



Systems and Technology Group

# System x & BladeCenter - BP Technical World -

*Alessandro Malosio*

System x Technical Sales Support Team



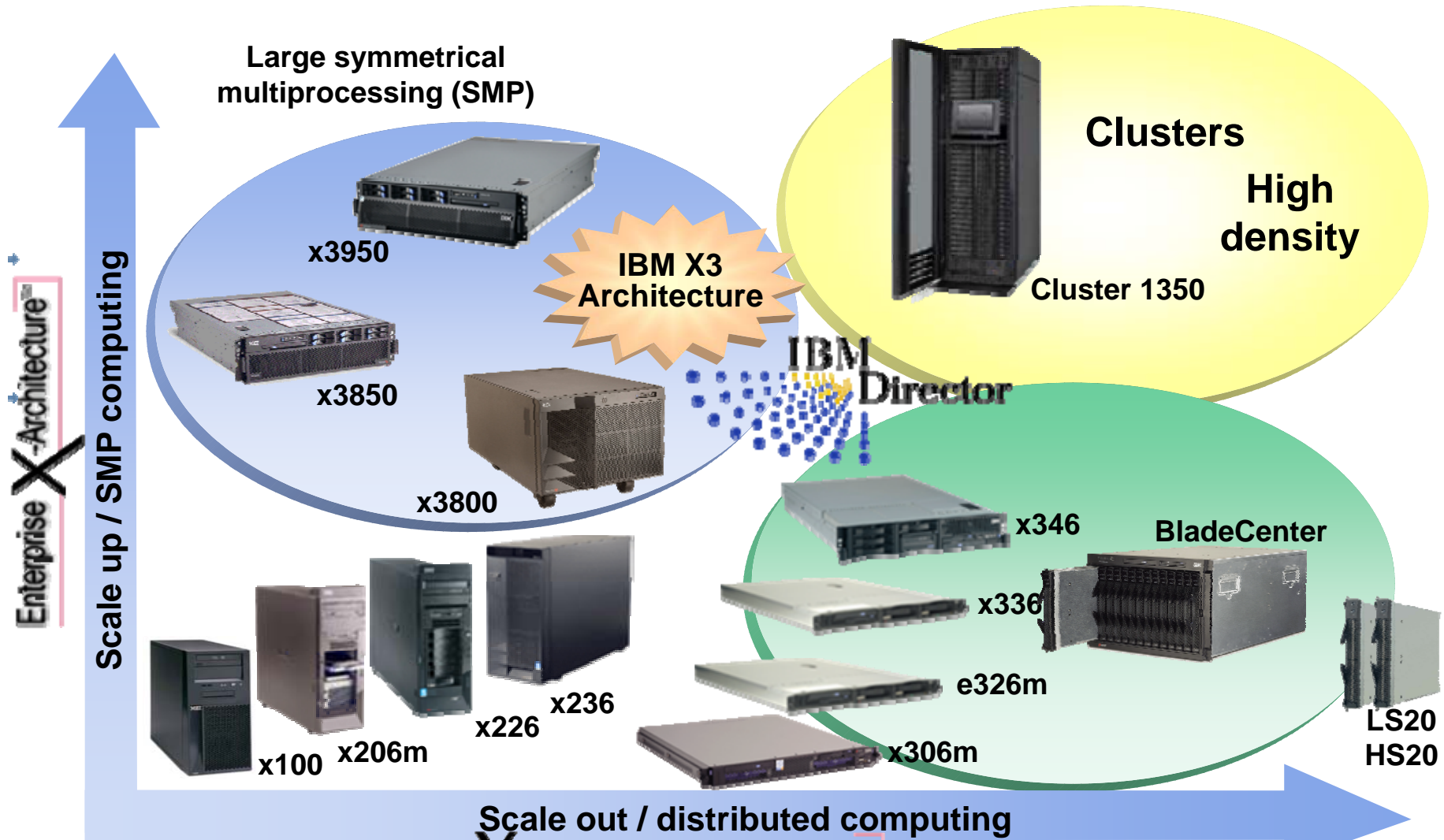
**ON** DEMAND BUSINESS™

© 2006 IBM Corporation

# Agenda

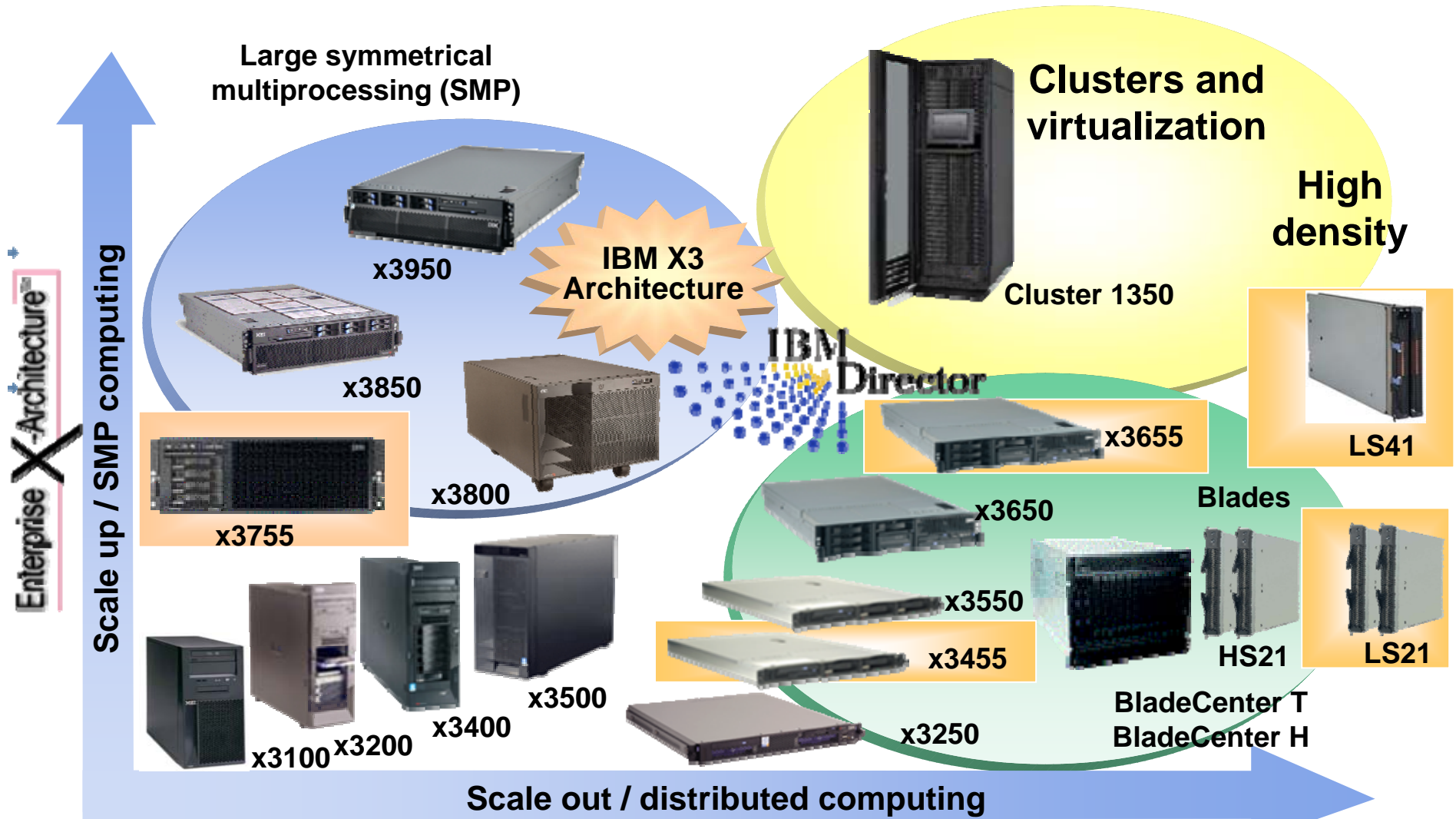
- **System x family**
- **BladeCenter offering**
- **New System x AMD Opteron portfolio**
- **System management – Cool Blue strategy**
- **Integration System i – System x**
- **System x HPC Linux clustering solutions**

# System x Portfolio is the Most Comprehensive in the x86 Industry



Source: IDC

# System x Portfolio is the Most Comprehensive in the x86 Industry

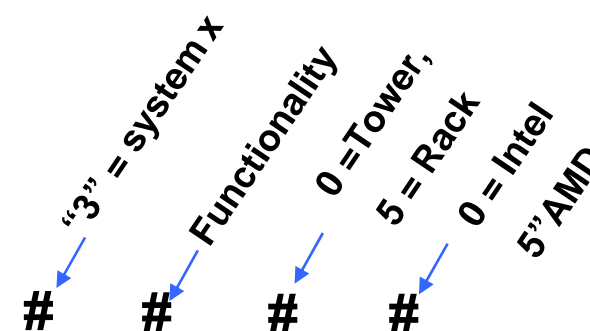


Source: IDC

**Xtended Design Architecture™**

| Characteristics                  | Current | NewName |
|----------------------------------|---------|---------|
| 1-way tower                      | x100m   | x3100   |
| 1-way tower                      | x206m   | x3200   |
| 1-way rack (1U)                  | x306m   | x3250   |
| 2-way tower                      | x226    | x3400   |
| 2-way AMD rack (1U)              | e326m   | x3455   |
| 2-way tower                      | x236    | x3500   |
| 2-way rack (1U)                  | x336    | x3550   |
| 2-way rack (2U)                  | x346    | x3650   |
| 2-way rack, Optimized for Telco  | x343    | x3650 T |
| 4-way Rack EXA Chipset, Intel    | x366    | x3850   |
| 4-way Tower EXA Chipset, Intel   | x260    | x3800   |
| 4-16 Scalable EXA Chipset, Intel | x460    | x3950   |
| 4-16 MXE, EXA Chipset, Intel     | x460    | x3950 E |

# System x il nuovo nome



- Il nome completo sarà “IBM System x####”
- Il nome abbreviato sarà “x####”

# New 2006 uni-dual socket Feature Comparison

## xSeries Dual core 64-bit rack servers:

- Optimize power and performance
- Manage hard and virtual resources
- Protect data and IT investment

**x306m**  
Lowest cost edge of network server



**1U 2 Core, 1 Socket**  
Target: SMB, remote/branch office  
Apps: Web, infrastructure, security

- Maximum Density
  - Optimize Space
- Lowest cost
  - Lower budget
- Storage Options
  - Investment Protection



**e326m FO**  
The best HPC price/performance



**1U 4 Core, 2 Socket**  
Target: HPC  
Apps: Engineering, research, oil and gas, manufacturing

- Lowest cost design
  - The best price/Performance
- Memory expansion
  - Scale Performance
- Cluster-optimized (HTx)
  - High performance expansion



**x3550**

Application density for power managed datacenters



**1U 4 Core, 2 Socket**  
Target: LE, mid-market, datacenter  
Apps: Database, ERP, e-mail collaboration, file/print, virtualization

- Application Density
  - Optimize Space
- Power Executive
  - Optimize/lower power cost
- Advanced Management
  - Lower support costs



**x3650**  
Stable Business Critical application server



**2U 4 Core, 2 Socket**  
Target: Med-large enterprise, IS's  
Apps: eBusiness, email/Collaboration, application consolidation, ERP, terminal services,

- Stable Integrated function
  - Lower business support costs
- High availability
  - Protect data/lower costs
- Power Executive
  - Optimize/lower power cost

# Volume Tower Product Feature Comparison

## xSeries Dual core 64-bit Tower servers:

- Optimize for business growth
- Manage remote business to lower costs
- Protect all data and IT investment

## x3500

Stable Business Critical application server



**x3400**  
Affordable performance for growing business



## x206m

Affordable enterprise class availability



## x100

Value for the smallest business



### Quad Core, Dual Socket

Target: Distributed Enterprise, Medium Business

Apps: Messaging / collaboration  
Distributed CRM/SCM,  
Workgroup applications,  
Consolidation

### Quad Core, Dual Socket

Target: SMB, Remote/  
Branch Office, Retail

Apps: Collaboration, SMB  
business applications

### Dual Core, Uni Socket

Target: SMB, Distributed  
Environments, Retail  
Apps: Distributed/Retail  
applications, Messaging, File &  
print,

### Uni Core, Uni Socket

Target: SMB  
Apps: File/print, small-  
business management

- Stable Platform life
  - Lower management costs for large roll outs
- Integrated HA and Management
  - Lowest solution price
- Maximum memory expansion
  - Grows with your business
- Large data storage
  - Long term Investment protection

- Low cost 2-way design
  - Affordable business growth
- Flexible Configuration options
  - Flexible business deployment
- Optional redundancy
  - Protect critical data

- Dual Core
  - Investment Protection
- Redundant Power Models
  - Data Protection

- Lowest Cost
  - Affordable
- Easy to use
  - Low cost to install

# High-Performance xSeries Positioning



## **x3800: 4-way Tower**

Target: SMB, Remote/  
Branch Office

Apps: SMB, Collaboration,  
Departmental database

eServer X3: 3rd Gen EXA  
64-bit Intel Xeon MP  
Competitive Price-perf  
Latest technology  
*SAS, PCI-X2, DDR2*  
High Availability  
7U Tower or Rack  
Maximum Int. Storage  
Tape Backup Support  
Dual-core Capable



## **x3850: 4-way Rack**

Target: Enterprise & Mid-  
market

Apps: Collaboration,  
Database, ERP, SCON

eServer X3: 3rd Gen EXA  
64-bit Intel Xeon MP  
Leadership 4-way perf  
*38% better than x365*  
Latest technology  
*SAS, PCI-X2, DDR2*  
High Availability  
3U Rack-optimized  
Maximum Int. Storage  
Dual-core Capable



## **x3950: 4-way+ Rack**

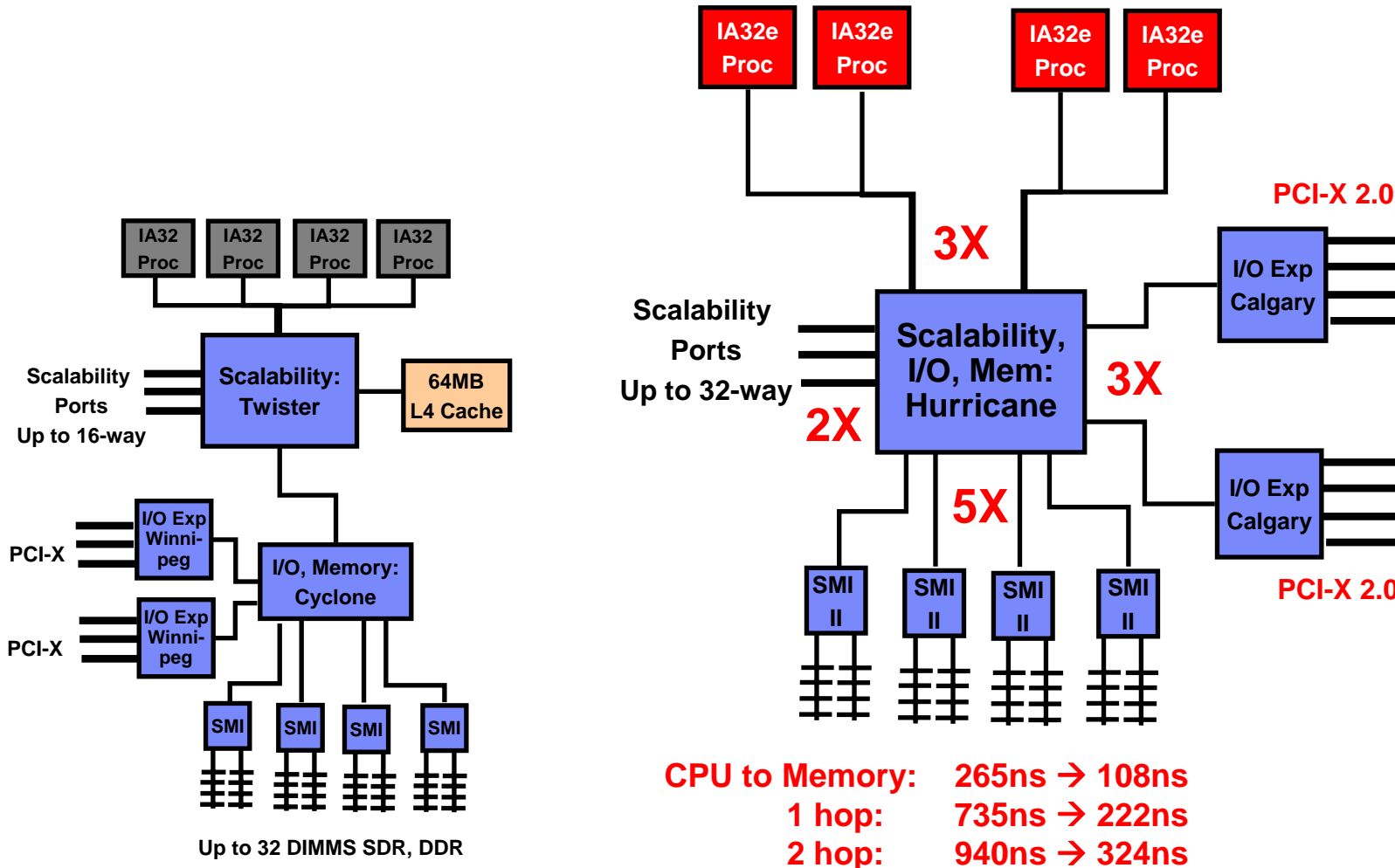
Target: Enterprise & Mid-  
market

Apps: Database, ERP, CRM,  
SCM, SCON

eServer X3: 3rd Gen EXA  
64-bit Intel Xeon MP  
Leadership 8-way perf  
*50% better than x445*  
Leadership 16-way+ perf  
*80% better than x445*  
Latest technology  
*SAS, PCI-X2, DDR2*  
High Availability  
XpandOnDemand to 32way  
Dual-core Capable



# IBM X3 chipset: Fatter pipes & lower latencies



*Up to 3x reduction in memory latency especially multi-chassis!*

# x3950 & x3950e - Supported Configurations

## *XpandOnDemand™ Scalability*

Modular Building-block Scalability eliminates the need for fork-life upgrades and provides an easier growth path to larger, scale-up high-performance SMP configurations

x3950 + (7) x3950e  
Eight Chassis 32-way  
Up to 512GB Memory



x3950 + (3) x3950e  
Four Chassis 16-way  
Up to 256GB Memory



x3950 + (1) x3950e  
Two Chassis 8-way  
Up to 128GB Memory



Perfect for:

