GB of DDR2 memory
- 3.5” SAS internal HDD
- Ready RAID and Ready RSA
- Trusted Platform Module
- Standard TOE

- Dual socket Opteron processors
- 32 GB of DDR2 memory
- SAS HDD technology
- TOE NIC solution
- High speed enablement
- Supports the new SIO blade

- Four socket Opteron processors
- 64GB of DDR2 memory
- 2 SAS HDDs and RAID
- TOE NIC solution
- High speed enablement
- Supports the new SIO blade
- 4 ethernet ports

High Performance System x

Third-Generation
Enterprise X-Architecture

IBM defines High-end Industry-Standard Servers

1st Generation: 2001

- x360: 6-month time to market advantage, Most rack dense 4w (3U) ever introduced
- x440: 12-month TTM, Most rack dense 8w (4U), Most successfully benchmarked server in history (35 #1's)
- XpandOnDemand Scalability up to 16-way plus Remote I/O
- Industry-first High Availability Technologies: Active Memory & Memory ProteXion
- Leadership Virtualization for Server Consolidation

2nd Generation: 2003

- x365: Leadership density (3U) with 4X storage capacity & advanced EXA features
- x445: the fastest industry-standard server in history, 20 more #1 benchmarks (little competition to compare)
- x455: Unleashing EXA on Itanium2 for pure 64-bit
- XpandOnDemand Scalability up to 32-way plus Remote I/O
- 10 Consecutive Quarters (3Q02) as #1 8-way database server in the Industry

3rd Generation: 2005

- x3850: Leadership 4-socket performance, First-to-market with 64-bit Xeon MP
- x3950: System x 32-socket flagship optimized for scalability & virtualization with up to 125% higher performance
- x3800: Extending EXA to the 4-way Tower space with maximum storage for SMB
- Attacking application-serving tier with 64-bit performance + 32-bit compatibility + dual-core capability

IBM defines High-end Industry-Standard Servers

3rd Generation: 2005

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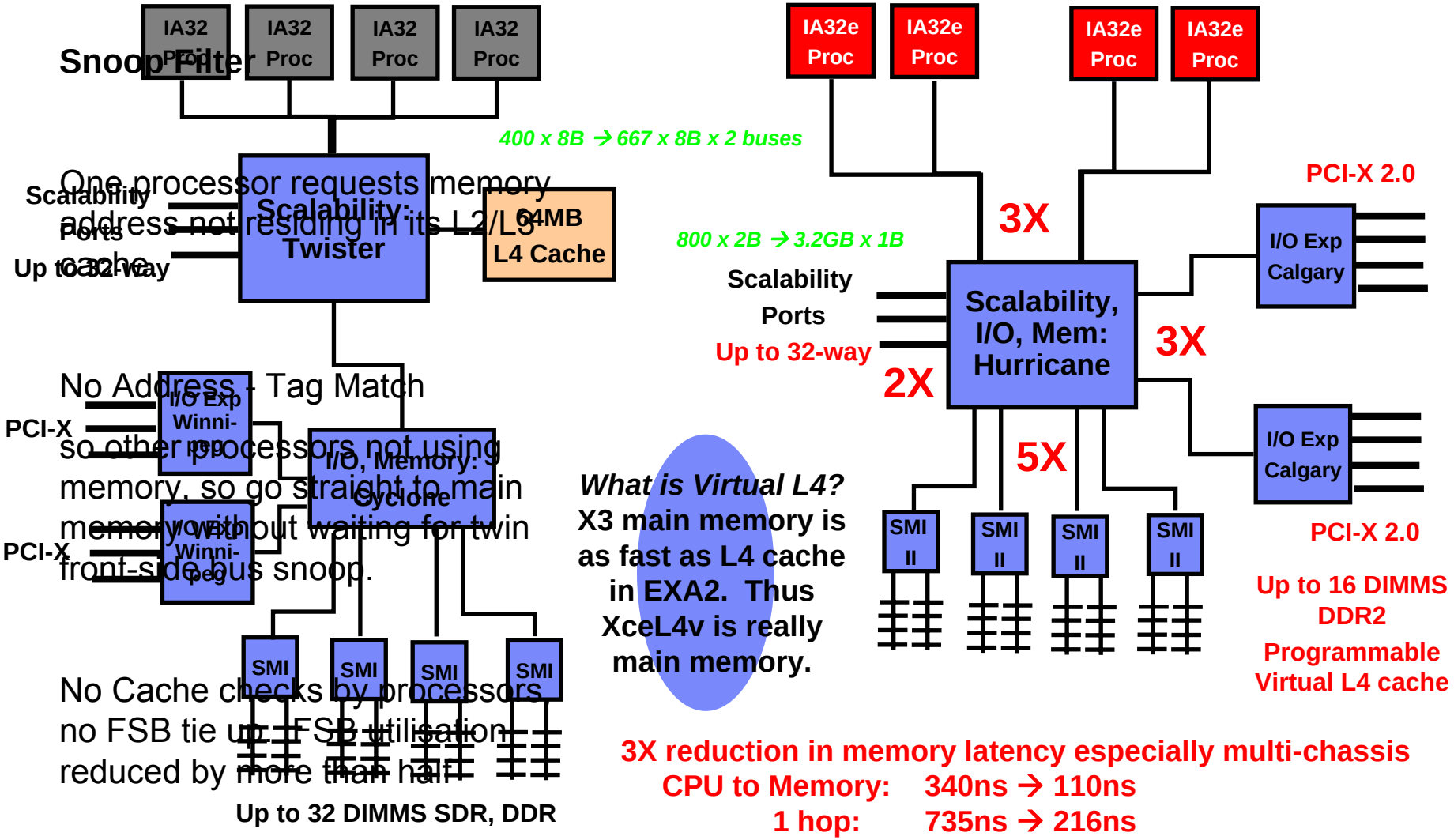
x3: Third-Generation Enterprise x-Architecture

Common Elements:

Xeon MP EM64T: 64-bit Extensions
Dual-core Ready, 667MHz FSB
Active Memory™: Faster DDR2
XceL4v™ Server Accelerator Cache
PCI-X 2.0 (Future PCI-E 4X/8X)
XA-64e™ 3rd Generation Chipset
Integrated SAS with optional RAID5 (8i)
Remote Supervisor Adapter II Slimline

exa2 vs. exa3: Fatter pipes & lower latencies



3X reduction in memory latency especially multi-chassis

CPU to Memory:	340ns → 110ns
1 hop:	735ns → 216ns
2 hop:	940ns → 324ns

System x3850 Your Ideal Application Platform

Targeting the application-serving tier with the first mainstream 4-socket server combining break-through 64-bit performance and high availability on the industry's most prevalent server instruction set architecture (x86 ISA).*

Infrastructure
SQL, DB2, Oracle

ERP/CRM/SCM
SAP, Siebel, i2

Email/Collaboration
Exchange, Notes

Web Services
WebSphere

Server Consolidation
VMware ESX

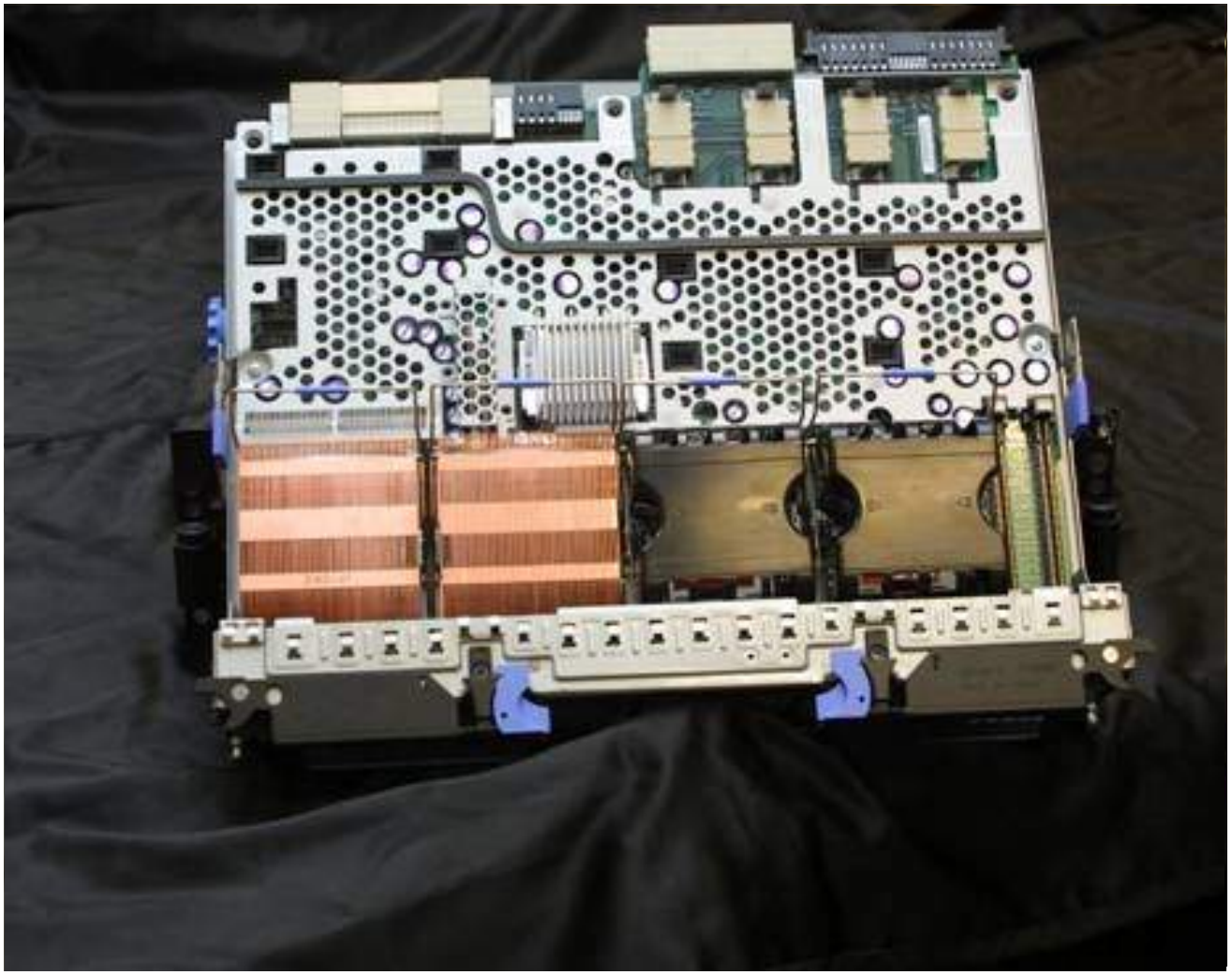
Application Flexibility + OS Flexibility

vmware Novell Microsoft redhat suse

*Source IDC: x86 servers outnumber by 10X all other server architectures combined, i.e. RISC/UNIX, SPARC, MIPS, et.al.

Top View of an x3 system

x3 Processor Module



The Unmatched 8-way: x3950 with eServer x3

MXE-460 x3950

Database
SQL, DB2, Oracle

ERP/CRM/SCM
SAP, Siebel, i2

Server Consolidation
VMware ESX

Ideal for database-serving tier - the first mainstream 8-socket x86 server combining break-through 64-bit performance and high availability on the industry's most prevalent server instruction set architecture (x86 ISA).*

Application Flexibility + OS Flexibility

vmware Novell Microsoft redhat suse

XpandOnDemand™ with the Modular Xpansion Enclosure

Easily scale the x3950 up to 32-sockets by adding capacity in 4-CPU increments. Each MXE-460 contains 4 CPU sockets, up to 16 DIMM slots and 6 PCI-X2 slots.

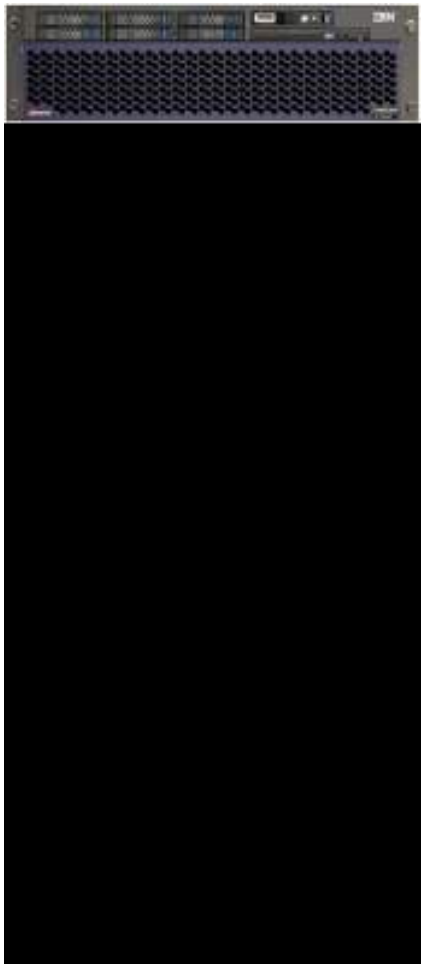
- 4 CPU sockets
- Up to 16 DIMM slots, 8 standard
- 6 PCI-X 2.0 slots up to 266MHz each

- MTM Part number (8874-1RX)
- 2 of 4 Memory Cards standard
- 3/3 NBD 9x5 Warranty
- No HDDs but all hard drives accessible
- No DVD but backplane is present for upgrade
- No memory, no CPUs for ease of configuration
- Scalability Cables optional
- 2 Power Supplies standard
- RSAII Slimline standard

x460 Partitioning Configurations

Two x460's
Two Chassis 8-way
or 4-way Cluster

Four x460's
Four Chassis 16-way
or 4/8-way Cluster



Eight x460's
Eight Chassis 32-way
or 4/8/16way Cluster

Scalable Systems Manager

Modular Building-block Scalability also powers more flexible partitioning for high-performance clustering. With Scalable Systems Manager, x460 customers can configure multiple x460 chassis into any combination of SMP or Clustering combinations.

Performance TPCc Dual core vs Dual Core

20	**IBM**	**IBM eServer xSeries 460 16P c/s**	**5.5**	***492307.0***	**6.37**	**3138060**	**Microsoft Windows Server 2003**	**Intel Dual-Core Xeon Processor 7040 3.0GHz**
21	Fujitsu	PRIMEPOWER 2000 c/s w 66 Front-Ends	5	455818.2	26.58	12025524	Sun Solaris 8	Fujitsu SPARC64 GP 563MHz
22	IBM	IBM eServer p5 570 8P	5.3	429899.7	4.99	2147035	IBM AIX 5L V5.3	IBM POWER5 1.9GHz
23	HP	HP 9000 Model Superdome Enterprise Server	5	423414.4	15.64	6621072	HP UX 11.i 64-bit	HP PA-RISC 8700 875MHz
24	Bull	Bull Escala PL3200R	5	403255.5	17.96	7245205	IBM AIX 5L V5.2	IBM Power 4 1300 MHz
25	HP	HP 9000 Superdome Enterprise Server	5	389434.4	16.41	6388889	HP UX 11.i 64-bit	HP PA-RISC 8700 750MHz
26	Unisys	Unisys ES7000/600 Enterprise Server (16P)	5.4	376045.0	3.97	1490375	Microsoft Windows Server 2003 Dat	Intel Xeon MP 3.33GHz
27	IBM	IBM eServer p570 8P	5.3	371044.2	5.26	1951215	IBM AIX 5L V5.3	IBM POWER5 1.9GHz
28	HP	HP Integrity rx8620	5.4	332265.9	4.48	1489153	Microsoft Windows Server 2003 Dat	Intel Itanium2 1.6GHz
29	Unisys	Unisys ES7000 Aries 420 Enterprise Server	5.4	327829.0	4.4	1441771	Red Hat Enterprise Linux AS 4.0	Intel Itanium2 1.6GHz
30	Unisys	Unisys ES7000 Aries 420 Enterprise Server	5.4	322805.0	4.48	1442995	Suse Linux Enterprise Server 9	Intel Itanium2 1.6GHz
31	Unisys	Unisys ES7000 Aries 420 Enterprise Server	5.1	309036.5	4.49	1384981	Microsoft Windows Server 2003 Dat	Intel Itanium2 1.5GHz
32	Unisys	Unisys ES7000 Orion 540 Enterprise Server	5.2	304148.5	6.18	1877165	Microsoft Windows Server 2003 Dat	Intel Xeon MP 2.8GHz
33	HP	HP rx8620	5.1	301225.0	4.56	1372435	Microsoft Windows Server 2003 Dat	Intel Itanium2 1.5GHz
34	Unisys	Unisys ES7000 Aries 420 Enterprise Server	5.2	291413.0	4.98	1448706	Microsoft Windows Server 2003 Dat	Intel Itanium2 1.5GHz
35	Unisys	Unisys ES7000 Orion 540 Enterprise Server	5.1	252920.5	7.22	1824732	Microsoft Windows Server 2003 Dat	Intel Xeon MP 2.8GHz
36	Unisys	Unisys ES7000/600 Enterprise Server (8P)	5.4	251691.0	3.64	915523	Microsoft Windows Server 2003 Ente	Intel Xeon MP 3.33GHz
37	**IBM**	**IBM eServer xSeries 460 8P c/s**	**5.3**	***250975.0***	**5.74**	**1440290**	**Microsoft Windows Server 2003**	**Intel Xeon MP 3.33GHz**
38	NEC	NEC Express5800/1160Xe	5.3	247650.0	5.48	1356338	Microsoft Windows Server 2003 Dat	Intel Itanium2 1.6GHz
39	**IBM**	**IBM eServer xSeries 460 8P c/s**	**5.4**	***241300.0***	**5.98**	**1442075**	**Microsoft Windows Server 2003**	**Intel Xeon MP 3.33GHz**
40	Unisys	Unisys ES7000 Orion 540 Enterprise Server	5.2	237869.0	5.08	1207108	Microsoft Windows Server 2003 Dat	Intel Xeon MP 3.0GHz
41	Unisys	Unisys ES7000 Orion 230 Enterprise Server	5	234325.1	11.59	2715310	Microsoft Windows Server 2003 Dat	Intel Xeon MP 2.0 GHz
42	HP	Compaq AlphaServer GS320	5	230533.0	44.62	10286029	Compaq Tru64 UNIX V5.1	Alphachip 21264A 1001MHz
43	Fujitsu	PRIMEPOWER 2000 c/s w /32 Front Ends	5	222772.3	42.42	9671742	Sun Solaris 8	Sun SPARC64 GP 563MHz
44	**IBM**	**IBM eServer xSeries 366 4P c/s**	**5.5**	***221017.0***	**8.27**	**1827784**	**Microsoft Windows Server 2003**	**Intel Dual-Core Xeon Precessor 7040/3.0GHz**
45	Bull	Bull Escala EPC2450 c/s	5	220807.3	34.67	7657157	IBM AIX 4.3.3	IBM RS64-IV 600 MHz
46	IBM	IBM eServer pSeries 680 Model 7017-S85	5	220807.3	29.3	6469929	IBM AIX 4.3.3	IBM RS64 IV 600 MHz
47	IBM	IBM eServer xSeries 445 16P c/s	5.2	215485.9	8.72	1879684	Microsoft Windows Server 2003 Dat	Intel Xeon MP 3.0GHz
48	Unisys	Unisys ES7000 Orion 540 Enterprise Server	5.2	212511.0	4.72	1001940	Microsoft Windows Server 2003 Dat	Intel Xeon 2.20 GHz
49	HP	HP ProLiant DL585-G1/2.4GHz/DC/4P	5.5	*206181.0*	2.3	472539	Microsoft Windows Server 2003 Ente	AMD Opteron 2.4GHz Dual Core 1MB L2
50	Unisys	Unisys ES7000 Orion 230 Enterprise Server	5	203518.0	13.18	2681773	Microsoft Windows Server 2003 Dat	Intel Xeon MP 1.6GHz
51	IBM	IBM eServer p5 570 4P	5.3	203439.9	3.93	799990	IBM AIX 5L V5.3	IBM POWER5 1.9GHz
52	HP	HP ProLiant DL585-G1 128GB/2.4GHz/DC/4P	5.4	*202551.0*	2.4	484822	Microsoft Windows Server 2003 Ente	AMD Opteron 2.4GHz Dual Core 1MB L2

HP AMD Dual Core DL585

Ordered by TPCc results

(as of 23 Nov 2005) taken from www.tpc.org.

Performance TPCc Single core vs Single Core

HP AMD Single Core DL585

63	IBM	IBM eServer xSeries 445 8P c/s	5.2	156105.7	4.31	672287	Microsoft Windows Server 2003	Intel Xeon MP 3.0GHz
64	HP	Compaq AlphaServer GS320 Model 6/731	5	155179.3	52.88	8205964	Compaq Tru64 UNIX V5.1	AlphaChip 21264A 731
65	IBM	eServer xSeries 440 c/s	5.1	151744.1	11.03	1674017	Microsoft Windows Server 2003	Intel Xeon MP 2.0 GH
66	IBM	IBM eServer xSeries 366 4P c/s	5.3	150704.0	6	904617	Microsoft Windows Server 2003	Intel Xeon MP 3.66 G
67	HP	HP ProLiant DL760G2/64GB/3.0GHz/8P	5.3	143367.0	3.96	567702	Microsoft Windows Server 2003 Ente	Intel Xeon 3.0GHz
68	IBM	IBM eServer xSeries 366 4P c/s	5.3	141504.0	7.02	993179	Microsoft Windows Server 2003 Ente	Intel Xeon MP 3.66 GHz
69	Unisys	Unisys e-@ction Enterprise Server ES7000	5	141138.4	23.84	3363483	Microsoft Datacenter Server Limited E	Intel Pentium III Xeon 900 MHz
70	HP	hp server rp8400	5	140240.0	14.37	2015289	HP UX 11.i 64-bit	HP PA-RISC 8700 750MHz
71	IBM	IBM eServer xSeries 445 8P c/s	5.1	139154.0	5.07	705115	Microsoft Windows Server 2003 Dat	Intel Xeon MP 2.8GHz
72	HP	HP ProLiant DL585/2.8GHz/64GB/4P	5.4	138845.0	3.04	422068	Microsoft Windows Server 2003 Ente	AMD Opteron 2.8GHz 1MB L2
73	HP	HP Integrity rx5670 Linux	5.1	136111.0	3.94	556853	Red Hat Enterprise Linux AS 3	Intel Itanium 2 Processor 6M 1.5GHz
74	HP	HP ProLiant DL585/2.6GHz/64GB/4P	5.3	130623.0	2.8	364539	Microsoft Windows Server 2003 Ente	AMD Opteron 2.6GHz
75	HP	HP ProLiant DL585-G1 64GB/2.4GHz/4P	5.3	123027.0	2.94	360470	Microsoft Windows Server 2003 Ente	AMD Opteron 2.4GHz
76	HP	hp server rx5670	5.1	121065.1	4.49	543023	Microsoft Windows Server 2003 Ente	Intel Itanium 2 Processor 6M 1.5GHz
77	Unisys	Unisys ES7000 Aries 520 Enterprise Server	5.1	118381.4	5.56	657533	Microsoft Windows Server 2003 Dat	Intel Xeon MP 2.0 GHz
78	HP	HP ProLiant DL585 32GB/2.4GHz/4P	5.3	115110.0	2.62	301430	Microsoft Windows Server 2003 Ente	AMD Opteron 2.4GHz
79	HP	HP Proliant DL760-G2 8P	5	115025.8	7.69	884216	Microsoft Windows Server 2003 Dat	Intel Xeon MP 2.0 GHz
80	NetworkA	Fujitsu PRIMEPOWER 850	5	112286.5	13.44	1508712	Sun Solaris 8	Fujitsu SPARC64 GP 675MHz
81	HP	HP ProLiant DL385-G1 32GB/2.4GHz/DC/2P	5.4	109633.0	2.73	298216	Microsoft Windows Server 2003 Ente	AMD Opteron 2.4GHz Dual Core 1MB L
82	HP	ProLiant BL45p - 4P	5.4	108574.0	3.34	362172	Microsoft Windows Server 2003 EE-S	AMD Opteron 2.6GHz
83	HP	HP ProLiant BL25p - 2P DC	5.4	107010.0	2.93	313003	Microsoft Windows Server 2003 Ente	AMD Opteron 2.4GHz Dual Core 1MB L
84	HP	HP ProLiant DL585 32GB/2.2GHz/4P	5.3	105687.0	3.23	341155	Microsoft Windows Server 2003 Ente	AMD Opteron 2.2GHz
85	Bull	Bull Escala PL800R	5	105025.0	25.41	2668861	IBM AIX 4.3.3	IBM RS64 IV 750MHz
86	IBM	IBM eServer pSeries 660 Model 6M1	5	105025.0	23.45	2462401	IBM AIX 4.3.3	IBM RS64 IV 750MHz
87	IBM	IBM eServer xSeries 365 4P c/s	5.2	102667.4	3.52	361742	Microsoft Windows Server 2003 Ente	Intel Xeon MP 3.0GHz
88	HP	HP ProLiant DL580G2/3.0GHz-4P	5.2	95163.0	2.93	278114	Microsoft Windows Server 2003 Ente	Intel Xeon MP 3.0GHz
89	IBM	IBM eServer xSeries 445 4P c/s	5.1	90271.8	3.97	357969	Microsoft Windows Server 2003 Ente	Intel Xeon MP 2.8GHz
90	IBM	IBM eServer xSeries 365 4P c/s	5.1	89616.3	3.72	333788	Microsoft Windows Server 2003 Ente	Intel Xeon MP 2.8GHz
91	HP	rx5670	5	87741.0	5.03	441022	Microsoft Windows Server 2003 Ente	Intel Itanium2 1 Ghz
92	HP	HP ProLiant DL580 G2/2.7GHz-4P	5.3	85554.0	3.58	305635	Microsoft Windows Server 2003 Ente	Intel Xeon MP 2.7GHz
93	HP	HP Proliant DL580G2/2.8GHz-4P	5.1	84712.9	3.83	324423	Microsoft Windows Server 2003 Ente	Intel Xeon MP 2.8GHz
94	Fujitsu	PRIMERGY T850	5	84598.4	1262	1.07E+08	Microsoft Windows Server 2003 Ente	Intel Xeon MP 1.6GHz
95	Fujitsu Sie	PRIMERGY T850	5	84598.4	6.96	589195	Microsoft Windows Server 2003 Ente	Intel MP 1.6GHz

HP's highest shown Intel Single Core Intel

Ordered by TPCc results

(as of 23 Nov 2005) taken from www.tpc.org.

x3950 Product Roadmap

2-32-socket Potomac

Intel 64-bit Xeon MP
- 3.33 GHz, 8MB L3
- 3.16 GHz, 8MB L3
- 2.83 GHz, 4MB L3
- 667 MHz FSB

8-socket: 2x4-CPUs (6U)
16-socket: 4x4-CPUs (12U)
32-socket: 8x4-CPUs (16U)
XA-64e 3rd Generation Chipset
3rd Generation Active Memory
- Chipkill, Mirroring, Hot-swap/add

Up to 512GB DDR2 ECC SDRAM
256MB XceL4v per CEC, Up to 2GB
6 Active PCI-X 2.0 Slots per chassis
Up to 6 2.5” Hot-swap SAS HDD
Optional RAID-5 (ServeRAID 8i)
Remote Supervisor Adapter 2 Slimline
Dual Gigabit Ethernet (Broadcom)
Copper Diagnostics™
3U Rack-optimized chassis
Dual HS 1300W Power Supplies

2-32-socket Paxville

Intel 64-bit Xeon MP
- **>3.0GHz, 2MB L2**
- **Dual-core**
- 667 MHz FSB

8-socket: 2x4-CPUs (6U)
16-socket: 4x4-CPUs (12U)
32-socket: 8x4-CPUs (16U)
XA-64e 3rd Generation Chipset
- **No Chipset changes required**

3rd Generation Active Memory
- Chipkill, Mirroring, Hot-swap/add

Up to 512GB DDR2 ECC SDRAM
256MB XceL4v per CEC, Up to 2GB
6 Active PCI-X 2.0 Slots per chassis
Up to 6 2.5” Hot-swap SAS HDD
Optional RAID-5 (ServeRAID 8i)
Remote Supervisor Adapter 2 Slimline
Dual Gigabit Ethernet (Broadcom)
Copper Diagnostics™
3U Rack-optimized chassis
Dual HS 1850W Power Supplies

2-32-socket Tulsa

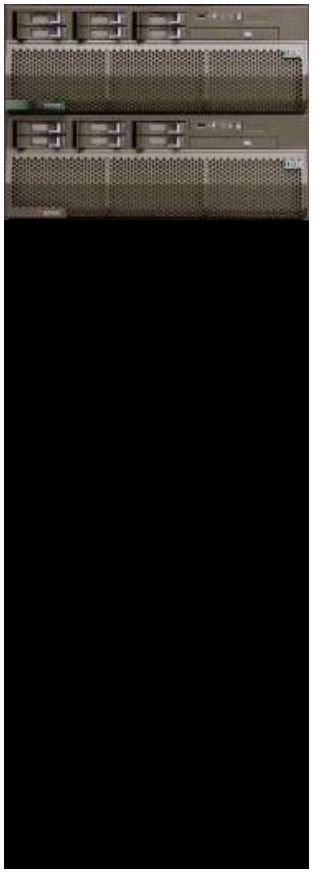
2-way to 32-way 64-bit Xeon MP
- **>3.6GHz, 2M L2, 16MB L3**
- Dual-core
- 667 MHz FSB

8-socket: 2x4-CPUs (6U)
16-socket: 4x4-CPUs (12U)
32-socket: 8x4-CPUs (16U)
XA-64e 3rd Generation Chipset
- **Native PCI-E South Bridge**

3rd Generation Active Memory
- Chipkill, Mirroring, Hot-swap/add

Up to 512GB DDR2 ECC SDRAM
256MB XceL4v per CEC, Up to 2GB
4 Active PCI-E slots per chassis
2 Active PCI-X 2.0 slots per chassis
Up to 6 2.5” Hot-swap SAS HDD
Optional RAID-5 (ServeRAID 8i)
Remote Supervisor Adapter 2 Slimline
Dual Gigabit Ethernet (Broadcom)
- **TOE + iSCSI + RDMA**

Copper Diagnostics™
3U Rack-optimized chassis
Dual HS 1850W Power Supplies
Fully ROHS Compliant



2Q 2005 | **4Q 2005 - 1Q2006** | **3Q 2006**

IBM BladeCenter®

ScaleOut Flexibility & Server Consolidation

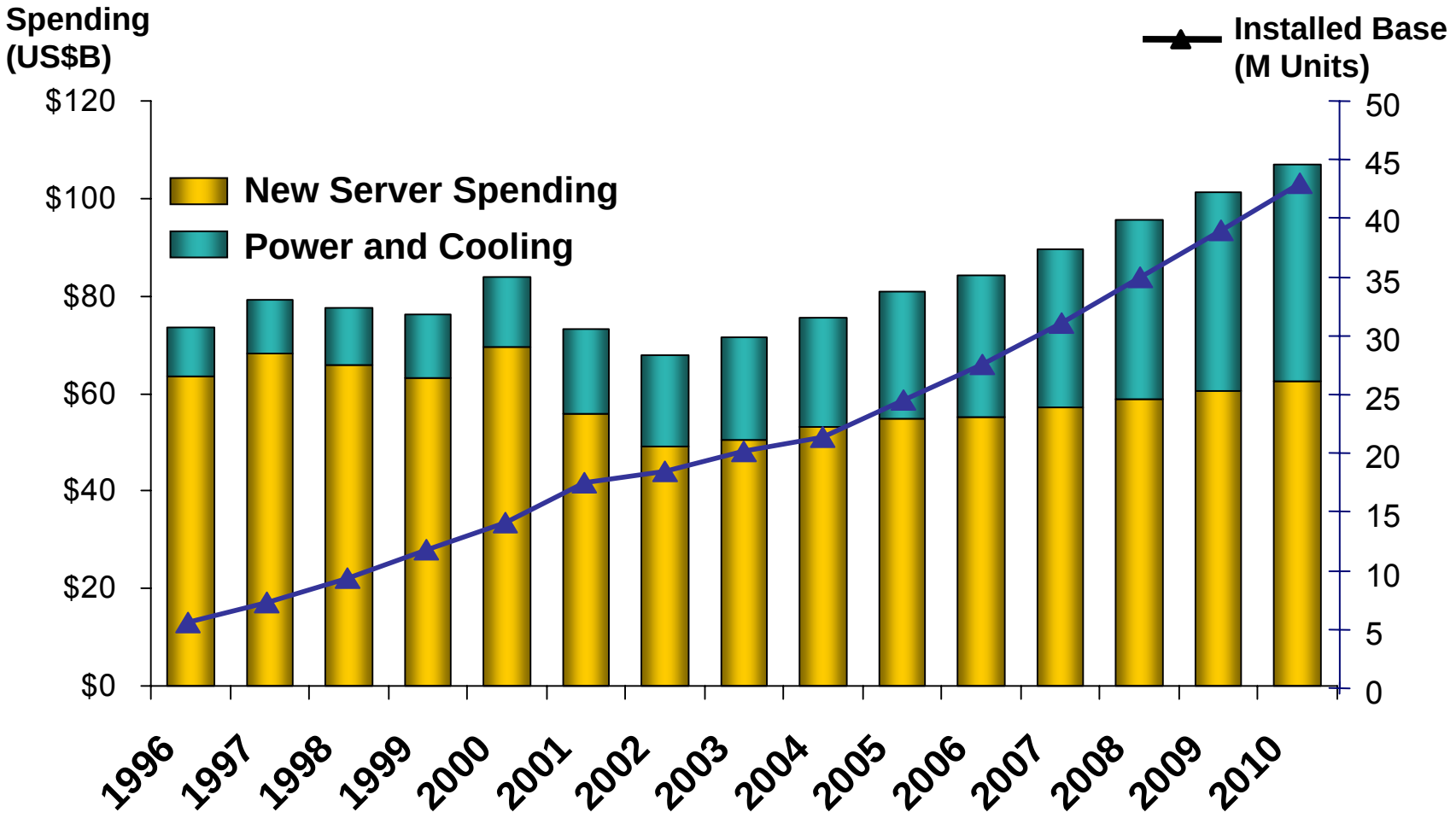
What problems should blades address?