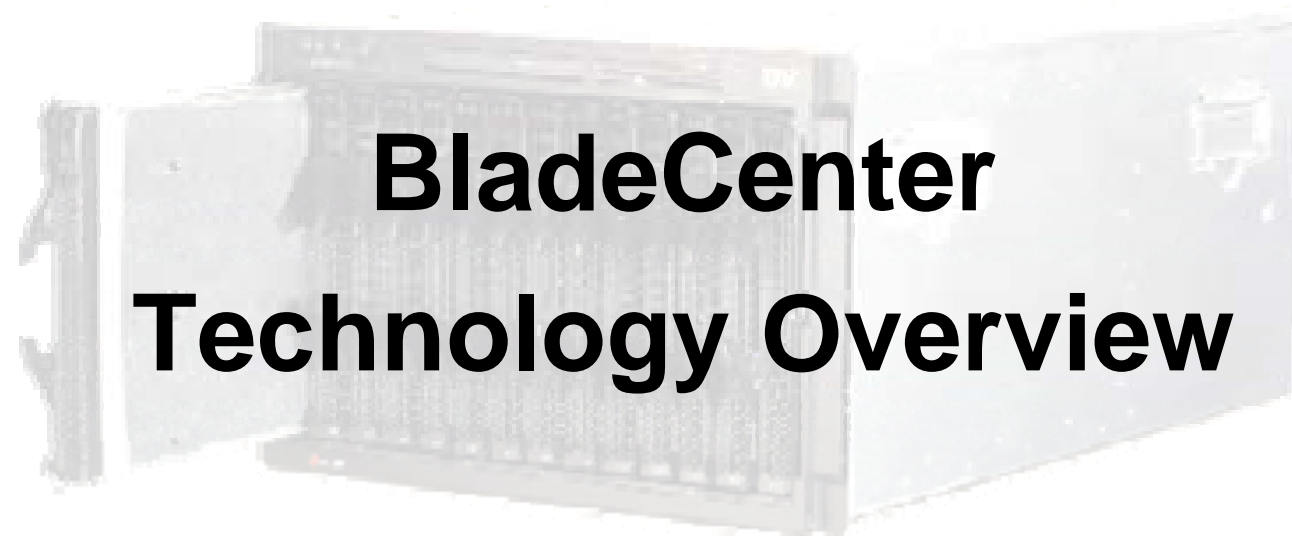


x3950 2w-4w Single Chassis  
Up to 64GB Memory





Systems and Technology Group



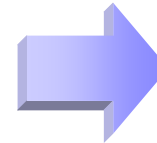
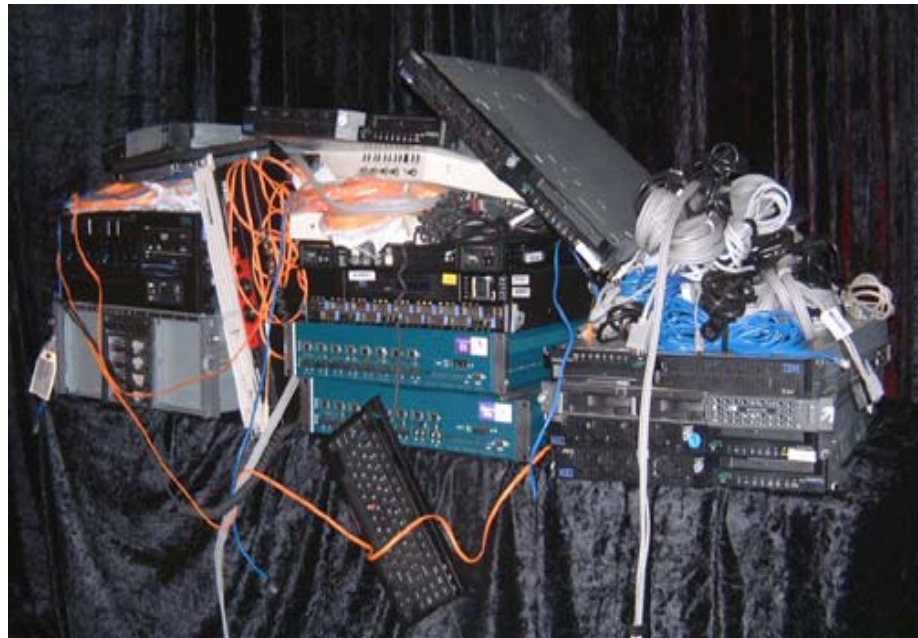
# BladeCenter Technology Overview



**ON** DEMAND BUSINESS™

© 2006 IBM Corporation

# Reintegration of the Datacenter



## Typical Datacenter Configuration

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



## Bladed Datacenter Configuration

IBM eServer BladeCenter

## What's a "BladeCenter" ? and what's a "Blade"?

A "server on a card" - each "Blade" has its own:

- processor
- ethernet
- memory
- optional storage
- etc.



IBM Blade ready for insertion into the BladeCenter

The chassis provides shared:

- management console (KVM)
- power supply
- cooling
- network switches
- CD-ROM drive
- diskette drive
- etc.



IBM BladeCenter chassis - 7U rackable

# BladeCenter One Family

## *Investment Protection*

### BladeCenter T

Announced: Apr. 2004



8 Blades, 8U

Ruggedized Chassis

Telco, Military,

Medical Imaging Apps

### BladeCenter

Announced: Nov. 2002



14 Blades, 7U

Enterprise & SMB Chassis

Mainstream Applications

Remote Sites (stores)

### BladeCenter H

Announced: Feb. 2006



14 Blades, 9U

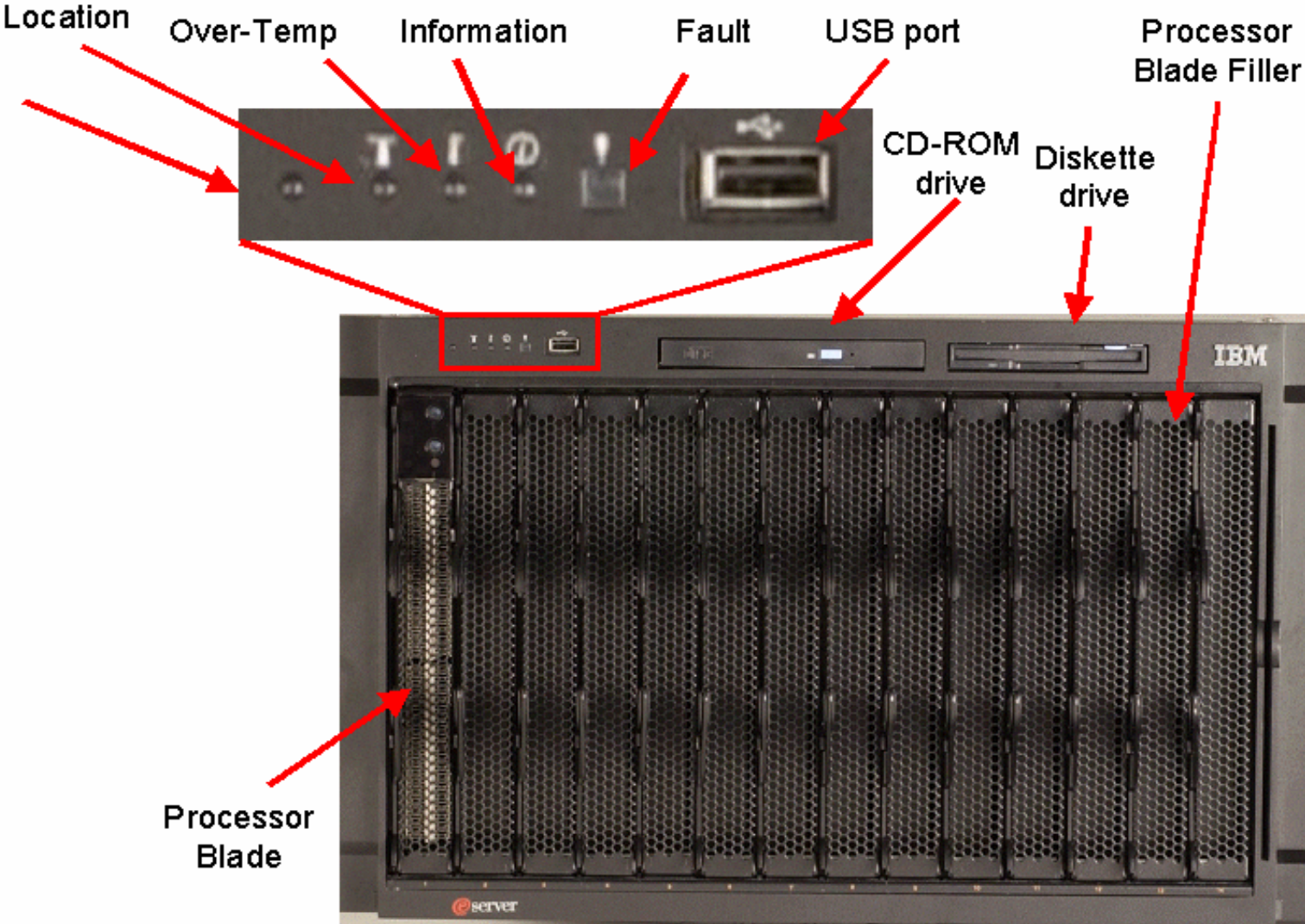
High Speed (>10GB)

Extreme I/O for data intensive environments

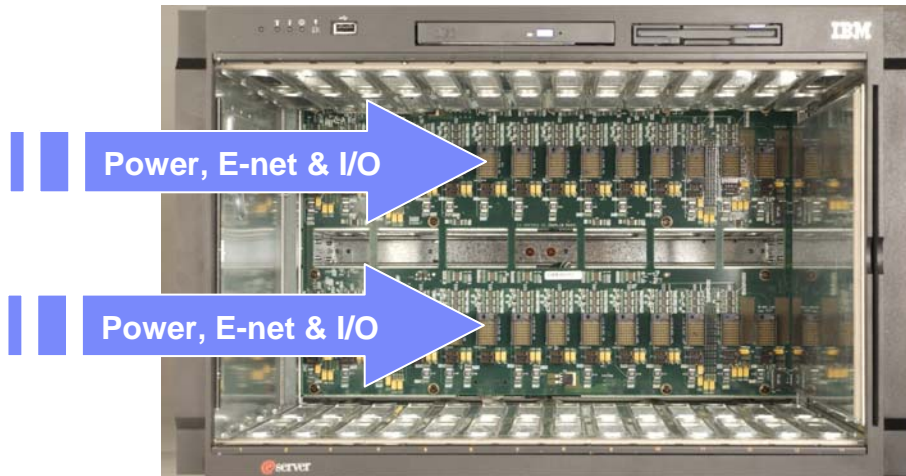
**Common Blades, Common Switches**



# Blade Center Chassis - front view



## BladeCenter technology advantage: dual midplane



- At least **two** connections from each blade server to the midplane
- **Dual** communication paths to the *passive* midplane for Ethernet, Fibre Channel, KVM, Power, and Management signals
- Chassis can be configured with **dual** Ethernet, Fibre Channel Modules providing **two** active paths to your external network
- **Multiple** paths from blade to chassis components helps to protect you from potential failed connectors or traces



## BladeCenter chassis – rear view

- **Gigabit Ethernet Switches**
  - ▶ Portfolio of switches (Cisco, Nortel)
  - ▶ Lower cost via Integration
  - ▶ Functions range from Layer 2 thru Layer 7
- **Fibre Channel Switches (4Gb FC Fabric)**
  - ▶ Portfolio of Switches (Qlogic, Brocade, MCdata)
  - ▶ Potentially lower cost via integration
  - ▶ Full support of FC-SW-2 standards
- **Power Subsystem**
  - ▶ Upgradeable as required
  - ▶ Redundant and load balancing for high availability
- **Calibrated, Vectored Cooling™**
  - ▶ Highly fault tolerant
  - ▶ Allow maximum processor speeds
- **BladeCenter Management Modules**
  - ▶ Full remote video redirection
  - ▶ Out-of-band / lights out systems management
  - ▶ Concurrent Serial connectivity



# BladeCenter I/O Switch Flexibility



**Qlogic**

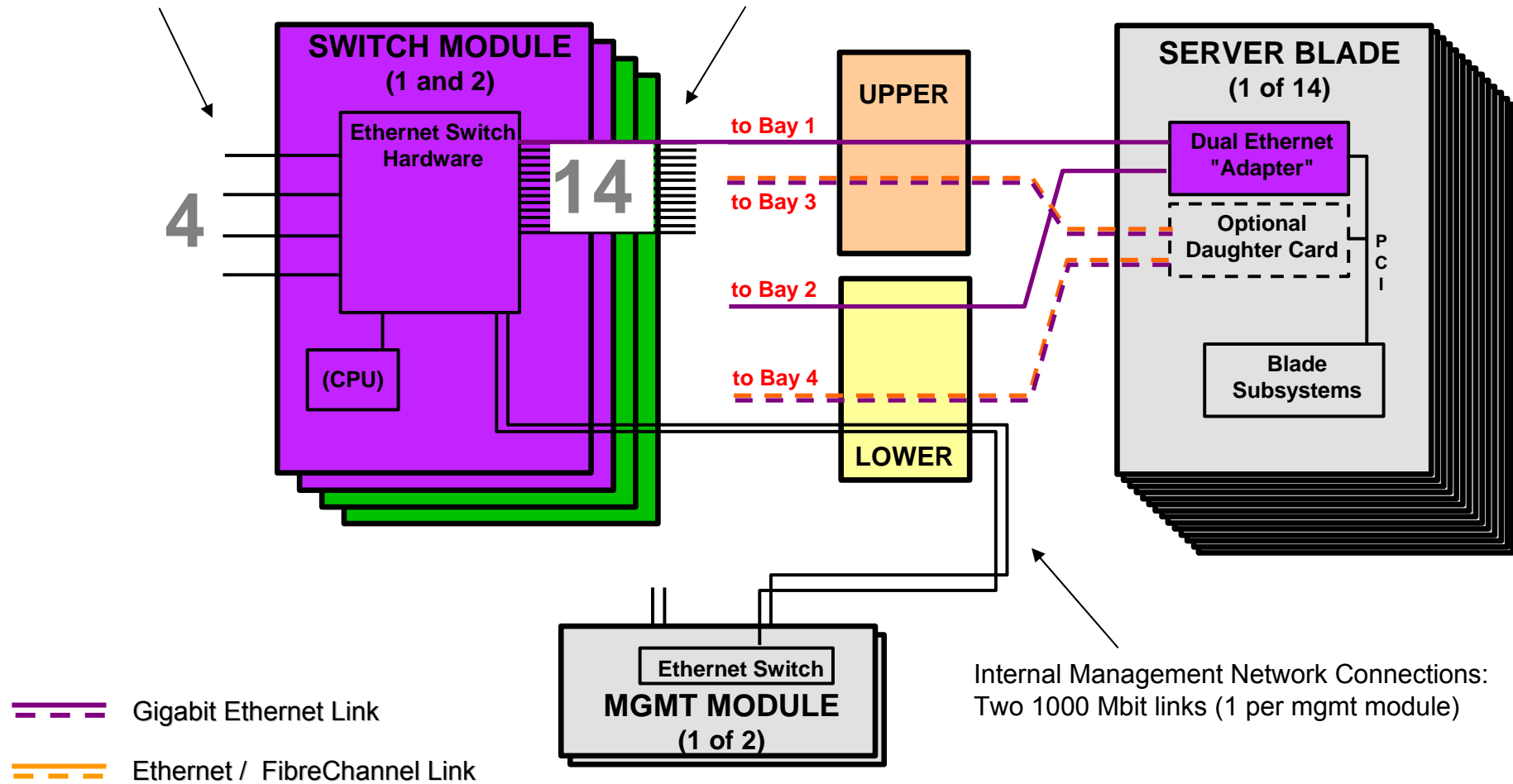
**McData**

**Brocade**

# Internal Switch Connectivity - Ethernet

**External** Network Connections:  
4 10/100/1000 Gigabit ports

**Internal** Ethernet Connections:  
14 Gigabit ports (1 per blade)



# BladeCenter Ethernet Components



Cisco Systems® Intelligent Gigabit Ethernet Switch Module



Cisco Systems® (Fiber) Intelligent Gigabit Ethernet Switch Module



Nortel Networks® Layer 2/3 (Fiber) Gigabit Ethernet Switch Module



Nortel Networks® Layer 2-3 Gigabit Ethernet Switch Module



Nortel Networks® Layer 2-7 Gigabit Ethernet Switch Module

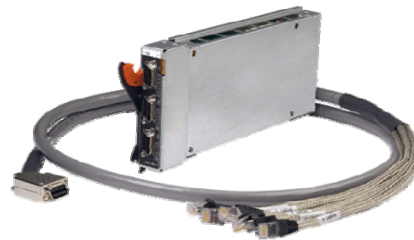


Server Connectivity Module for IBM BladeCenter



Nortel Networks® Layer 2/3 10GbE Uplink Switch Module

- (1) 10 Gb MM Fiber Ports
- (2) 10 Gb Copper Ports



Copper Pass-thru Module with cable



BladeCenter Telco



BladeCenter



BladeCenter H

# 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
- Avail June 2006

# BladeCenter Optical Module/SAN Switch Portfolio

## 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 or MCDATA 6-port Fibre Channel Switch Module



- Supplier: QLogic
- Equivalent to SANbox 5200
- 6-1/2Gb Auto sensing ext ports
- Cascades to (239) Switches
- 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 ext ports
- **Cascades to (2) Switches**
- **Supports Brocade Advanced Feature Key options**

## Brocade® Enterprise SAN Switch Module



- Supplier: Brocade
- Equivalent to Silkworm 3900
- 2-1/2Gb Auto sensing external ports
- **Cascades to (239) switches**
- **Supports Brocade Advanced Feature Key options**

***A full suite of integrated offerings to provide additional flexibility and choice***

# 2006 Ethernet Switching Portfolio

**Server Connectivity Module for IBM BladeCenter**



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

**List Price:**  
**\$999**

**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

**List Price:**  
**\$1,899 (Cu)**  
**\$3,999 (fiber w/SFPs)**

**Cisco Systems® Intelligent Gb Ethernet Switch Module**



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

**List Price:**  
**\$4,999 (Cu)**  
**\$4,999 (Fiber w/o SFPs)**

**Nortel® L2-7 GbE Switch Module**



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

**List Price:**  
**\$8,999**

**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
- Avail June 2006

**Target List Price:**  
**\$4,999**  
(excluding XFP)  
**SR XFP: \$1399**  
**LR XFP: \$2199**

# BladeCenter Storage Components



**QLogic® Enterprise 6-port Fibre Channel Switch Module**

- Supplier: QLogic
- Equivalent to SANbox 5200
- 6-1/2Gb Auto sensing ext ports
- Cascades to (239) Switches
- Supports performance monitoring and advanced zoning
- FC-SW-2 Compliant



**McDATA® 6-port Fibre Channel Switch Module**

2Gb ports

-

**McDATA® 10 /20 ports FC Switch Module**

4 Gb ports



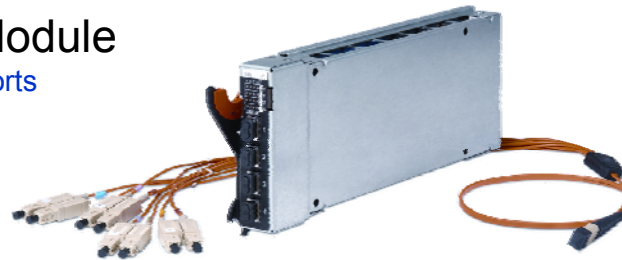
**Brocade® Entry SAN Switch Modules**

- Supplier: Brocade
- Equivalent to Silkworm 3900
- 2-1/2Gb Auto sensing ext ports
- Cascades to (2) Switches
- Supports Brocade Advanced Feature Key options



**Brocade® Enterprise SAN Switch Modules**

- Supplier: Brocade
- Equivalent to Silkworm 3900
- 2-1/2Gb Auto sensing external ports
- Cascades to (239) switches
- Supports Brocade Advanced Feature Key options



**Optical Pass-thru Module with cable**

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



# BladeCenter Storage Components



McDATA® 6-port  
Fibre Channel  
Switch Module



Brocade® Enterprise  
SAN Switch  
Modules



Brocade® Entry  
SAN Switch  
Modules



QLogic® Enterprise 6-  
port Fibre Channel  
Switch Module



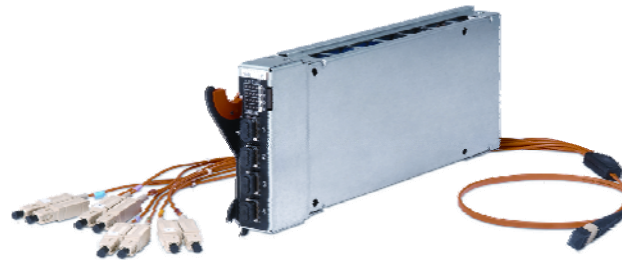
iSCSI Expansion Card



Fibre Channel I/O  
Expansion Card (Stff)



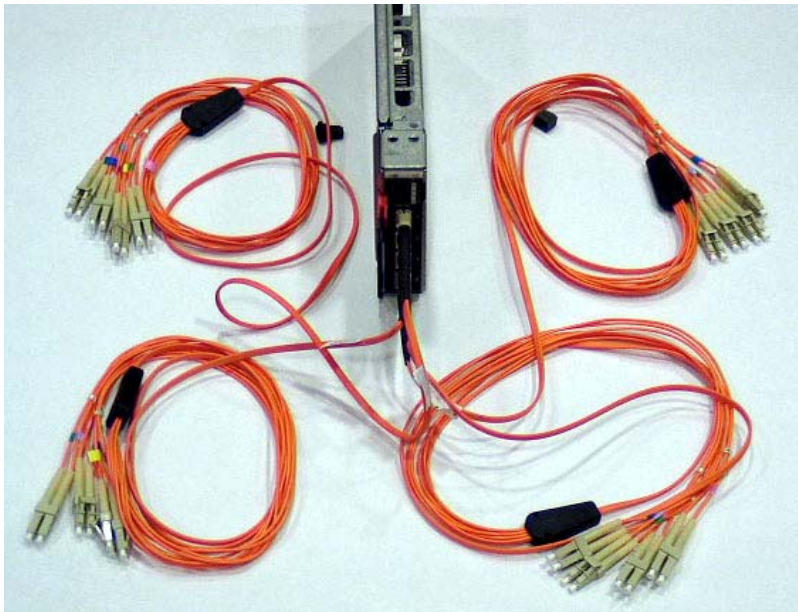
Fibre Channel I/O  
Expansion Card (Smff)



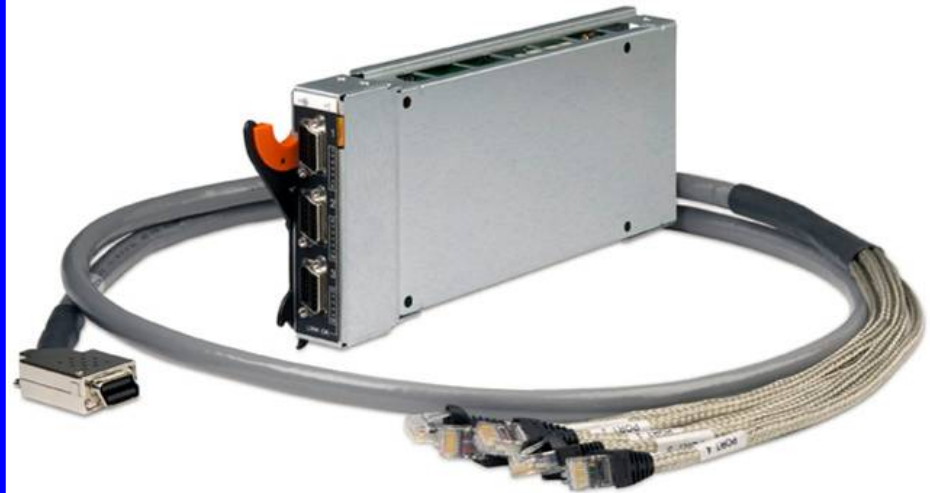
Optical Pass-thru Module with cable

## IBM eServer BladeCenter Pass-thru Modules

Fiber Pass-thru Module



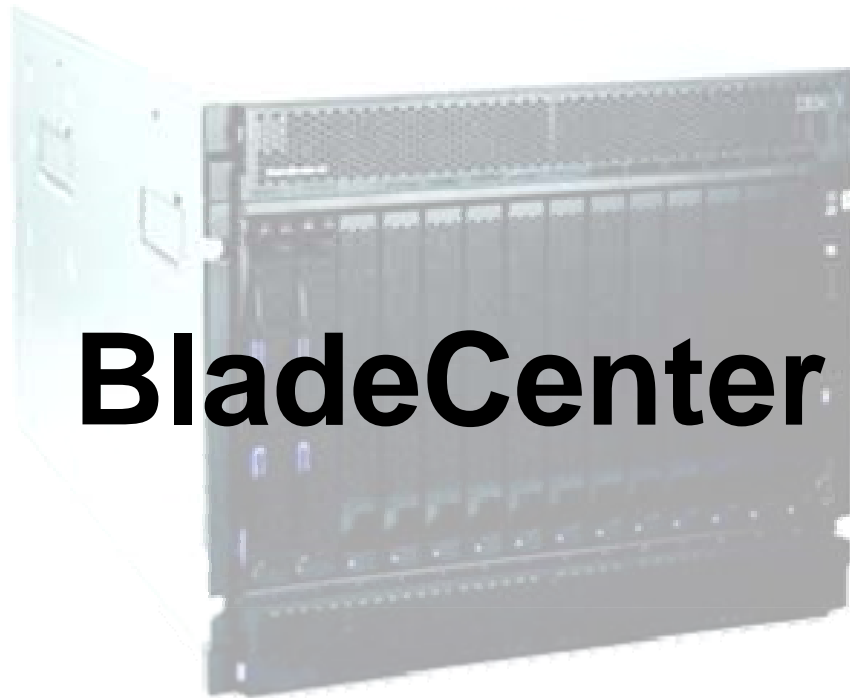
Copper Pass-thru Module



***Investment protection in existing infrastructure***



Systems and Technology Group



# BladeCenter H

**ON** DEMAND BUSINESS™

© 2006 IBM Corporation

# BladeCenter H Tour

## *A Look At The Front*

### Server Blades

- Same Blades
- Same I/O Feature Cards
- Same Server Blade Features
- Same Dual Slot PCI adapter 'sidecar'
  
- BC-H and new Blades add:
  - Additional Blade Power/Thermal Capacity
  - Additional High Speed I/O Options
    - PCI-Express x8 chipset link
    - 4 4x Switch Module links

### Power Modules (2 or 4)

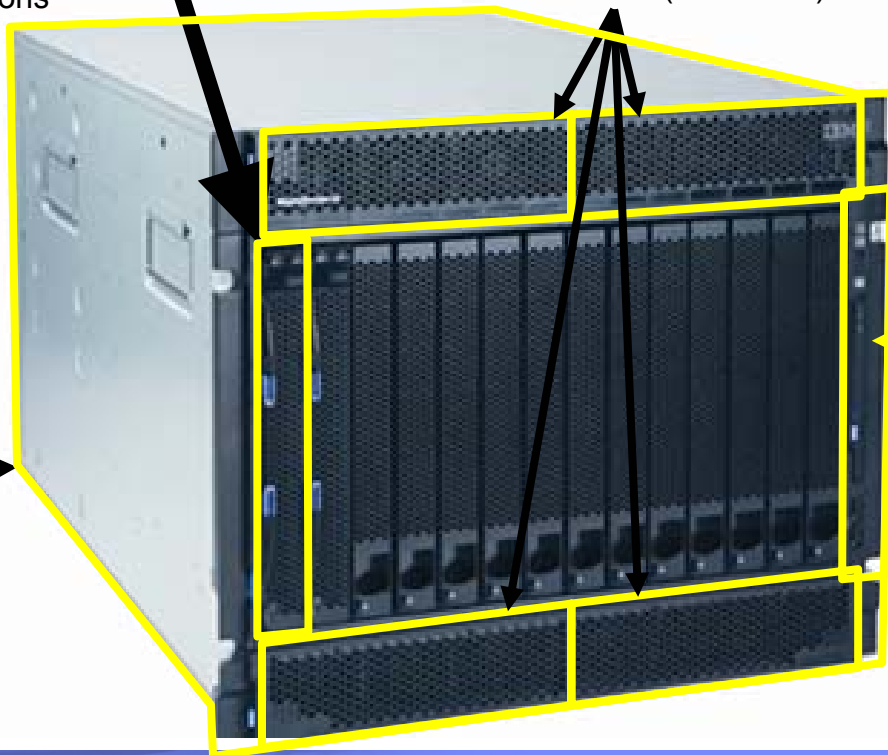
- Hot Swap, Redundant
- 200-240V 50/60Hz AC (worldwide)

### BC-H Chassis

- 18 inch rack mount
- Front to rear airflow
- Front/rear service
- Rear cabling
  - 14 Server Bays
  - 9U high, 28" deep

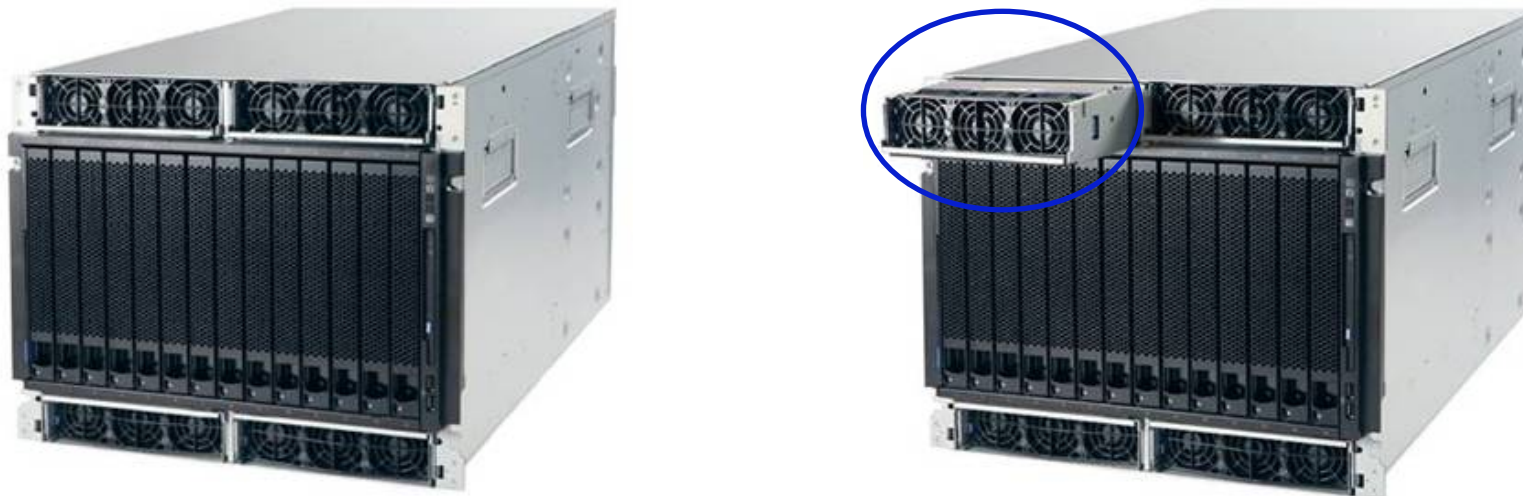
### Op Panel & Media

- Chassis level LEDs-
  - Power, Alert, Info
  - Chassis 'Locate'
- 2 USB Ports
- Removable storage media
  - DVD



## 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**



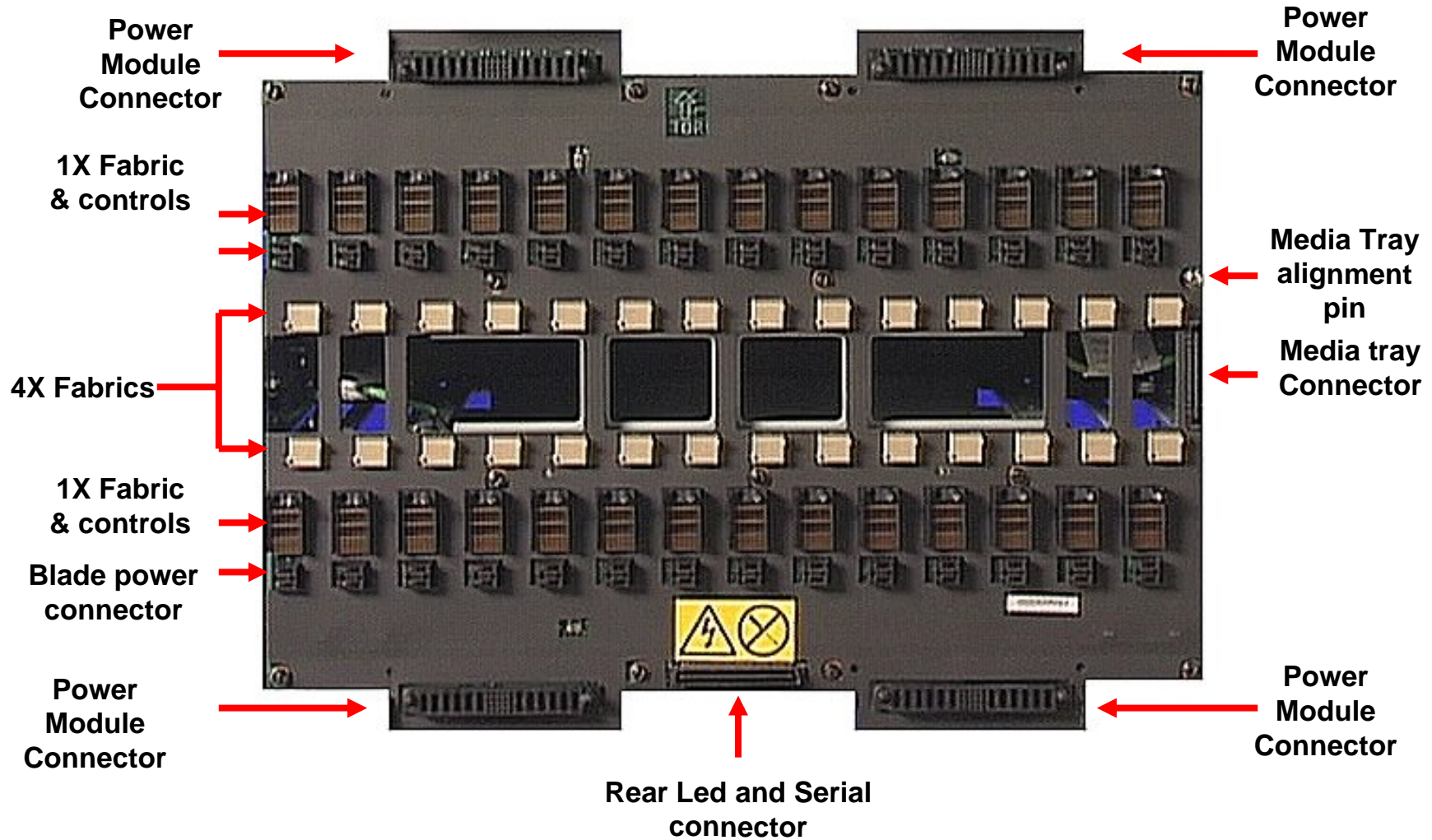
## BladeCenter AC Power Topology

- **New power supply option for BladeCenter H**
  - ▶ Rated DC output of supply is 2900W
  - ▶ Power Modules directly attach to Mid-plane, AC input provided by internal cabling
  - ▶ Power Modules 1 and 2 ship standard, 3 and 4 are optional
  - ▶ Optional Power Supply Module includes 2 power supplies and matching fan kits
- **Front loading for easier service – no cable removal for replacement**
- **RoHS ready**
- **Power subsystem is completely redundant**
  - ▶ VPD available via I2C
- **Each power supply includes a three pack of fans**
  - ▶ Two of three fans needed for operation
  - ▶ 60mm fans (3), and is a CRU
  - ▶ Fan Pack control logic is via I2C bus thru supply
- **IBM part number - 31R3335 (available WW)**



*Officially the IBM BladeCenter H 2900W AC Power Module. Short Name BCH 2900W Power Module*

# IBM BladeCenter H Midplane Internal Detail



# BladeCenter H Tour

## What is Where?

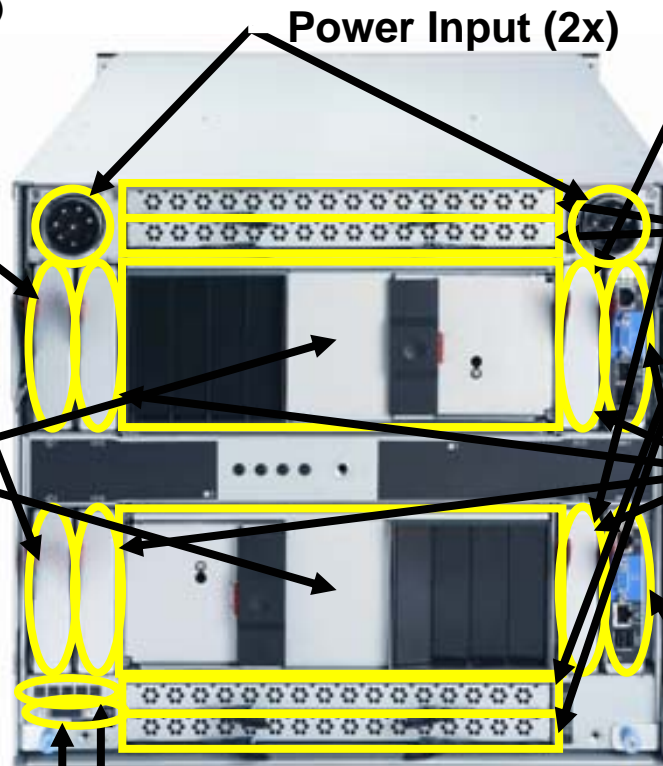
### Rear View

#### Ethernet Switch Module (1 - 2)

- Hot Swap, Optionally Redundant
- Input: 14 blades + 2 MM (Gb, 100Mb)
  - Ethernet Switch
  - Optical Passthru, Copper Passthru