A properly designed blade should:

- Reduce power consumption
- Be easier and less costly to cool (less heat and less air flow)
- Reduce weight over 1U/2U alternatives
- Drive out costs and reduce TCO
- Reduce points of failure and increase RAS (reliability, scalability, serviceability)
- Increase manageability
- Speed deployment
- Drive out cable complexity
- Be flexible enough to match current infrastructures and fabrics
- Be able to run all your applications and OS varieties not just Linux/Windows
- Reduce the ‘churn’ needed to bring on new technology
- Increase density

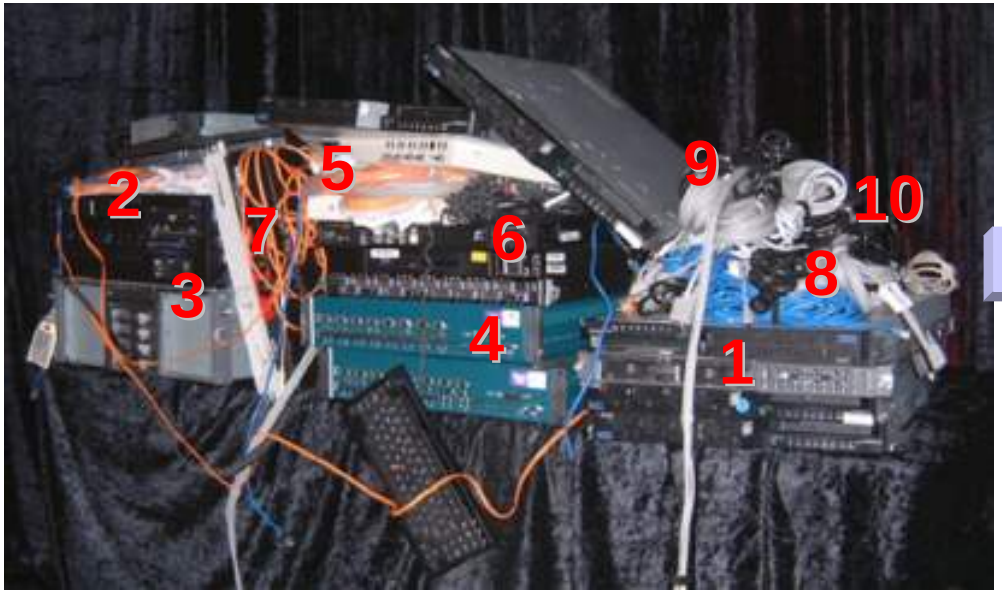
Turning a 1U on its side is not going to sort out many of these issues

Worldwide Server Market (IDC)



IDC Presentation, The Impact of Power and Cooling on Data Center Infrastructure, Doc #201722, May 2006

Simplifying Datacenter Topology



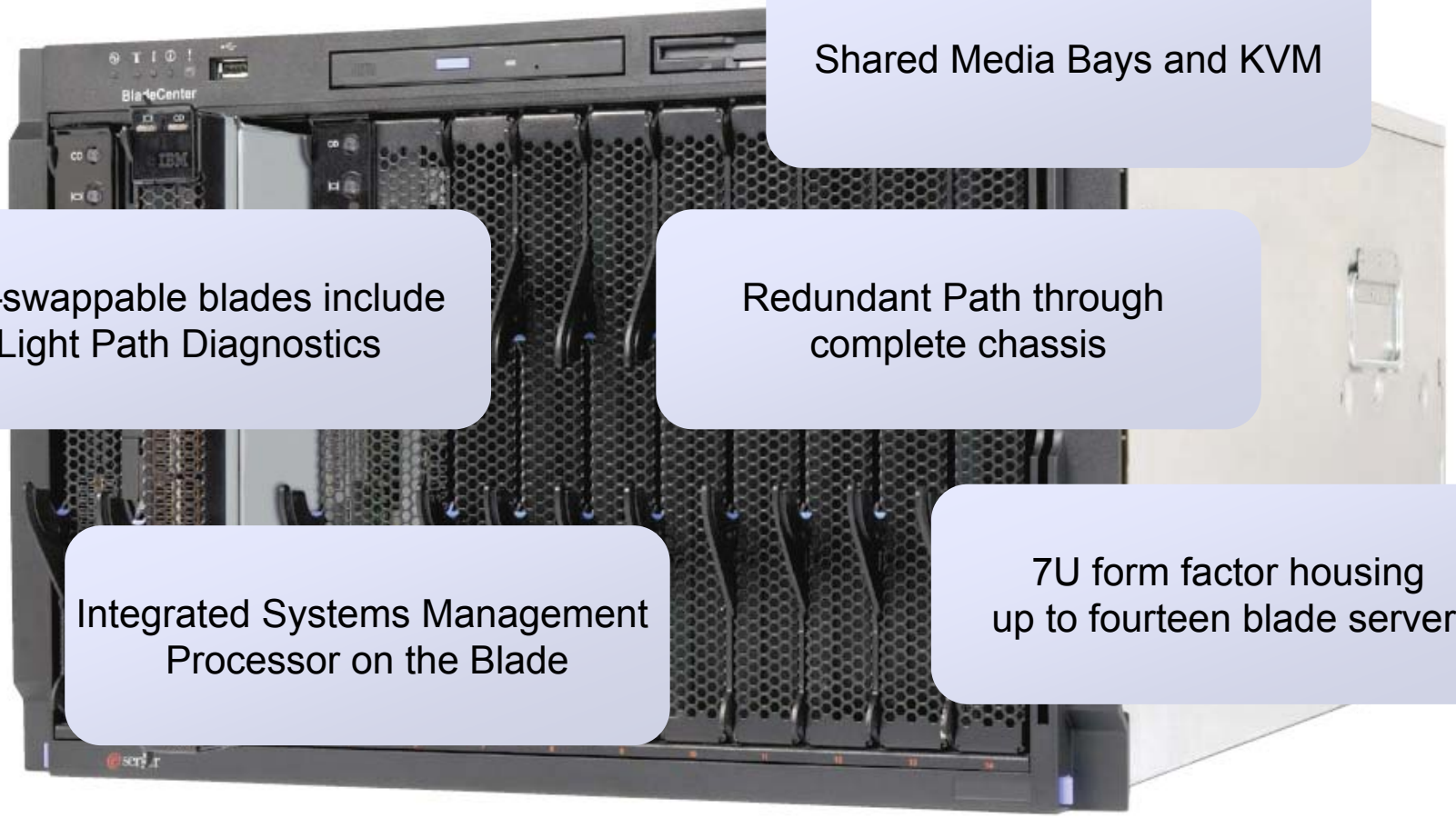
Typical Datacenter Configuration

1. Ten x86 1U 2-way servers
2. RISC-based 2-way server
3. HPQ 4-way server
4. Alteon L7 E'net switches
5. FC SAN switches / Cables
6. Layer 2 GbE switches
7. KVM switches
8. Ethernet cables
9. KVM cables
10. Power cables

Bladed Datacenter Configuration

IBM eServer BladeCenter

BladeCenter – Front View



Shared Media Bays and KVM

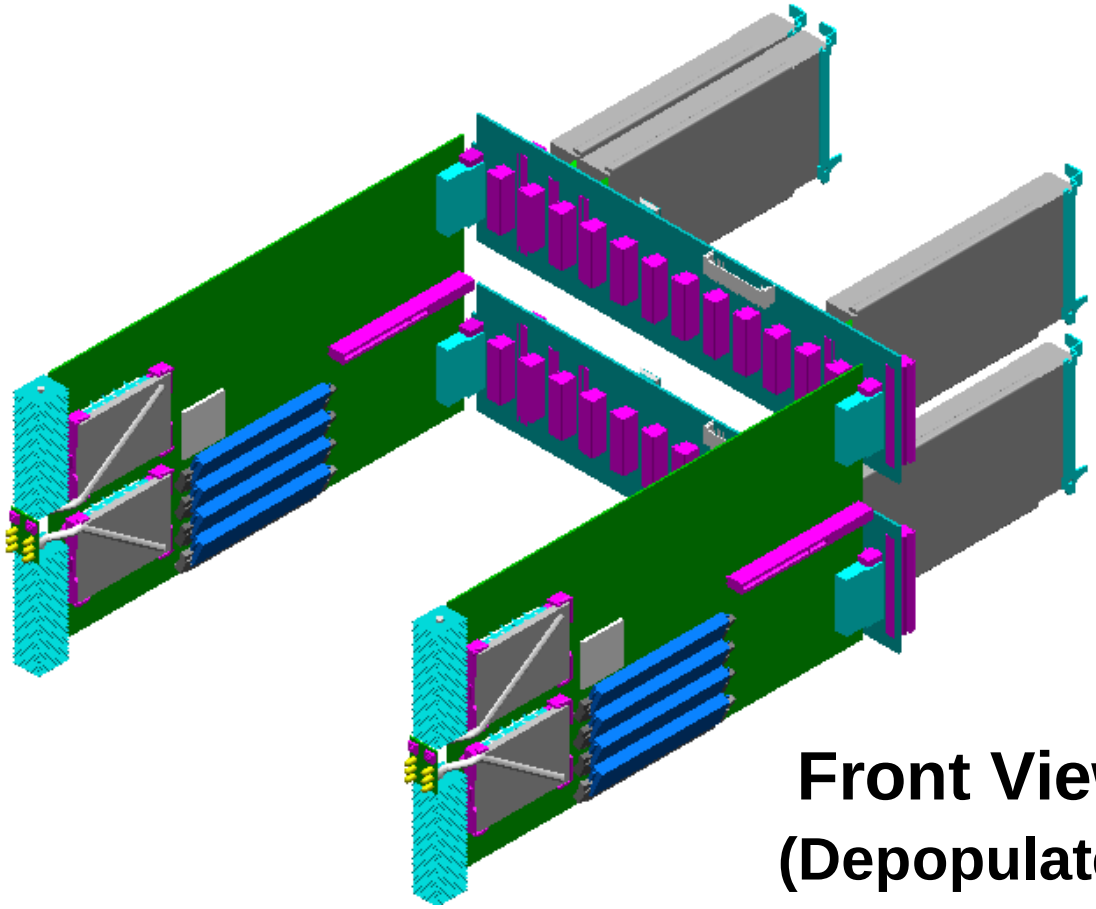
Hot–swappable blades include Light Path Diagnostics

Redundant Path through complete chassis

Integrated Systems Management Processor on the Blade

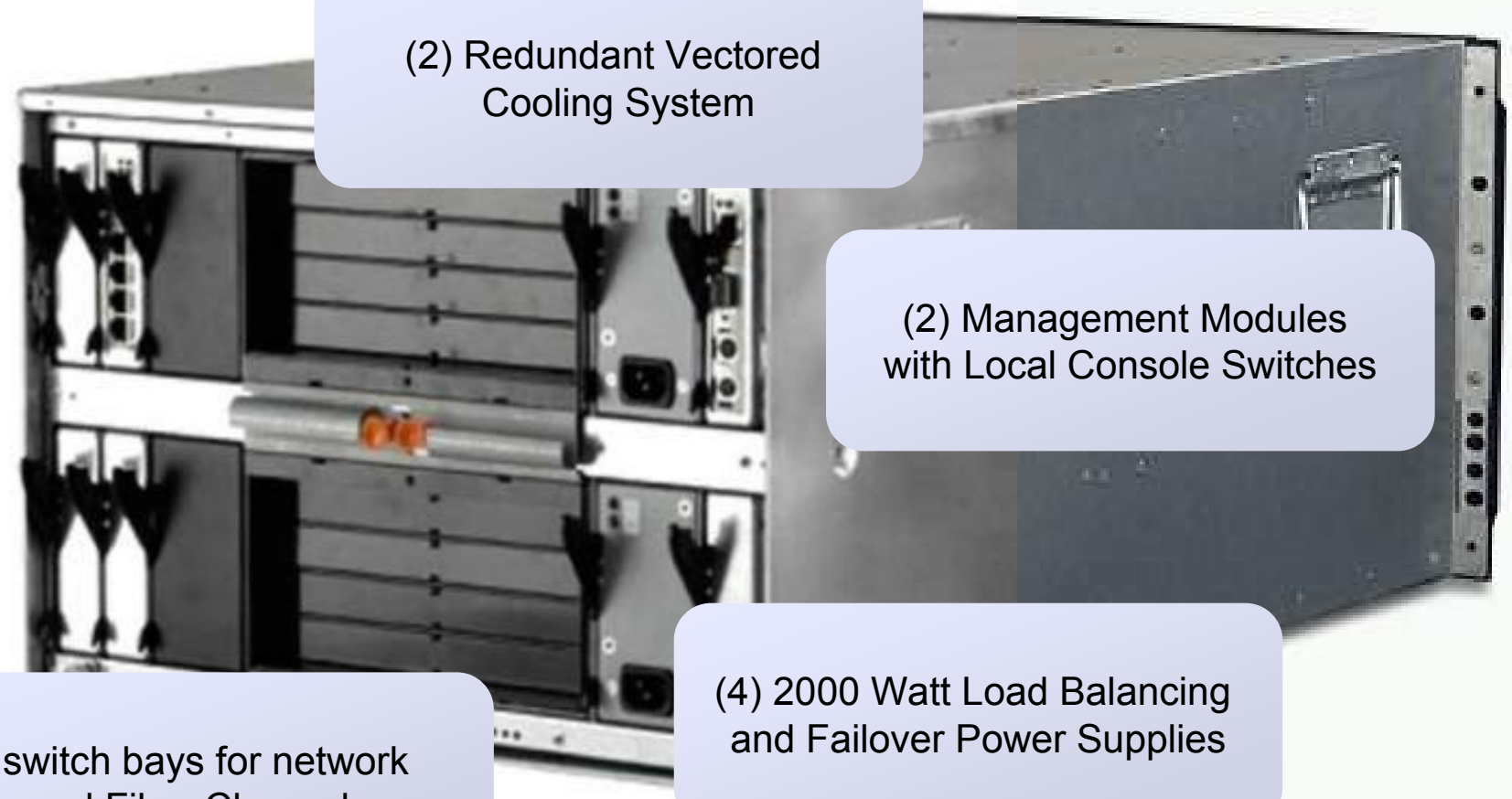
7U form factor housing up to fourteen blade servers

BladeCenter – dual path Midplane



Front View
(Depopulated)

BladeCenter – Back View



(2) Redundant Vectored Cooling System

(2) Management Modules with Local Console Switches

(4) 2000 Watt Load Balancing and Failover Power Supplies

4 switch bays for network and Fibre Channel

IBM BladeCenter - Three Products, One Family

Expanding clients ability to 'BladeCenter'

March 2004

BladeCenter T
Highly rugged, Telco, AC/DC, long life, NEBS, Air Filtration Gb Ethernet, fibre

Telco/Core Applications, Government, Military, Rugged Industrial, DC medical

Nov 2002

BladeCenter
Highest density, lowest cost, super power efficient, consolidated management

Web hosting/serving, SUN Solaris to x86/Linux, FSS, File/Print, Geophysical analysis, Collaboration, Graphic rendering, Retail.

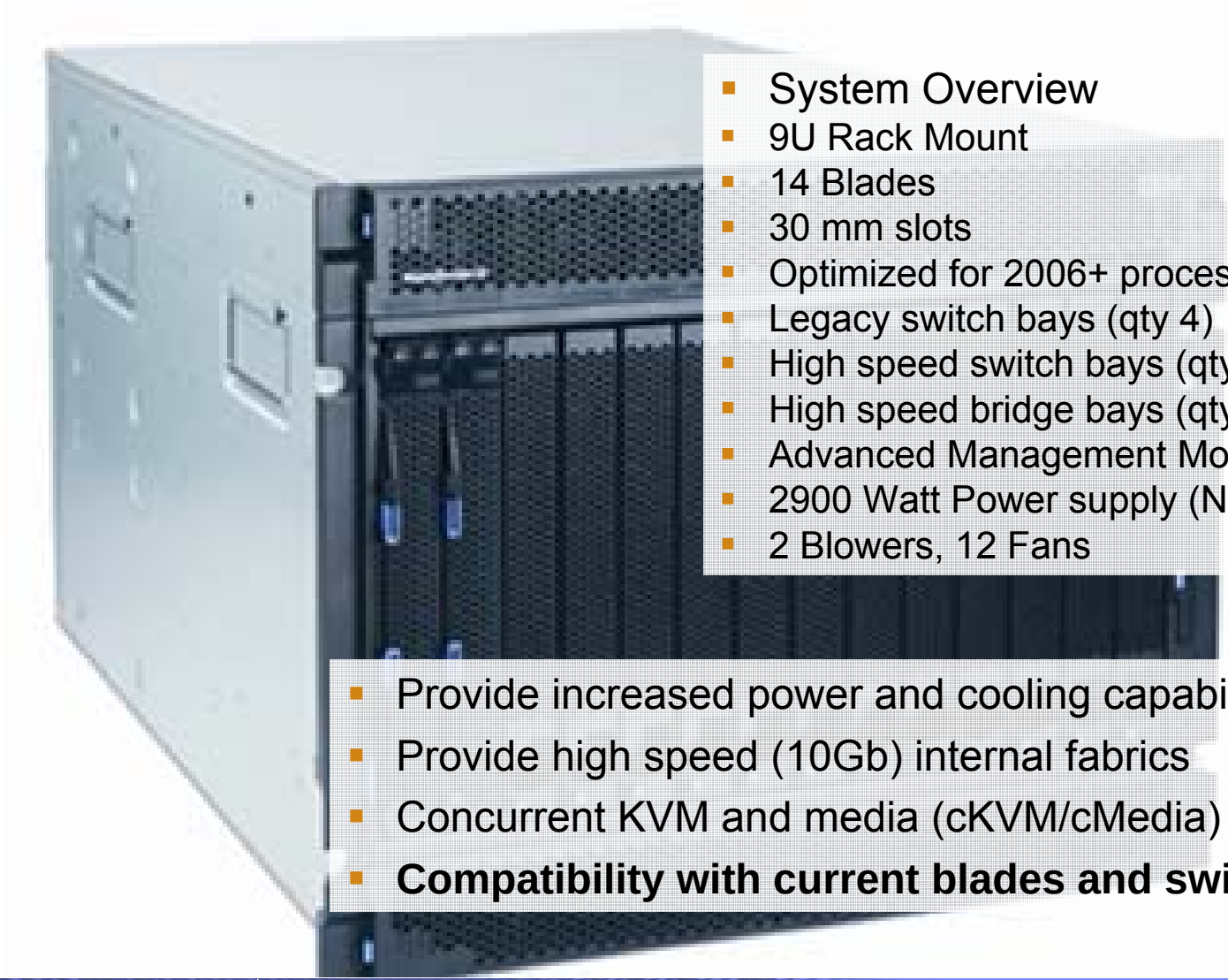
Feb 2006

BladeCenter H
Ultra high performance, 4X IB backplane, virtualization, future proof power and cooling, New management module

High Performance Computing, Technical Clusters, Virtualized Enterprise Solutions, Future I/O.

Common Blades, Common Switches

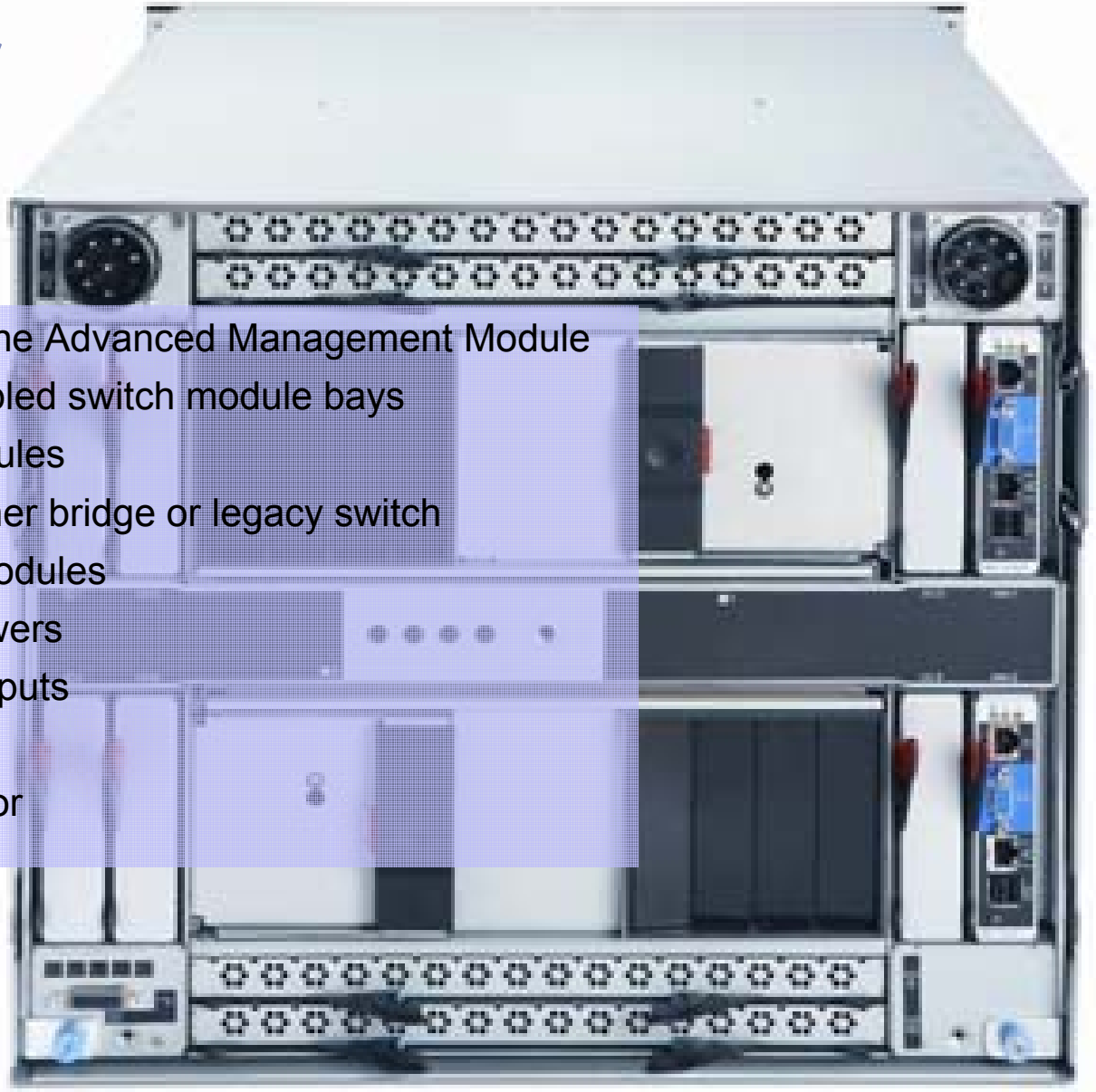
IBM introduces the BladeCenter H



- System Overview
- 9U Rack Mount
- 14 Blades
- 30 mm slots
- Optimized for 2006+ processors
- Legacy switch bays (qty 4)
- High speed switch bays (qty 4)
- High speed bridge bays (qty 4)
- Advanced Management Module
- 2900 Watt Power supply (N+N redundant)
- 2 Blowers, 12 Fans

- Provide increased power and cooling capability over BC-1
- Provide high speed (10Gb) internal fabrics
- Concurrent KVM and media (cKVM/cMedia) capabilities
- **Compatibility with current blades and switches**

BladeCenter H Tour
A Look At The Back



- Two MM slots supporting the Advanced Management Module
- Up to four high speed enabled switch module bays
- Two dedicated bridge modules
- Two shared modules – either bridge or legacy switch
- Up to four legacy switch modules
- Redundant, Hot-Swap blowers
- Two consolidated power inputs
- Light path diagnostic panel
- Aggregated serial connector

BladeCenter H Tour

A Look At The Front

- 9U, 28 in deep
- Supports up to (14) 30mm Blades (same as BC)
- Customer serviceable , hot swappable Media Tray direct docs to mid plane
- 9.5mm combo drive (CD/DVD)
- 2 USB front inputs
- Full Light Path Diagnostics panel
- Rack mounted on rails just as current BladeCenter
- Four front load 2900W Power Supplies
- Each power supply includes a replaceable fan pack with 3 fans (60 mm x 38 mm)

Power Supply overview BCH

- **Power Module Bays**
  - Maximum of four per chassis
  - Two ship standard with the chassis
  - Other two come as a single option part number

- **Power domains**
  - BladeCenter H chassis deploys same ‘domain style’ power topology
  - Having two domains reduces the chance that any catastrophic failure can take out all four power supplies as might be seen in a topology where all supplies are on same bus

BladeCenter AC Power Topology

- New power simplifies power inputs for BladeCenter
  - Allows several power cord input options
  - Solution will vary based on number of chassis being installed
- Differs with WW location of solution set up - several Geo/Region specific options
- Connector on the back of the BladeCenter assures that the cable can not be installed incorrectly
- These cables work in the same fashion as the connectors on many of the IBM PDU family
  - Customer serviceable
  - Easy to install and remove
  - Same chassis WW

This end of the cable allow a single chassis to work WW.

Different voltages

Different ratings

WW Safety certifications

BladeCenter AC Power Input Cables (pictures)

- Several options available WW
- Cables can be of mixed variety to meet unique needs

TRIPLE 16A IEC 320-C20 (200-240V) 2.8M 	DOUBLE 30A KSC 8305 (S. KOREA) (220V) 4.3M 
DOUBLE 30A NEMA L6-30P (208V) 4.3M 	DUAL 32A IEC 309 P+N+G/16A IEC 320-C20 OR DUAL 32A AS/NZS 3112/16A IEC 320-C20 (AUS/NZ) Both (230V) 4.3M 

Media Tray Overview BCH

- **Customer Serviceable Media Tray**
  - New half blade design media tray slides in and is serviceable similar to a blade
  - Direct wired to the mid-plane
  - Can be removed without impacting operation of chassis
  - Tray contains
    - 2 External USB connectors, 1 Internal connector
    - Full Light Path Diagnostic Panel
    - 9.5mm DVD

Developing the BladeCenter Ecosystem

- Wide range of companies convinced that BladeCenter architecture will add value to their customers' solutions
- Industry-leading technology companies delivering innovative business solutions running on Windows, Linux, Novell
- More choice for customers

SAN Switch/Optical Module Portfolio

Expanding the Ecosystem and building partnerships

IBM eServer BladeCenter Optical Pass-thru Module

- Supplier: IBM
- Provides unswitched/unblocked optical connection
- Up to 14-optical connections to external SAN (requires breakout cable option)

QLogic™ Enterprise 6-port Fibre Channel Switch Module

- Supplier: QLogic
- Equivalent to SANbox 5200
- 6-1/2Gb Auto sensing external ports
- Supports performance monitoring and advanced zoning
- FC-SW-2 Compliant

Brocade® Entry SAN Switch Module

- Supplier: Brocade
- Equivalent to Silkworm 3900
- 2-1/2Gb Auto sensing external ports
- Supports (2) Domain IDs
- Supports Brocade Advanced Feature Key options

McDATA® 6-port Fibre Channel Switch Module

- Supplier: QLogic/McDATA
- Equivalent functionality to McDATA Sphereon 4500
- 6-1/2Gb Auto sensing external ports
- Supports McDATA Advanced Feature Key options

Brocade® Enterprise SAN Switch

- Supplier: Brocade
- Equivalent to Silkworm 3900
- 2-1/2Gb Auto sending external ports
- Supports Brocade Advanced Feature Key options

A full suite of integrated offerings to provide flexibility and choice!

NOTE: List prices as of 11/30/2004

2006 Ethernet Switching Portfolio

Server Connectivity Module for IBM BladeCenter

- Supplier: IBM
- Layer 2 Switching
- VLANS
- Simplified Configuration
- Avail: May 2006

Nortel Layer 2/3 Gb Ethernet Switch Modules

- Supplier: Nortel
- OS: AOS
- 6-port copper/fiber
- Layer 2 Switching
- Multiple STP
- Layer 3 Routing
- Avail: Now

Cisco Systems ® Intelligent Gb Ethernet Switch Module

- Supplier: Cisco
- OS: IOS
- Layer 2 Switching
- Layer 3/4 services
- Avail: Now

Nortel ® L2-7 GbE Switch Module

- Supplier: Nortel
- Layer 2 - 7
- OS: AOS
- Load Balancing
- Routing / Switching
- Advanced Filtering
- Content Intelligence
- Avail: Now

Nortel® L2/3 10GbE Uplink Switch Module

- Supplier: Nortel
- OS: AOS
- Layer 2 Switching
- Multiple STP
- Layer 3 Routing
- (1) 10 Gb MM Fiber Ports
- (2) 10 Gb Copper Ports
- June 2006

A full suite of integrated offerings to provide flexibility and choice!

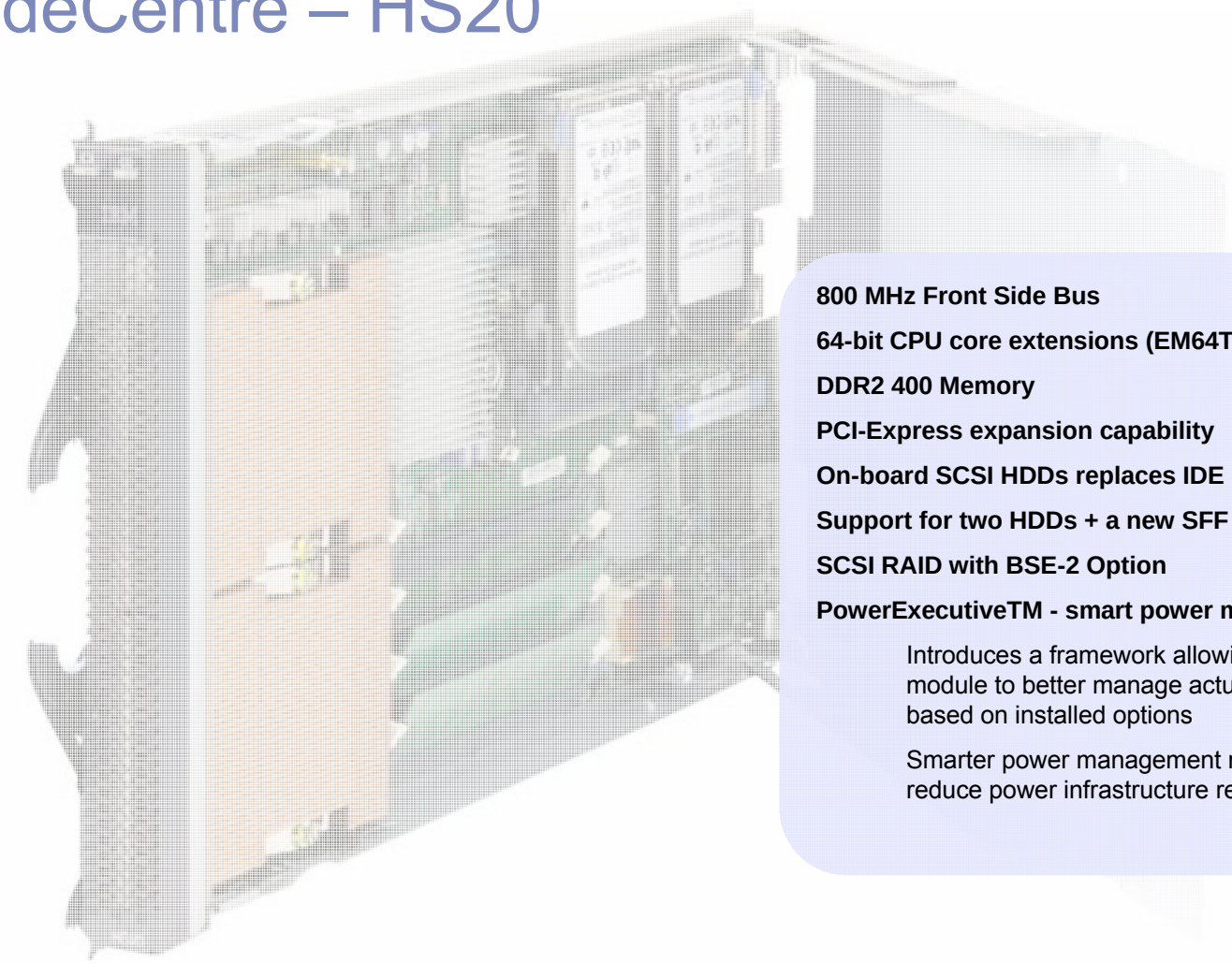
The BladeCentre portfolio continues to build . . .