#### Opt. Switch Module (0 - 2)

- Hot Swap, Optionally Redundant
- Input: 14 blades + 2 MM
  - Ethernet, FC, InfiniBand Switch
  - Optical Passthru, Copper Passthru



#### Power Input (2x)

#### Opt. High Speed Switch (0 - 4)

- Hot Swap, Optionally Redundant
- Input: 14 blades + 2 MM
- Out: 2 Bridge Modules

#### Blower Module (2x)

- Hot Swap, Redundant
- Speed Controlled

#### Opt. High Speed Bridge (0 - 4)

- Hot Swap, Optionally Redundant
- Input: 2 High Speed SM + 2 MM

#### Mid-plane

- Redundant data and control paths
- Point-to-point connections

#### Rear Op panel

- Duplicate LEDs

#### Advanced Management Module (1 - 2)

- Hot Swap, Optionally Redundant
- AMM adds:
  - Concurrent Remote KVM
  - Serial Port, USB Port

#### Aggregated Serial Ports

- 14 individual Serial Ports
- One Breakout Cable



## BladeCenter H 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 H

## 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**



## BladeCenter H Serial Port Break Out Cable

### *It Is All About Choice*

- For customers looking for a serial connection to the blades the BCH and AMM offer two choices
  - ▶ Serial of LAN on the AMM
  - ▶ Direct Serial Connection on the back of the BCH
- The special cable is designed to provide customers a direct serial interface to each blade
- One input on the chassis is converted to 14 individual CAT5/RJ45 serial connections
- IBM part number - 40K9605 (available WW)



***IBM BladeCenter Serial Port Break Out Cable. Short name BC Serial Break Out Cable***

## BladeCenter H Blower Modules

- **Customer serviceable**
  - ▶ **Simple handle design makes installation and removal simple**
  - ▶ **When one blower is removed, chassis is designed to prevent air flow issues**
  - ▶ **Single unit fits in either blower slot**
  
- **Hot Swap**
- **Full N+N Redundant**
- **Directly powered by AC for maximum efficiency**
- **Highly efficient use of air- the blower speed is controlled by MM according to incoming air temperatures into the chassis**



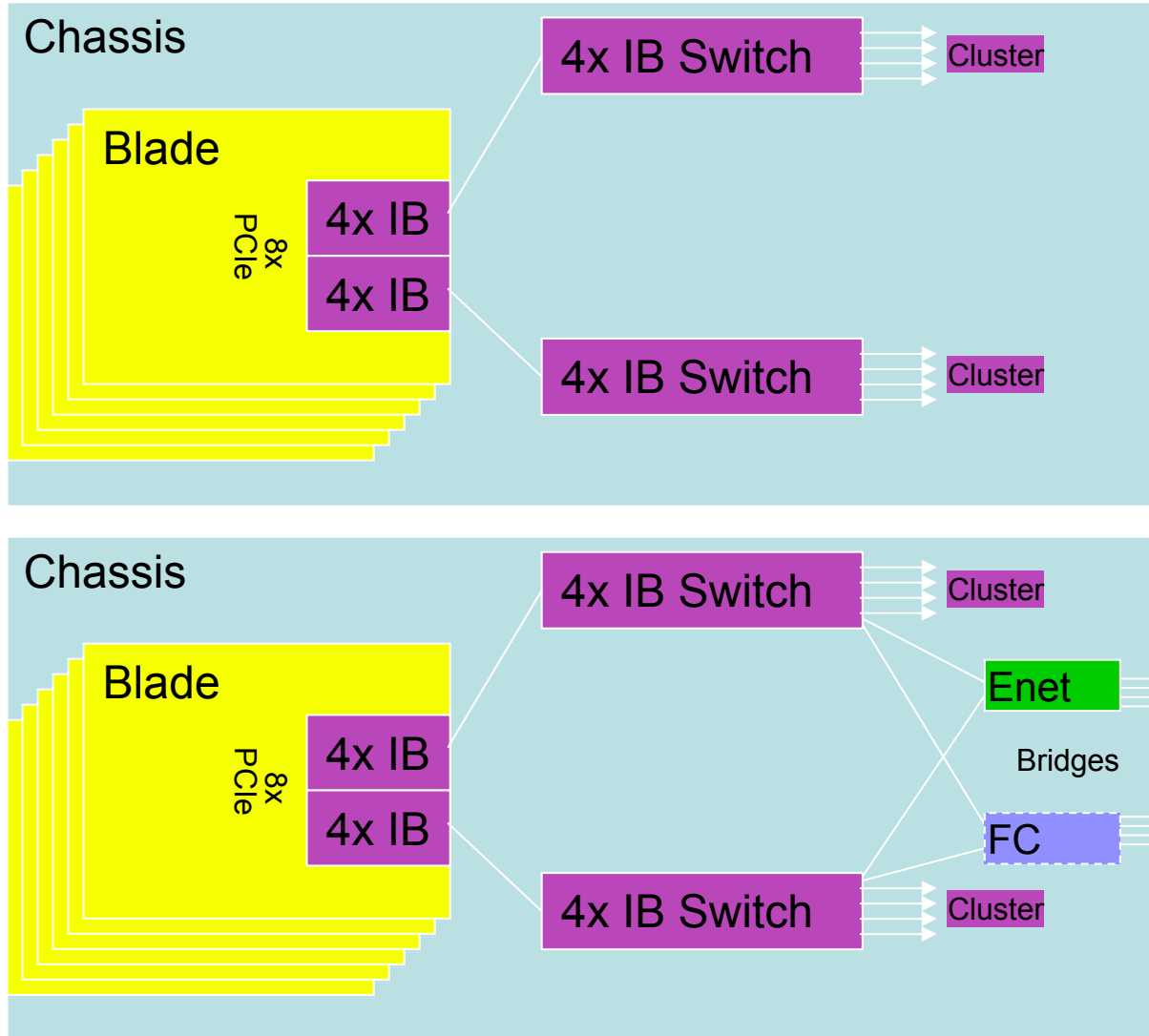
## InfiniBand on BladeCenter H

### *Enterprise Virtualization Plus High Performance*

- **IBM and Cisco jointly developed a 4X (10Gb) InfiniBand solution for BladeCenter H**
  - Daughter Cards: Provide dual 4X connectivity to high speed switch modules - use PCI-Express (PCIe) connection on next generation Blades (e.g., JS21, HS21)
  - InfiniBand Switch Module: (14) 4X ports interfacing to blades (with daughter card) and (2) 4X and (2) 12X (30Gb) ports to network
- **Virtualized I/O via VFrame (Cisco) software**
- **Ship Support: July 25**



# InfiniBand Clustering or Convergence



## BladeCenter H – High Speed Network

- **Support for high speed switches**
  - 4X InfiniBand,
  - 10G Ethernet
- **Support for high speed DC's on blades**
  - 4 high-speed fabrics
  - Still have access to legacy fabrics

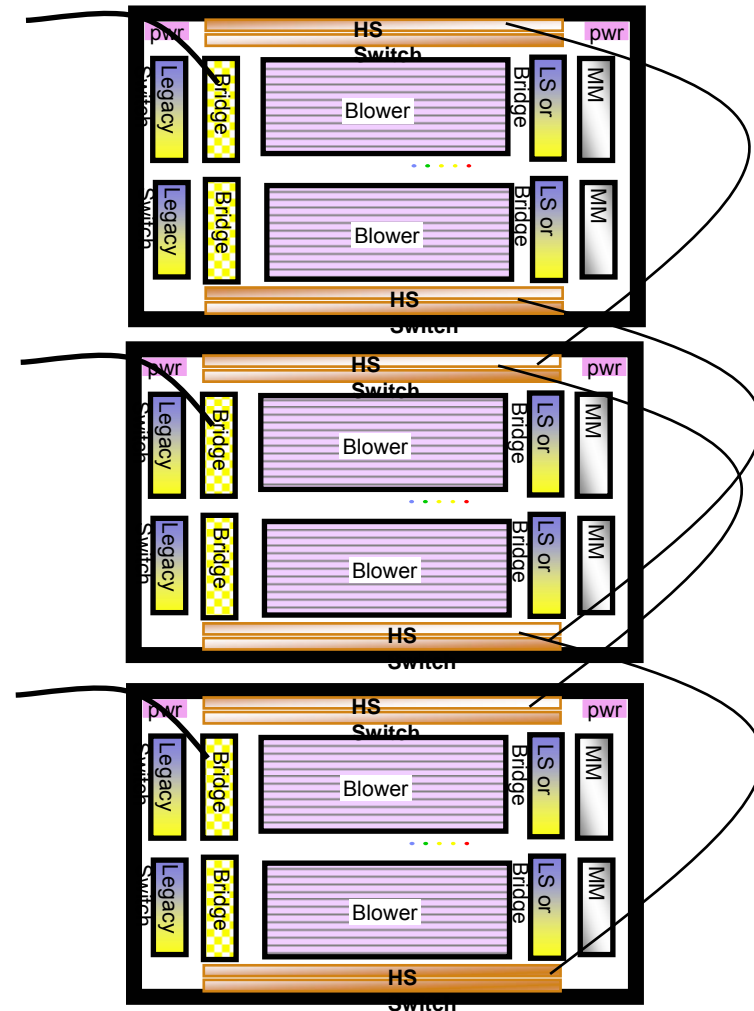


# What can BladeCenter H be used for?

Installation of a 4X IB card and 4X switch allows blades to be added to high speed IB fabric. 80G per switch of bandwidth.

Customers can build a complete 4X IB fabric using only internal BladeCenter switches. Allows for redundancy, and high bandwidth.

For the ultimate virtualized solution the bridges inside the chassis can be used to deliver traditional ethernet and fibre connections at the rack level.

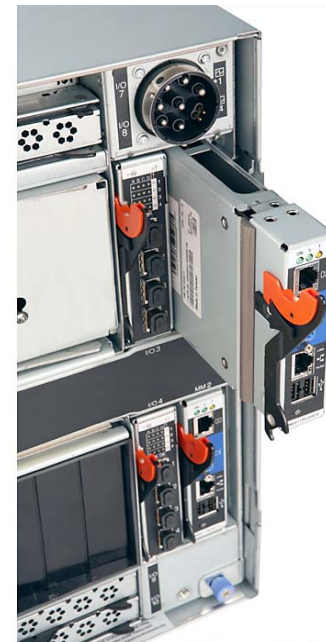




## Simplify Management: Advanced Management Module

### *The Power of One – Manage the Chassis Not the Parts*

- 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



# Management Module Features

*Open, Integrated, Autonomic*

## Management Module

- **Proprietary RTOS**
- **Proprietary Technology Enablers**
  - ▶ RTOS Web Server
  - ▶ RTOS Web Scripting
- **Proprietary Hardware Management Interfaces**
- **Monolithic Architecture**

**More function, better RAS,  
long term protection, and  
improved total solution management**

## Advanced Management Module

- **Open Source Linux OS**
- **Industry Standard Technology Enablers**
  - ▶ Apache
  - ▶ PHP
- **Industry Standard Management Interfaces**
  - ▶ SMASH/CLP
  - ▶ CIM
  - ▶ HPI
- **Modular Architecture**
- **Backward Compatibility**

- **Open, Industry Standard, Secure**
- **Improved serviceability**
- **Improved TTM on new functions**
- **Enables more 3rd party ecosystem development and integration**

# What works with BladeCenter H?

## Blades

- All HS20 blades - type 8678 (Arbuckle), type 8832 (Laurel), type 8843 (Groucho)
- All HS40 blades - type 8839 (McCarran)
- All JS 20 blades - type 8842 (Marlene and Razor)
- All LS20 blades - type 8850 (Morrison)
- Supporting all future blades

## Switches

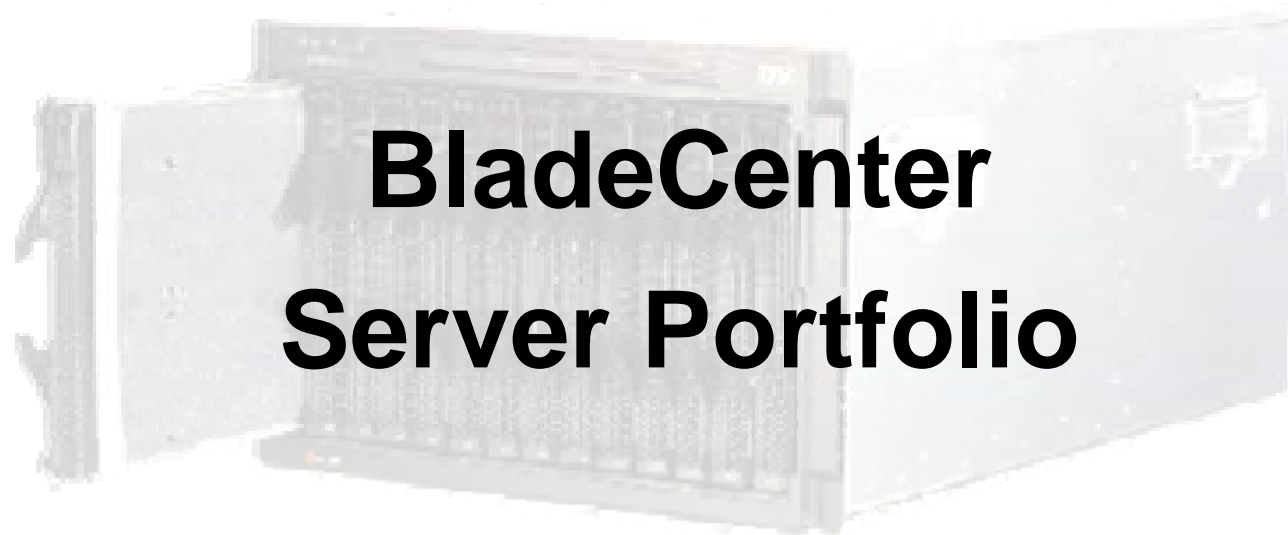
- All current fibre channel switches
- All current Gb ethernet switches
- IBM BladeCenter Optical Pass-thru Module
- IBM BladeCenter Copper Pass-thru Module
- TopSpin Infiniband Switch
- Supporting all future legacy fabric switches

## Management Modules

- AMM (note: today's MM will not fit in BCH)



Systems and Technology Group

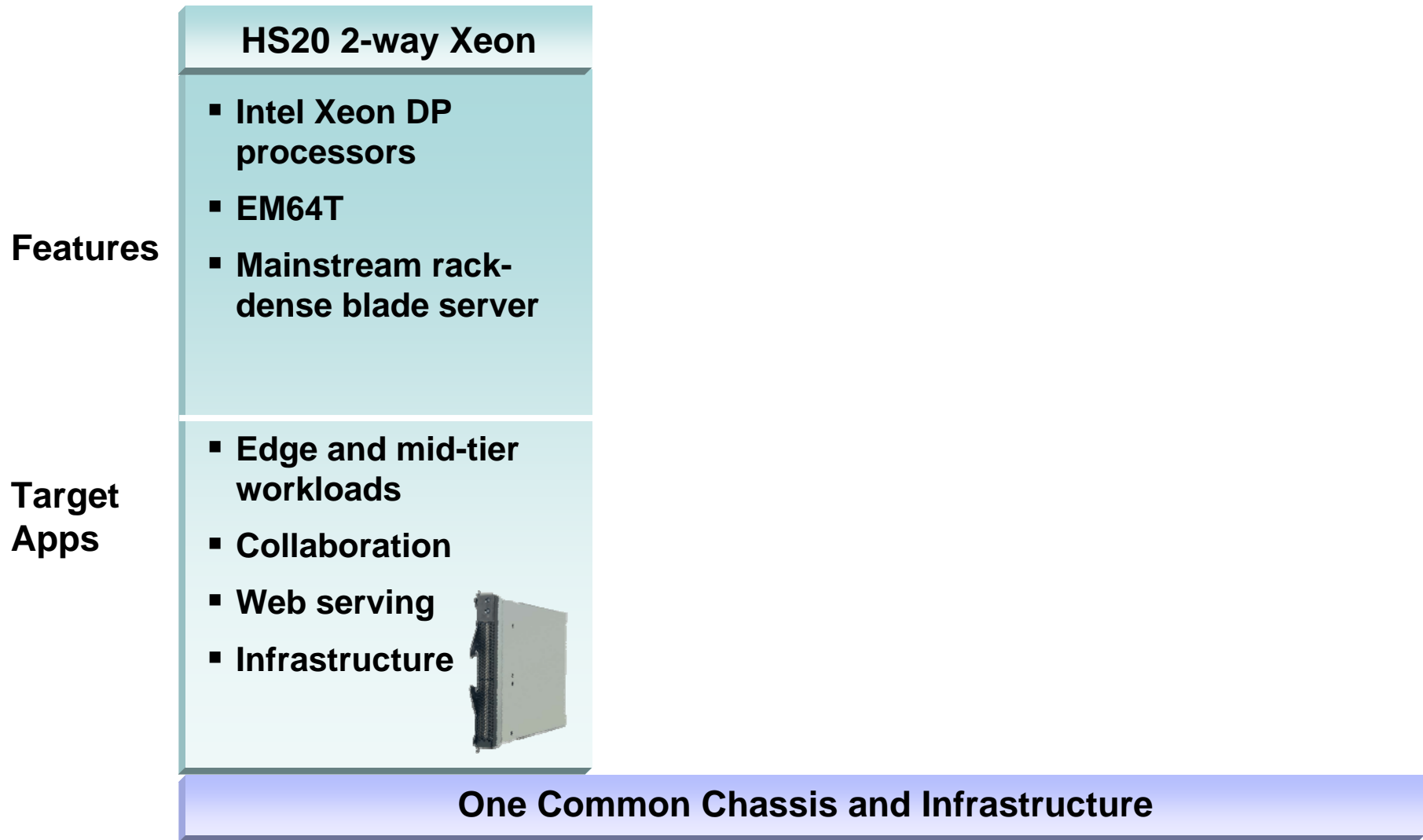


# BladeCenter Server Portfolio

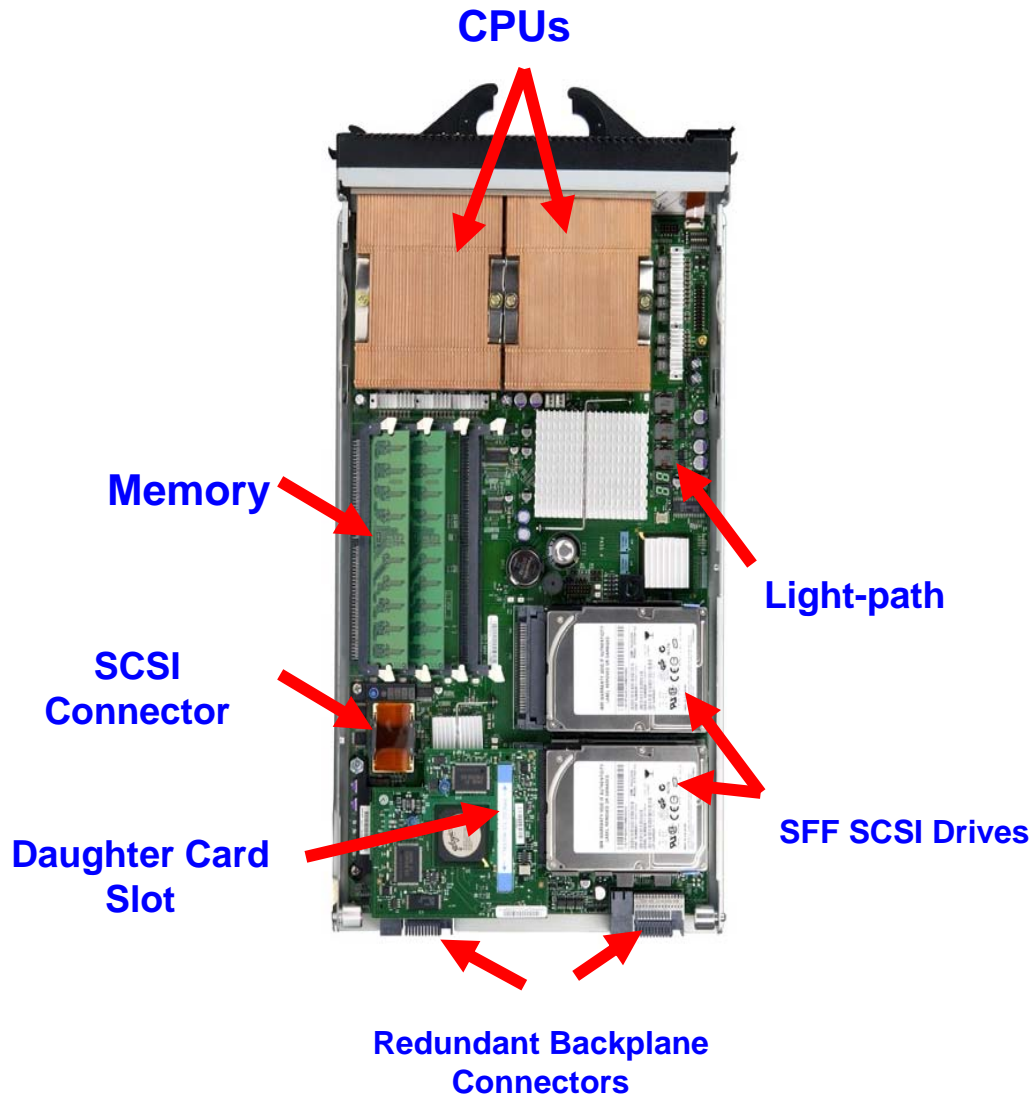
**ON** DEMAND BUSINESS™

© 2006 IBM Corporation

# BladeCenter Server Portfolio



# HS20 Features



## IBM eServer BladeCenter HS20



- **Dual Intel Xeon EM64T up to 3.8GHz with 800MHz Front Side Bus**
- 14 Blades per Chassis (30mm blade width)
- 2x 1Gb Ethernet Ports standard
- One I/O slot for optional daughter cards
- Up to 8GB of RAM with 4 DIMM slots
- Up to two 73GB SFF SCSI with RAID1
- **Support for Blade Storage Expansion:**
  - dual Hot Swap SCSI Ultra320 bay
  - up to (2) 146.8GB HDD
  - up to (2) I/O slot (Eth or FC)
- **Available Xeon EM64T 2.8Ghz Low Voltage** (consumes 55W of power, instead of 110W)
- Support for IBM Director and RDM (Remote Deployment Manager)

## HS20 *Ultra Low Power* (7981)

- **Dual socket - Dual Core blade based on Intel Low Voltage Xeon processors and Lindenhurst chipset**
  - ▶ 1.67GHz or 2.0 GHz
- **Processors consume only 31W of power per socket**
  - ▶ 180W per blade: 53% lower than HP dual core 2.4GHz Opteron blade
- **Four DDR2 DIMM slots supporting up to 16GB of memory**
- **Two SFF SAS hard drives – 36 and 73GB**
- **LSI SAS RAID controller supports RAID 0,1**
- **Broadcom 5704 NICs**
- **Does not support Blade Storage Exp (BSE) unit; PCI Exp unit; EM64T extensions**
- **Supported in all three IBM BladeCenter chassis**



# BladeCenter Server Portfolio

|                    | HS20 2-way Xeon   | HS21 2-way Xeon  |
|--------------------|---|--|
| <b>Features</b>    | <ul style="list-style-type: none"> <li>▪ Intel Xeon DP processors</li> <li>▪ EM64T</li> <li>▪ Mainstream rack-dense blade server</li> </ul>   | <ul style="list-style-type: none"> <li>▪ Intel Xeon DP processors - Woodcrest</li> <li>▪ Dual Core / EM64T</li> <li>▪ Expandable with MIO &amp; SIO exp units</li> </ul> |
| <b>Target Apps</b> | <ul style="list-style-type: none"> <li>▪ Edge and mid-tier workloads</li> <li>▪ Collaboration</li> <li>▪ Web serving</li> <li>▪ Infrastructure</li> </ul>  | <ul style="list-style-type: none"> <li>▪ Similar to HS20, more workload</li> </ul>  |

**One Common Chassis and Infrastructure**

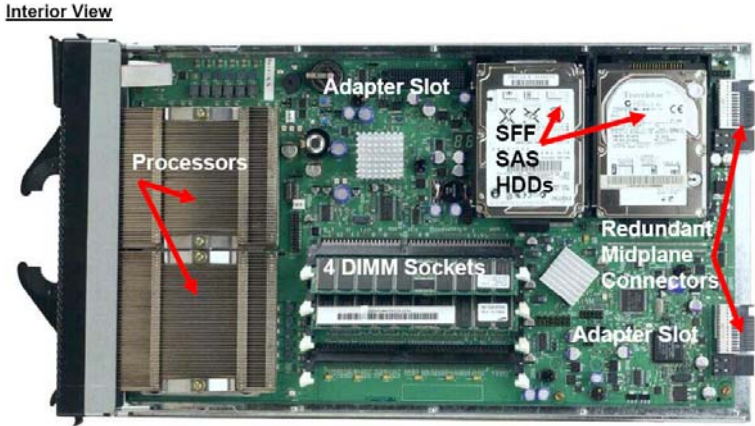
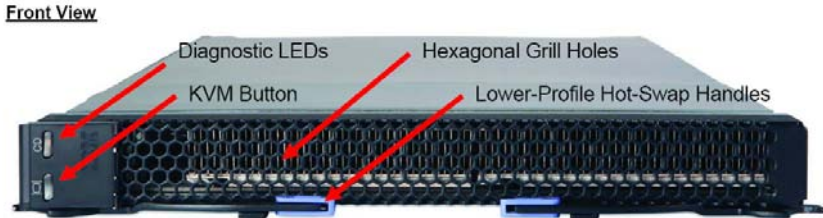


# BladeCenter HS21

## Maximum Density

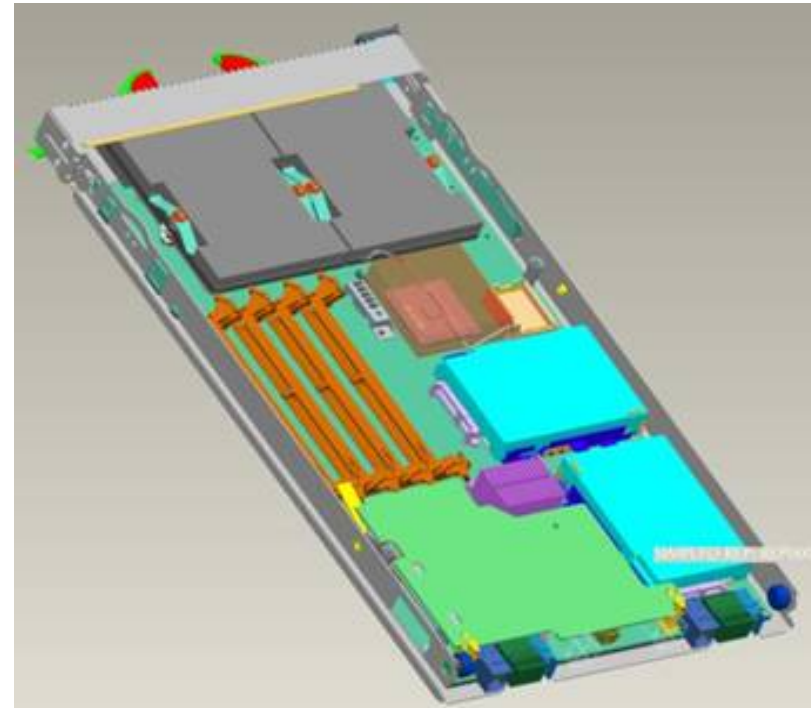
- DP Intel **Dual Core Woodcrest** from **1.6Ghz to 3.0Ghz**
- **1066/1333** MHz Front Side Bus (Blackford Chipset)
- 4 Fully Buffered DIMMs in 30mm blade (up to **8 DIMMs** - 32GB RAM with MIO expansion unit)
- 2 Gb Eth ports, TOE enabled (5708)
- 2 SFF **SAS** HDDs with RAID 0, 1 on base blade
- Support for SIO expansion unit: 3 HS SAS HDD, 2 I/O Exp Cards, RAID 1E, optional RAID 5 with ServRAID and battery backed cache
- Support for legacy Exp Cards
- Support for new **High Speed Cards**
- **cKVM** and cMedia feature card support (w. option)
- Support for IBM Director, RDM, ServerGuide, UpdateXpress, and Toolkit support

Just Announced:  
27 Jun 2006  
G.A. 25 Aug 2006



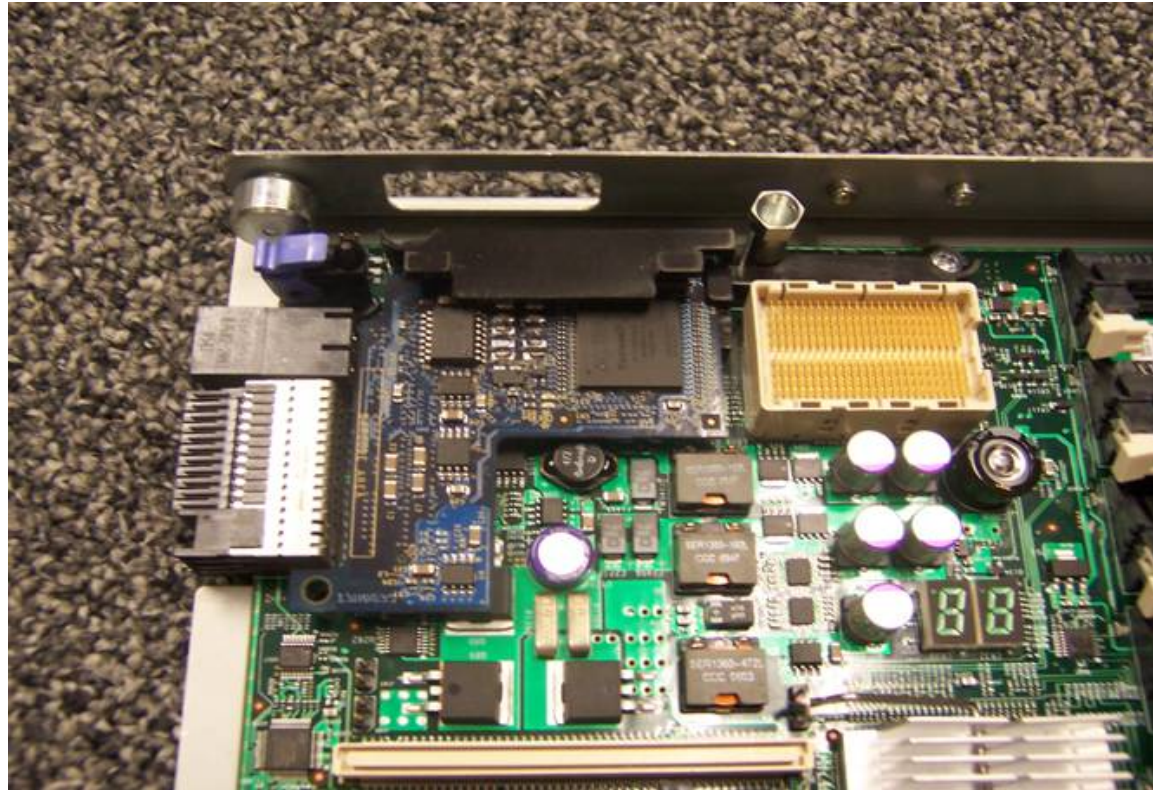
## BladeCenter HS21 *Maximum Density*

- The 30MM High Density Offering
  - ▶ 4 FB DIMMs (up to 16GB of memory per blade)
  - ▶ 2 SFF Non Hot Swap 10K RPM SAS HDD
  - ▶ 2 NICs - TOE enabled
  - ▶ Supported in all chassis for 65W processors. BladeCenter H only with 80W processors
    - 3.0Ghz only 80W part
    - 65W parts provide industry leading performance/watt
    - 1.66-2.66Ghz (BIN-1)
  - ▶ Supported BladeCenter T with 65W part (available SS + 60days)
  
- Ship Support: July 21



## cKVM – Concurrent KVM

the card is positioned under the SFF Daughtercard.



## BladeCenter HS21 + the MIO (Memory - I/O expansion unit)

- Start with the feature packed 30mm base and add a 30mm Memory and I/O Expansion Blade
  - ▶ 4 additional DIMM slots
  - ▶ 2 additional NICs
  - ▶ 1 additional PCI-E slot
  - ▶ 1 additional PCI-X slot
- **Combined** they create the 60MM higher function offering
  - ▶ 8 FB DIMMs (up to 16GB of memory per blade)
  - ▶ 2 Non Hot Swap SAS HDD
  - ▶ 4 NICs - 2 TOE enabled
  - ▶ Supported in all IBM Chassis with 65W processors (follows same rules as base 30mm blade)
- General Availability for the MIO: Sept. 06



## the SIO (Storage - I/O expansion unit)



- Three hot swap SAS 2.5" drives
- ServeRAID – 8k provide RAID 5 capability and 256MB cache.
- Additional PCI-E + PCI-X slot (or 2 legacy PCI-X slots)

## BladeCenter HS21 *Intel Line Comparison*




### IBM BladeCenter HS20 (Groucho)

- DP Intel Xeon “Irwindale” 2.8 - 3.8GHz with 800MHz Front Side Bus
- Lindenhurst Chipset
- 14 Blades per Chassis (30mm blade width)
- 2 Gb Ethernet Ports standard (5704)
- 4 DIMM slots
- Up to (2) 73GB SFF SCSI with RAID 1 standard
- Internal Switches (Enet/FC/KVM)
- Support for BSE2 ( 2 HS HDD, 2 Exp Cards, RAID 1E)
- Support for dual SCSI drives and Expansion Card
- Support for IBM Director, RDM, ServerGuide, UpdateXpress, and Toolkit support

### IBM BladeCenter HS21 (Crichton)

- DP Intel **Dual Core Woodcrest 1066/1333** MHz Front Side Bus
- Blackford Chipset
- 14 – 30mm mid power blades per chassis
- 7 – 60mm blades per chassis
- Up to **8 DIMMs** with SIO blade (4 DIMMs in 30mm blade)
- 2 Gb EN ports. TOE enabled (5708)
- 2 SFF **SAS** HDDs with RAID 0, 1 on base blade
- Support for SIO
  - 3 HS SAS HDD, 2 I/O Exp Cards, RAID 1E, optional RAID 5 with ServRAID and battery backed cache
- Support for legacy Exp Cards
- Support for new **High Speed Cards**
- cKVM** and cMedia feature card support
- Support for IBM Director, RDM, ServerGuide, UpdateXpress, and Toolkit support

# BladeCenter Server Portfolio

|  | HS20 2-way Xeon   | HS21 2-way Xeon  | JS21 POWER-based   |
|--|---|--|--|
| <b>Features</b>                              | <ul style="list-style-type: none"> <li>Intel Xeon DP processors</li> <li>EM64T</li> <li>Mainstream rack-dense blade server</li> </ul>   | <ul style="list-style-type: none"> <li>Intel Xeon DP processors Woodcrest</li> <li>Dual Core / EM64T</li> <li>Expandable with MIO &amp; SIO exp units</li> </ul>       | <ul style="list-style-type: none"> <li>Two PowerPC® 970 processors</li> <li>Single/Dual Core</li> <li>32-bit/64-bit solution for Linux &amp; AIX 5L™</li> <li>Built-In virtualization APV</li> </ul>               |
| <b>Target Apps</b>                           | <ul style="list-style-type: none"> <li>Edge and mid-tier workloads</li> <li>Collaboration</li> <li>Web serving</li> <li>Infrastructure</li> </ul>  | <ul style="list-style-type: none"> <li>Similar to HS20, more workload</li> </ul>  | <ul style="list-style-type: none"> <li>Performance for deep computing clusters</li> <li>UNIX server consolidation</li> </ul>  |
| <b>One Common Chassis and Infrastructure</b> |   |  |  |

# IBM BladeCenter JS21

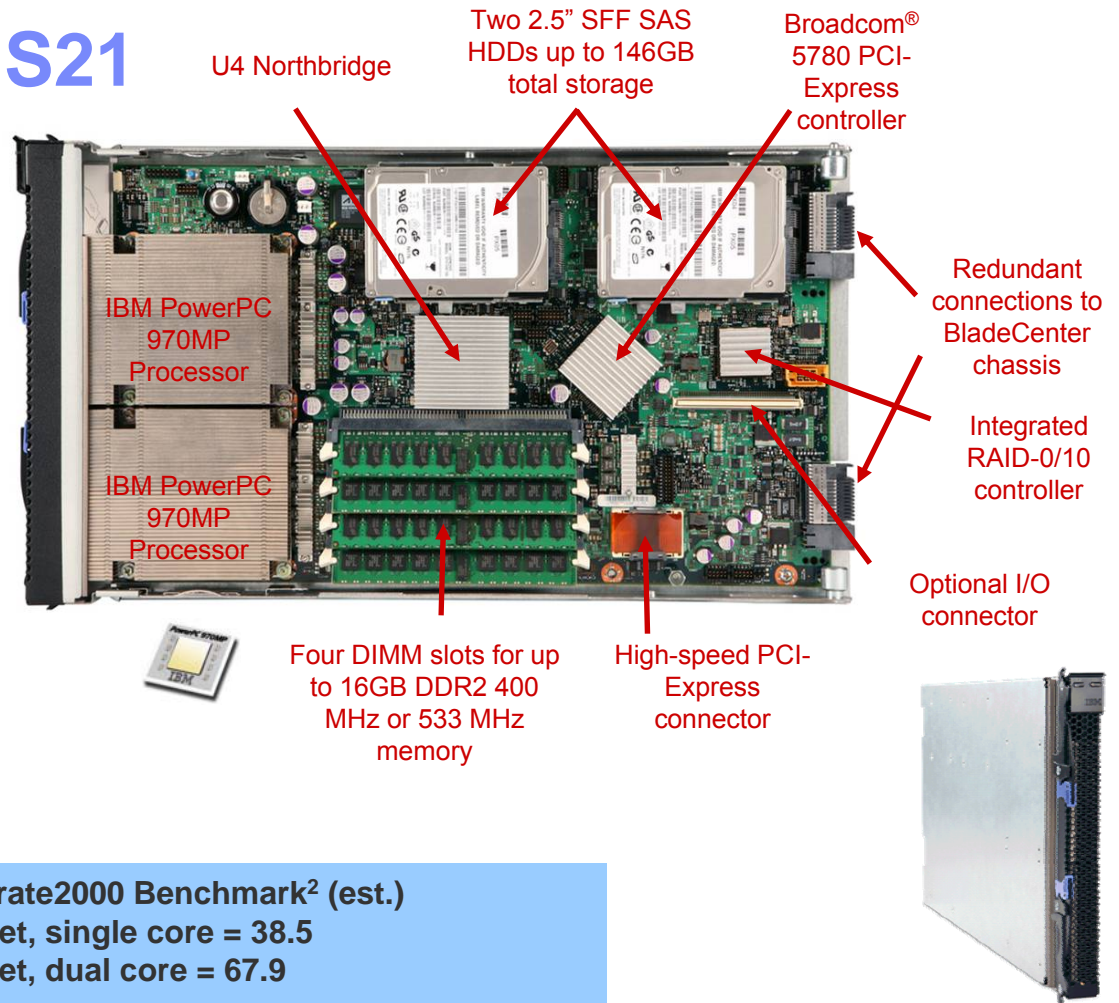
- 2 socket, dual core PowerPC 970MP 2.5 GHz/2x1MB L2
- Max 16GB DDR2 PC3200 ECC/Chipkill
- Up to two 73GB SAS HDDs + RAID10
- PCI-Express (10GbE/4X IB) + Dual GbE
- Integrated Systems Mgmt

Configured price<sup>1</sup> = \$5,856  
 (2-socket, single core w/ 2GB = \$3,696) –

G.A. : 03 / 2006

SPECint\_rate2000 Benchmark<sup>2</sup> (est.)  
 2 socket, single core = 38.5  
 2 socket, dual core = 67.9






JS21 delivers exceptional performance at lower prices than competitive UNIX Blades, integrating with BladeCenter to help lower cost and improve management.