	HS21 Xeon	JS21 Power	LS21 AMD	LS41 AMD	QS20 Cell
Features	▪ Intel Xeon DP ▪ EM64T ▪ Mainstream rack dense blade ▪ High availability apps ▪ Optional HS HDD	▪ Two PowerPC® 970 processors ▪ 32-bit/64-bit solution for Linux & AIX 5L™ ▪ Performance for deep computing clusters	▪ Two socket Opteron ▪ Dual core Rev F ▪ Similar feature set to HS21	▪ Four socket Opteron ▪ Dual core Rev F ▪ Similar feature set to HS21 ▪ LS41 Double width with double perf.	▪ Dual 3.2GHz Cell BE ▪ ~410 GFLOPS peak ▪ Double Wide ▪ Infiniband (IB) Option
Target Apps	▪ Edge and mid-tier workloads ▪ Collaboration ▪ Web serving	▪ 32-bit/64-bit HPC ▪ UNIX server consolidation ▪ Virtualisation	▪ 32- or 64-bit ▪ HPC stellar performer	▪ 32- or 64-bit ▪ HPC stellar performer	▪ breakthrough competitive performance requirements




Common Chassis and Infrastructure

BladeCentre – HS20



800 MHz Front Side Bus

64-bit CPU core extensions (EM64T)

DDR2 400 Memory

PCI-Express expansion capability

On-board SCSI HDDs replaces IDE

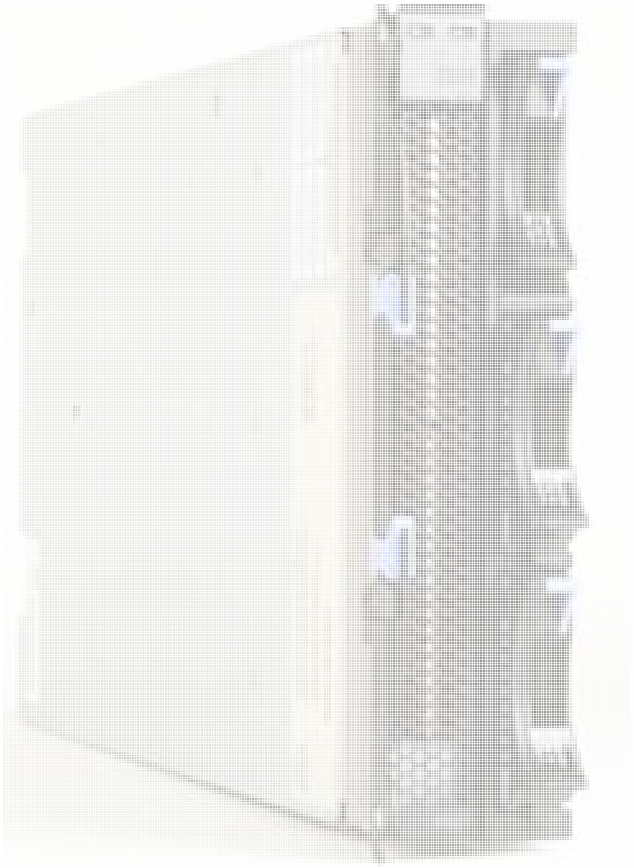
Support for two HDDs + a new SFF Daughter Card

SCSI RAID with BSE-2 Option

PowerExecutiveTM - smart power management

- Introduces a framework allowing the management module to better manage actual power consumption based on installed options
- Smarter power management methods help customers reduce power infrastructure requirements

BladeCentre – HS21



Intel Dual IA-32e Woodcrest (1333/1066) CPUs

Supported in BC1, BC-H, BCT

2 SFF 2.5" SAS HDDs supported on blade (non-hot-swap)

Memory - Four channel FBD DDR2 - 533 or 667 MHz

4 DIMM slots/2 channels

1 High-speed x8 PCI-E daughter card slot (combined w/ BSE3 slot)

1 PCI-X legacy daughter card slot 133 MHz (supports StFF, SFF daughter cards)

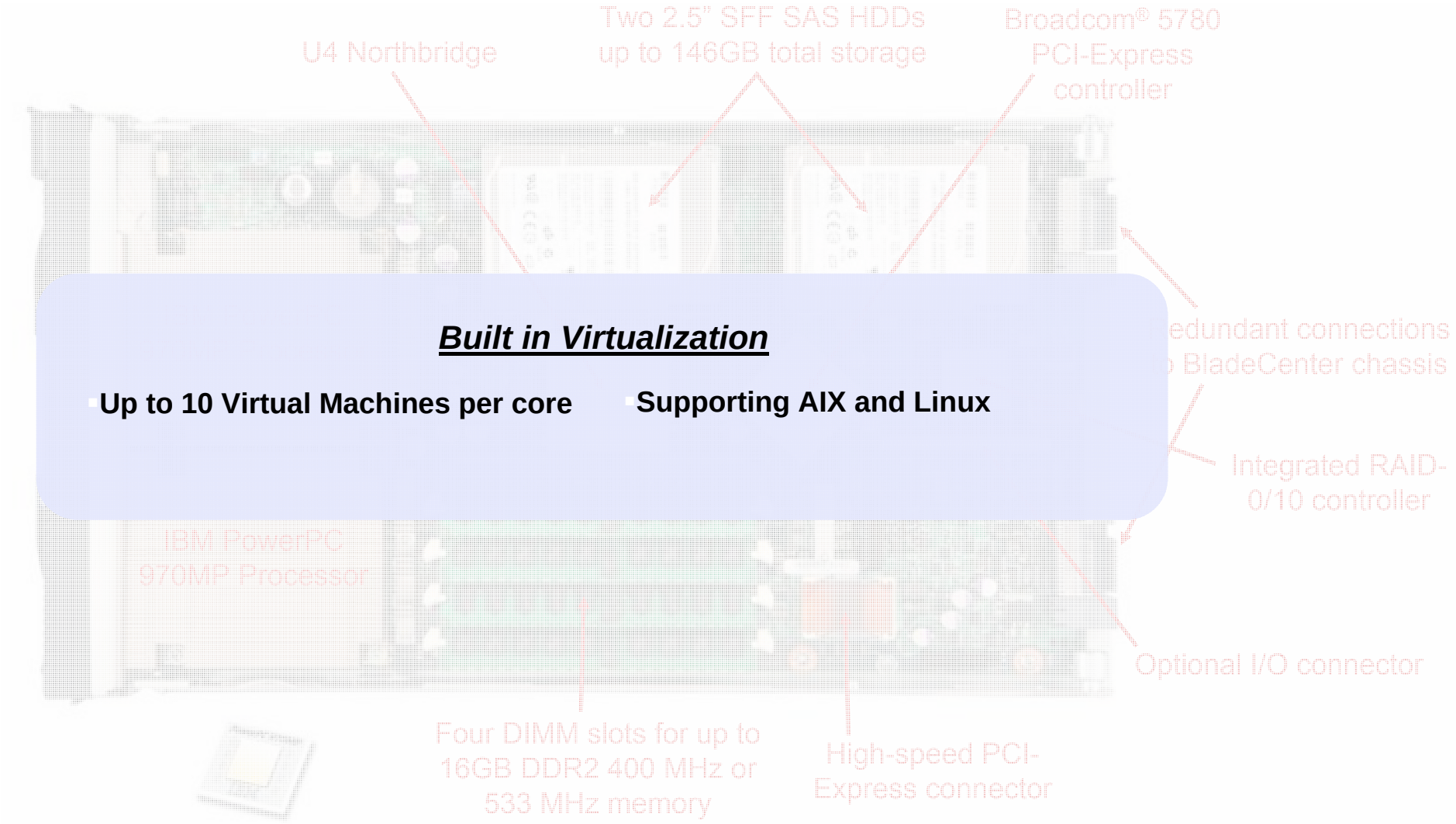
Integrated LSI 1064E SAS, RAID 0,1 down (2 ports)

Integrated Gigabit Ethernet: Broadcom BCM5708S x2

ATI RN-50 Video; National 87427 Super-IO

- 60mm second board (with MIO) mezzanine card
- 4 DIMM slots/2 channels (yields 8 DIMM slots – 32GB max / memory mirroring and hot spare)
- 1 HSDC & 1 legacy DC slots, and BCM5714S NIC (x2 Gbit)
- 60mm second board (with SIO) mezzanine card
- 3 SFF Hot-Swapable Serial Attached SCSI drives

BladeCentre – JS21



Built in Virtualization

- **Up to 10 Virtual Machines per core**
- **Supporting AIX and Linux**

LS21/41 – 2 or 4 Way Blade and expansion capability

30/60mm blades (up to 14/7 per chassis)

Serverworks HT2000 and HT1000

DDR2 667 / 16 DIMM / 64GB max

AMD Opteron 800 Series Dual Core 2MB L2 cache (Santa Rosa)

2.0Ghz and, 2.4Ghz (68W) and 2.2 and 2.6Ghz (95W)

SAS

2/4 ports, Integrated Dual Gigabit Ethernet (Broadcom 5708 and 5706) TOE

Integrated BMC, functions with BC Management Module

(Up to 3) I/O Adapter slots (not all can be used at once)

Up to two Legacy: (2) PCI-X supporting legacy daughter cards

High speed: (1) PCI-E supporting new high speed cards

External only

Optional: (not in plan) two 2.5” NHS SATA drives

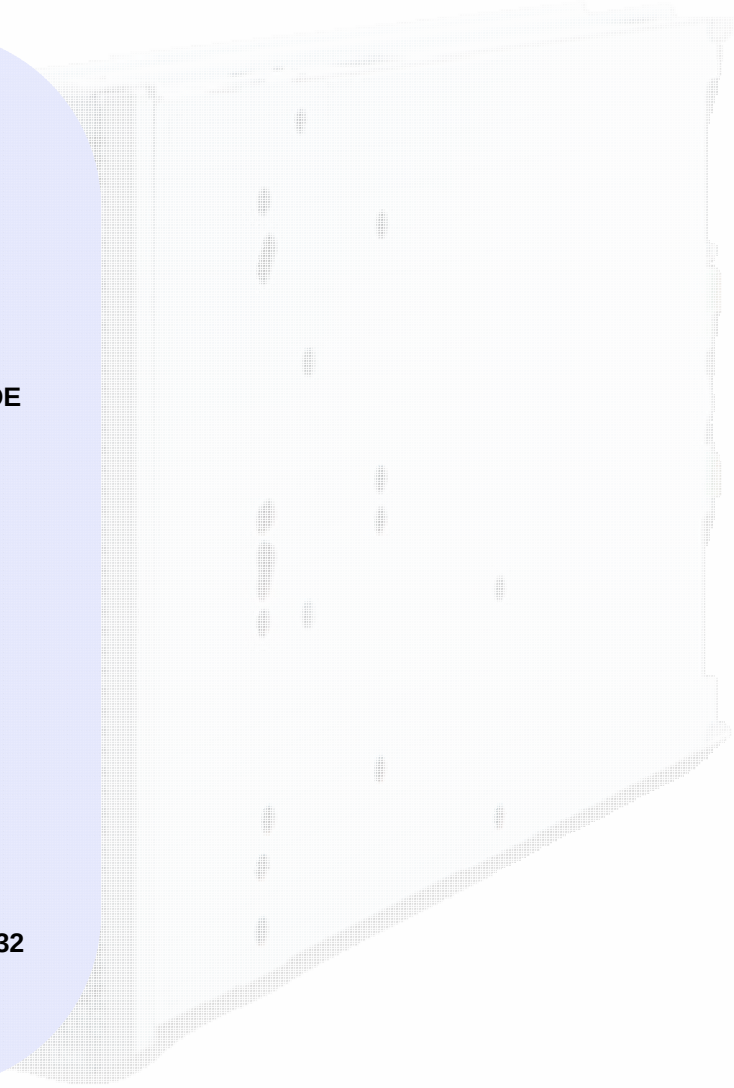
RAID 0,1. Supports SIO blade for RAID 1,1E, and 5

All on chassis: (2) USB – Front / (2) USB - Rear, 1 Video – Rear

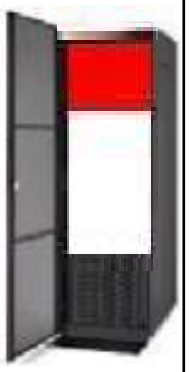
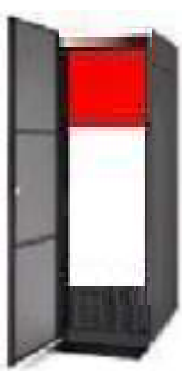
Shared inside BladeCenter chassis, fully redundant

Shared inside BladeCenter, N+N, hot swap cooling

Windows 64, RHEL 4.0 64 bit, RHEL 4.0 32 bit, SLES 9.0 64 bit, Windows 32 bit, SLES 9 32 bit, VMware ESX Server, SLES 10 64 bit, Solaris 10



A look at how power limits density

KW/rack	17KW	13KW	10KW	7KW	5KW
HP BL35p	**67** 	**51** 	**40** 	**27** 	**20** 
IBM LS20	**81** 	**62** 	**48** 	33 	24 
IBM Advantage	14 more 20%	11 more	8 more	5 more	4 more

- In older data centers it is not uncommon to find power limitations at the rack level as low as 5KW
- These are some very common envelopes out customers typically ask us to maintain
- The lower the per rack power number the more critical efficiency is
- The ability to pack more in each and every rack is a direct benefit of power efficiency

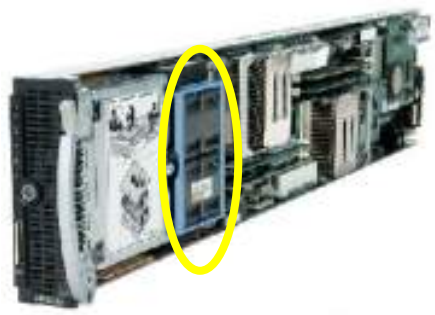
The lower the power envelope the more critical power efficiency is to getting the most from the data center

LS20 savings for TCO?

Several ways in which this 20% savings can improve the bottom line

- Power costs
  - 20% lower electrical costs to utility provider
  - In the UK the cost for power is relatively high, the estimated cost for power in this example was $.12/KW/h
- Cooling costs
  - 20% lower cost to run air conditioning and air handling equipment
  - Power and heat output are directly related- every watt of power used by a server will result in heat in the computer room
- Rack savings
  - 20% more servers in each rack, means less total racks would be required to house the solution
  - This customer had a relatively new data center capable of handling 17KW in each rack, many customers can only house a fraction of this
- Floor space savings
  - 20% less expensive floor space consumed due to less rack foot prints
  - The cost for floor space varied greatly by region, the floor space in our example approached $300/square foot annual maintenance burden

Smarter thermal solutions



FANS - 14 Blade Comparison

Two N+N Hot Swap Blowers

2 moving parts

Hot Swap

4800 Blades = 686 Fans

56 Non Hot-Swap Fans (4 in each server)

56 moving parts

All non Hot Swap

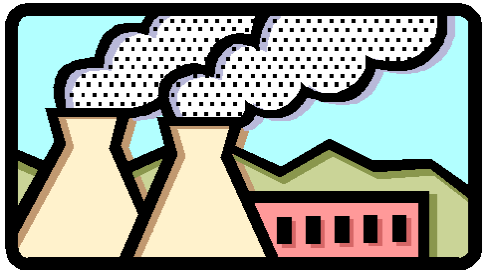
4800 Blades = 19,200 Fans

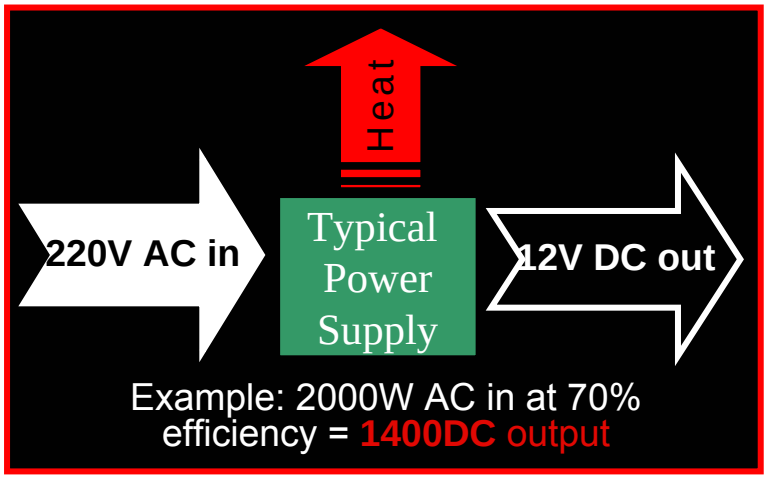
28 times more possible points of failure (all non hot swap)

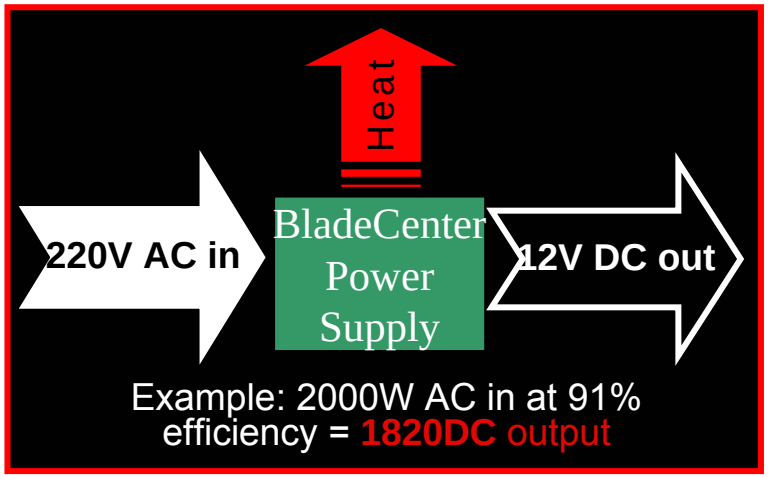
How Power Works and why BladeCenter is better

There are two kinds of power

- **DC** – the type of power the server components run on
- **AC** – the type of power that we distribute in the data center
- Power supply converts AC to DC







- Because BladeCenter power supplies are over 90% energy efficient a lot less power is wasted as it is transitioned from AC to 12V DC for the server to run on
  - Internal power topology means that IBM can perform a single power conversion from AC direct to 12V DC
- HP does not offer near the energy efficiency gains in their blade chassis
  - They have external power that reqires two separate power conversions- first from AAC to -48V DC, then from -48V DC to 12V DC at the server.
  - Two conversions means twice as many places for energy loss

IBM BladeCenter – it pays to be efficient!

Costs	Item	IBM HS21 (3.0GHz)	HP BL460c (3.0GHz)
Annual	Power	$23,200	$31,500
	Cooling	$11,600	$15,800
	Floor space (5KW racks)	$13,200	$17,600
One-time	Racks	$21,000	$28,000
Three-year		$165,000	$222,700

IBM BladeCenter

The more efficient choice for power and cooling

HP BladeSystem

$57,700 in **additional cost** to power, cool, host HP solution

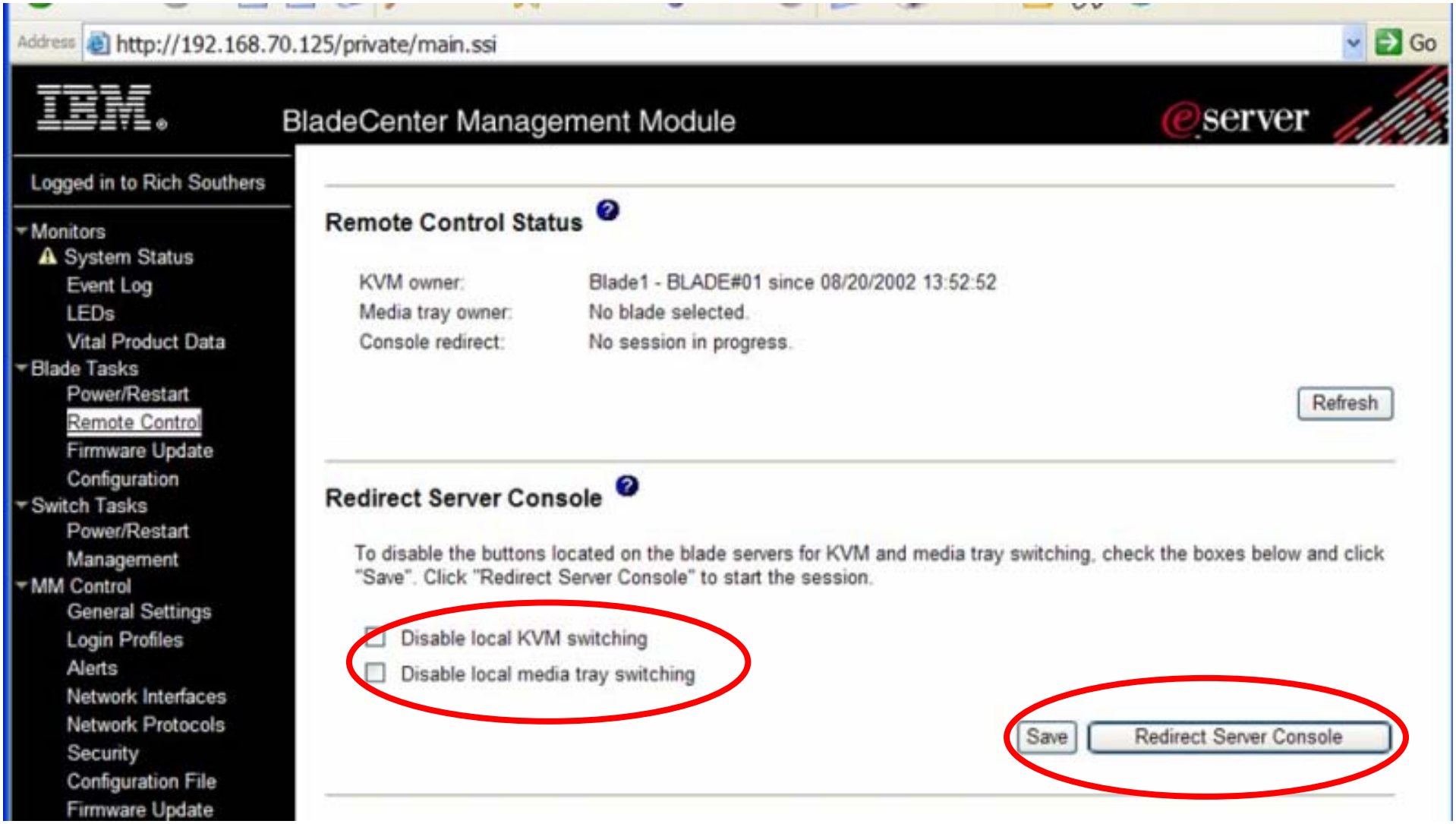
44 additional square feet consumed in data center

Comparison of IBM HS21 and HP BL460c with same configuration. Cost of power assumed $.10US kwh. Racks of 5KW maximum, cost of rack based on $100/ft2 x 22ft2/rack. Rack cost $3500 with flat panel and KVM switch.

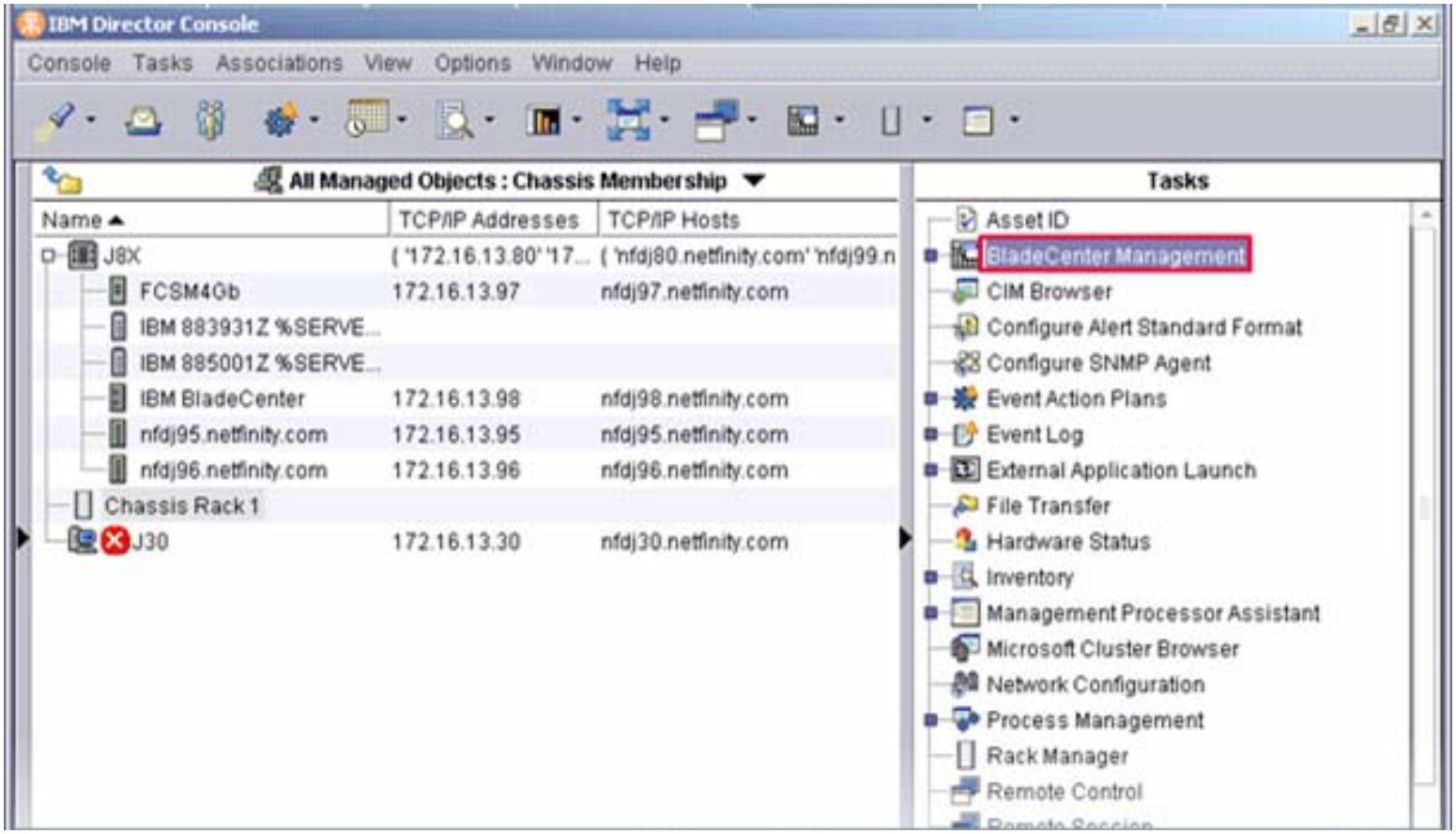
BladeCentre Advanced Management Module

- **Consolidates management for the entire chassis**
  - Manage, control, install from a single point
  - Empowers IT managers to do more
  - Delivers “RSA like” remote functionality
  - Complete KVM switch local functionality
  - Serial connection
- **BCH comes standard with one Advanced MM; second one is available as an option for redundancy**
- **Hot swap, removal of the MM does not effect server operation**
- **Local KVM is USB based**
  - **Keyboard and mouse are now USB connections**
  - **Older Management Module was USB internal, but PS2 external**
  - **There are several IBM and non-IBM USB based KVM solutions. There will also be a USB to PS2 conversion cable announced with BCH**

BladeCentre Management Module

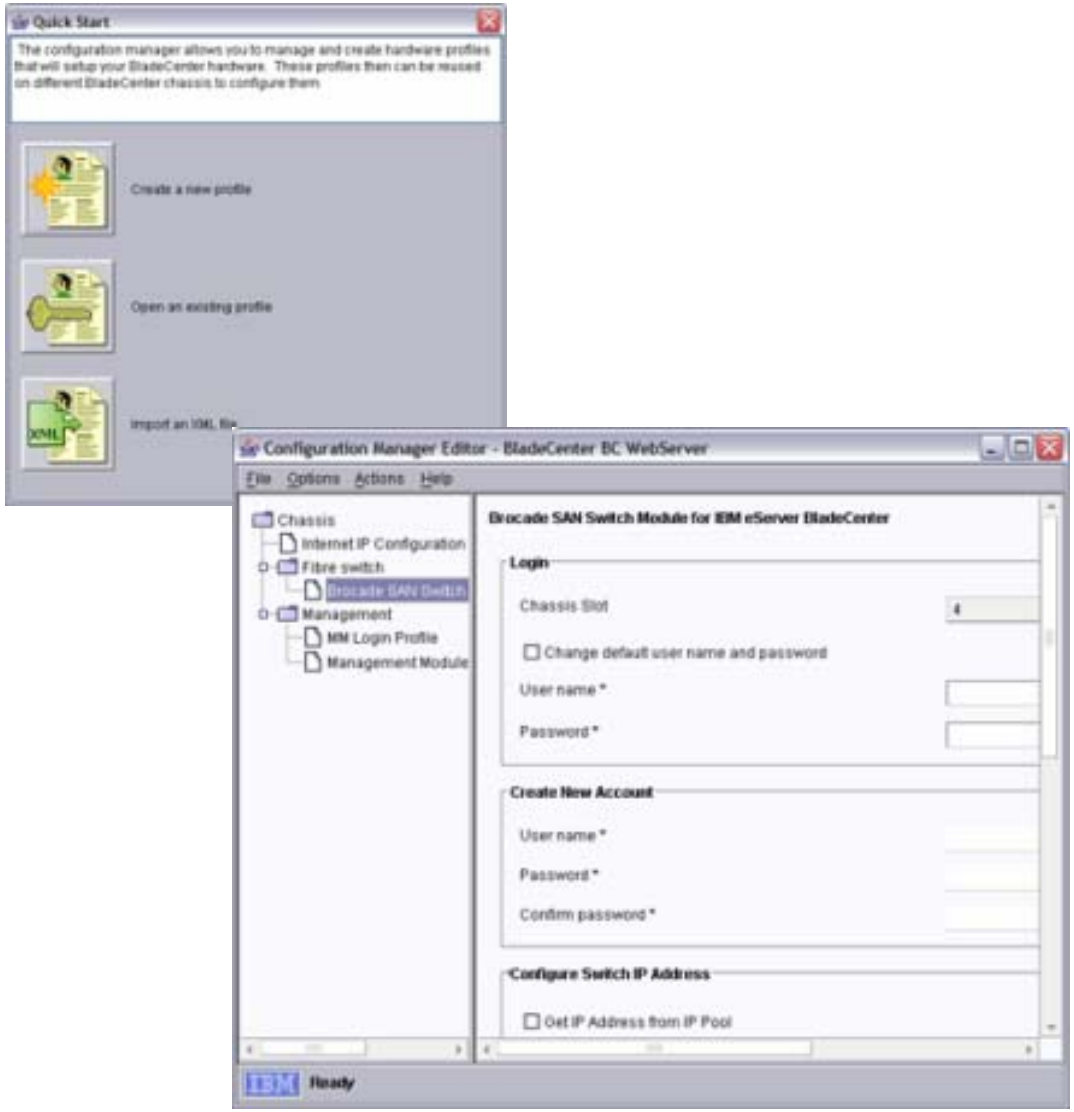


BladeCenter Management into IBM Director



BladeCenter Chassis Configuration Manager

- **Provides integration point for BladeCenter subsystem configurations**
- **Create configurations for chassis component devices**
- **Read configurations for chassis component devices**
- **Broadcast configurations to multiple chassis**
- **Modify single configuration without affecting others**
- **Detect and apply configurations to chassis and chassis components**



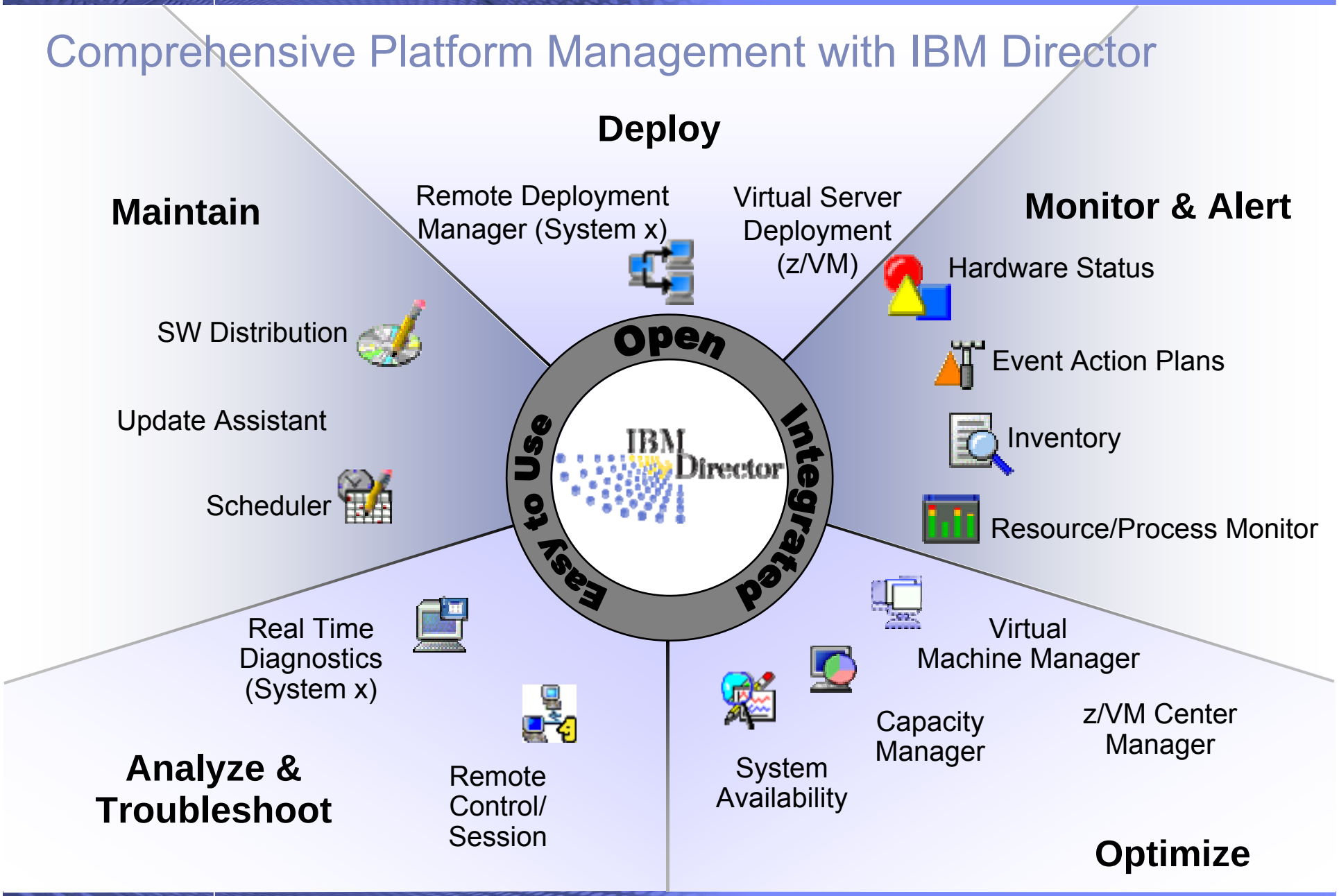
IBM BladeCenter®

Simplified cable management

Systems Management

Advanced systems management supplied with IBM System x

Comprehensive Platform Management with IBM Director



IBM Director Topology

IBM Director Server
Application Logic
Database

Management Console(s)
Java GUI

Managed Clients
(Servers, Desktops, Laptops)

IBM Director

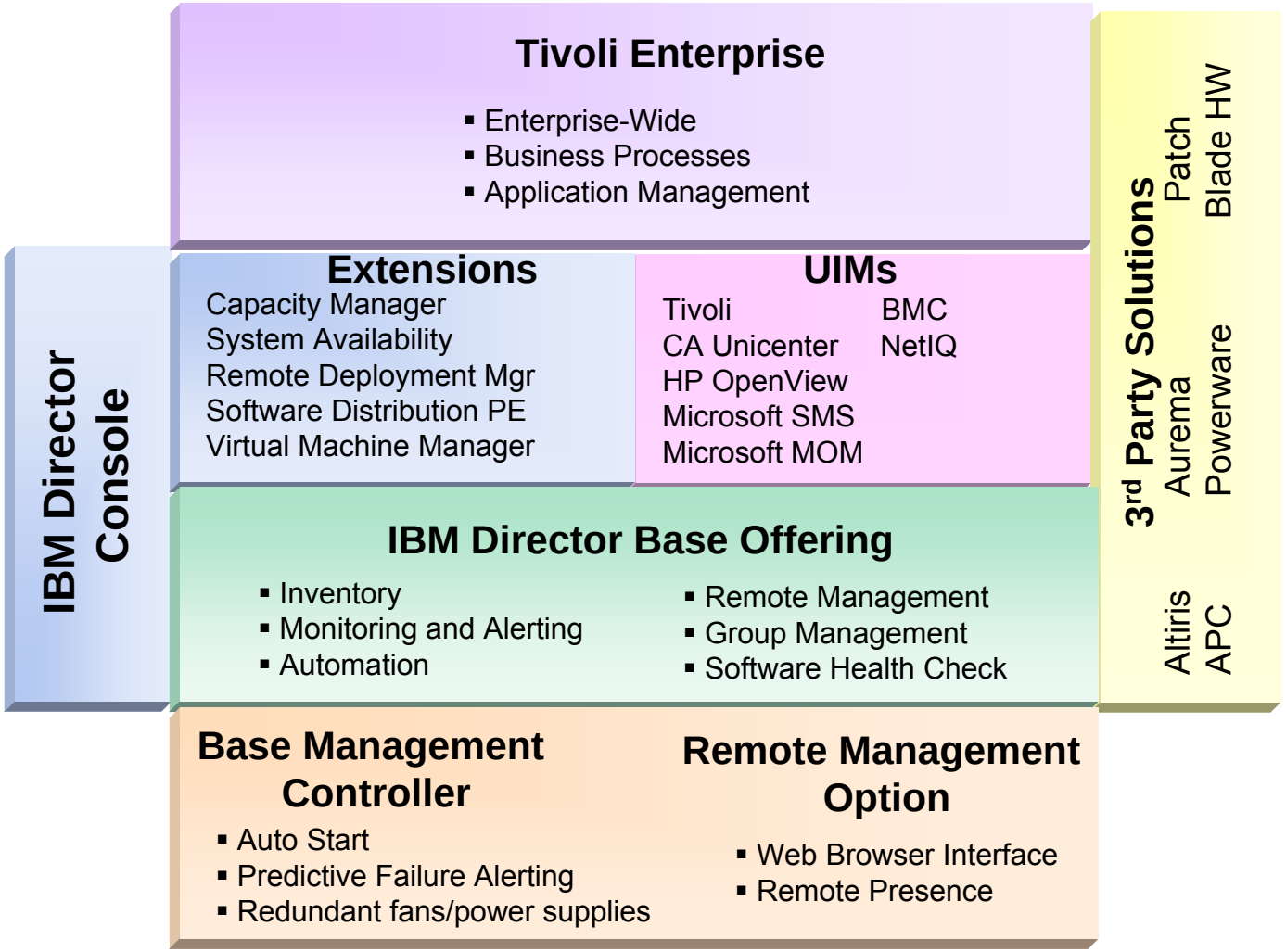
Hardware Management
Inventory
Monitoring
Alerting
Group Management
Scheduler

IBM Director
5000 Managed Nodes
Upward Integration
(Tivoli, CA, HP, MS SMS, MOM, BMC, NetIQ)

IBM Director Agent

Help Desk & Support
Remote Control
Remote Session
File Transfer

IBM Systems Management Offerings



Server Plus Pack Integration

Capacity Manager now Sold separate.

Sys Availability included

Customizable console

Simpler event action plans

Access for individuals with disabilities

Changes to extensions

Lightweight tiered agent

Enhanced hardware alerting Including FRU numbers

Software health check

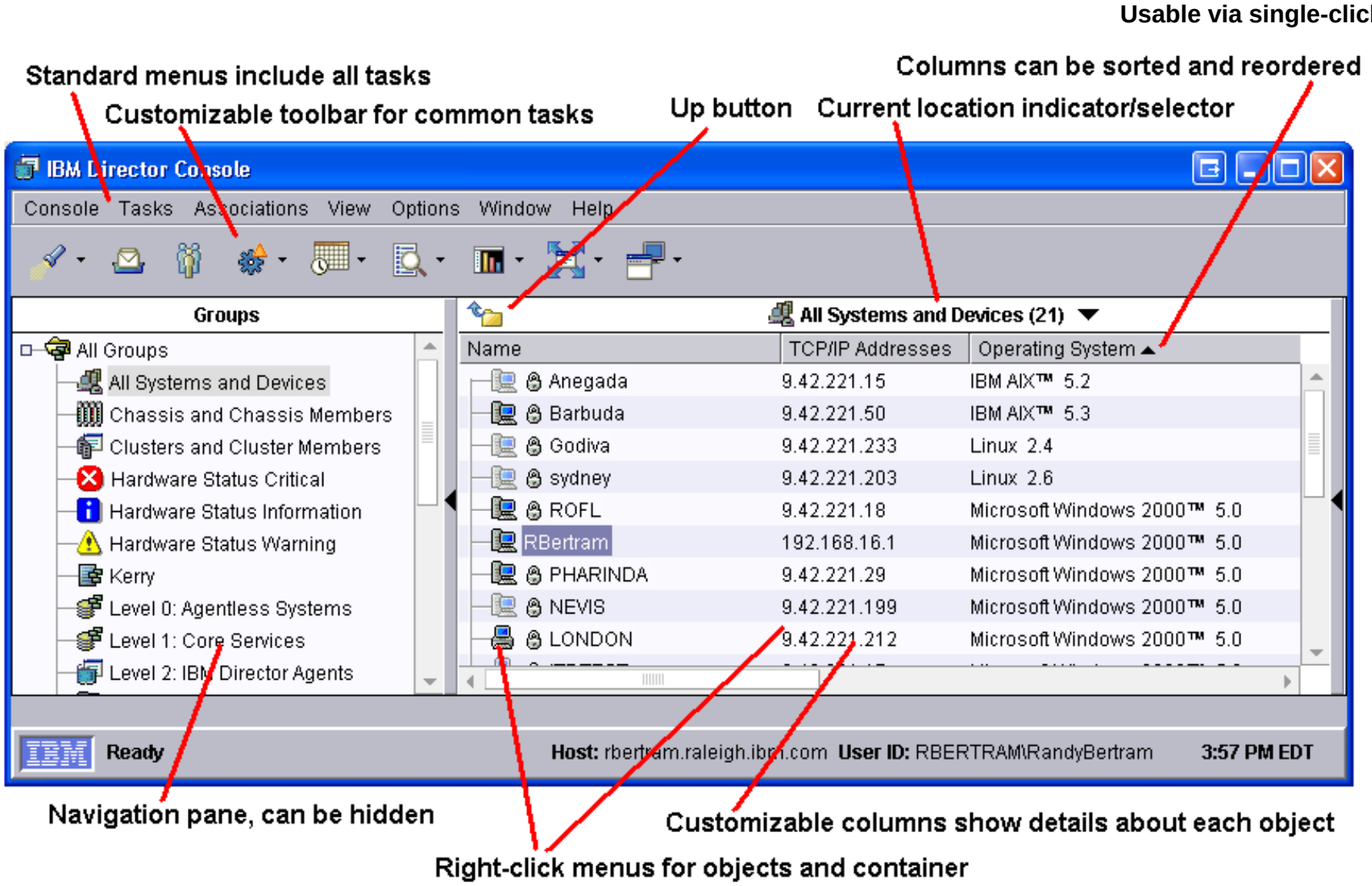
BladeCenter Chassis Configuration Manager

Cross Platform

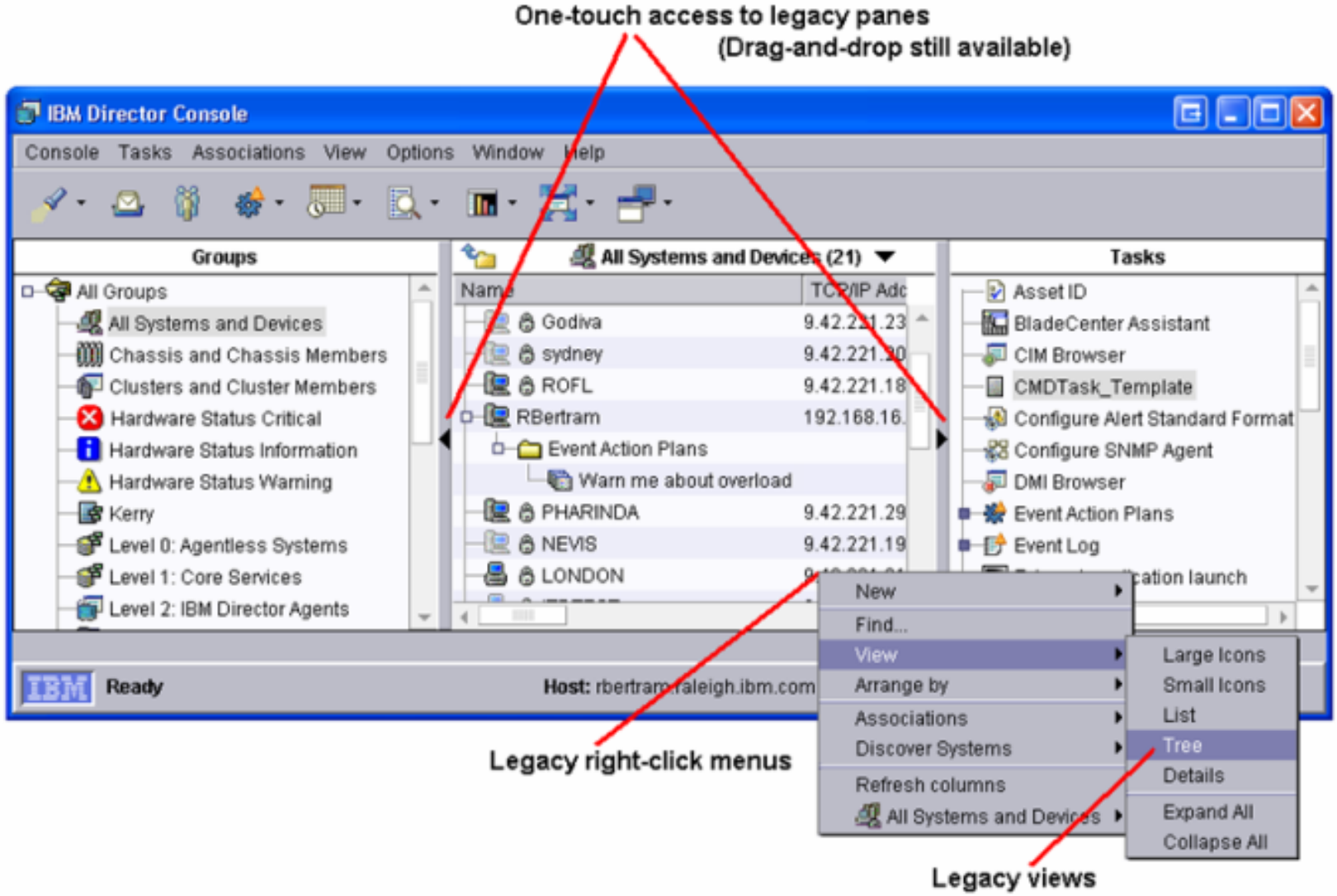
IBM Director 5.10 Degrees of Management

IBM Director Feature	Agentless *Level 0*	Core Services *Level 1*	IBM Director Agent *Level 2*
Discovery System Attributes Power Control Remote Session on Linux Basic Inventory			
Platform Specific Inventory Hardware Status Event Action Plans Event Log Update Assistant Upward Integration			
Process Management Remote Session on Windows File Transfer ServeRaid Manager Software Distribution CIM Browser SNMP Browser Scheduler			

Director 5.10 New User Interface – Familiarity

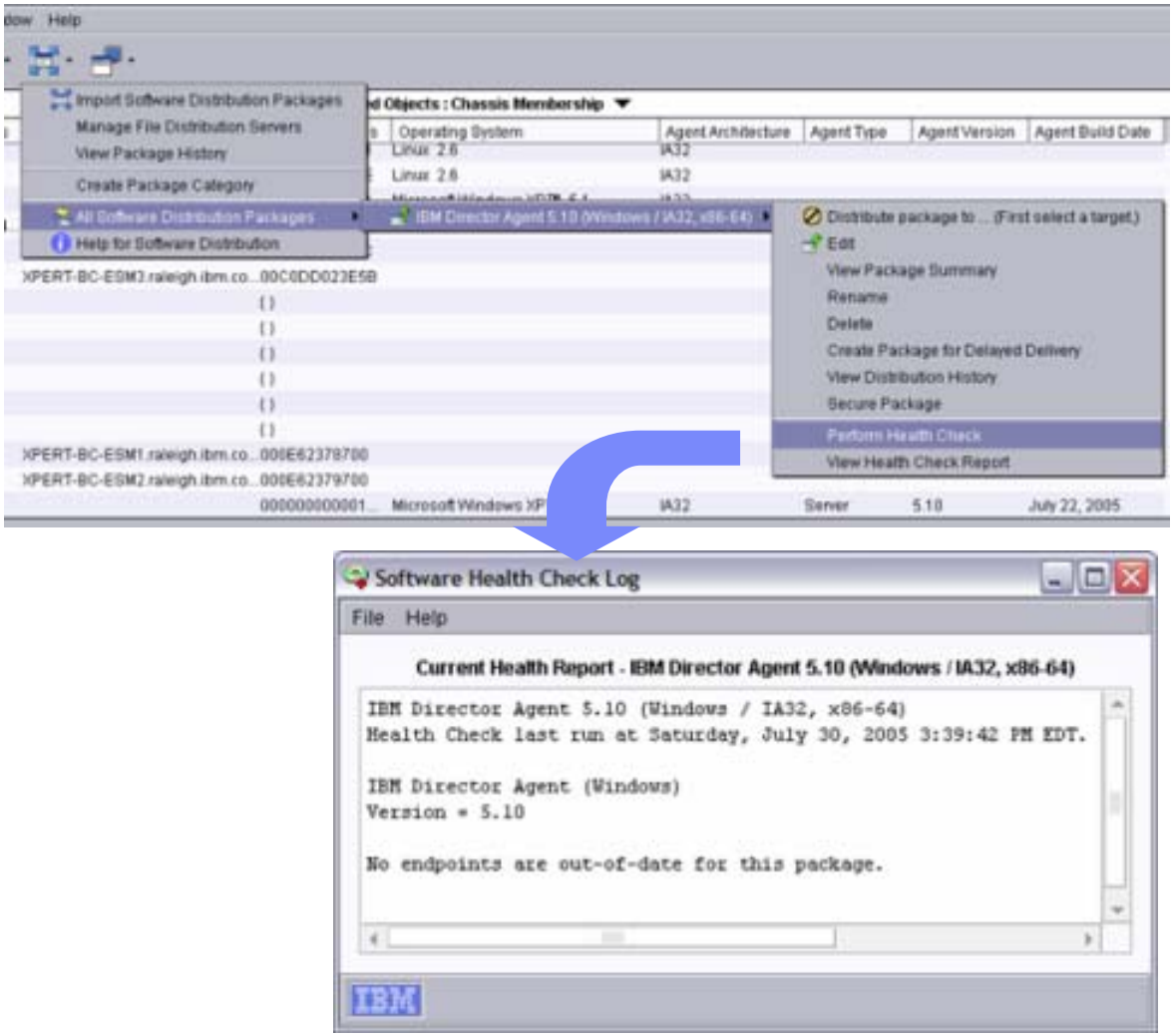


You can also choose “Classic” View

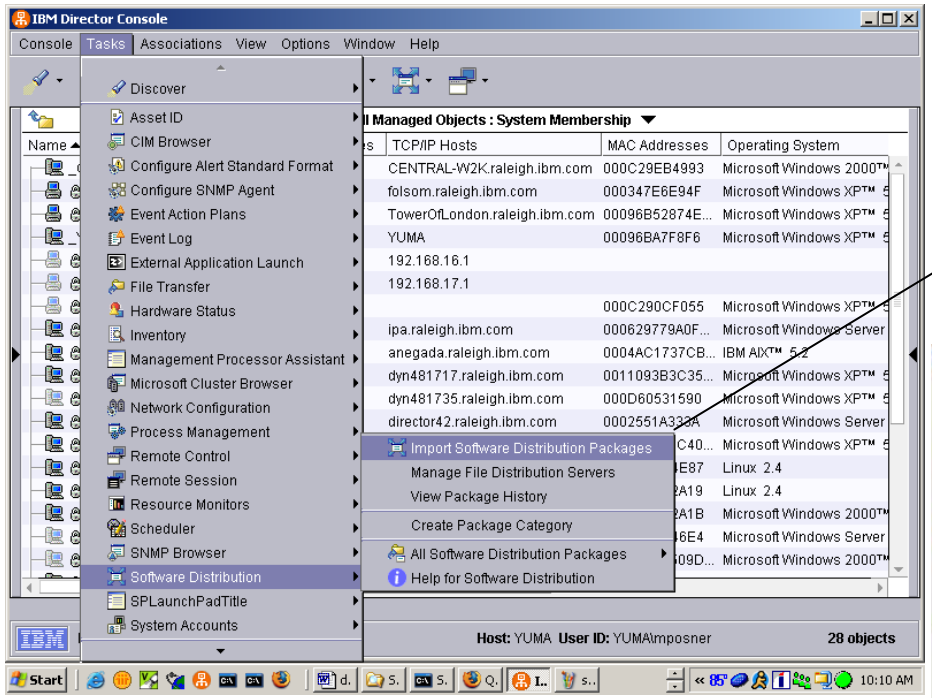


Software Health Check

- Import Update Package (Agents for VE, System x/BladeCenter Firmware & Device Driver)
- Right-click package to create dynamic group of all systems needing the update
- Push update to new group or individual systems using Software Distribution

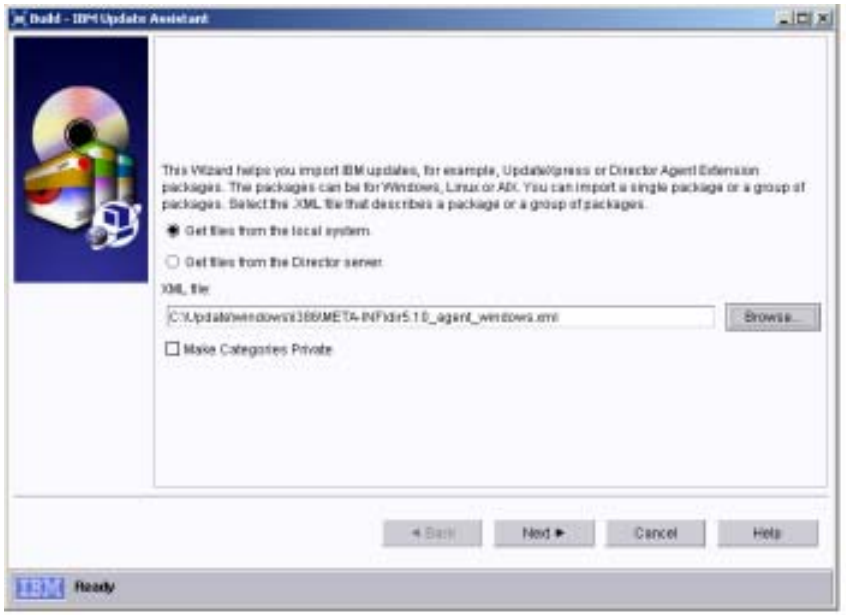


Managing System Software Updates

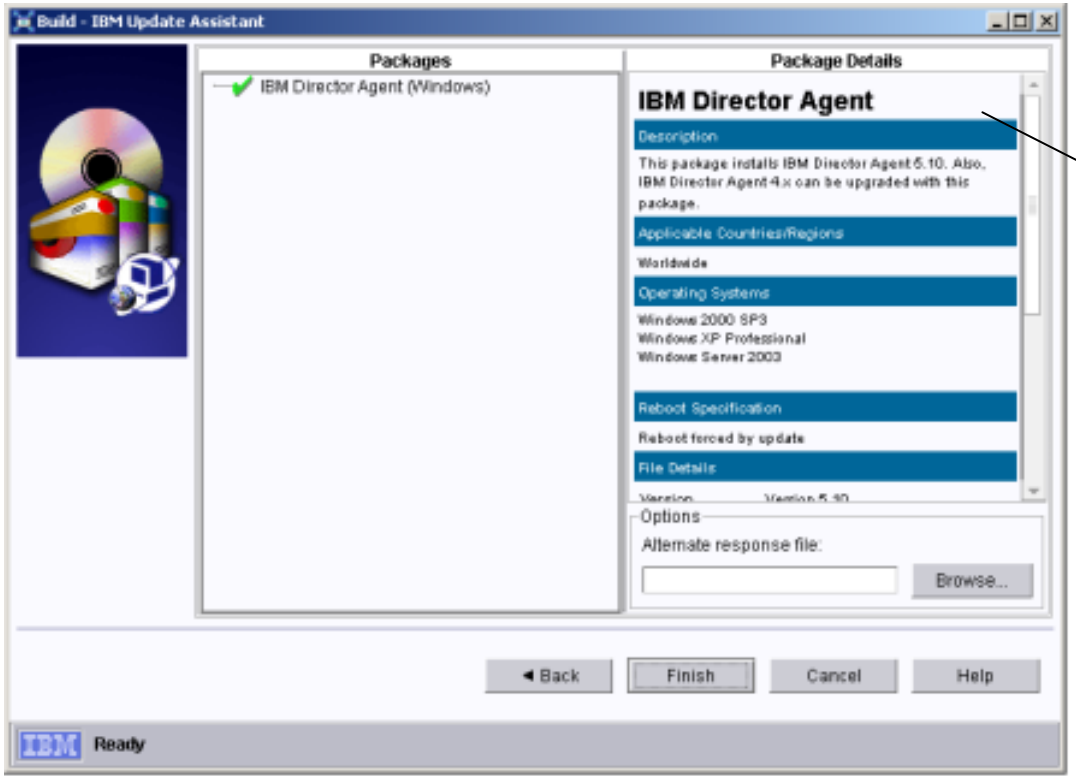


1

Import updates from UpdateXpress CD or Content Server



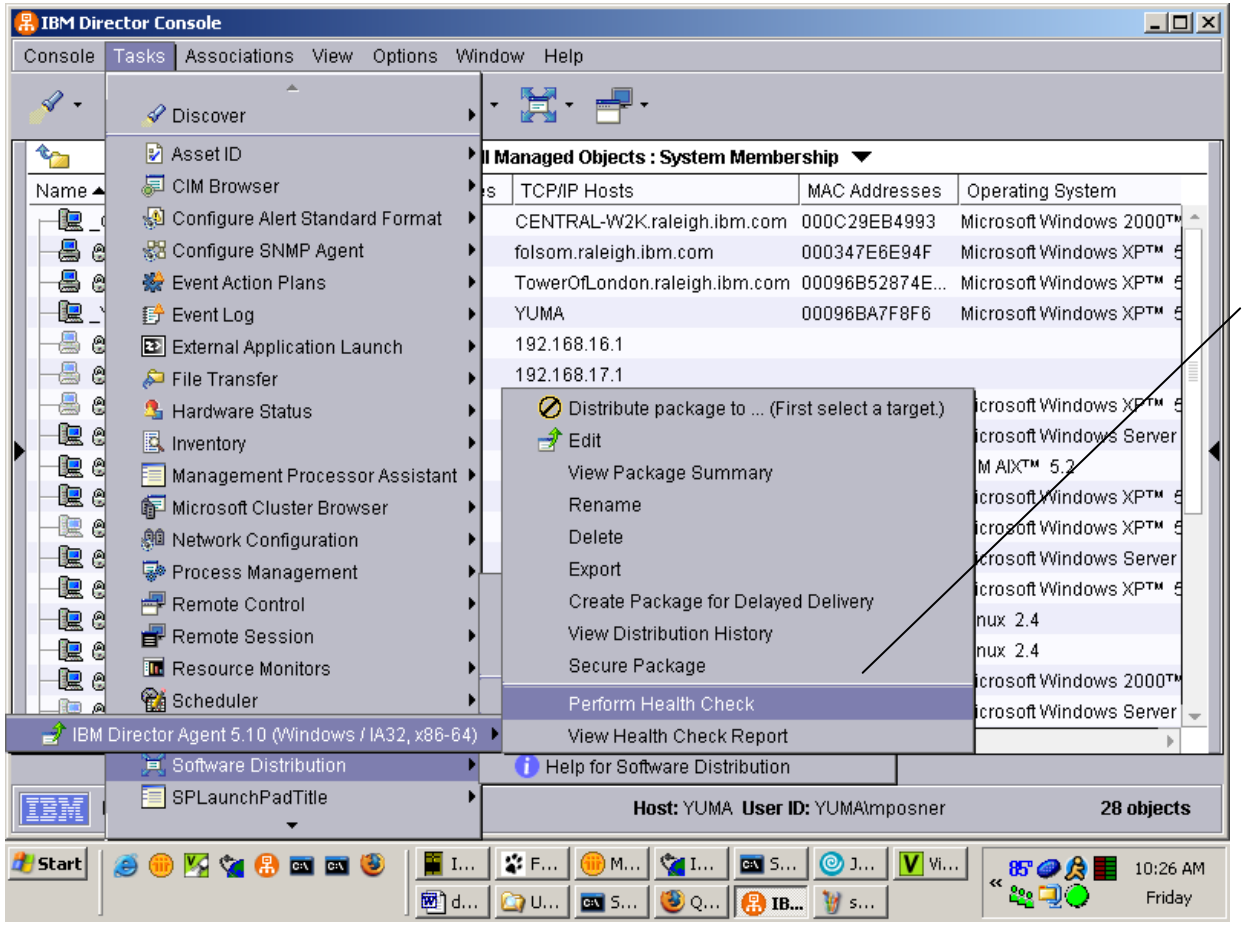
Managing System Software Updates



2

View detailed information and severity level of the selected update package

Managing System Software Updates



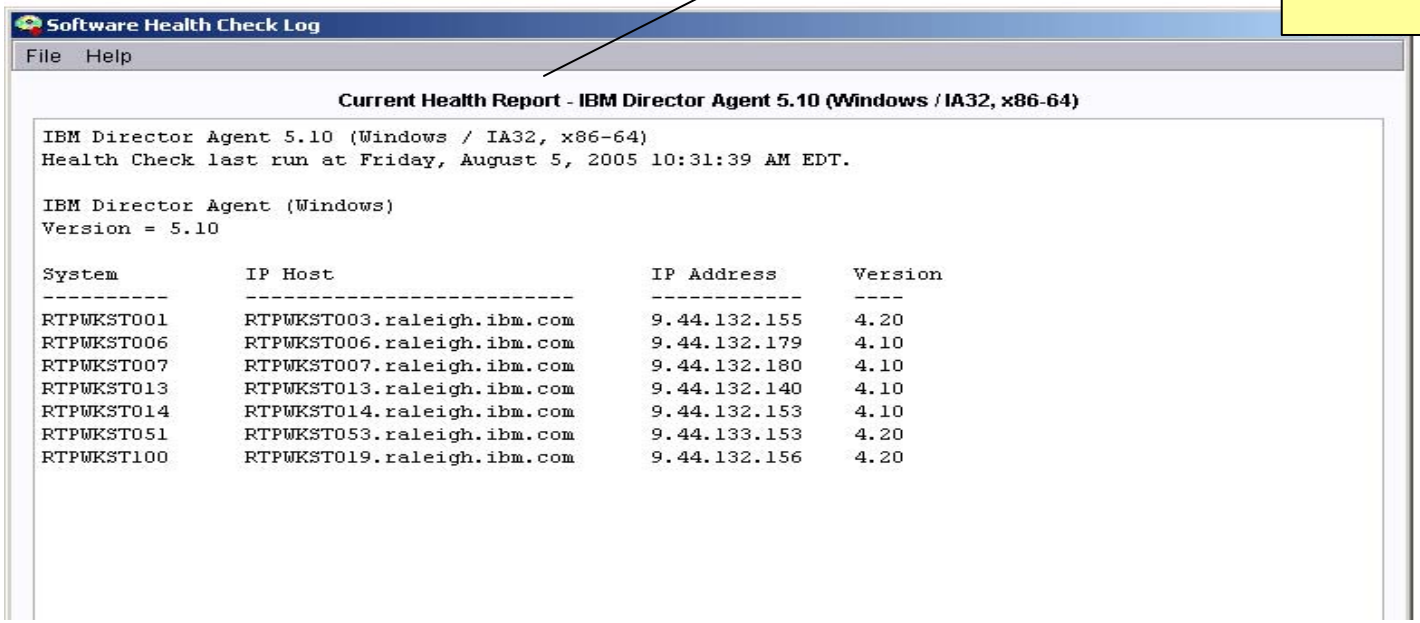
3

Right click on update to perform software health check

Managing System Software Updates

4

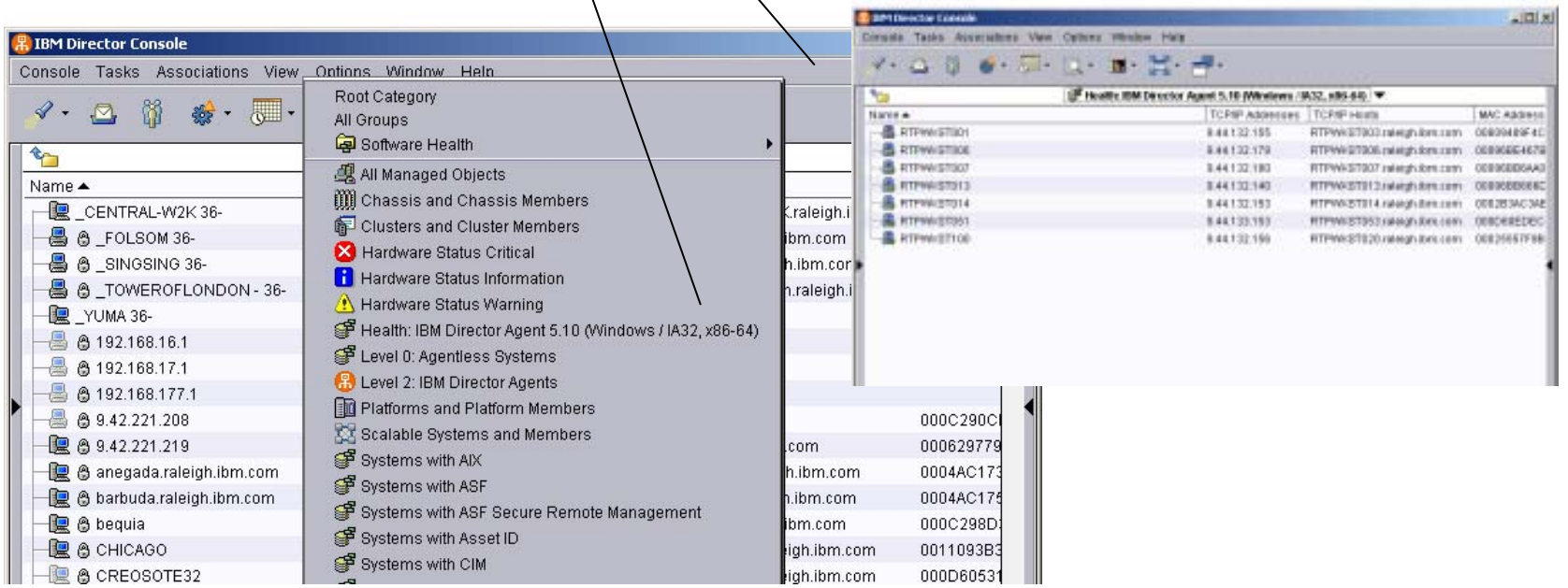
IBM Director automatically creates 'Health Report' listing systems in need of the selected update