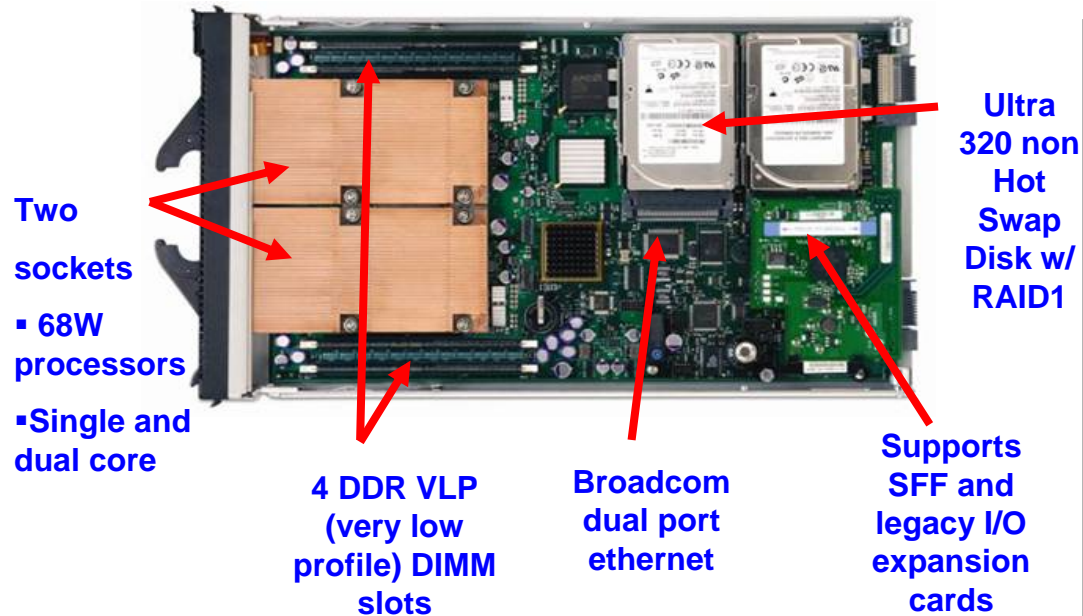
1. 2w DC JS21 or 2x36GB HDDs, www.ibm.com, www.hp.com, Pricing as of 2/606  
 2. SPEC Benchmark results as of Feb 8, 2006, Source: www.spec.org IBM SPEC results submitted to SPEC on 2/09/06




# Blades for BladeCenter

|  | HS20 2-way Xeon   | HS21 2-way Xeon   | JS21 PowerPC   | LS20 2-way AMD   |
|--|---|---|--|--|
| <b>Features</b>                          | <ul style="list-style-type: none"> <li>▪ Intel Xeon DP</li> <li>▪ EM64T</li> <li>▪ Mainstream rack dense blade server</li> <li>▪ High availability apps</li> </ul>  | <ul style="list-style-type: none"> <li>▪ Intel Xeon DP processors</li> <li>▪ Dual Core / EM64T</li> <li>▪ Expandable with MIO &amp; SIO exp units</li> </ul>            | <ul style="list-style-type: none"> <li>▪ Two PowerPC® 970 processors</li> <li>▪ Single/Dual Core</li> <li>▪ 32-bit/64-bit solution for Linux &amp; AIX 5L™</li> <li>▪ Built-In virtualization APV</li> </ul>   | <ul style="list-style-type: none"> <li>▪ Two socket AMD Opteron</li> <li>▪ Single / Dual core</li> <li>▪ Similar feature set to HS20</li> </ul>                                |
| <b>Target Apps</b>                       | <ul style="list-style-type: none"> <li>▪ Edge and mid-tier workloads</li> <li>▪ Collaboration</li> <li>▪ Web serving</li> </ul>  | <ul style="list-style-type: none"> <li>▪ Similar to HS20, more workload</li> </ul>  | <ul style="list-style-type: none"> <li>▪ Performance for deep computing clusters</li> <li>▪ UNIX server consolidation</li> </ul>   | <ul style="list-style-type: none"> <li>▪ 32- or 64-bit</li> <li>▪ HPC focused</li> </ul>  |
| <b>Common Chassis and Infrastructure</b> |   |   |  |  |

# LS20 features



**LS20 for**  
**IBM eServer BladeCenter**



- Dual AMD Opetron up to 2.8GHz (single core)
- Dual AMD Opetron up to 2.4GHz (dual core)
- Integrated Memory Controller
- 14 Blades per Chassis (30mm blade width)
- 2x 1Gb Ethernet Ports standard
- 4 DIMM slots (1/2GB – 4GB when available)
- Up to (2) 73GB SFF SCSI w/ RAID 1 standard
- Support for dual SCSI drives and Expansion Card
- Support for IBM Director/RDM



Systems and Technology Group



# Blade Servers ..just announced..

**ON** DEMAND BUSINESS™

© 2006 IBM Corporation

# BladeCenter QS20

## Cell BE – (Broadband Engine processors)

- **Dual Cell BE based Processors**
  - ▶ Each with **nine-cores**: 1 Power Processing Element (PPE) plus 8 Synergistic Processing Units (SPUs) connected via high speed data ring (192 GB/sec), the Element Interconnect Bus (EIB)
- **Double-wide blade; up to 7 blades per chassis (BC1)**
- **Supports 1 IDE drive per blade**
- **2 embedded 1Gb NICs and 2 InfiniBand daughter cards supported on each blade for connection to external I/O**
- **Fedora Linux for Cell BE and SDK 1.1**
  - ▶ Downloadable from the Barcelona SuperComputing Centre
- **Announced on 12 sept 2006; G.A. on 29 sept**
- **Target applications:**
  - ▶ Medical imaging, molecular diagnostics
  - ▶ Digital media (design, content creation, rendering)
  - ▶ Automotive,
  - ▶ Petroleum & gas (seismic analytics)
  - ▶ *Financial analytics*
- **Up to 10x advantage vs normal processors**

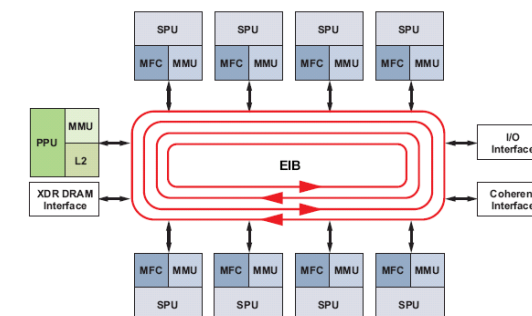
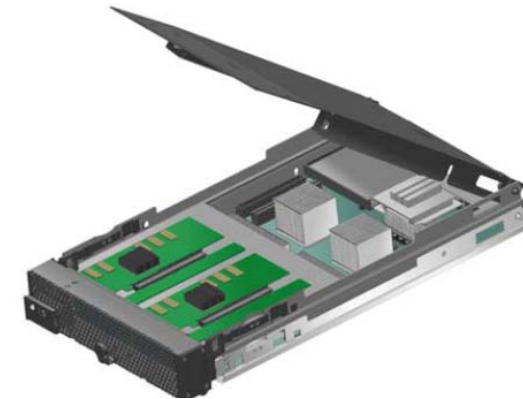


Figure 1. Cell Broadband Engine Processor Block Diagram



Systems and Technology Group

# AMD Opteron Blades LS21 & LS41 for IBM BladeCenter

Announced on 15 august 2006  
Available on 6 october 2006

**ON** DEMAND BUSINESS™

© 2006 IBM Corporation

# LS21 ..to LS41 – components

*The industry's first "snap-in" scalable blade server*

- Two socket dual core AMD Opteron
- 8 DDR2 DIMMs (32 GB max)
- 4-way expansion
- Single 30mm HDD
- 2 TOE Enabled Ethernet ports
- High speed I/O enabled
- Supported in BC and BCH chassis
- cKVM/cMedia option
- SIO optional
- 30mm form factor

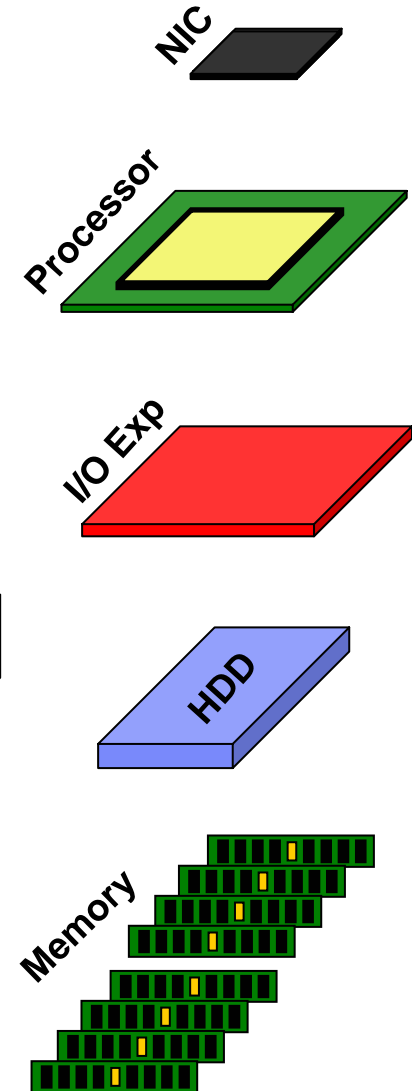
**Performance**

2-way

30mm



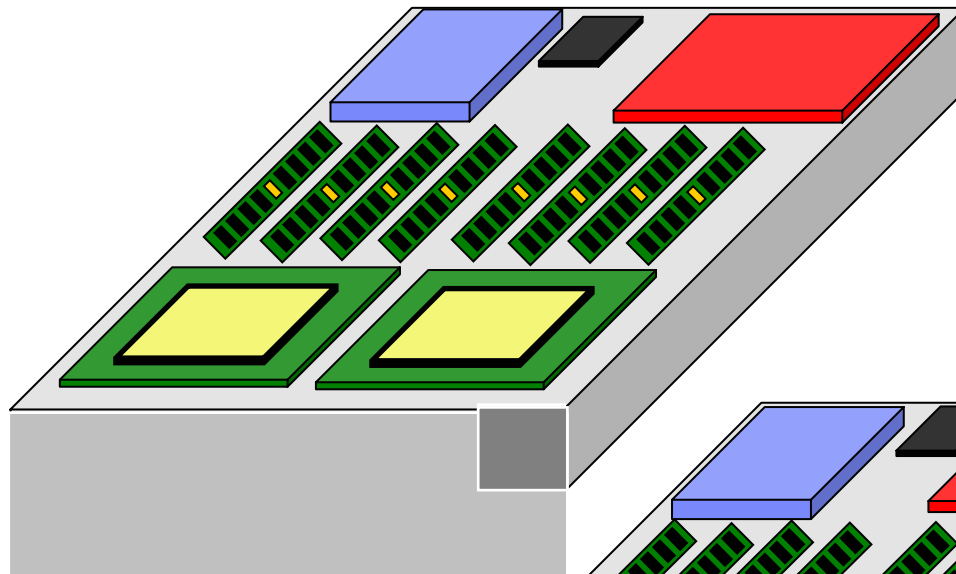
Picture for understanding only. Not to scale or correct for placement of components



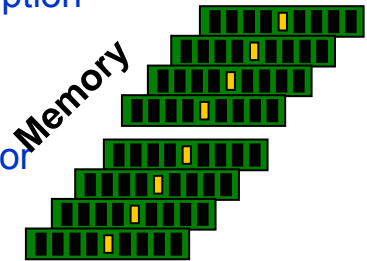
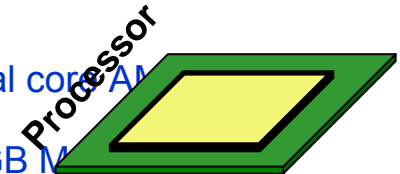
# LS21 ..to LS41 – components

*The industry's first "snap-in" scalable blade server*

## How 2+2 Scalability Works



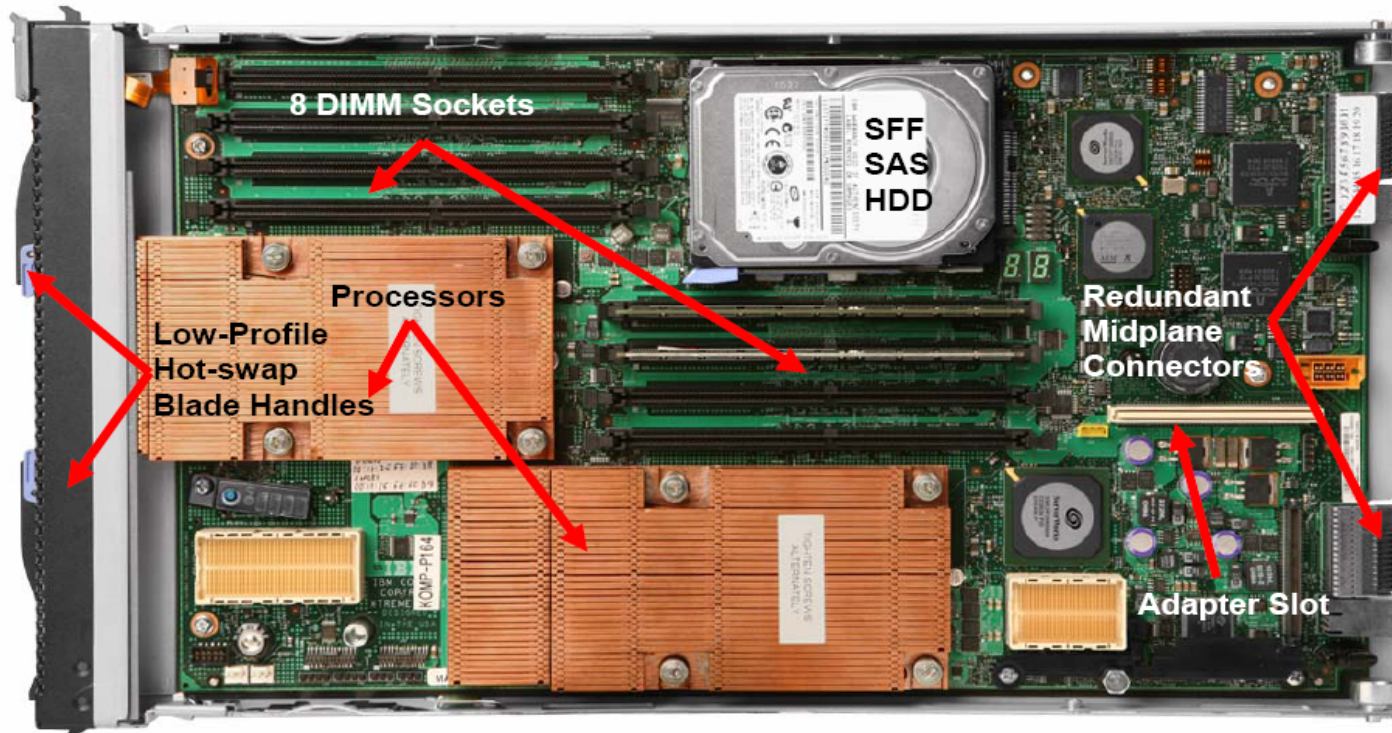
- Four socket dual core AMD
- 16 DIMMs (64GB Max)
- Dual SAS drives – RAID 0 or 1
- 4 TOE Enabled Ethernet
- Supported in BC and BCII Chassis
- High speed I/O enabled. Legacy and HS can be mixed
- Scalable in the field
- cKVM/cMedia option
- SIO optional
- 60mm form factor



Picture for understanding only. Not to scale or correct for placement of components