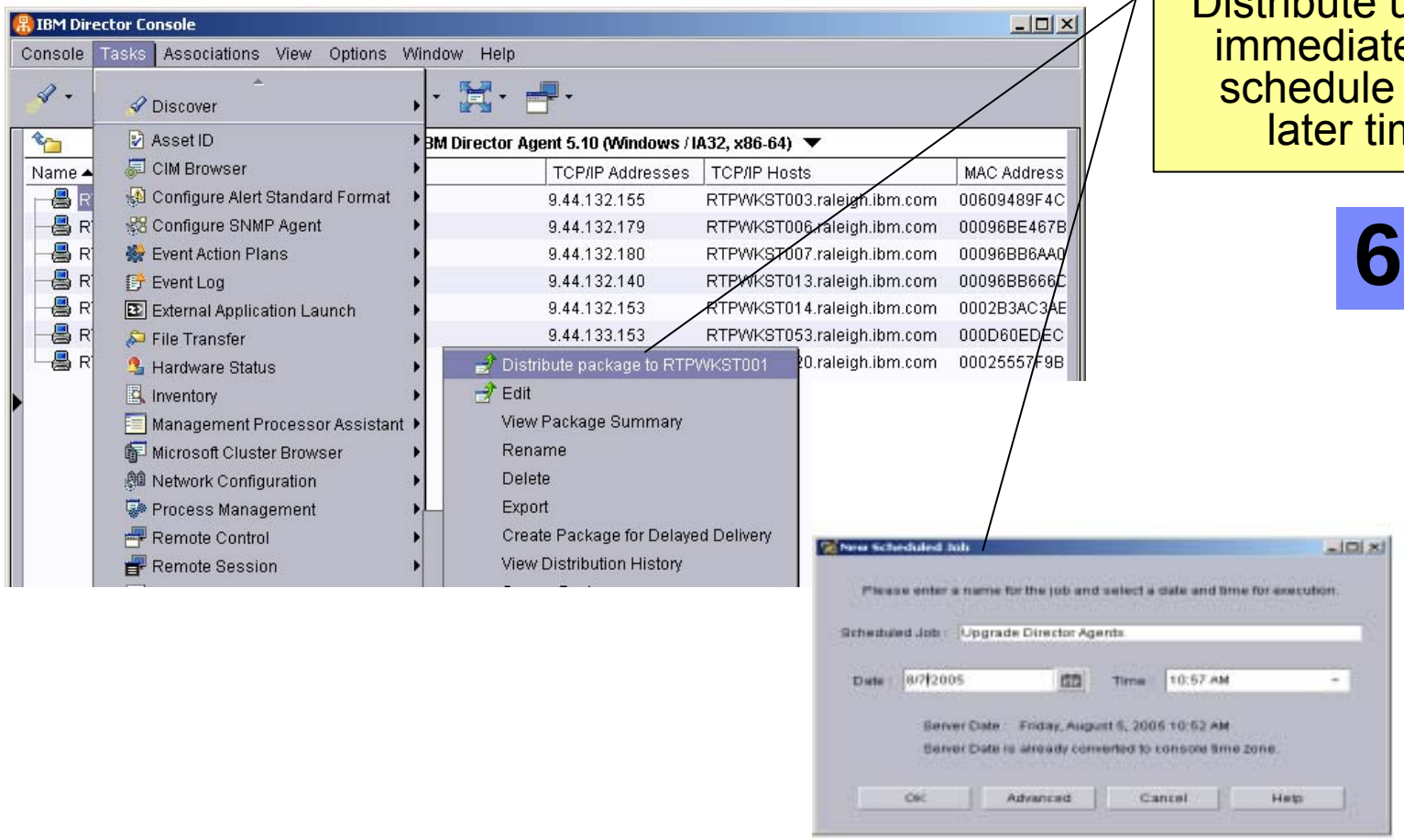
Managing System Software Updates

IBM Director automatically creates a dynamic group of all systems in need of the selected update

5



Managing System Software Updates

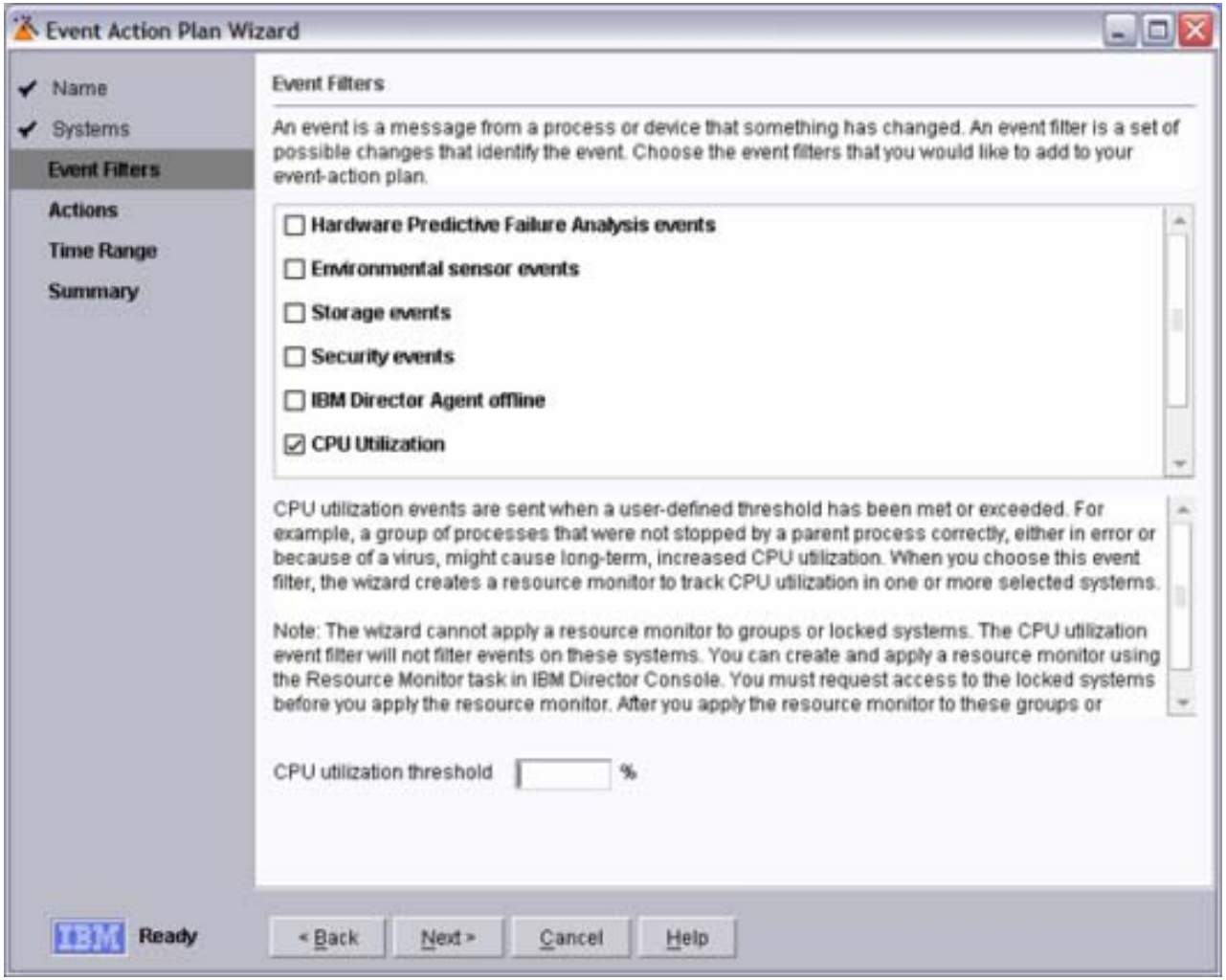


Distribute update immediately or schedule for a later time

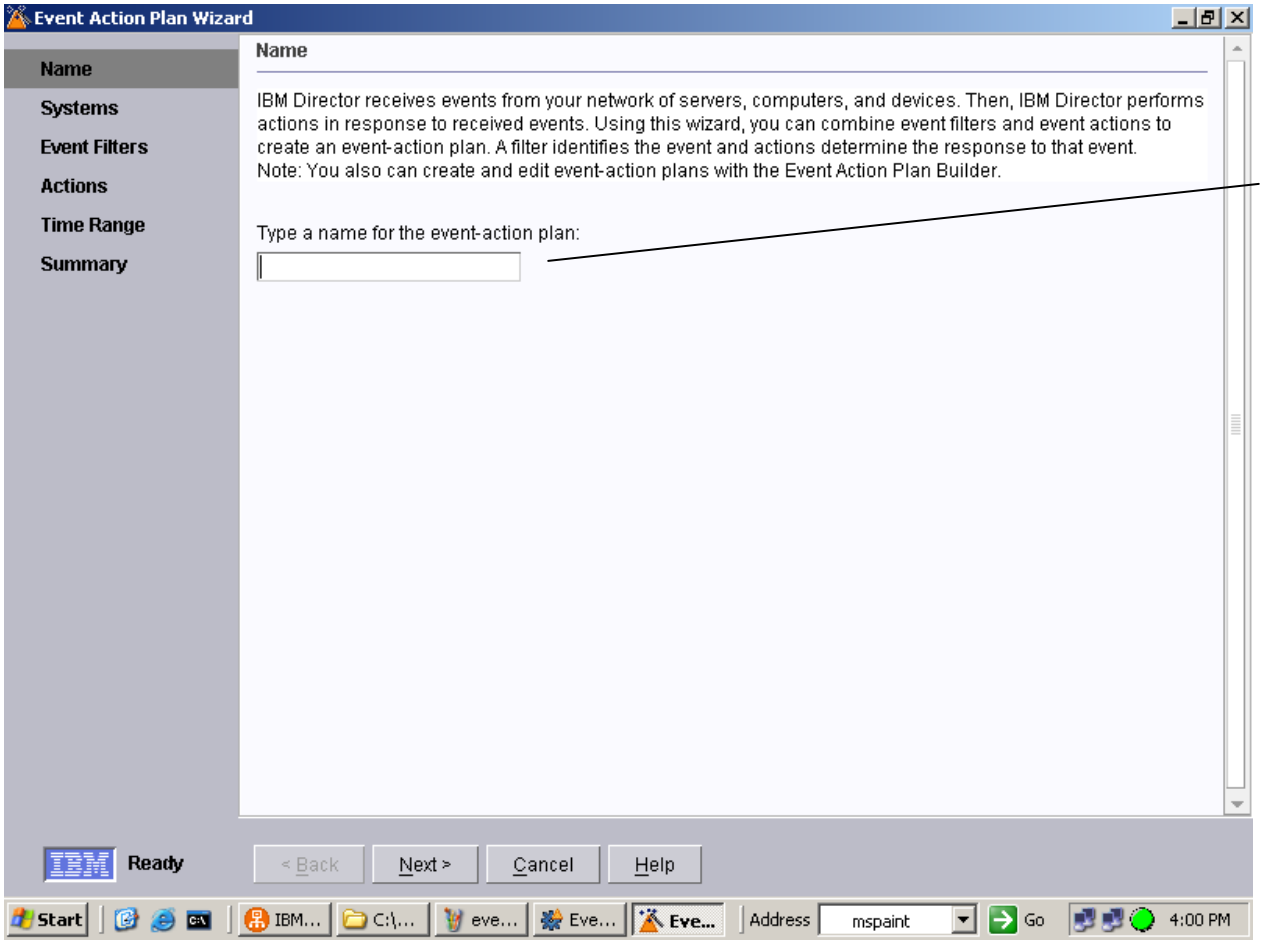
6

Event Action Plan Wizard

- Simplifies the process of creating an event action plan and applying it to a group or system
- Starts integration monitor thresholds (like CPU Utilization) into a streamlined wizard
- Used to create and later modify Event Action Plans built with Wizard



Event Action Plan Wizard



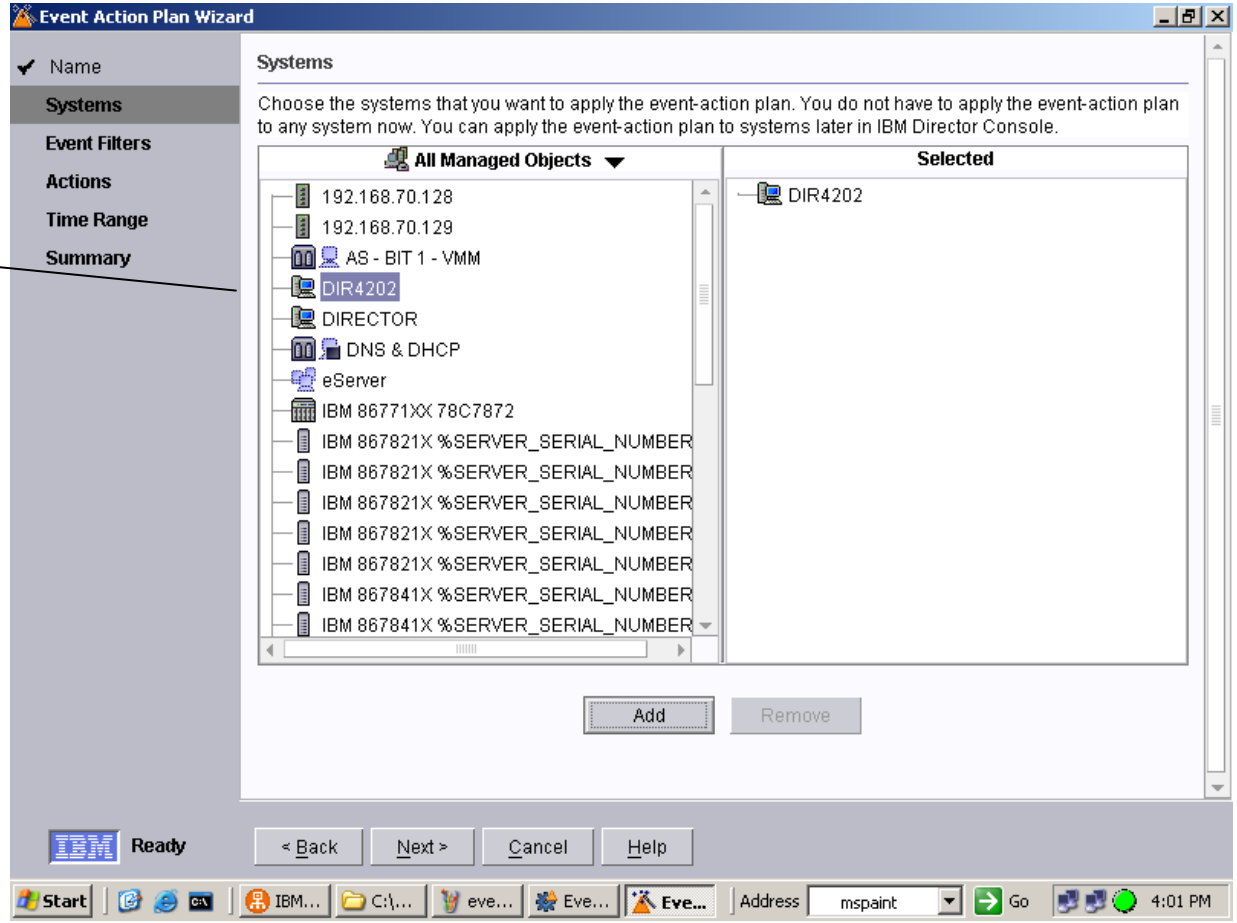
1

Enter a name for the action plan you would like to create

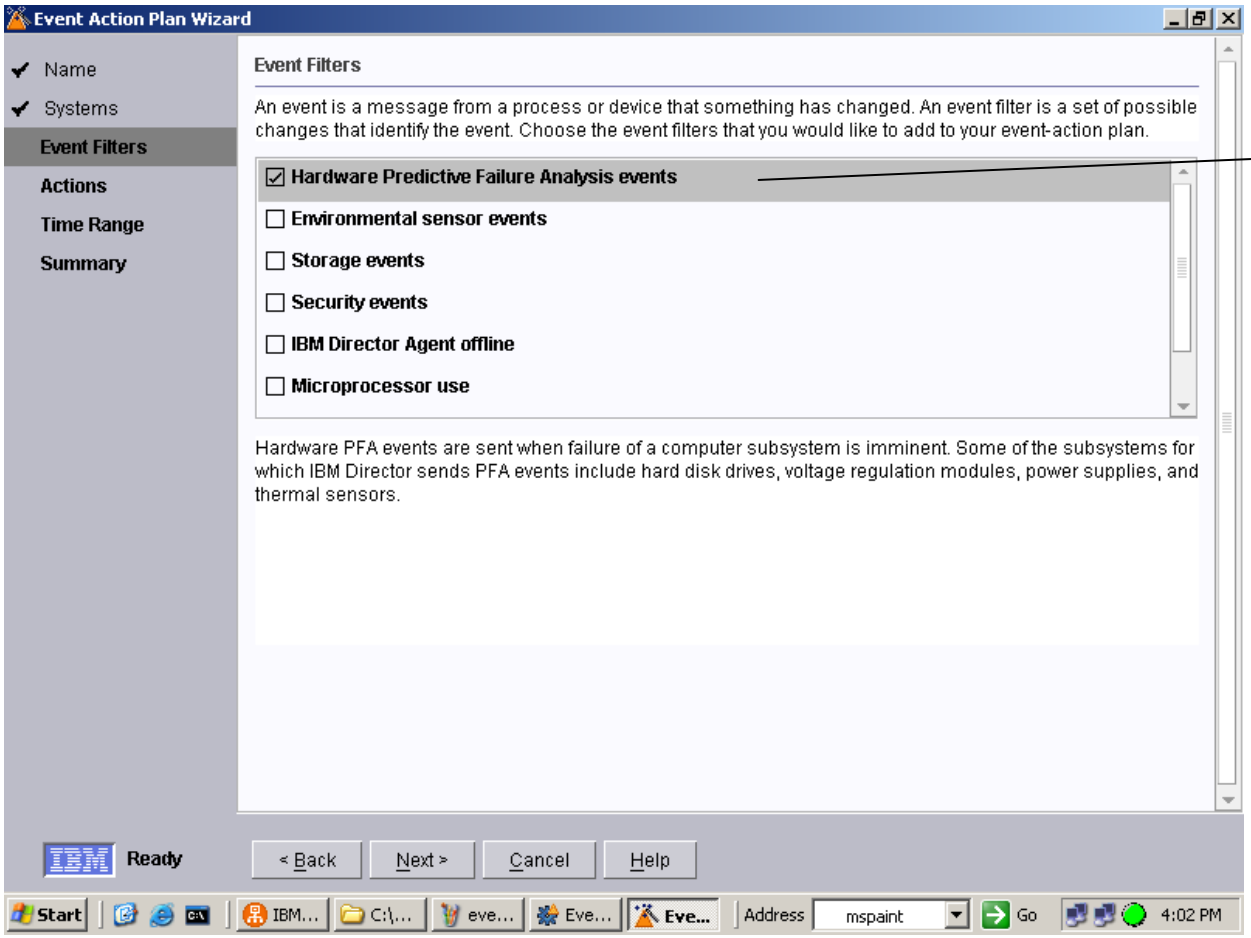
Event Action Plan Wizard

2

Choose the systems you want to apply the event action plan to



Event Action Plan Wizard



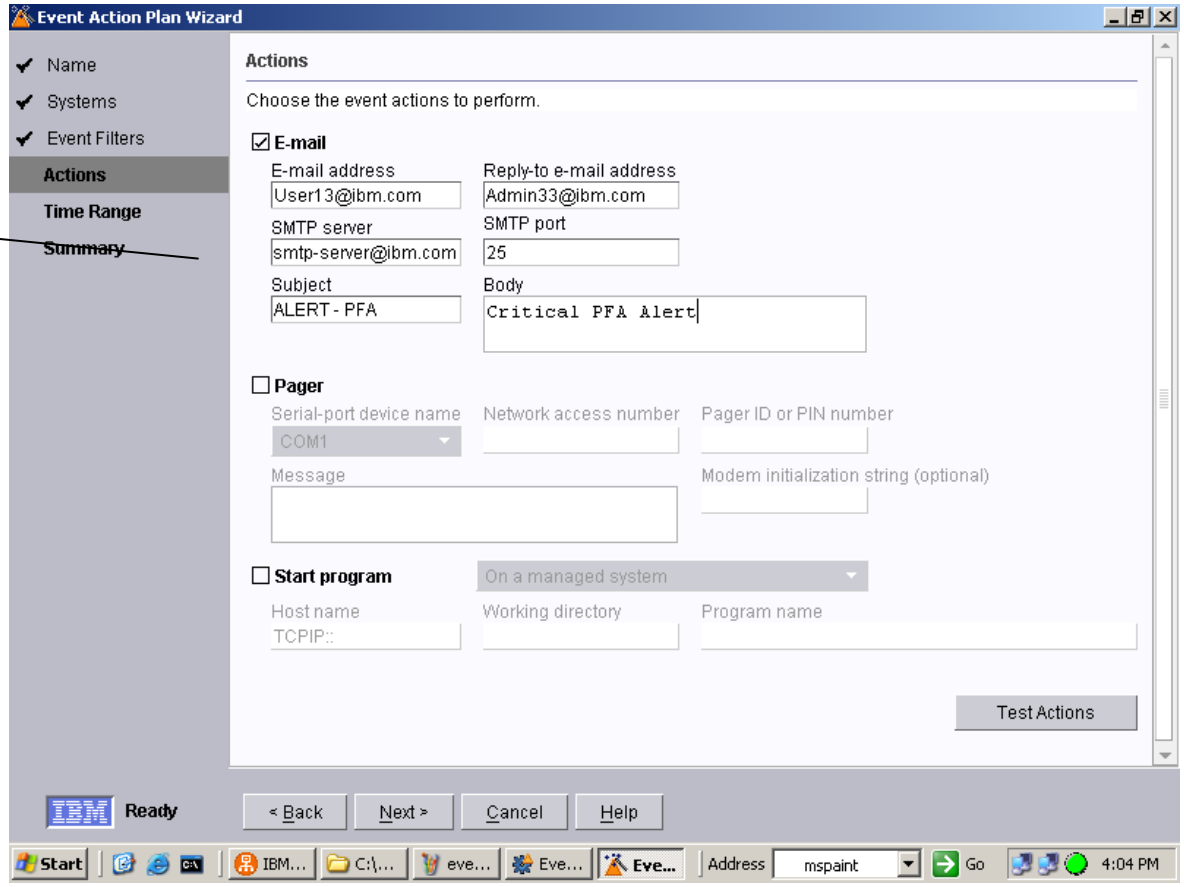
3

Choose the events that you wish to take automated action on

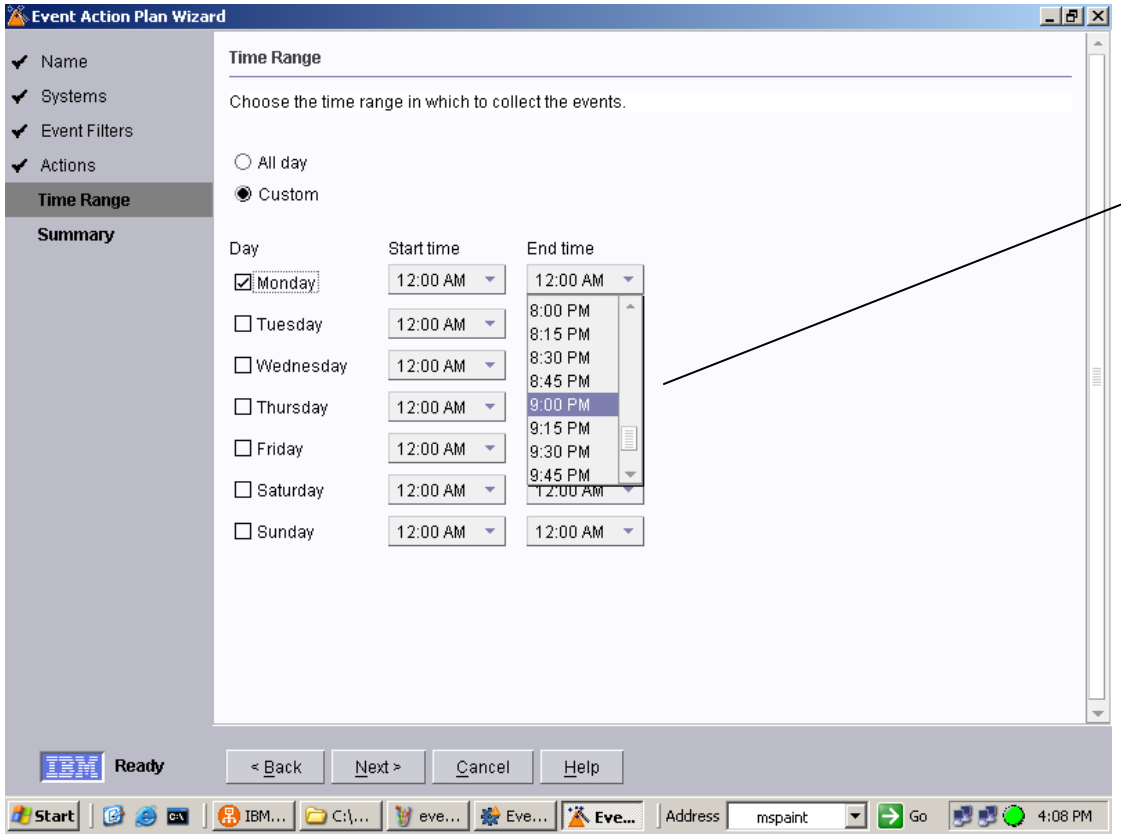
Event Action Plan Wizard

4

Choose the actions you want to take in response to the event



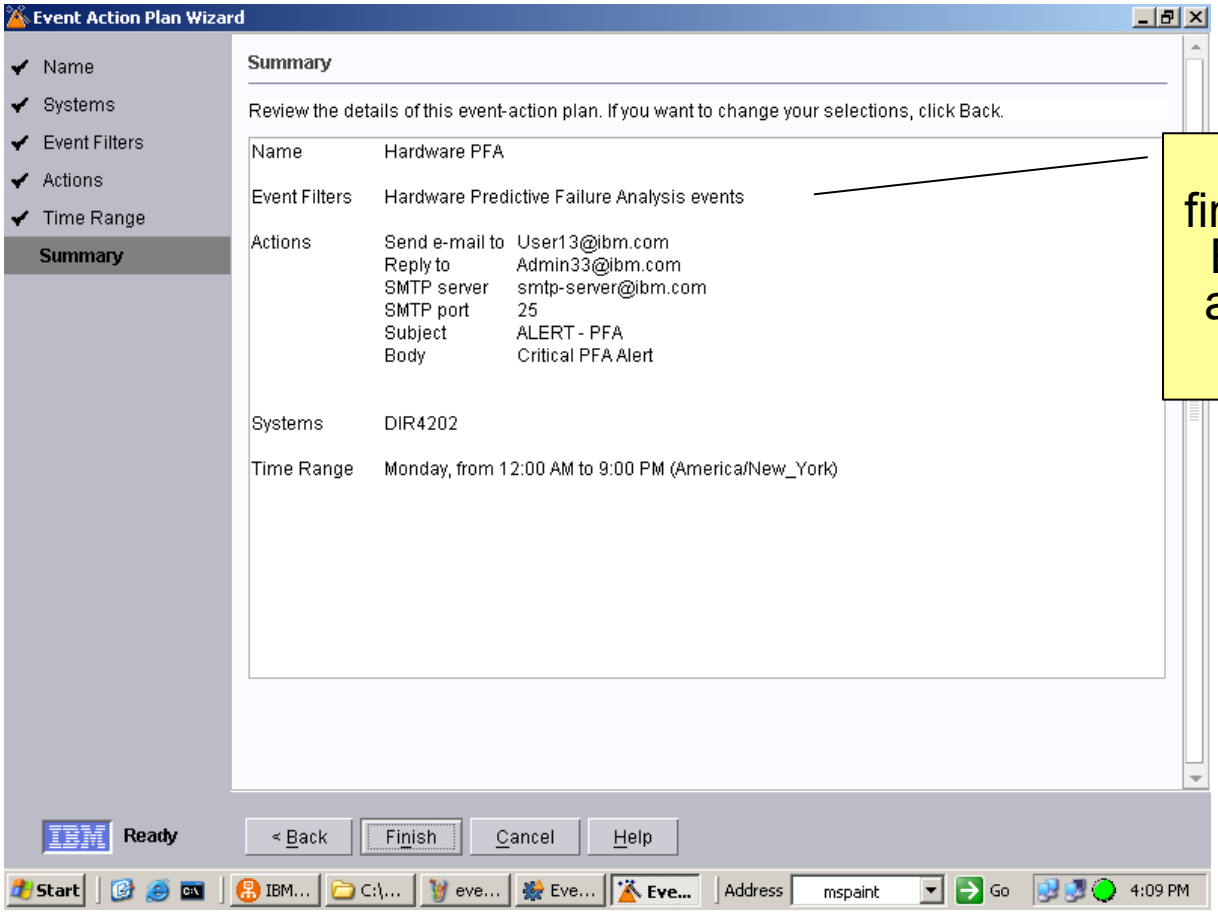
Event Action Plan Wizard



5

Choose the days and times you want to collect the events

Event Action Plan Wizard

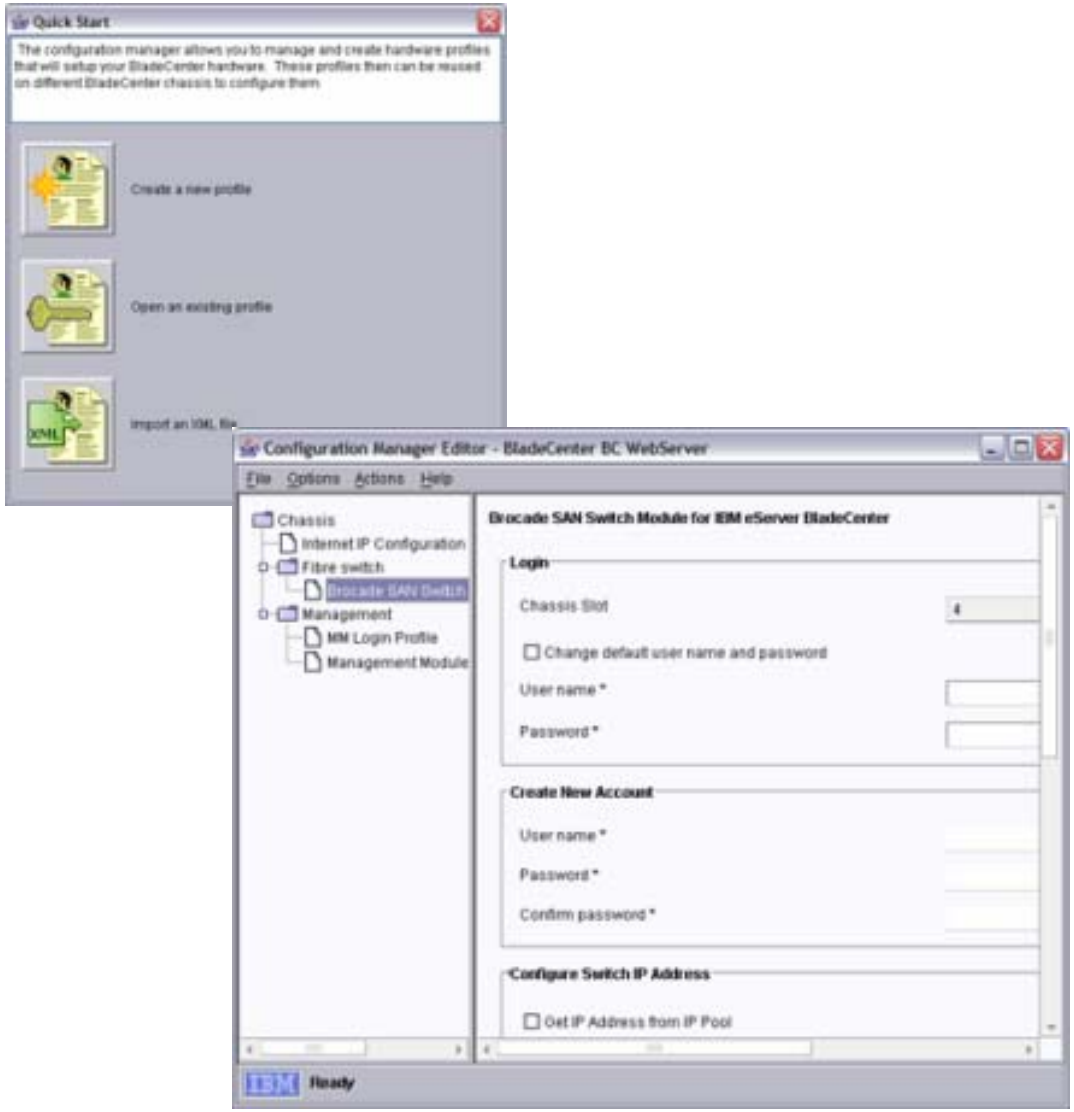


6

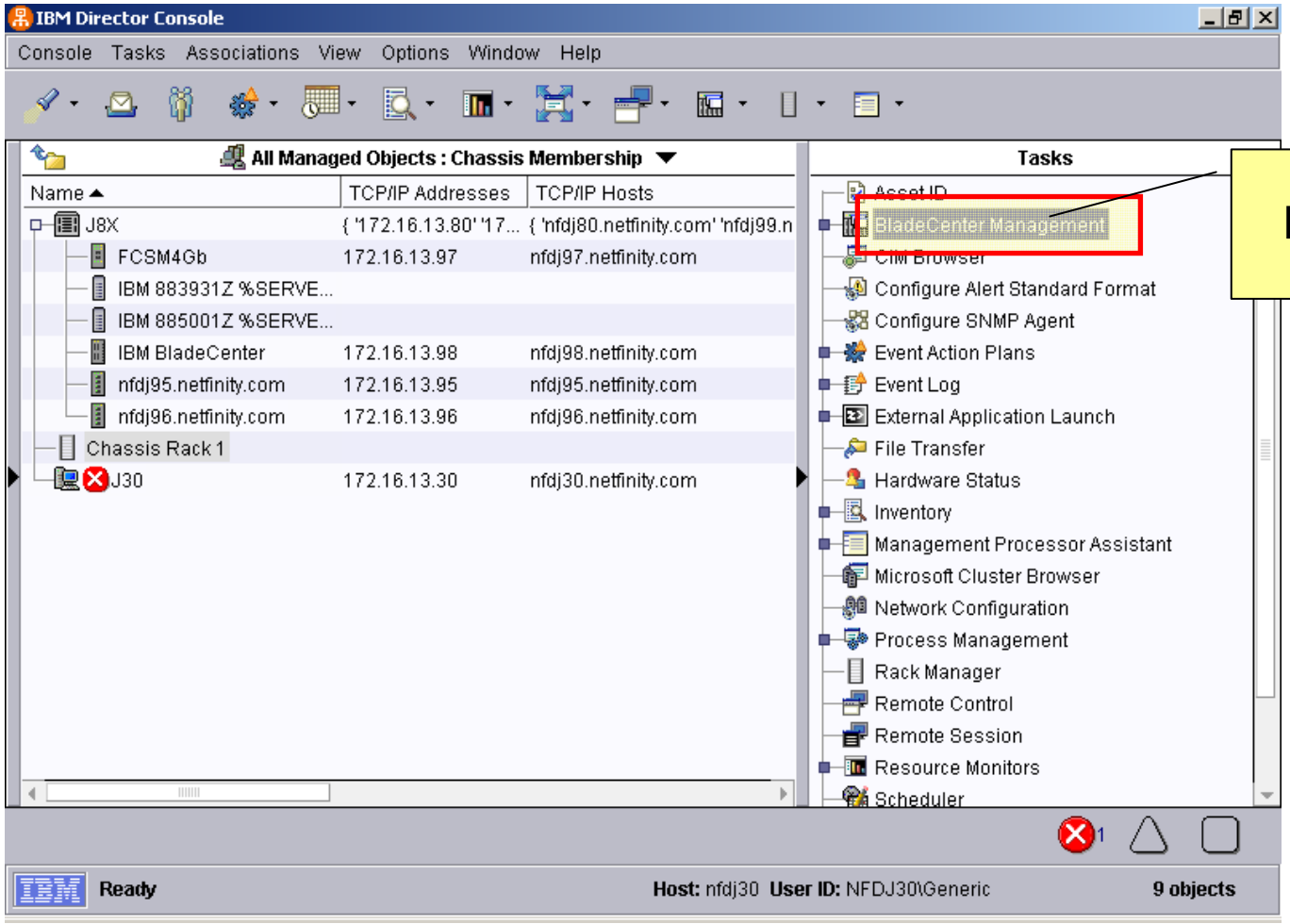
You are now finished creating the Event Action Plan and are presented with a summary

BladeCenter Chassis Configuration Manager

- Provides integration point for BladeCenter subsystem configurations
- Create configurations for chassis component devices
- Read configurations for chassis component devices
- Broadcast configurations to multiple chassis
- Modify single configuration without affecting others
- Detect and apply configurations to chassis and chassis components



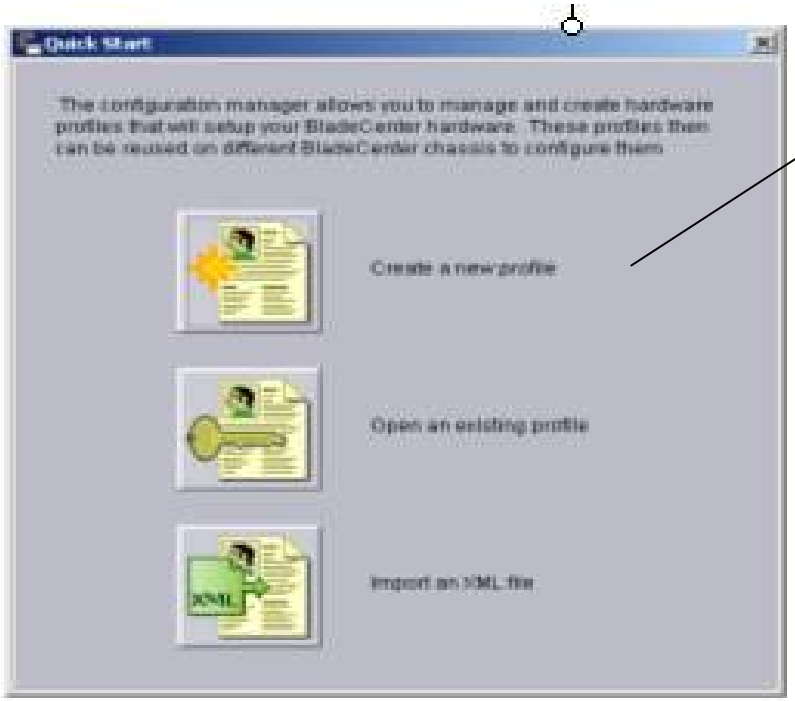
BladeCenter Management



1

BladeCenter Management Task

BladeCenter Management

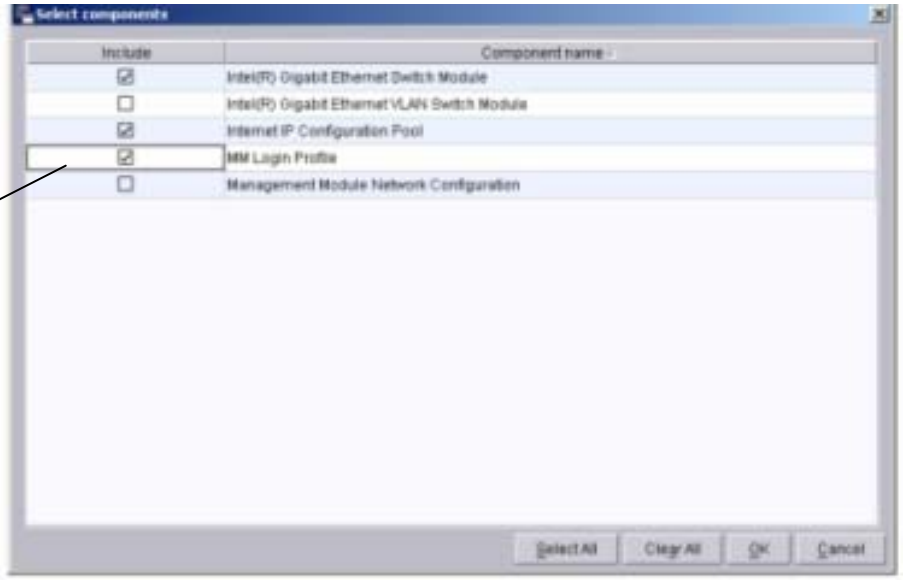


2

Create new profile for your BladeCenter hardware

3

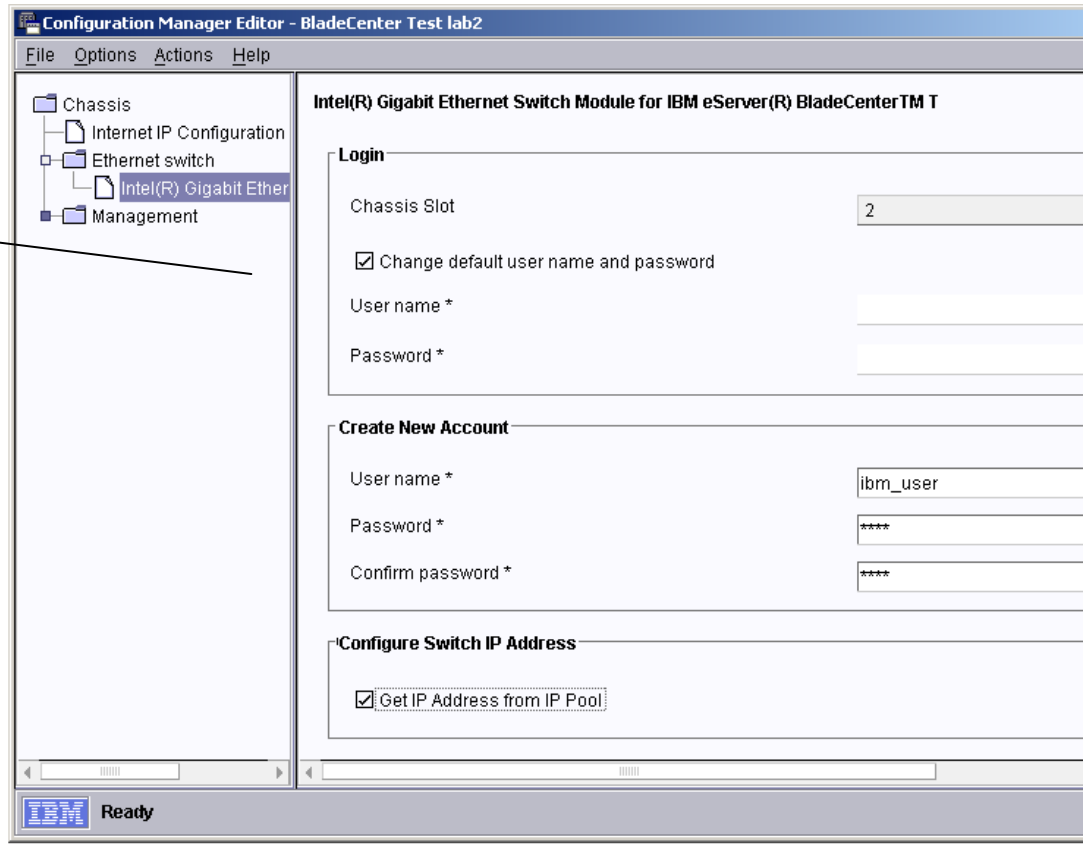
Select the components to add to the BladeCenter profile



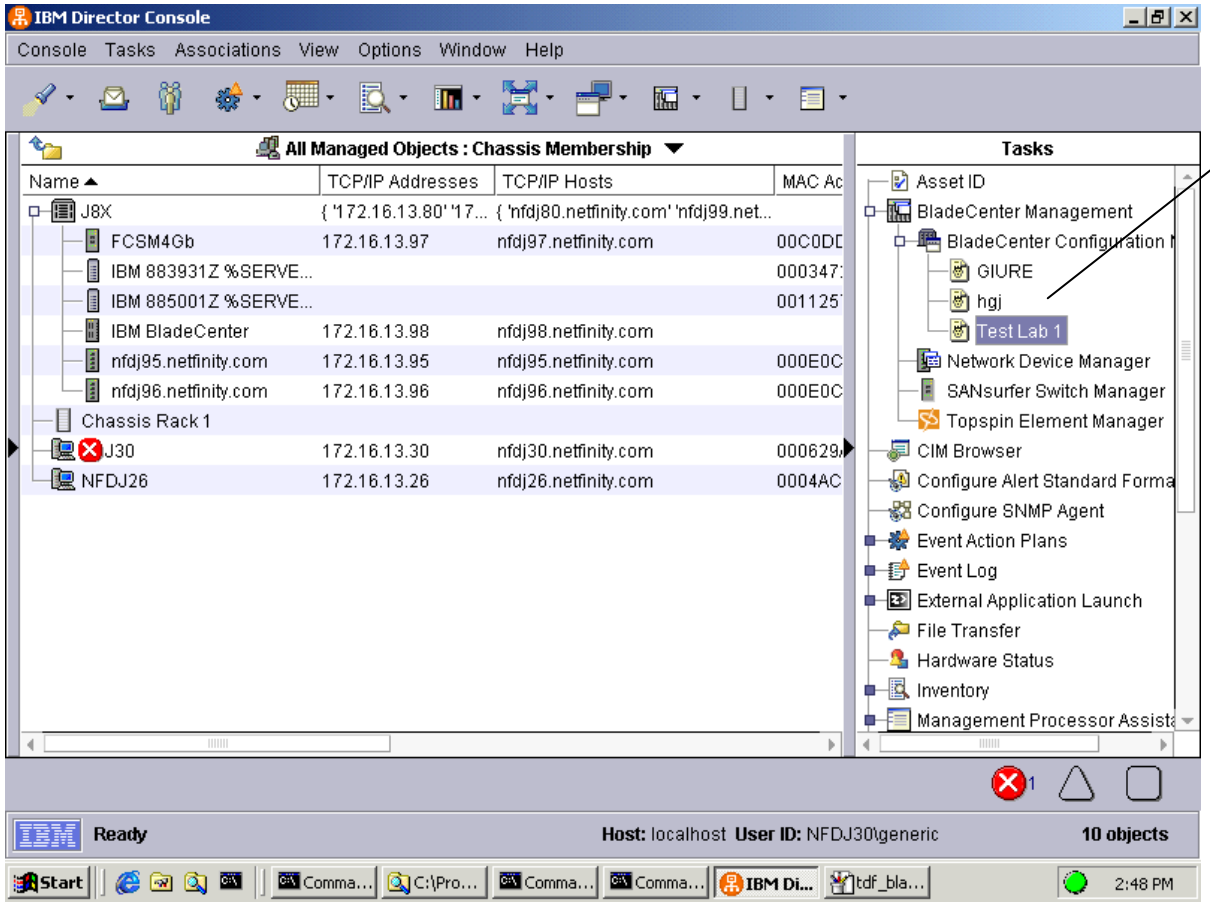
BladeCenter Management

4

Enter the configuration for the selected component



BladeCenter Management



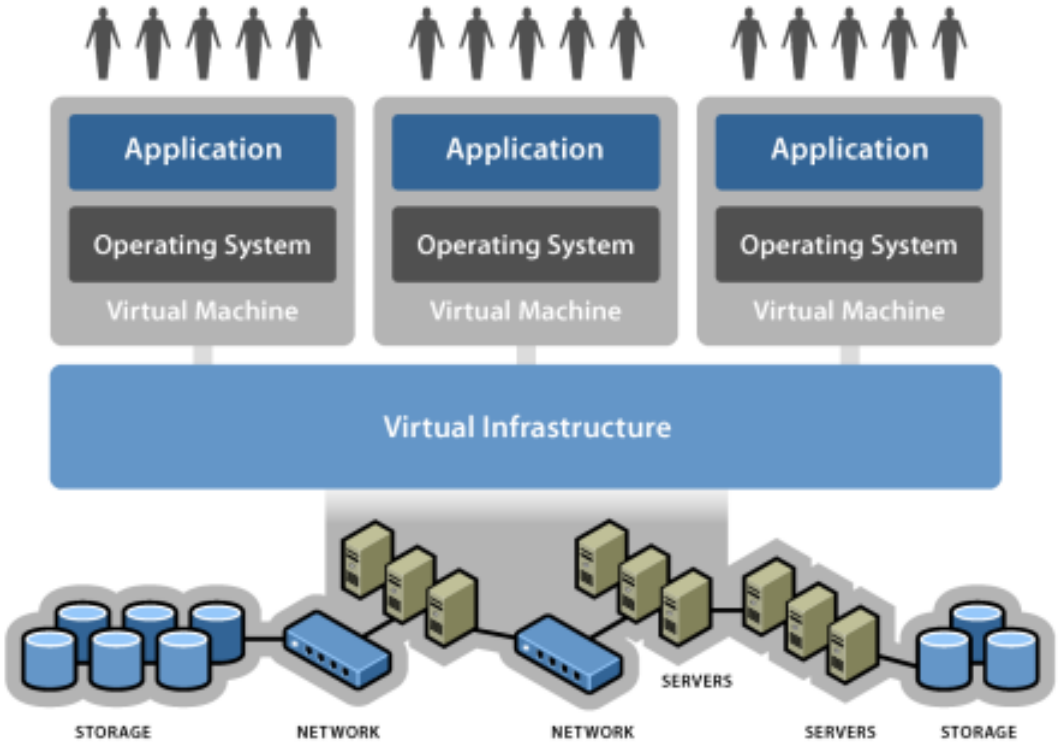
5

The new profile is listed in the task list under BladeCenter Management and can be automatically applied to a new BladeCenter system

Virtualisation and Consolidation

VMware ESX Server on System x

What is Virtual Infrastructure?



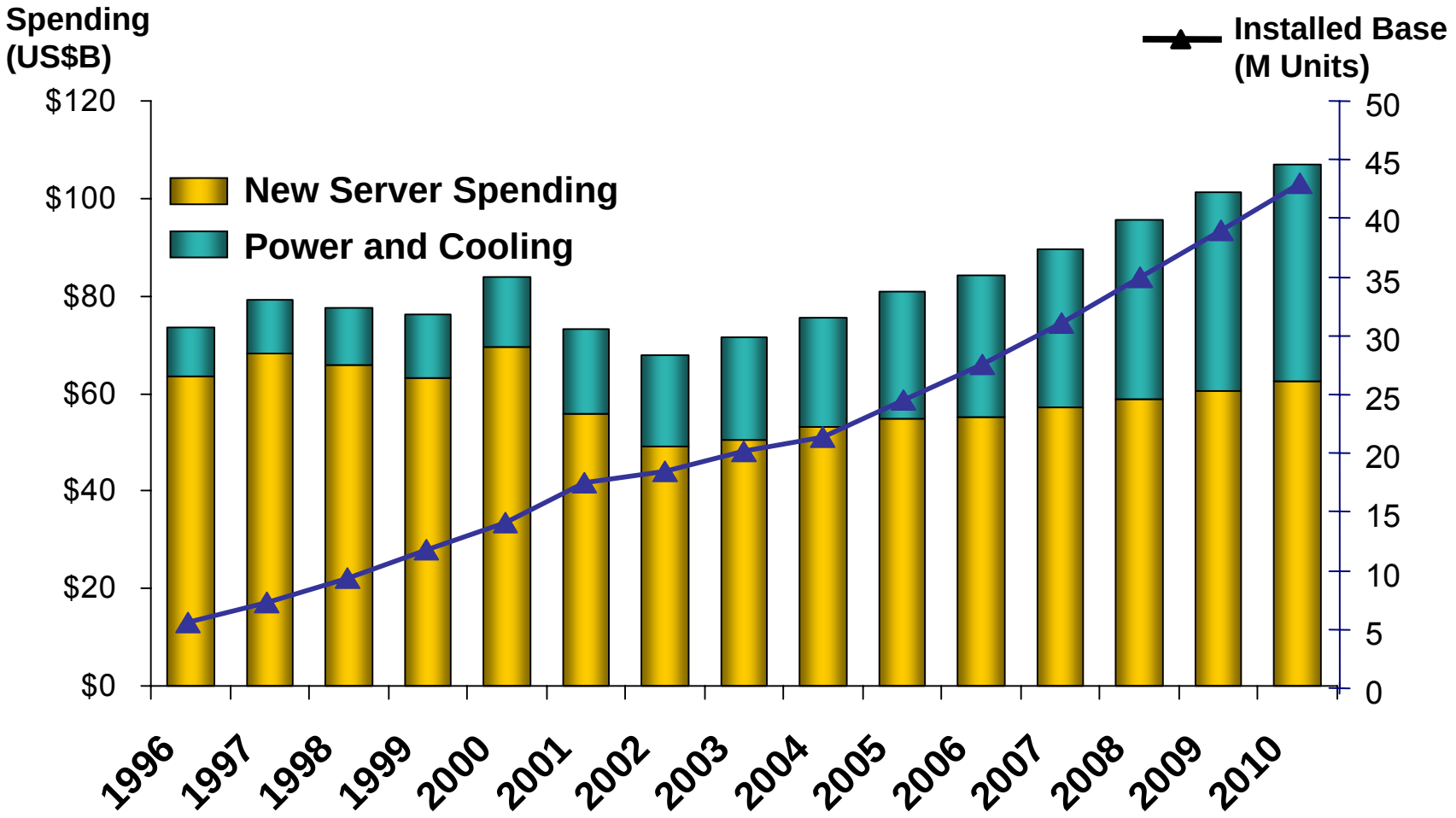
Infrastructure is what connects resources to your business

Virtual infrastructure is a dynamic mapping of your resources to your business

Result: decreased costs and increased efficiencies and responsiveness

VMware technology provides a thin virtualization layer that encapsulates operating systems and applications into portable virtual machines

Worldwide Server Market (IDC)



IDC Presentation, The Impact of Power and Cooling on Data Center Infrastructure, Doc #201722, May 2006

Virtual Infrastructure Savings

Higher resource utilization and flexibility are top benefits across all platforms,

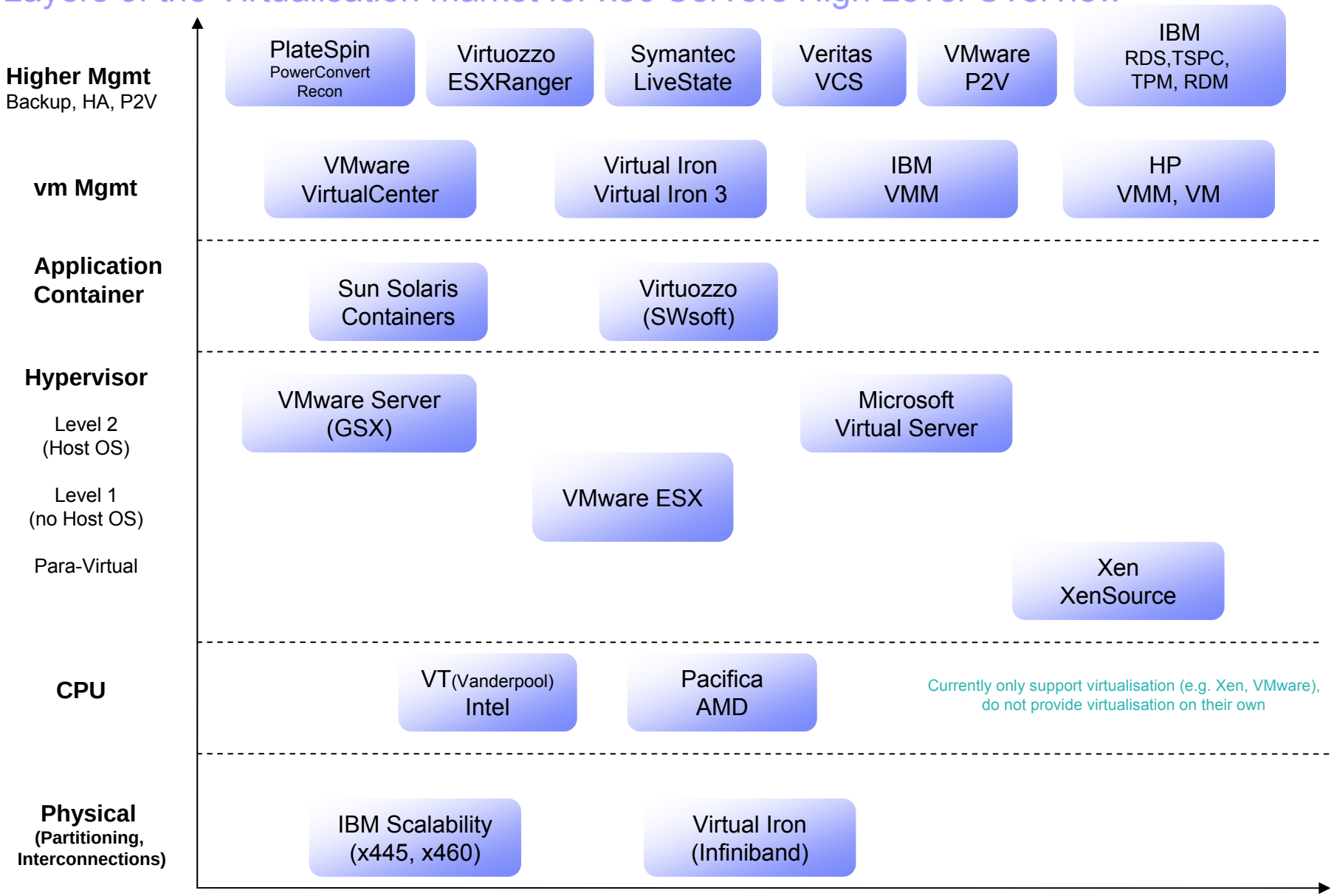
Economic	Operational	Strategic
Costs potentially lower and easier to manage	It's the most flexible way to build IT	It responds faster to business demands
▪ Get more out of your IT investment ▪ ROI in ~6-12 months ▪ Reduce TCO by up to 60% ▪ Don't pay for what you don't need	▪ Leverage technologies you already own ▪ Increase capacity without more hardware ▪ Gain instant provisioning and deployment ▪ Increase quality and consistency ▪ Minimize technology risk	▪ Create a foundation for utility computing ▪ Deploy and move resources more quickly ▪ Expand faster
Less Hw $	Less Cost $	New Capabilities

Industry trends – x86 Server Virtualisation becomes pervasive

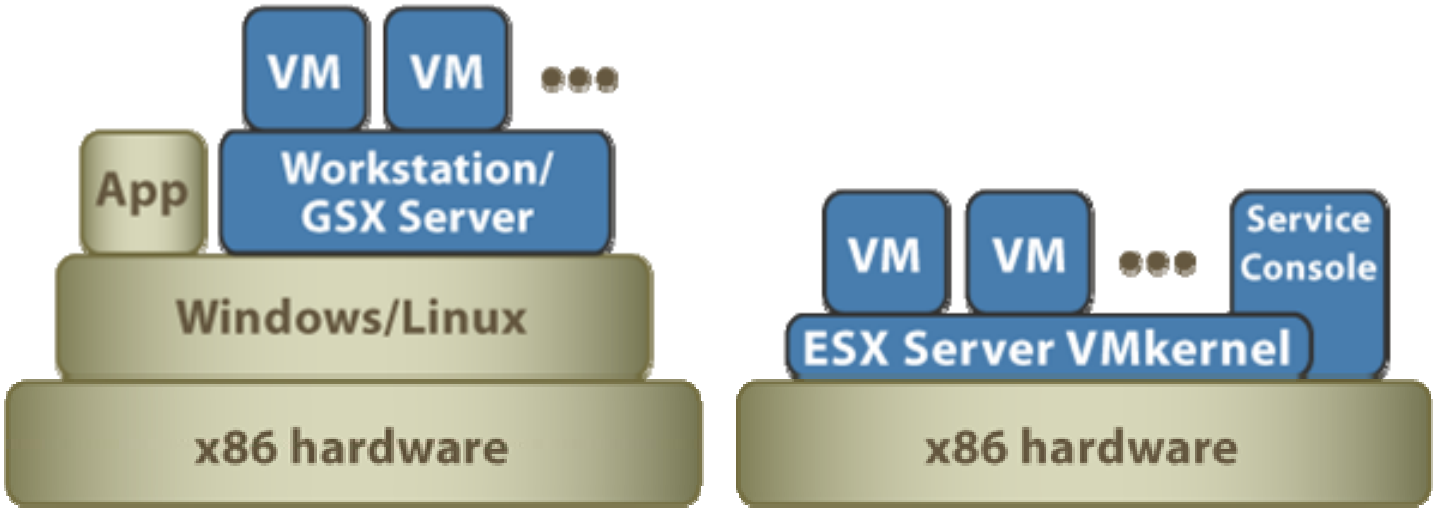
2000006

Are they all “doing” the same….?

Layers of the Virtualisation market for x86 Servers High Level Overview



Bare-Metal vs. Hosted Virtualization



Hosted (Workstation & Server)

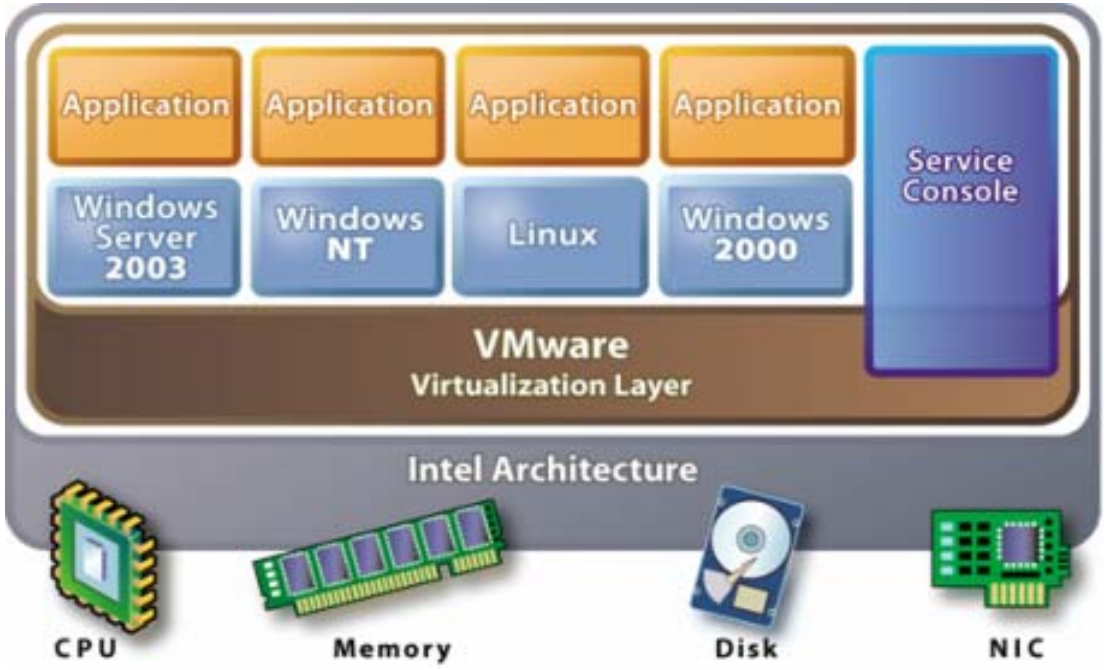
- Device support is inherited from host operating system for maximum hardware compatibility
- Virtualization installs like an application rather than like an operating system
- Can run alongside conventional applications

Bare Metal (ESX Server)

- Maximum performance with lowest overhead using certified hardware
- Highly efficient direct I/O pass-through architecture for network and disk
- Highly secure micro-kernel virtualization layer—only 100Ks of lines of code versus 10–25 million lines of host operating system code
- Advanced features like VMotion available

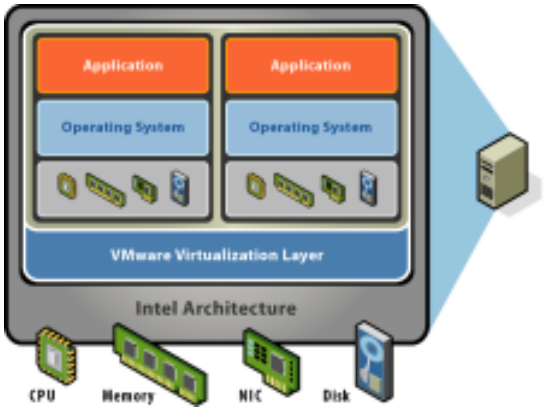
VMware ESX Server

Virtual Machines with EXA Technology



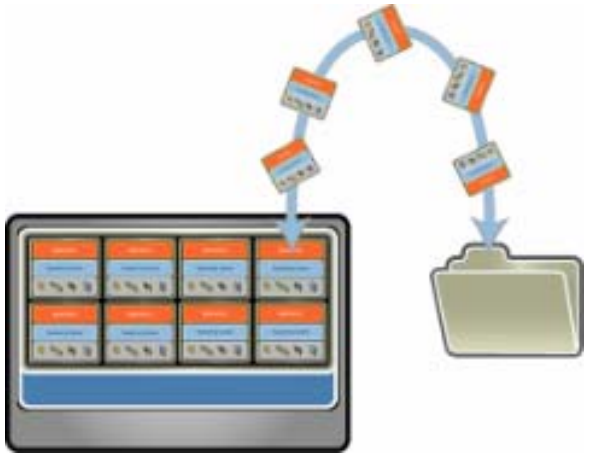
- Runs directly on hardware
- Manages resource allocations
- Partitioning
- Strong fault and security isolation
- Encapsulation
- Highly scalable architecture