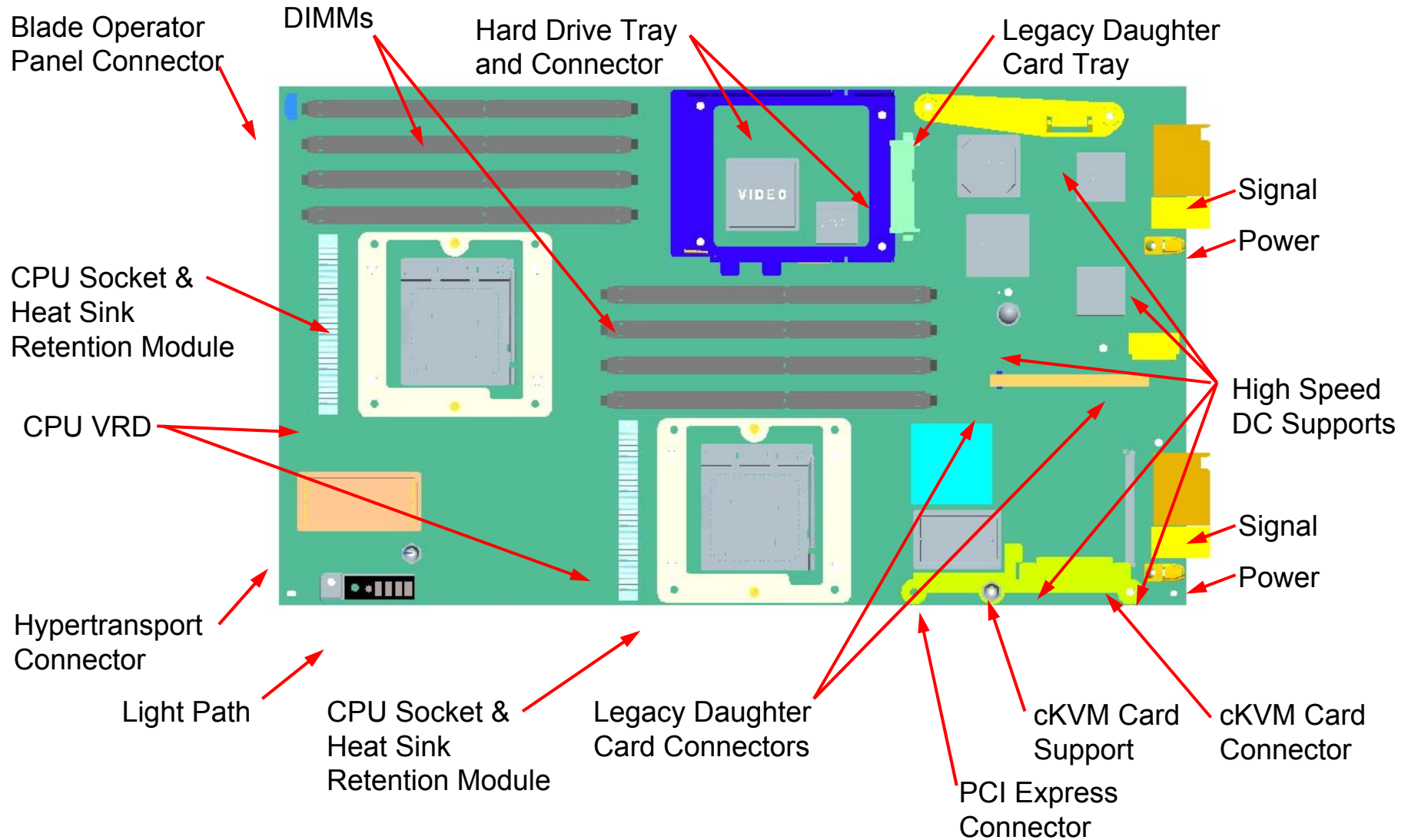
# Introducing LS21/LS41

Interior View: Base LS41 Blade Server

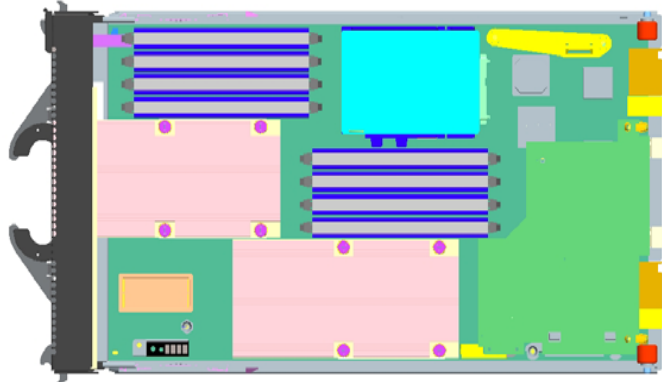




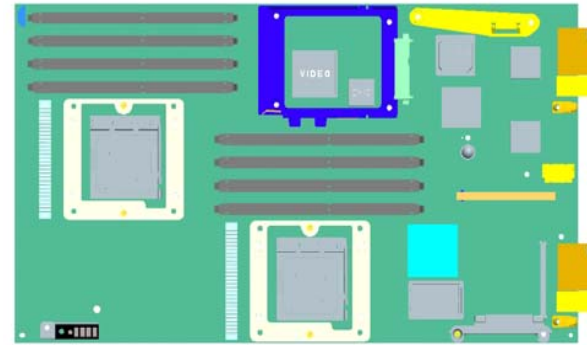
# LS21/LS41 Planar Board



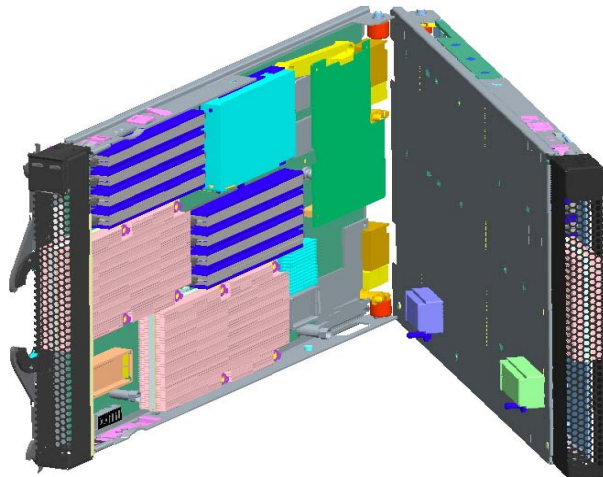
# Introducing LS21/LS41



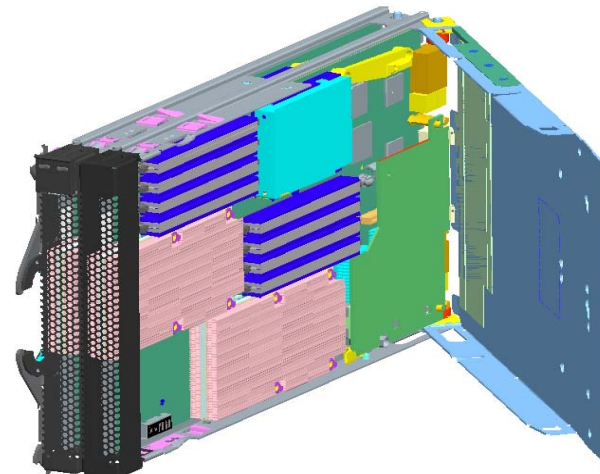
**The LS21/41 2-socket**



**The MP Expansion Unit**

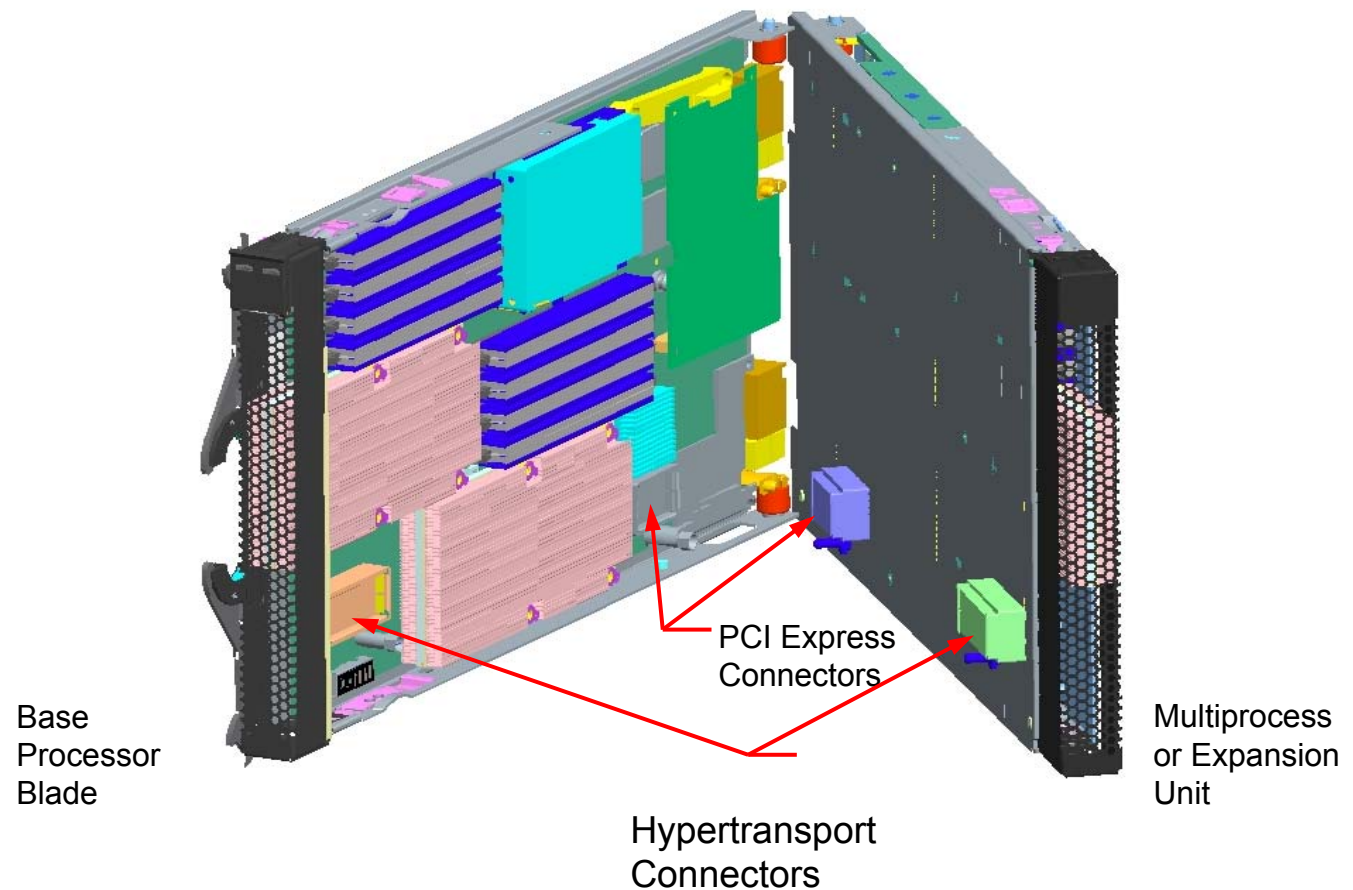


**Assembling the parts**



**The LS41 4-socket**

# The LS41 Connections



**Using AMD HyperTransport interconnect technology, clients can easily double the processing capacity of a two-socket blade in a "pay-as-you-grow" model**

# Introducing LS21/LS41

## Key Product Features

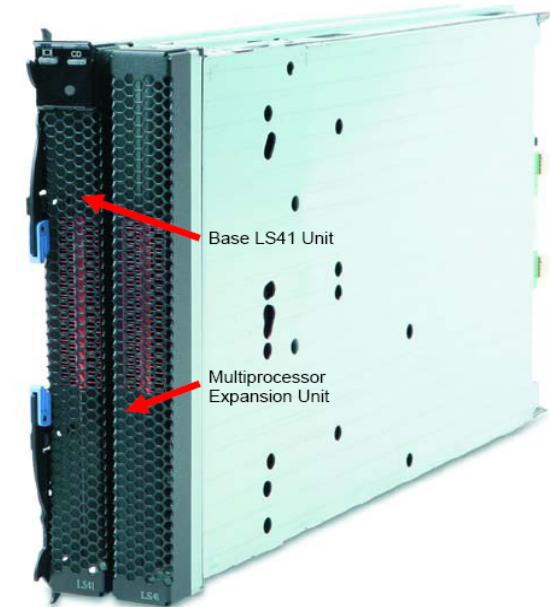
- Next Generation AMD Opteron CPUs
  - Up to 4 *Opteron 8218 Rev F*, 2.6GHz / 1MB Dual Core
- 16 DIMMs - Up to 64GB DDR2 Memory
- Up to 2 SAS Disk Drives
- High speed (10GB/s) capability in BladeCenter H chassis
- Multiprocessor Expansion Unit (adds 2 additional processor sockets and 8 DIMM slots)

### **LS41 Images**

**Front View: Base LS41 Blade Server**



**LS41 With Multiprocessing Expansion Unit**

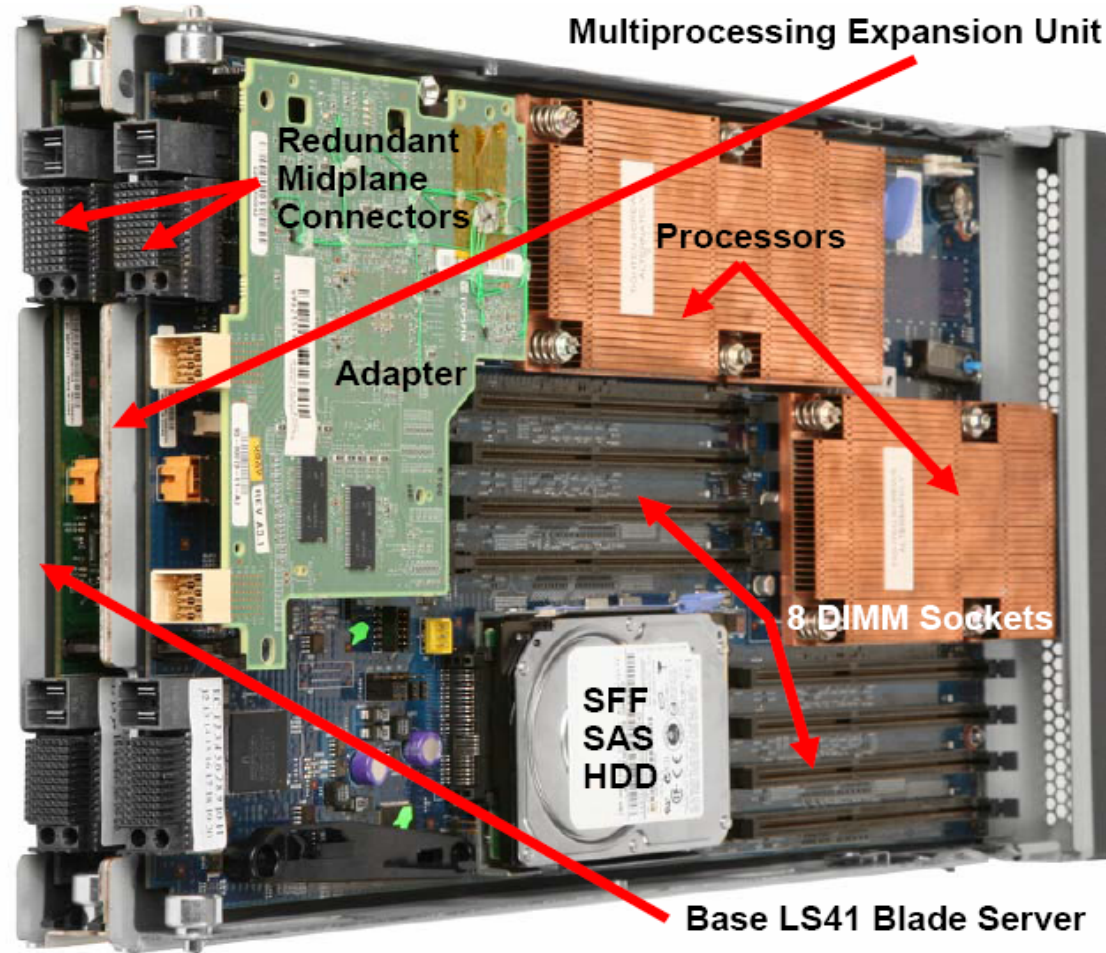


### **Next Gen (Rev F) Opteron processors**

- New memory controller supporting DDR2
- Improved performance
- Virtualization technology

# Introducing LS21/LS41

## Interior View: Multiprocessing Expansion Unit



## the SIO (Storage - I/O expansion unit)

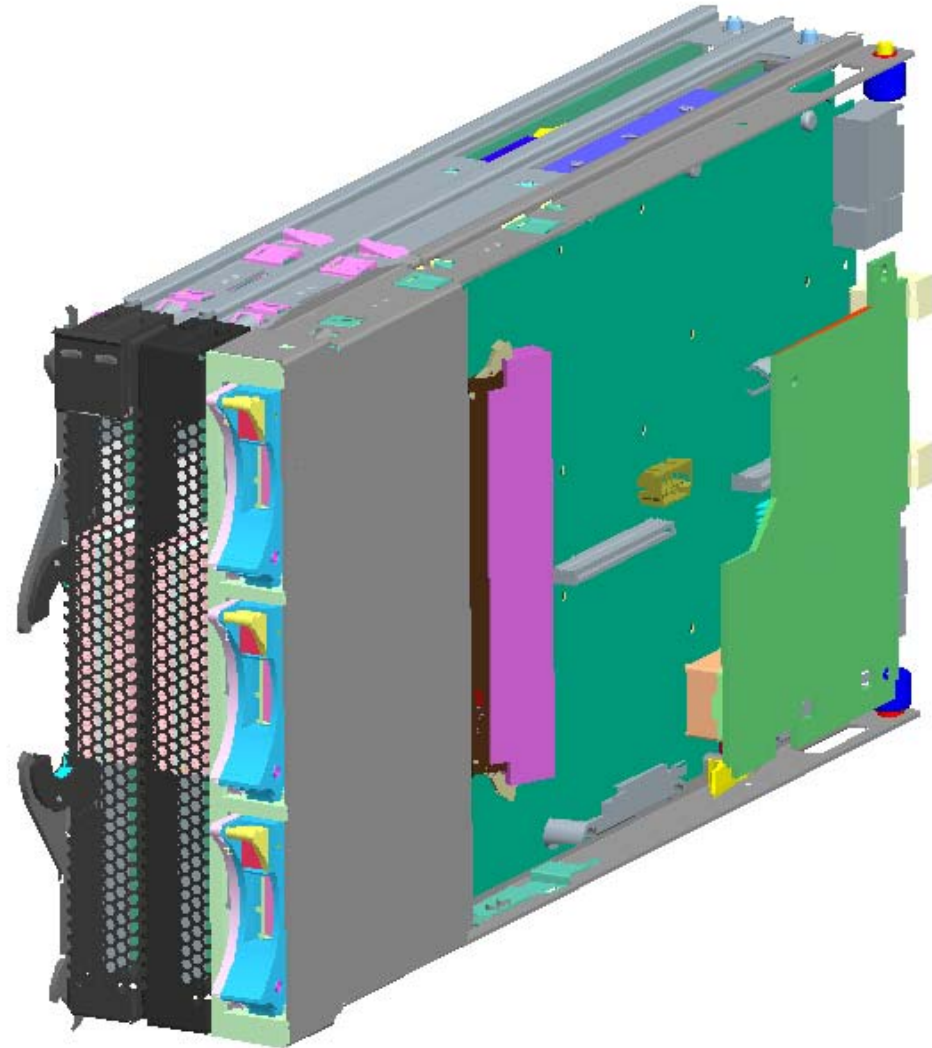


- Three hot swap SAS 2.5" drives
- ServeRAID – 8k provide RAID 5 capability and 256MB cache.
- Additional PCI-E + PCI-X slot (or 2 legacy PCI-X slots)

## LS41 – 4 Way Blade with SIO (Storage and I/O Expansion)

A 30mm LS41 blade server can be upgraded, via a **Multiprocessor Expansion Unit** to a double-wide LS41 (with double the capabilities).

Either blade can be expanded further with a **Storage and I/O Expansion Unit** and/or a **PCI I/O Expansion Unit**. This expandability allows configurations that are **30mm, 60mm, 90mm** or **120mm** wide, with a variety of storage and I/O options, depending of need.