Key Features: Partitioning, Isolation, and Encapsulation



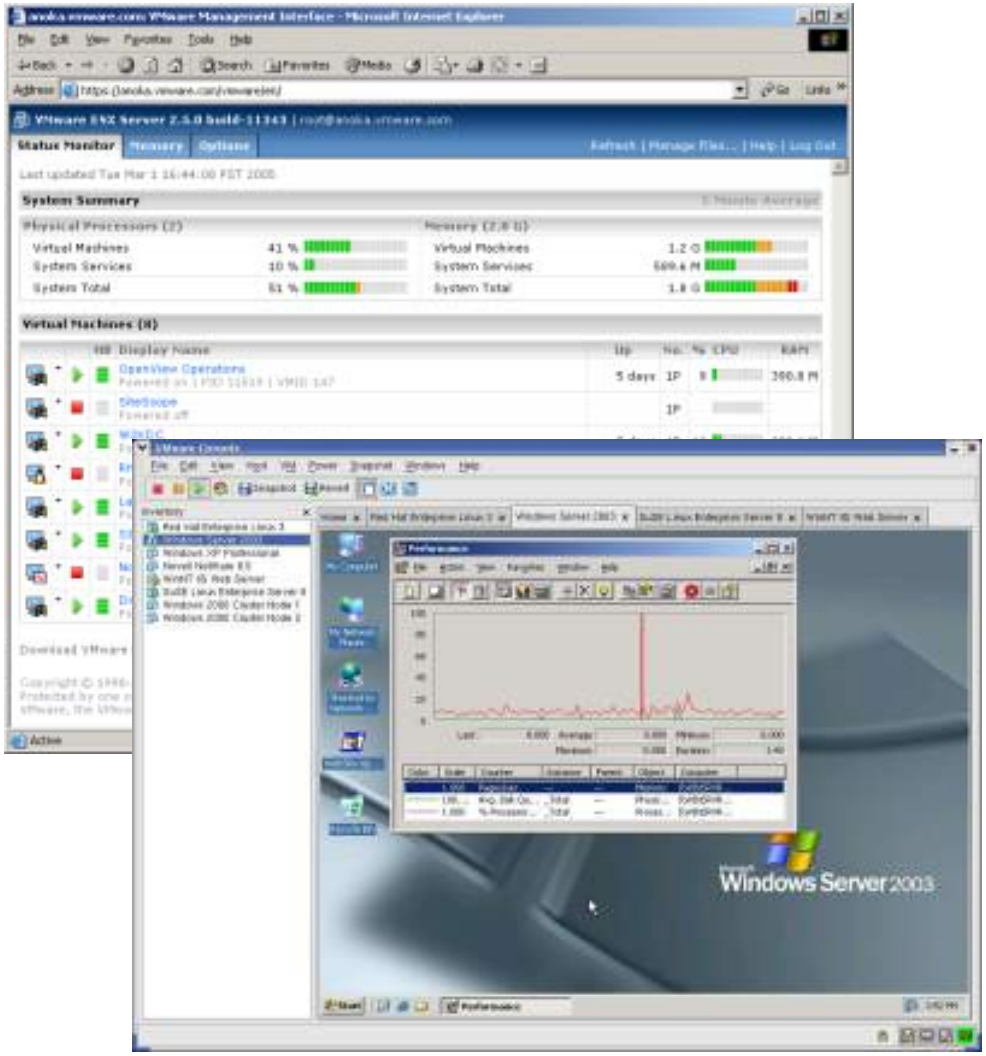
- Run multiple operating systems on one physical machine
- Fully utilize server resources
- Shared data is cluster-ready for failover and redundancy

- Fault and security isolation at the hardware level
- CPU, RAM, Disk, and network resource controls preserve performance
- Guarantee service levels



- Entire state of the VM is encapsulated: Memory, disk images, I/O device state
- VM state can be saved to a file – “Check pointing”, aka “Suspend / Resume”
- Re-use or transfer whole VMs with a file copy

ESX Server Remote Management Features

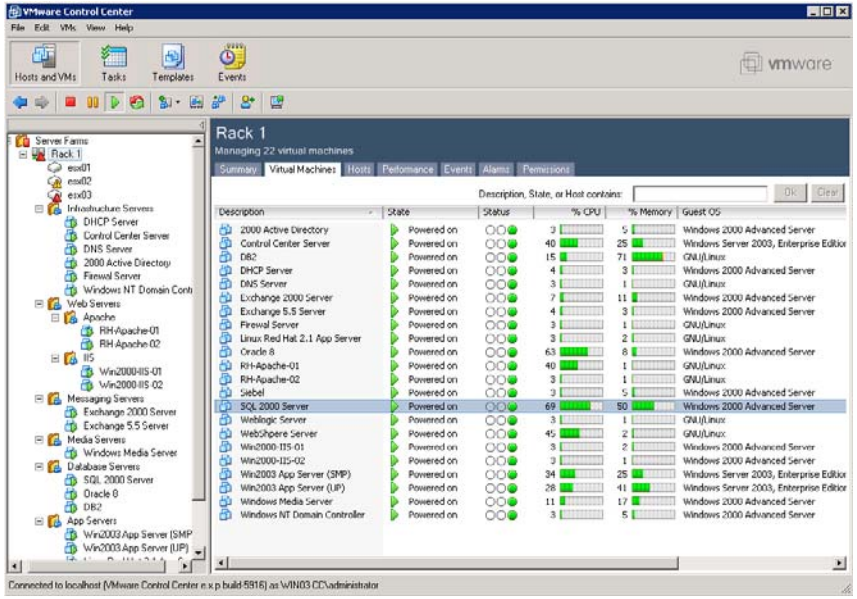


- Web-based management interface
  - Create, modify, stop, start, suspend/resume virtual machines
  - Monitor CPU and memory usage
  - Access from any browser
- Remote console
  - Windows and Linux versions
  - Create, configure & manage VMs
  - Full mouse and keyboard support
  - Remote full screen
  - Tabbed “quick switch” interface
  - Good low-bandwidth performance
- SSL security

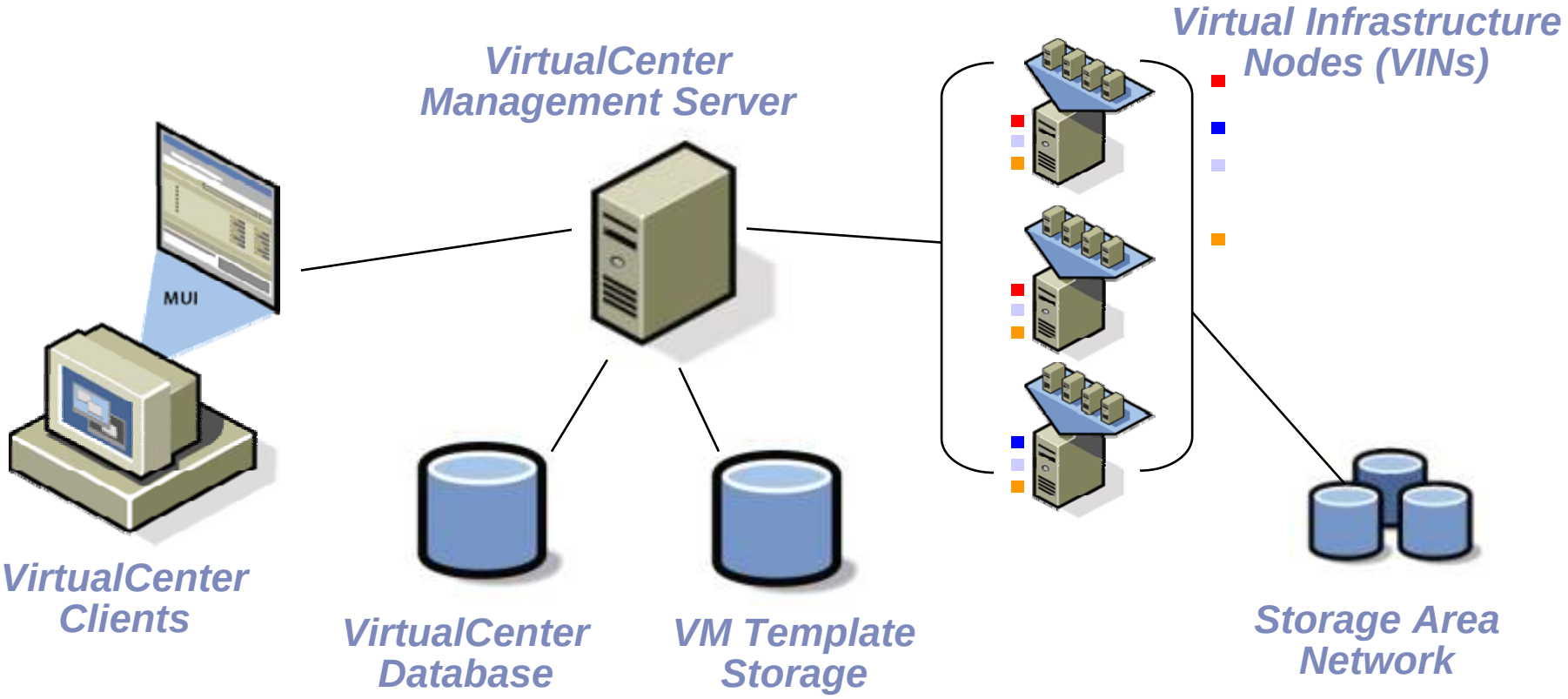
VMware VirtualCenter

Virtual Infrastructure Management Software for the Responsive Enterprise

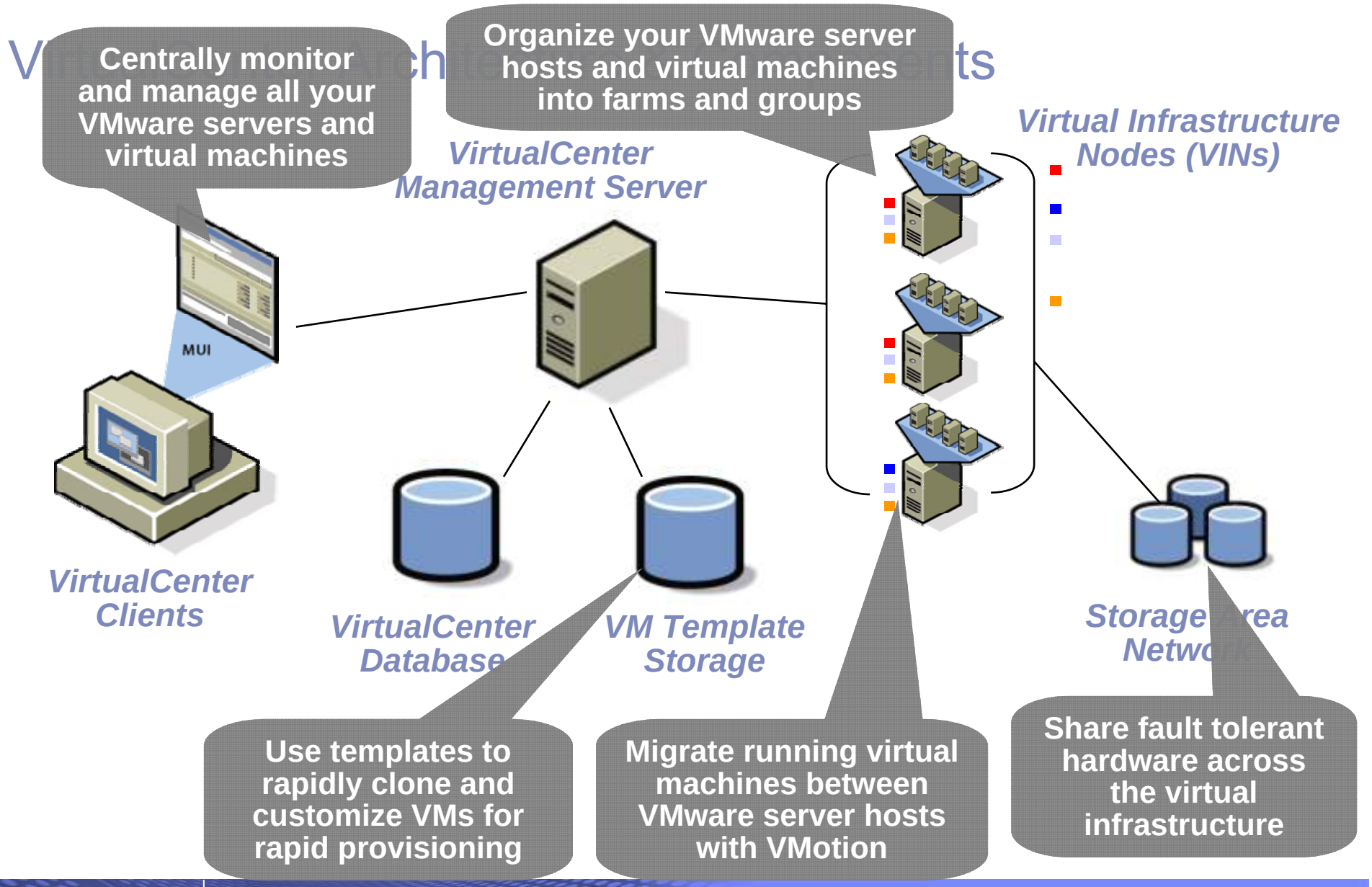
- **Securely Centralize Management** of your virtual infrastructure
- **Optimize Server Utilization** by dynamically moving workloads across servers
- **Instantly Provision New Servers** with standardized templates
- **Enhance Business Continuity** and eliminate scheduled downtime



VirtualCenter Architecture & Components

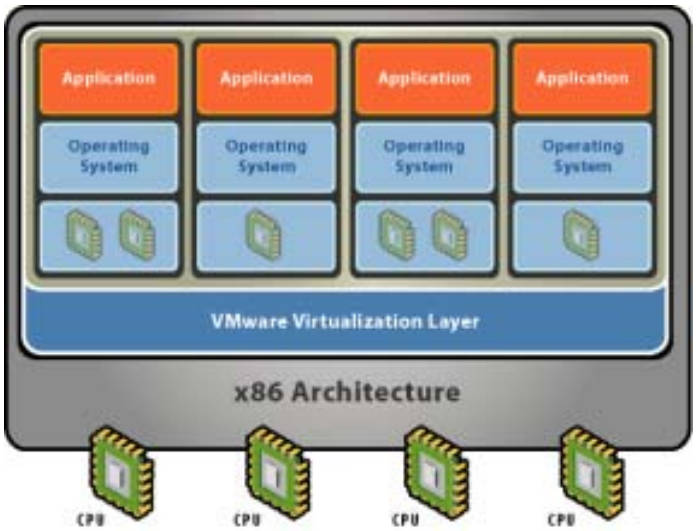


VirtualCenter provides a central and secure point of control for Virtual Infrastructure across the enterprise



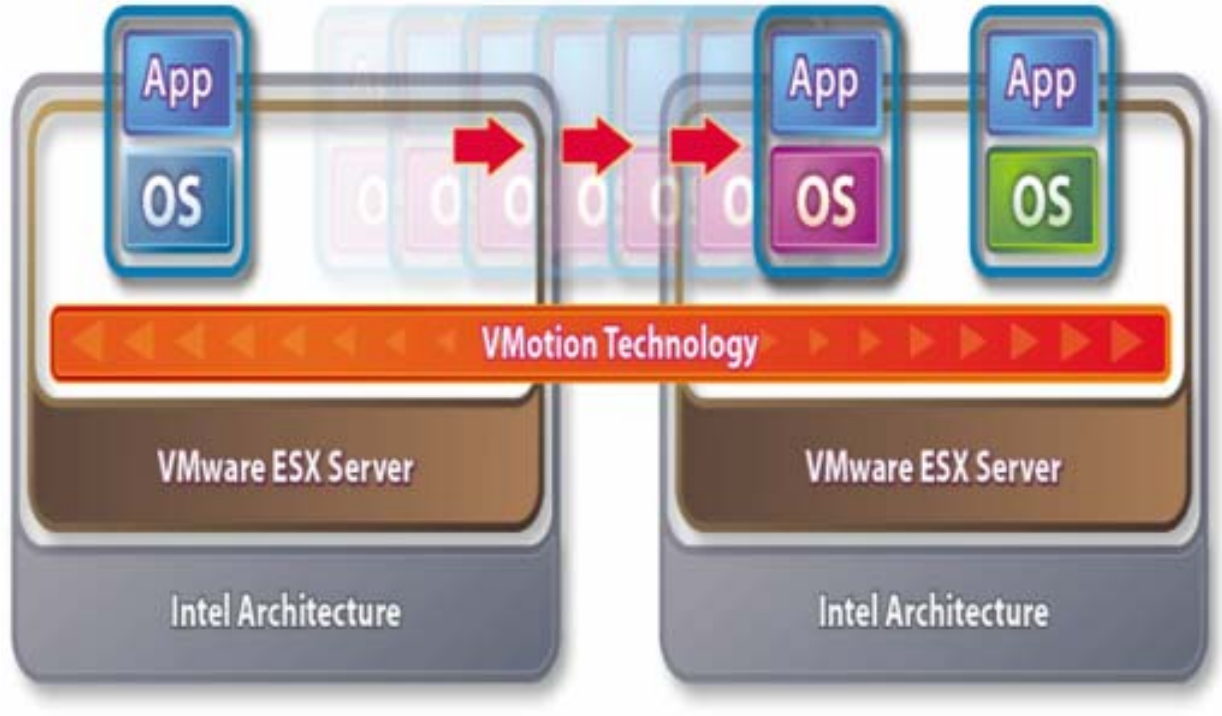
VMware Virtual SMP

- Add-on module for ESX Server
- Allows single virtual machine to span two processors
- Benefits
  - Increased virtual machine performance
  - Move more intensive workloads into virtual machines
  - Meet requirements of applications designed for 2-way systems
  - Develop and test applications in dual processor environments
- Compatible with dual-core and hyperthreaded processors



VMotion™ Technology

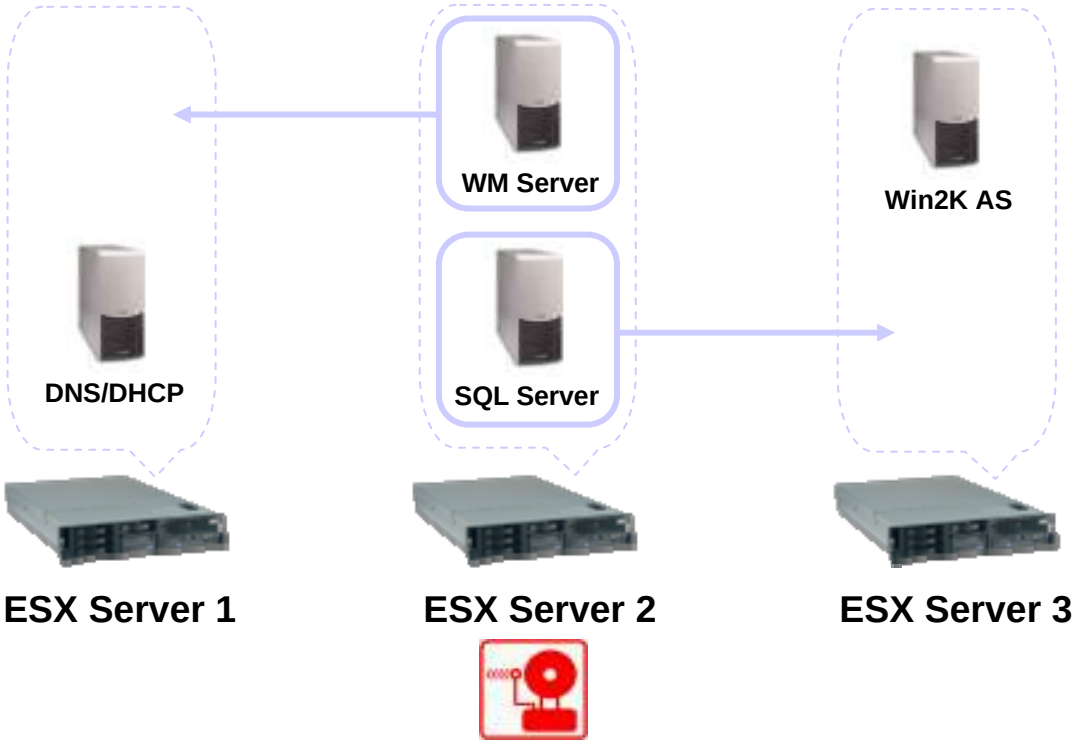
Instantly shift running systems across hosts with imperceptible downtime



- Proactively migrate systems across an environment to optimize workloads
- Perform zero downtime, rolling hardware upgrades
- Proactively migrate VMs to new hosts in response to hardware failure

Zero-Downtime Maintenance

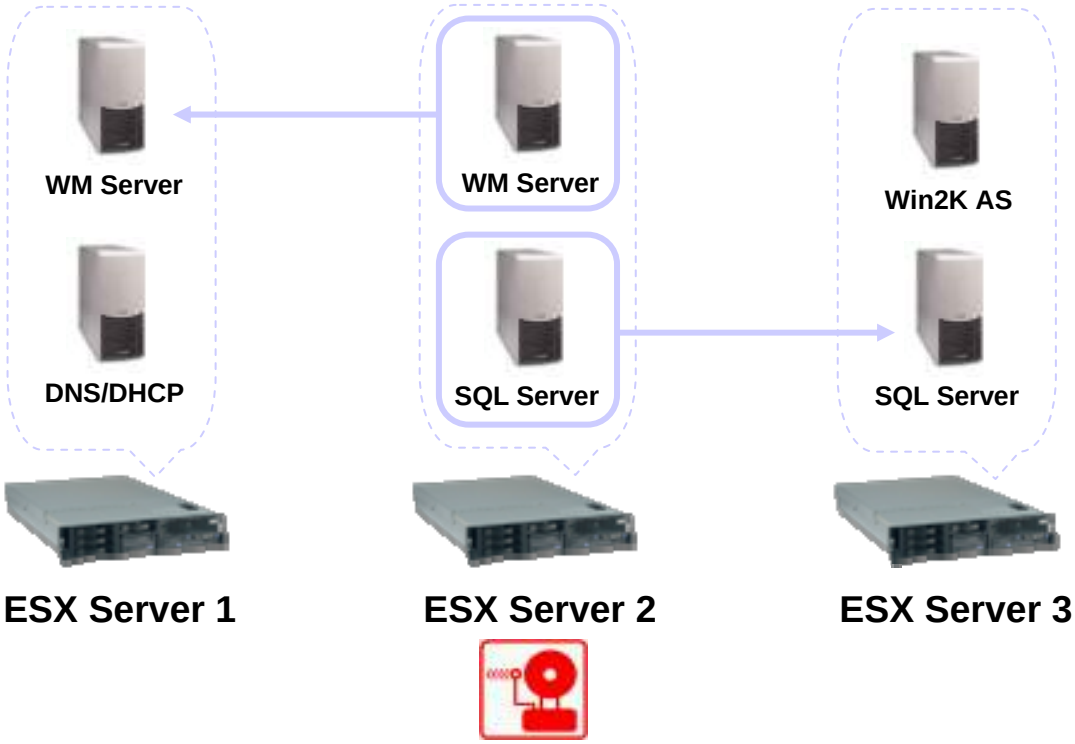
Upgrade and service production hardware through VM migration with zero downtime and 100% customer transparency



Virtualization → Virtual Infrastructure → **VirtualCenter** *→ Business Benefits*

Zero-Downtime Maintenance

Upgrade and service production hardware through VM migration with zero downtime and 100% customer transparency



Virtualization → Virtual Infrastructure → **VirtualCenter** *→ Business Benefits*

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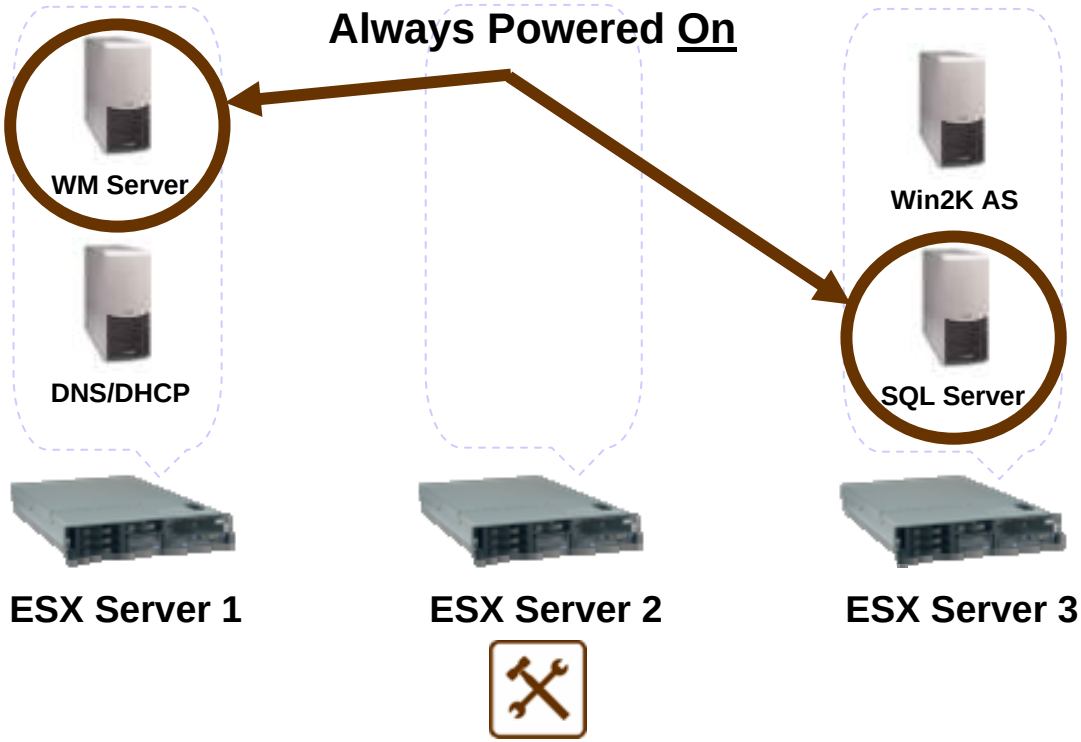

Virtualization → Virtual Infrastructure → **VirtualCenter** *→ Business Benefits*

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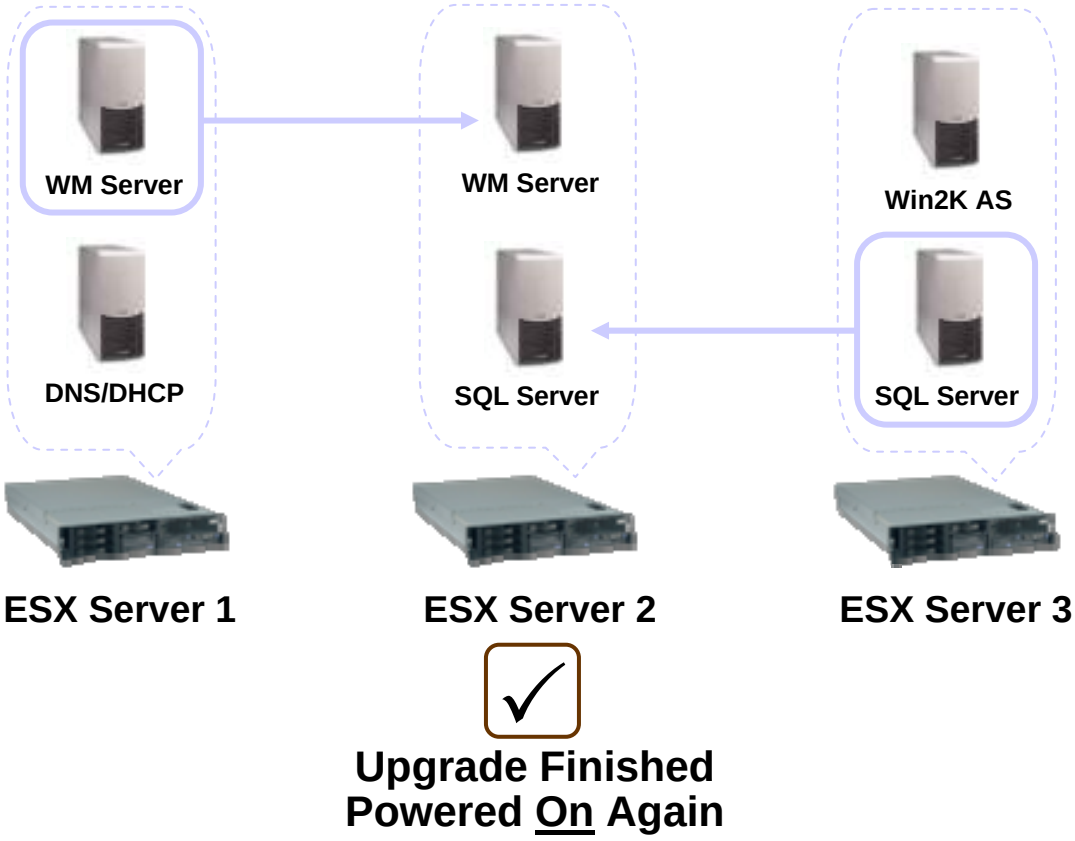
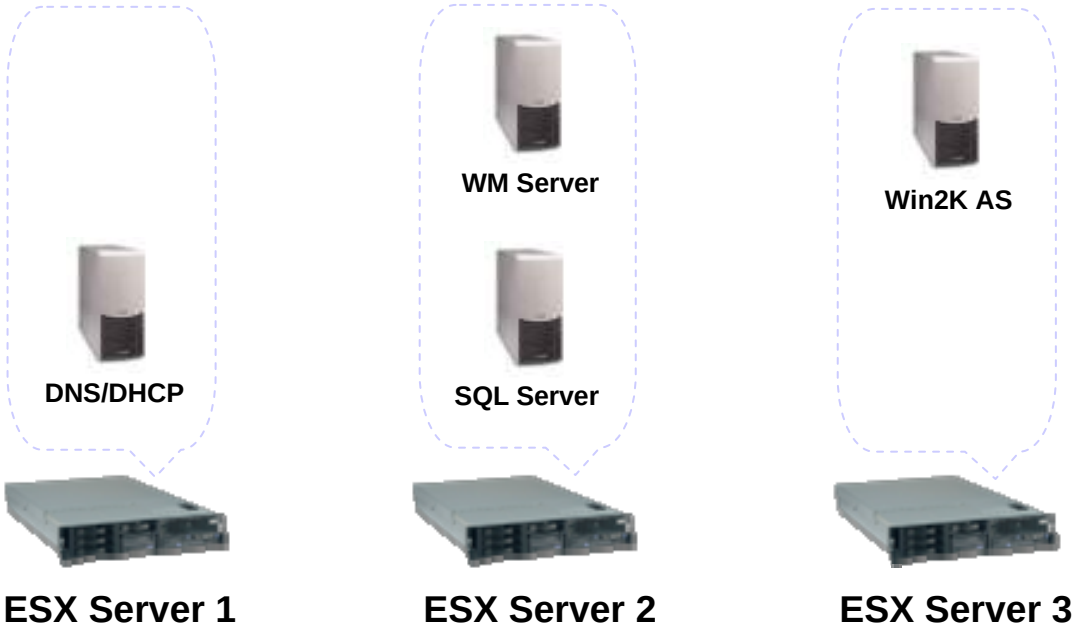


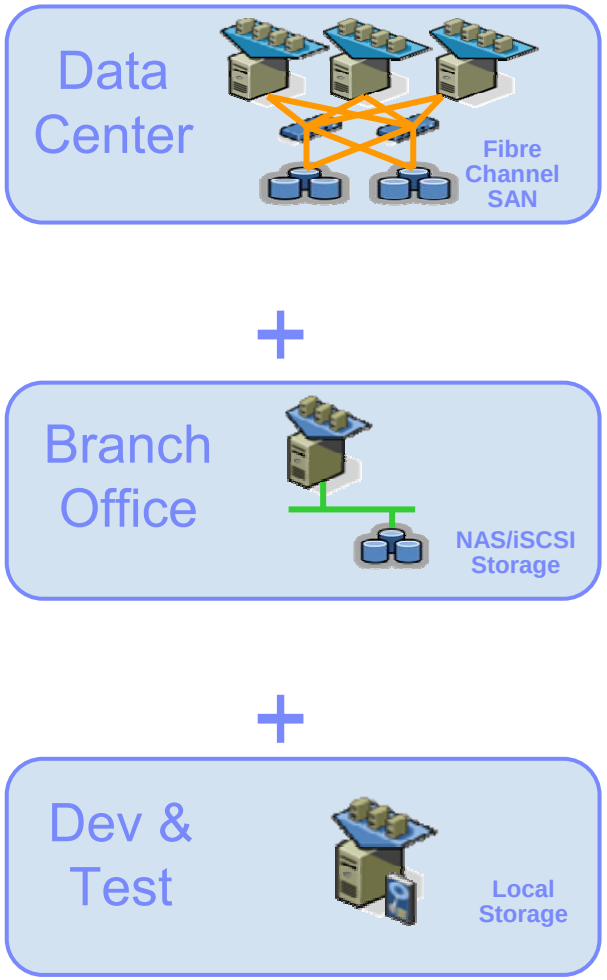
Zero-Downtime Maintenance

*Upgrade and service production hardware through VM migration with **zero downtime and 100% customer transparency***



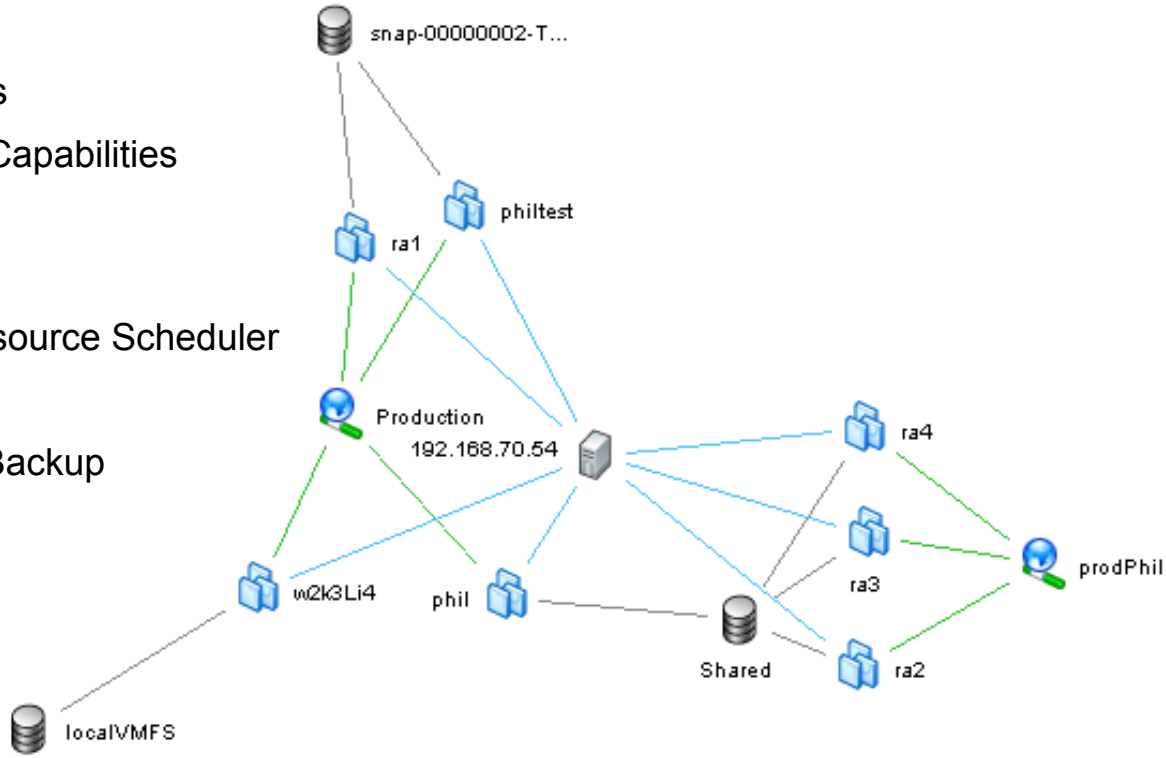
What is new in ESX 3

- NAS and iSCSI storage
  - Build in NFS client
  - HW and SW intiator
- 4-way Virtual SMP
- 16GB guest memory
- VMFS3
  - hot-add virtual devices
- more flexible networking
  - More NICs, more virtual switch ports



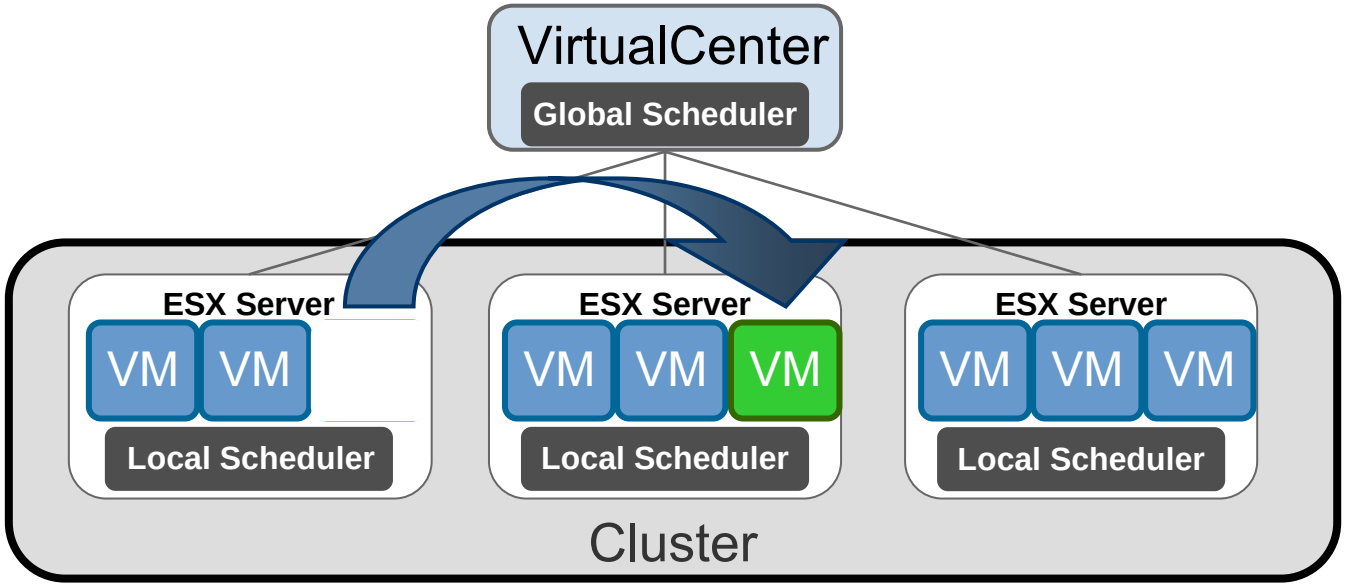
What is new in VirtualCenter 2

- Virtual Center 2
  - Common GUI
  - Topology Maps
  - New VMotion Capabilities
- New Services
  - Distributed Resource Scheduler
  - HA
  - Consolidated Backup



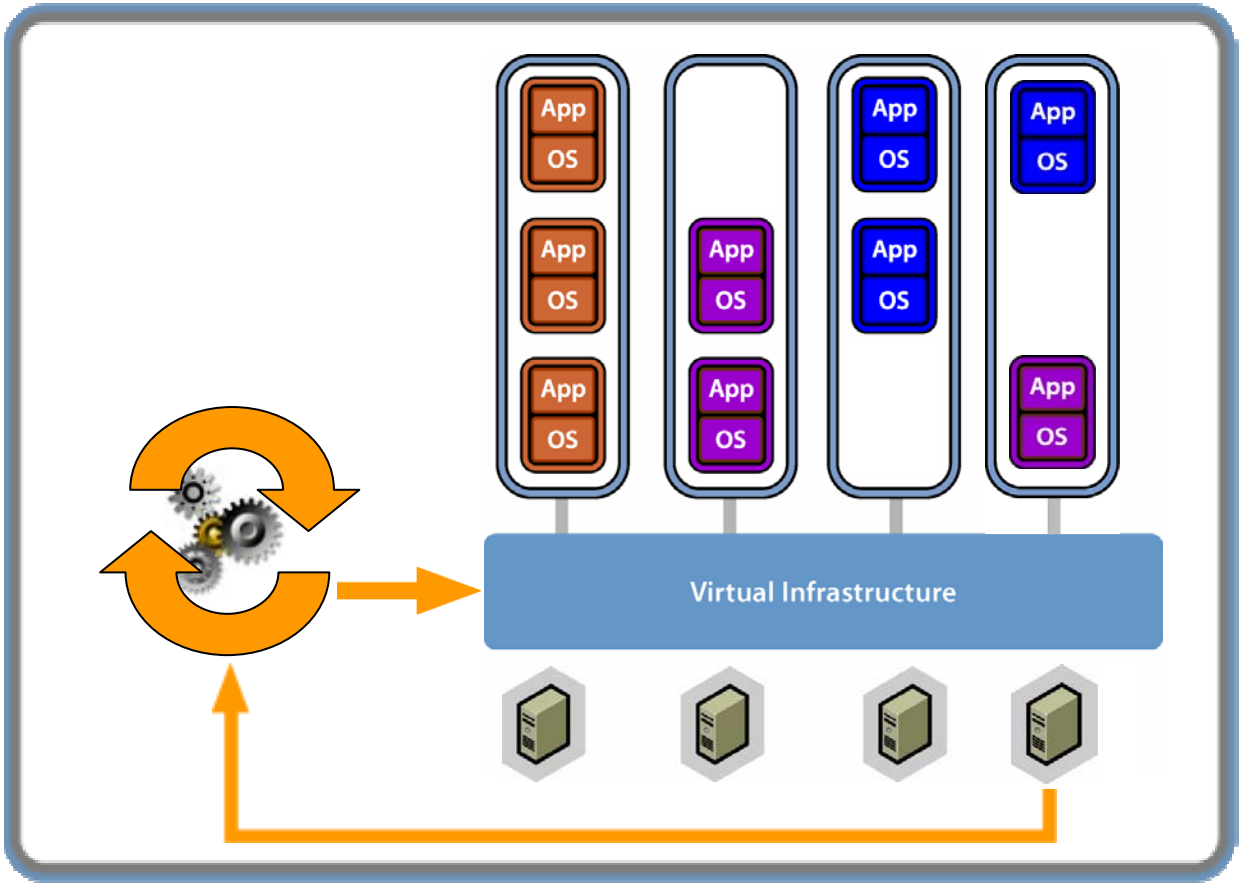
VirtualCenter 2 cont - DRS

- DRS
  - (fee-based) plug-in for Virtual Center
  - Automatic virtual machine placement
  - Cluster-wide resource management, Resource Pools
  - Policy based VMotion
  - 32 hosts, LAN – not WAN



VirtualCenter 2 cont - DRS

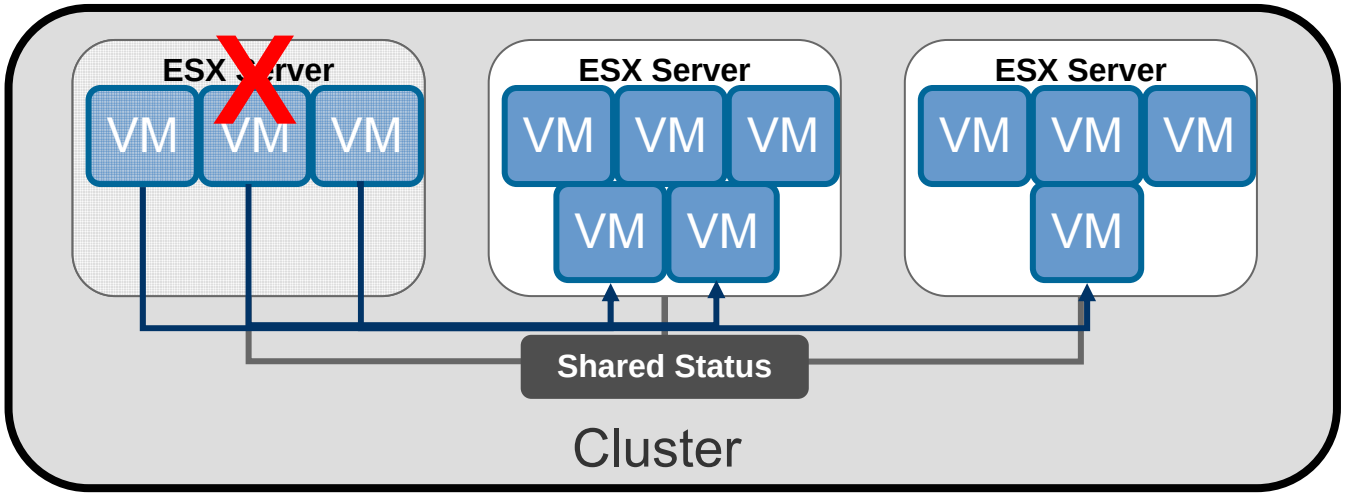
- Instand capacity on demand
  - Combine with bare-metal provisioning



VirtualCenter 2 cont - HA

- HA
  - (fee-based) plug-in for Virtual Center
  - Automatic "failover" of virtual machines between physical ESX servers
  - Placement optimised by global scheduler (in conjunction with DRS)

None of the complexity of “classic” clustering, OS independent



Virtualization Manager

- **Virtualization Managermakes it easy to manage instances of VMware ESX Server and Microsoft Virtual Server running on multiple physical platforms**
- **Provides "single glass" management of both physical and virtual systems**
- **Easily administer VMware ESX Server in IBM eServer BladeCenter environments by accessing all VMware ESX instances from one view**
- **Hardware health alerts can drive VMware's VMotion technology**
- **Enables increased availability and serviceability**
- **Allows you to perform predictive failure analysis, virtual machine migration (VMware) and provisioning**
- **Enables enterprise-wide on-demand power conservation**
- **Integration into IBM Director reduces training costs by providing a consistent look and feel and a familiar single point of management**
- **Allows you to take advantage of IBM Director's existing facilities for alerting, event action plans, security and system health**
- **Virtualization Manageris available at no additional cost to IBM customers**

IBM System x Technology

close

Storage in System x

Entry to Mid level Storage devices

DS4700 Specification Overview

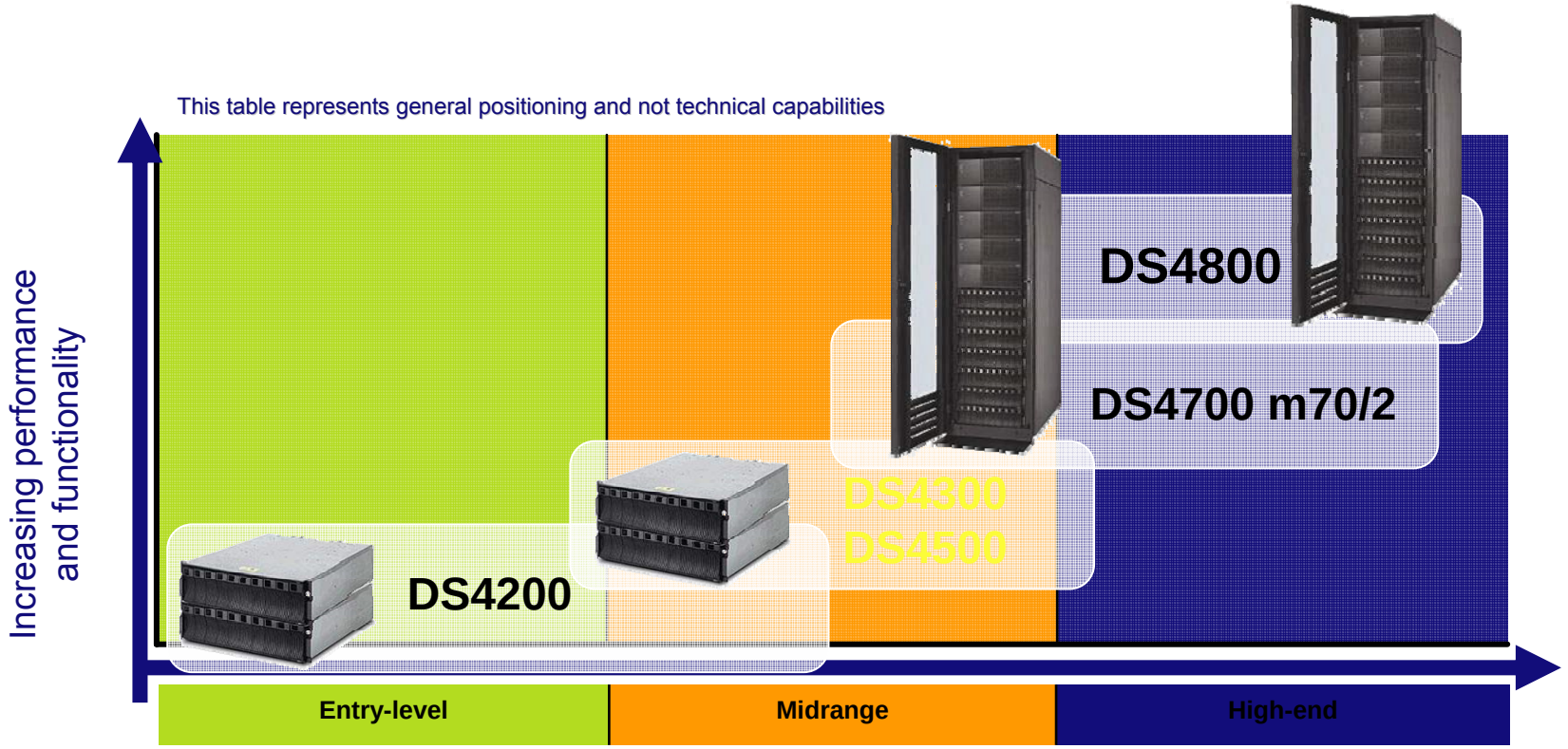
Model 72

- Eight 4 Gb/s FC host ports
- Four 4 Gb/s FC drive ports
- Max of 112 drives
  - FC and/or SATA
- 4 GB of cache memory
- Integrated XOR engine
- Storage Manager software
  - Partitions
  - FlashCopy
  - VolumeCopy
  - Enhanced Remote Mirroring

Model 70

- Four 4 Gb/s FC host ports
- Four 4 Gb/s FC drive ports
- Max of 112 drives
  - FC and/or SATA
- 2 GB of cache memory
- Integrated XOR engine
- Storage Manager software
  - Partitions
  - FlashCopy
  - VolumeCopy
  - Enhanced Remote Mirroring

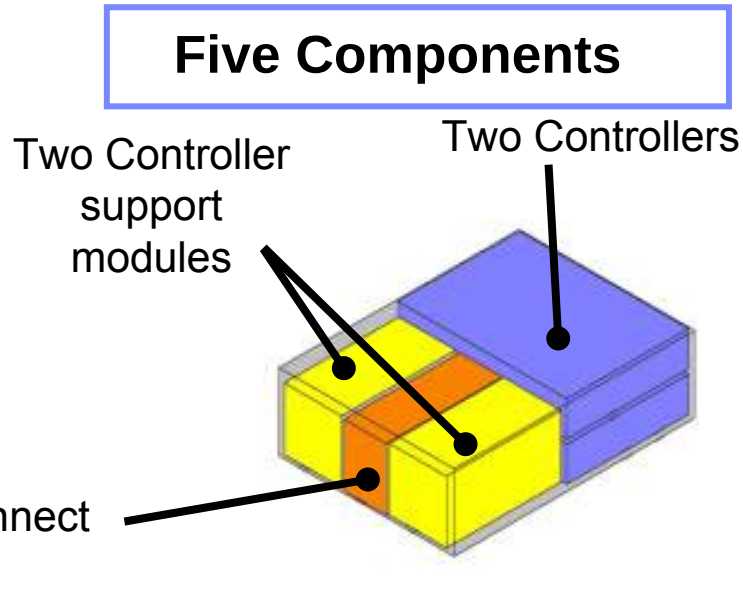
DS4000 Series Positioning



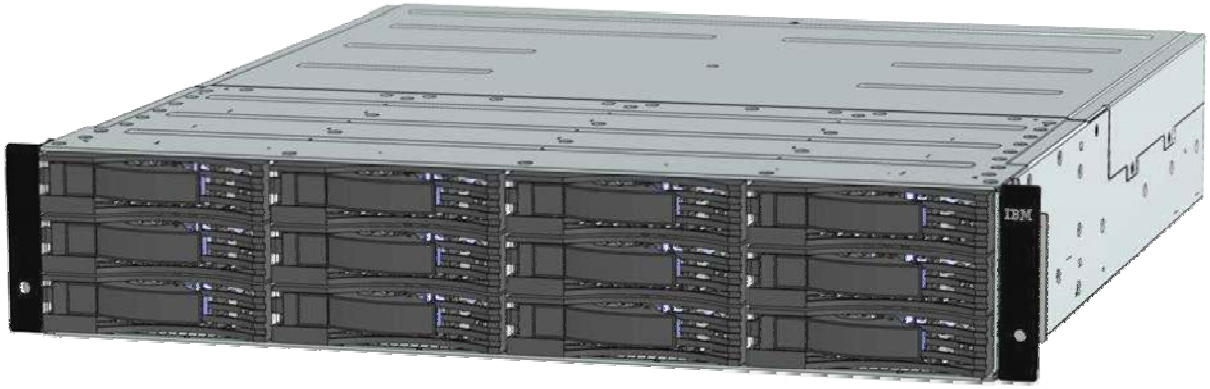
	Entry-level	Midrange	High-end
Workload	Light workloads	Medium workloads	Heavy workloads
Typical platforms	Window/Linux direct attach	Homogeneous SAN	Heterogeneous SAN
Applications	SMB operational	SME business-important	SME business-critical
Primary drive type	SATA	FC / SATA	FC
Data replication	FlashCopy	FlashCopy, VolumeCopy, Enhanced Remote Mirroring	FlashCopy, VolumeCopy, Enhanced Remote Mirroring

Introducing the DS4800

- 4 Gbps technology is here with the latest member of the DS4000 Series of products, the IBM TotalStorage DS4800!
- Targeted at enterprises with compute-intensive applications and replication requirements
- Eight 4 Gbps host and SAN interfaces support existing infrastructures - helping protect investments
- High performance designed for open systems
- Support for 224 Fibre Channel or Serial ATA disk drives
- DS4000 Storage Manager designed to deliver robust functionality through an intuitive GUI



EXP3000 Enclosure



- High-density 2U, 19” deep, enclosure housing up to 12 SAS drives
- High-speed SAS drives with 3Gbps data transfer rates
- 4 x 3-Gbps SAS “wide” ports for host connectivity
- One ESM module standard
- Customer replaceable and hot-swappable disks
- RoHS and WEEE compliant

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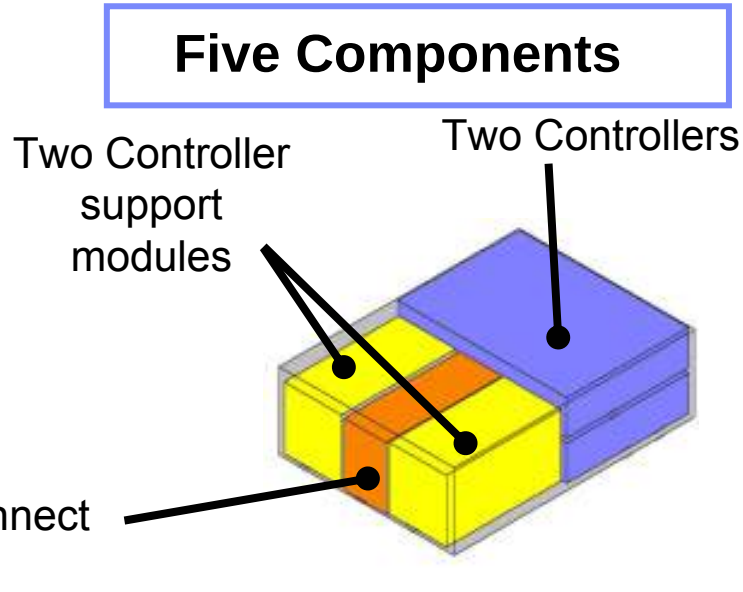


IBM System x Storage Servers

Microsoft Windows Powered

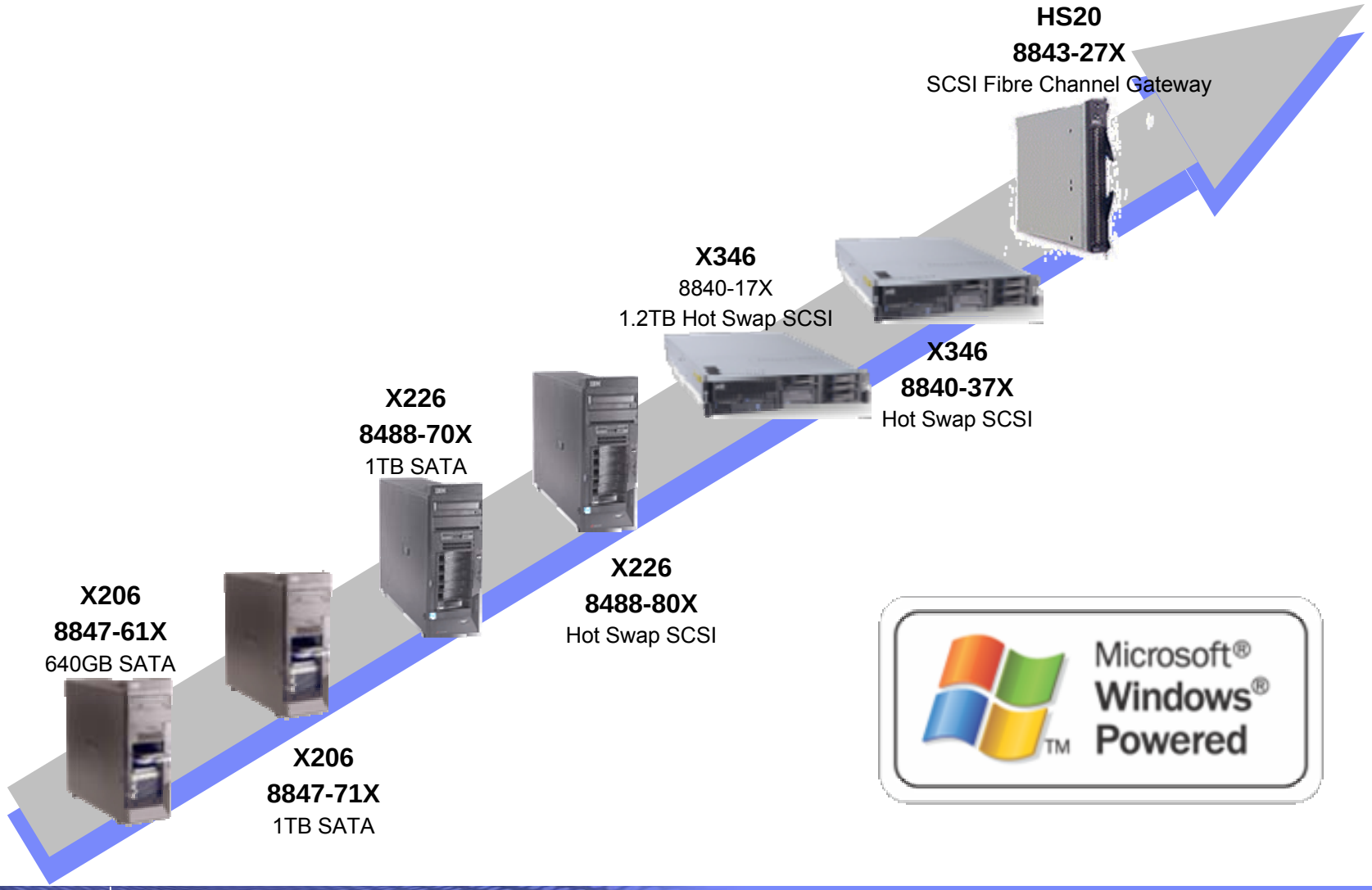
IBM xSeries Storage Servers

- xSeries Storage Server family delivers affordable, easy-to-use network attached storage (NAS) solution utilizing industry standard server hardware and software.
  - Leverage the combination of industry standard xSeries hardware server technology and Windows Storage Server 2003.
  - Windows-based NAS represents over 40% of NAS market and its share is growing.
- A comprehensive range of xSeries Storage Server solutions for a wide range of customers
  - Enterprise data center customers (x346, HS20 Blade)
  - Branch office, department and store deployments (x346, x226)
  - Small and medium business (x206, x226)

- Optimized file and print server that easily integrates in Windows IT infrastructures.
  - They're affordable, easy to understand, and simple to deploy
  - Ideal for file server consolidation and lowers TCO
  - Windows Active Directory, systems management, Ethernet network, backup
  - Supports heterogeneous environments and file systems

- xSeries and IBM Benefits:
  - Provides a 'fully clothed' server solution – disk, memory, adapters and operating system included
  - Provides an attractive solution to attaching additional IBM Storage'
  - Fill gap in xSeries portfolio removing barriers on large customer xSeries bids requiring total server solution from one vendor.

IBM xSeries Storage Server Offerings



xSeries Storage Server Product Offerings

					
x206 Storage Server 640MB or 1TB SATA	x226 Storage Server Performance - SATA	x226 Storage Server Flexible Disk – SCSI	x346 Reliable - File Server SCSI	x346 Reliable – Gateway SCSI	HS20 Blade Storage Server SCSI / Fibre Gateway
▪Uni processor ▪3.2 or 3.4Ghz – Pentium4 w/EM64T ▪800MHz front side bus ▪4 SATA preconfigured drives - 640GB or 1TB ▪ServeRAID 7t ▪512 or 1GB Std - Up to 4 GB Memory ▪Integrated GB Ethernet ▪management adapter ▪4U Towe ▪ASF 2.0 Remote Power On/Off Support ▪Windows Storage Server 2003 Express ▪Storage Manager ▪IBM Director	▪2-way capable ▪3.0Ghz Xeon (Irwindale) processor 2M L2 Cache, w/EM64T 800MHz front side bus ▪4 SATA preconfigured drives 1TB ▪ServeRAID 7t ▪512 MB Std - Up to 16 GB Memory ▪Integrated GB Ethernet ▪4U Tower ▪ASF 2.0 Remote Power On/Off Support Windows Storage Server 2003 w/Print ▪Storage Manager ▪IBM Director	▪2-way capable ▪3.4Ghz Xeon ▪(Irwindale) processor 2M L2 Cache, w/EM64T ▪800MHz front side bus ▪(2) 36GB 15K Hot-swap SCSI preconfigured drives ▪No Data Volumes ▪ServeRAID 6i Plus ▪1GB Std - Up to 16 GB Memory ▪Integrated GB Ethernet ▪4U Tower ▪ASF 2.0 Remote Power On/Off Support ▪Windows Storage Server 2003 w/Print ▪Storage Manager ▪IBM Director	▪2-way capable ▪3.0 Ghz Xeon (Irwindale) processor 2M L2 Cache, w/EM64T ▪800MHz front side bus ▪(2) 36GB 15K Hot-swap SCSI preconfigured drives ▪(4) 300GB 10K Hot-swap Data Volumes ▪ServeRAID 7k ▪1GB Std - Up to 16 GB Memory ▪Integrated Dual GB Ethernet ▪2U Rack ▪Integrated IPMI management processor ▪Windows Storage Server 2003 w/Print ▪Storage Manager ▪IBM Director	▪2-way capable Xeon (Irwindale) processor 2M L2 Cache, w/EM64T ▪3.4Ghz ▪800MHz front side bus ▪(2) 36GB 15K Hot-swap SCSI preconfigured drives ▪No Data Volumes ▪ServeRAID 7k ▪1GB Std - Up to 16 GB Memory ▪Integrated Dual GB Ethernet ▪2U Rack ▪Integrated IPMI management processor ▪Windows Storage Server 2003 w/Print ▪Storage Manager ▪IBM Director	▪2-way capable Xeon (Irwindale) processor 2M L2 Cache, w/EM64T ▪3.2Gz ▪800MHz front side bus ▪(2) 36GB 10K Hot-swap SCSI preconfigured drives ▪No Data Volumes ▪1GB Std - Up to 8 GB Memory ▪Integrated Dual GB Ethernet ▪Single Blade ▪Windows Storage Server 2003 w/Print ▪Storage Manager ▪IBM Director

N series Portfolio

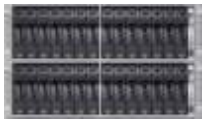
All Systems share the same:

- **Network Protocols (NAS, iSCSI, FC SAN)**
- **Operating system: Data ONTAP**
- **System management tools**
- **Storage management tools**
- **RAID levels**
- **High availability features**
- **Disk Drives (FC & SATA)**
- **WORM data protection**
- **Advanced software features and functions***

* Some features are not available with the gateway models

FAS270

N3700



16TB (non-clustered)
16TB (clustered)

N5200G

V3020
FAS3020

N5500G

V3050
FAS3050

N5200

84TB (non-clustered)
84TB (clustered)

N5500

168TB (non-clustered)
168TB (clustered)

N7600G

V6030
FAS6030

N7800G

V6070
FAS6070

N7600

420TB (non-clustered)
420TB (clustered)

N7800

504TB (non-clustered)
504TB (clustered)

IBM eServer System x Technology

close

optional slides

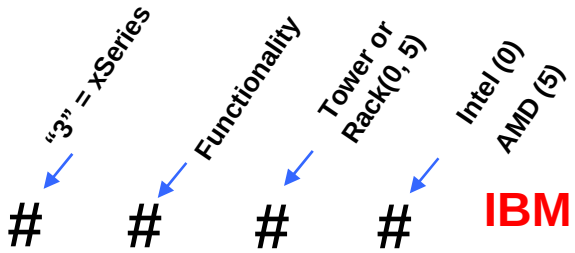
High Volume Renaming

Characteristics	Current	1st Generation	2nd Generation	Subsequent Generation
1-way tower, entry price	**x100**	**x3105**	**x3105 M2**	**x3105 M3**
1-way tower	**x206m**	**x3200**	**x3200 M2**	**x3200 M3**
2-way tower	**x226**	**x3400**	**x3400 M2**	**x3400 M3**
2-way tower	**x236**	**x3500**	**x3500 M2**	**x3500 M3**
1-way rack	**x306m**	**x3250**	**x3250 M2**	**x3250 M3**
2-way rack – value / AMD -1U	**e326**	**x3455**	**x3455 M2**	**x3455 M3**
2-way rack	**x336**	**x3550**	**x3550 M2**	**x3550 M3**
2-way rack	**x346**	**x3650**	**x3650 M2**	**x3650 M3**
Optimized for Telco	**x343**	**x3650 T**	**x3650 T2**	**x3650 T3**

- **Full name will be “IBM System x####” and perhaps an additional Alpha.**
- **Short name will be “x####” with perhaps additional Alpha.**

Assumptions:

- Use modifier (“M”) for subsequent product generations
- Utilize digits with meaning
- Include specialty servers with HV



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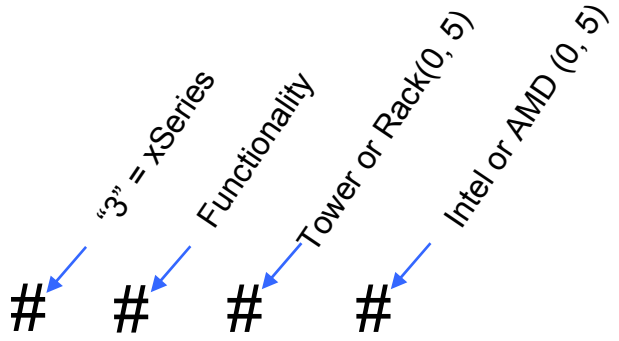
High Performance Renaming

Characteristics	Current	1st Generation	2nd Generation	Subsequent Generation
4way Rack EXA Chipset, Intel proc	**x366**	**x3850**	**x3850 M2**	**x3850 M3**
4way Tower EXA Chipset, Intel proc	**x260**	**x3800**	**x3800 M2**	**x3800 M3**
4-16 Scalable EXA Chipset, Intel proc	**x460**	**x3950**	**x3950 M2**	**x3950 M3**
4-16 MXE, EXA Chipset, Intel proc	**x460**	**x3950 E**	**x3950 E2**	**x3950 E3**

- **Full name will be "IBM System x####" and perhaps an additional Alpha.**
- **Short name will be "x####" with perhaps additional Alpha.**

Assumptions

- Use modifier ("M") for subsequent product generations
- Utilize digits with meaning
- Include specialty servers with HV
- X37xx Reserved for Low Cost High Performance Platforms
- X38xx Reserved for 4 socket only
- X39xx Reserved for >4 socket only



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