# Technical Overview

## High-performance Processors

- ▶ Dual Core Opteron models
- ▶ 95W supported in BC2

Fail safe mode if installed in BC1, processors throttling to 66W, n-2

- ▶ 68W supported in all chassis

## Mechanical

- ▶ 2 processor dual core single wide blade
- ▶ Combines with MP expansion unit for 4 processor double wide operation
- ▶ Add PEU2 and / or BSE3

## Specification:

- ▶ Chipset- ServerWorks HT 2000/1000
- ▶ VLP Memory – DDR2 - support for both 533 & 667 MHz
  - 4 DIMMS per processor – 16 total (on 4-socket)
  - 512MB, 1GB, 2GB and 4GB (late 4Q06)
- ▶ 1 SAS HDD per/ blade, exp to 2 HDDs w/ CPU/IO Exp Card (MPE)
  - 36 & 73 GB HDDs – non-hot swap
- ▶ 2P can support these daughter cards.
  - 1 High Speed Daughter Card w/ cKVM (PCI-E)
  - Or 1 Standard Daughter card w/ cKVM (PCI-X)
  - Or 1 SFF Daughter card w/ cKVM (PCI-X)
- ▶ 4P can supports these daughter cards
  - 1 High Speed Daughter Card w/ cKVM (PCI-E)
  - Or 2 Standard Daughter card w/ cKVM (PCI-X)
  - Or 2 SFF Daughter card w/ cKVM (PCI-X)
  - Or 1SFF and 1 Standard Daughter w/ cKVM (PCI-X)
- ▶ 2 Gigabit ethernet controllers on the base blade (Broadcom 5706S) w/ Failover, Teaming and TOE
- ▶ 2 Gigabit ethernet controller on the CPU/IO exp unit (Broadcom 5708S) w/ Failover, Teaming and TOE
- ▶ Supported in BC1 w/MM1 or MM 2, BC2 w/ MM2 and Telco w/MM2
- ▶ MM1 support equivalent to Groucho plus BSE & CPU Expansion
- ▶ RoHS compliant
- ▶ NEBS compliant (post GA certification run).

## New Options:

- ▶ Multiple Processor (MP) Expansion Unit
- ▶ 2000 series 95W processors - 2.0 & 2.6 GHz
- ▶ 8000 series 95W processors - 2.0 & 2.6 GHz
- ▶ 2000 series 68W processors – 2.0 & 2.4 GHz
- ▶ 8000 series 68W processors – 2.0 & 2.4 GHz

## Related New Options

- ▶ Infiniband 4x switch & card
- ▶ SIO
- ▶ cKVM
- ▶ Memory option kits – 512MB, 1, 2 & 4GB

## System Management

- ▶ Renesas 2166 BMC w/ IPM v2.0 firmware (OSA) UpdateXpress
- ▶ Dynamic Systems Analysis 1.4 (realtime diags)
- ▶ Director 5.1x, RDM 4.3x
- ▶ Server Guide 7.x

## Operating Systems Supported

- ▶ Preloaded
  - Windows 2003 (Std, Ent, Web)
  - RHEL 4 (AS, ES, WS)
  - RHEL 4 for x64 (AS, ES, WS)
- ▶ Supported (Priority 1)
  - RHEL 4 (x86 & x64)
  - SuSE Linux ES 9(x86 & x64)
  - VMWare ESX Server 3
- ▶ Supported (Priority 2)
  - Windows Server 2003 & R2 (x86 & x64)
- ▶ Supported (Priority 3):
  - RHEL 3 (x86 & x64)
  - Open Enterprise Server (NW 6.5)
  - Solaris 10



## LS21/LS41 Positioning



### LS21: High Performance Compute Blade

- ▶ **Optimized for Memory Bandwidth Intensive/HPC Applications**
- ▶ **Increased memory: 8 DIMMs (32GB max) for higher levels of performance**
- ▶ **Target workloads include Financial Services, Research/Scientific, SQL databases**

### LS41: Scalable, Enterprise Performance Blade Server

- ▶ **Targeted at Scalable Enterprise Workloads and Scientific Computing**
- ▶ **16 DIMMS (64GB max) for max performance**
- ▶ **Elegant 2+2 scalability allows pay as you grow flexibility: start as a 2-way and upgrade to 4-way as needed**
- ▶ **Target Workloads include ERP, Data warehousing, large HPC cluster nodes**

## LS21 / LS41 Variants

- Machine Types
  - ▶ **7971-xxx**
    - **2-way based on dual core Opteron 2000 series processor**
  - ▶ **7972-xxx**
    - **2-way expandable to 4-way based on dual core Opteron 8000 series processor**
- Models
  - ▶ **x#x – (#=number) signifies 68W processor**
  - ▶ **xAx – (A=alpha) signifies 95W processor**
- Processor Speeds
  - ▶ **2.0GHz, 2.6GHz (95W)**
  - ▶ **2.0GHz, 2.4GHz (68W)**

## LS21/LS41 Features

- **The LS21 and LS41 have the following additional features:**
  - ▶ **Expansion**
    - **LS21: Triple-wide (Base Blade, SIO, PEU-2)**
    - **LS41: Quad-wide (Base Blade, MPE, SIO, PEU-2)**
  - ▶ **RAID**
    - **LS21 – RAID 0, 1, 5 w/ SIO attached**
    - **LS41 – RAID 0, 1 w/ MPE; RAID 0, 1, 5 w/ SIO**
  - ▶ **Concurrent KVM w/ cKVM Daughter Card installed**
    - **Note: Support scheduled POST ship support**
  - ▶ **USB Virtualization**
  - ▶ **Memory Address Parity**
    - **Note: Not supported at ship support at this time**

## LS21/LS41 vs. LS20 Comparison

| <b>Feature</b>                            | <b><u>LS21</u></b>                      | <b><u>LS41</u></b>           | <b><u>LS20</u></b>          |
|---|---|------------------------------|-----------------------------|
| <b>Opteron CPU Type</b>                   | <b>2000 Series<br/>Rev F</b>            | <b>8000 Series<br/>Rev F</b> | <b>200 Series<br/>Rev E</b> |
| <b>Max # CPU Sockets</b>                  | <b>2</b>                                | <b>4</b>                     | <b>2</b>                    |
| <b>Max # DIMM Sockets</b>                 | <b>8</b>                                | <b>16</b>                    | <b>4</b>                    |
| <b>Memory Technology</b>                  | <b>PC2-5300 DDR-2 (4 GB @ PC2-4200)</b> |                              | <b>PC-3200 DDR-1</b>        |
| <b>Chipset</b>                            | <b>ServerWorks HT-2000, HT-1000</b>     |                              | <b>AMD 8131, 8111</b>       |
| <b>HDD Controller</b>                     | <b>LSI 1064 SAS</b>                     |                              | <b>LSI 1020 SCSI</b>        |
| <b>Ethernet Controller<br/>(Broadcom)</b> | <b>BCM5706S</b>                         | <b>BCM5706S<br/>BCM5708S</b> | <b>BCM5704S</b>             |
| <b>Video Controller</b>                   | <b>ATI RN-50</b>                        |                              | <b>ATI Radeon 7000M</b>     |
| <b>Concurrent KVM</b>                     | <b>Yes</b>                              |                              | <b>No</b>                   |
| <b>Expansion</b>                          | <b>SFF/CFF DC, HSDC, SIO, PEU-2</b>     |                              | <b>SFF/CFF DC</b>           |

## LS21 Maximum Supported Chassis Configurations

- **BladeCenter 1 / BladeCenter T**
  - ▶ **2 – Opteron 2000 Series Processors**  
95 W Processors must be throttled to 66 W
  - ▶ **8 – 2 GB VLP DDR-2 DIMMs**
  - ▶ **1 – 73 GB SAS Hard Drive**
  - ▶ **1 – SFF/CFF Daughter Card or 1 – High-Speed Daughter Card**
  - ▶ **1 – cKVM Card**
- **BladeCenter H**
  - ▶ **2 – Opteron 2000 Series Processors**
  - ▶ **8 – 4 GB VLP DDR-2 DIMMs**
  - ▶ **1 – 73 GB SAS Hard Drive**
  - ▶ **1 – SFF/CFF Daughter Card or 1 – High-Speed Daughter Card**
  - ▶ **1 – cKVM Card**

## LS41 Maximum Supported Chassis Configurations

- **BladeCenter 1 / BladeCenter T**
  - ▶ 4 – Opteron 8000 Series Processors  
95 W Processors must be throttled to 66 W
  - ▶ 16 – 2 GB VLP DDR-2 DIMMs
  - ▶ 2 – 73 GB SAS Hard Drives
  - ▶ 1 – High-Speed Daughter Card and 1 – SFF/CFF Daughter Card      or 2 – SFF/CFF Daughter Cards
  - ▶ 1 – cKVM Card
- **BladeCenter H**
  - ▶ 4 – Opteron 8000 Series Processors
  - ▶ 16 – 4 GB VLP DDR-2 DIMMs
  - ▶ 2 – 73 GB SAS Hard Drives
  - ▶ 1 – High-Speed Daughter Card and 1 – SFF/CFF Daughter Card      or 2 – SFF/CFF Daughter Cards
  - ▶ 1 – cKVM Card

# Summary – Match the system with its workload

|                          |   |   |
|--------------------------|---|---|
| <b>Compute Intensive</b> | <p>Integer</p> <p><b>Woodcrest systems expected to outperform</b></p>   | <p>Floating Point</p> <p><b>Woodcrest and Opteron systems expected to have similar performance (within 10%)</b></p> |
|                          | <p>Memory Latency</p> <p><b>Woodcrest and Opteron systems expected to have similar performance (within 10%)</b></p> | <p>Memory Bandwidth</p> <p><b>Opteron systems expected to outperform</b></p>  |



Systems and Technology Group

A photograph of an IBM blade server chassis, showing multiple server blades inserted into a rack. The chassis is silver and black, with a prominent IBM logo on the front panel.

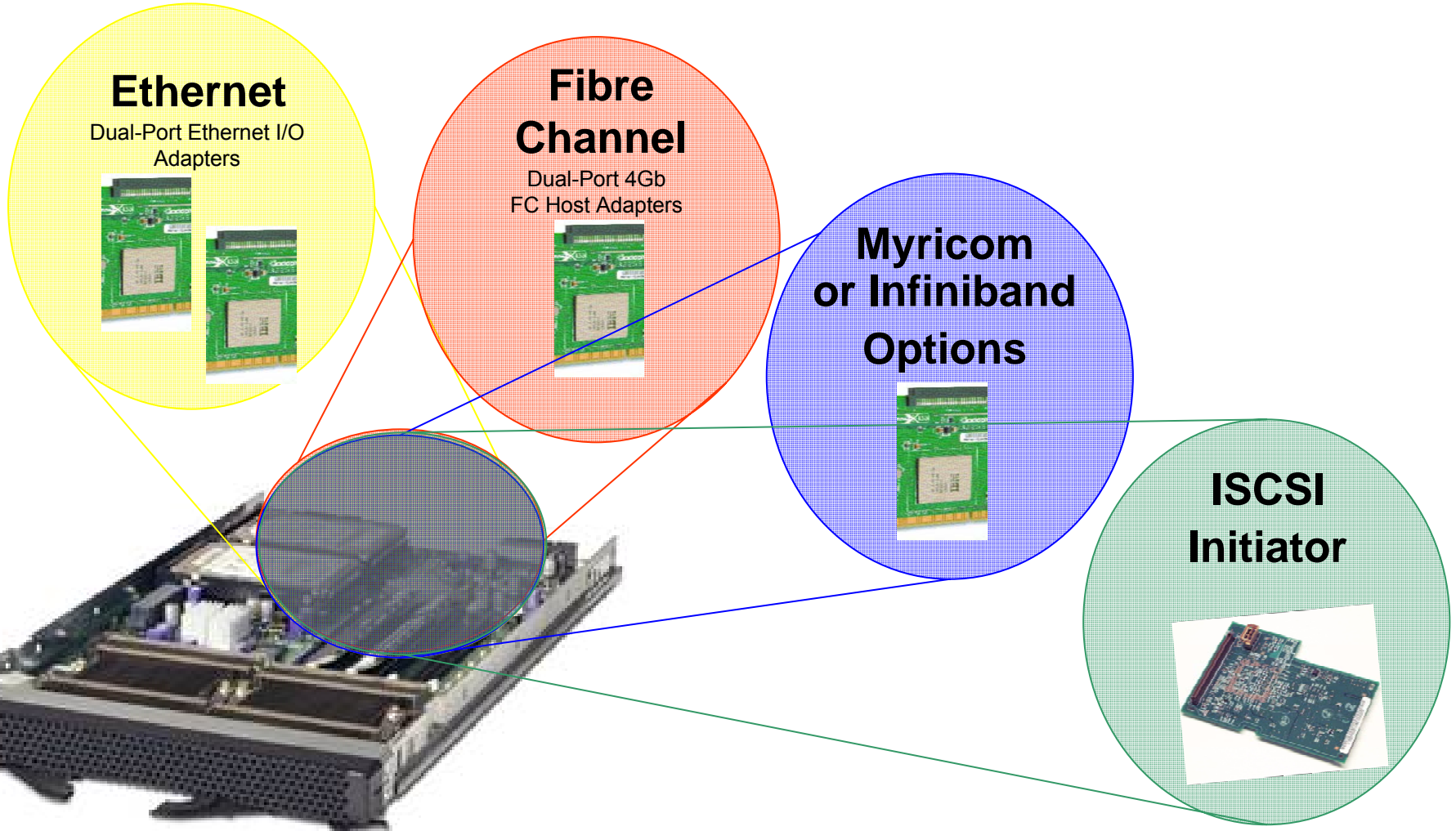
# Blade Servers Options Portfolio

**ON** DEMAND BUSINESS™

© 2006 IBM Corporation

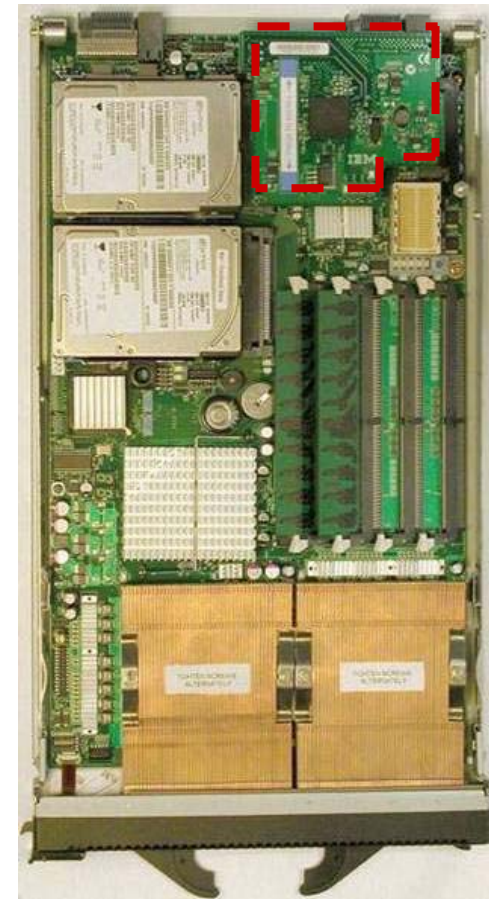


# Blade I/O Daughter Cards



# Blade Expansion Card Options

- **Ethernet**
  - ▶ Provides 2 independent 1Gb Ethernet channels
  - ▶ Must be paired with Ethernet Switch Module or CPM /OPM
  
- **Fibre Channel**
  - ▶ Provides 2 ports for 1Gb-2Gb-4Gb fibre channel connectivity
  - ▶ Must be paired with Fibre Channel Switch Module or OPM
  
- **iSCSI**
  - ▶ Provides full iSCSI initiator functionality from IBM Blade to an iSCSI storage device
  - ▶ Delivers full TOE (TCP/IP Offload Engine) functionality to reduce CPU processing
  - ▶ Must be paired with Ethernet Switch Module or CPM /OPM
  
- **Myrinet**
  - ▶ Provides 1 dedicated high-speed/low-latency cluster interconnect
  - ▶ Must be paired with Optical Pass-thru Module (OPM) (..and external dedicated Myrinet switch)



## BladeCenter PEU II (PCI Expansion Unit)

The 30mm **PCI I/O Expansion Unit II** provides **two PCI / PCI-X 100 / 133 Mhz** slots in addition

Supported on blades:  
-HS21; HS21+MIO; HS21+SIO  
-LS21  
-LS41; LS41+SIO



**BladeCenter PCI Expansion Unit**

# Blades are not just about servers

Application

Environment/Performance

Data Center

**Microsoft** **redhat**  
**HS20/21 2-way Xeon**

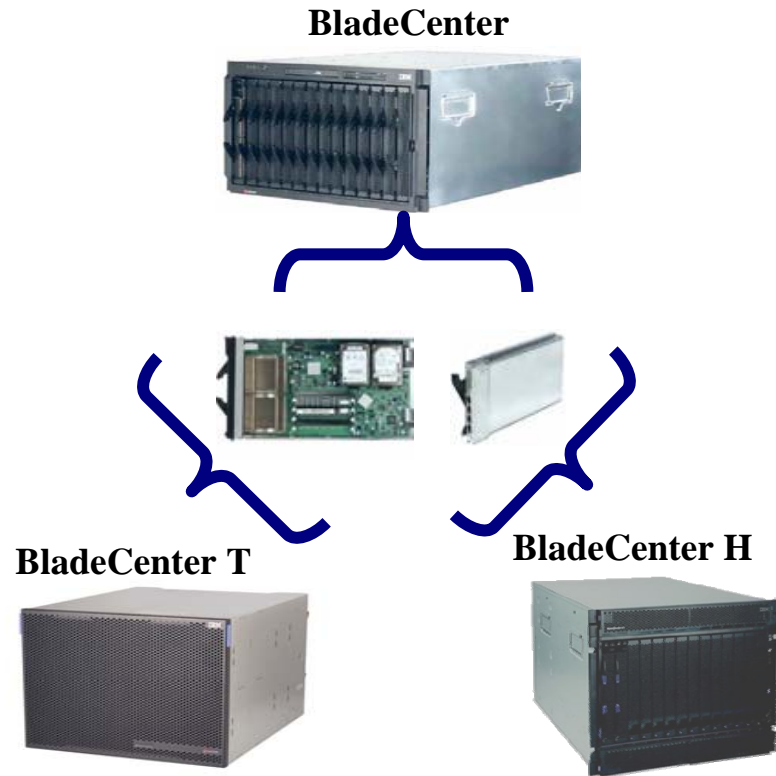
**Novell** **vmware**  
**LS 21 AMD Opteron**

**SOLARIS** **suse**  
**LS41 AMD Opteron**

**IXL**  
**JS21 PowerPC**



IBM + Partners



IBM

**BROCADE**

**Myricom**

**CISCO SYSTEMS**

**QLOGIC**

**NETEL NETWORKS**



IBM + Partners

**BladeCenter delivers a single IT building block**



## Blade.org - Partnership to success





Systems and Technology Group

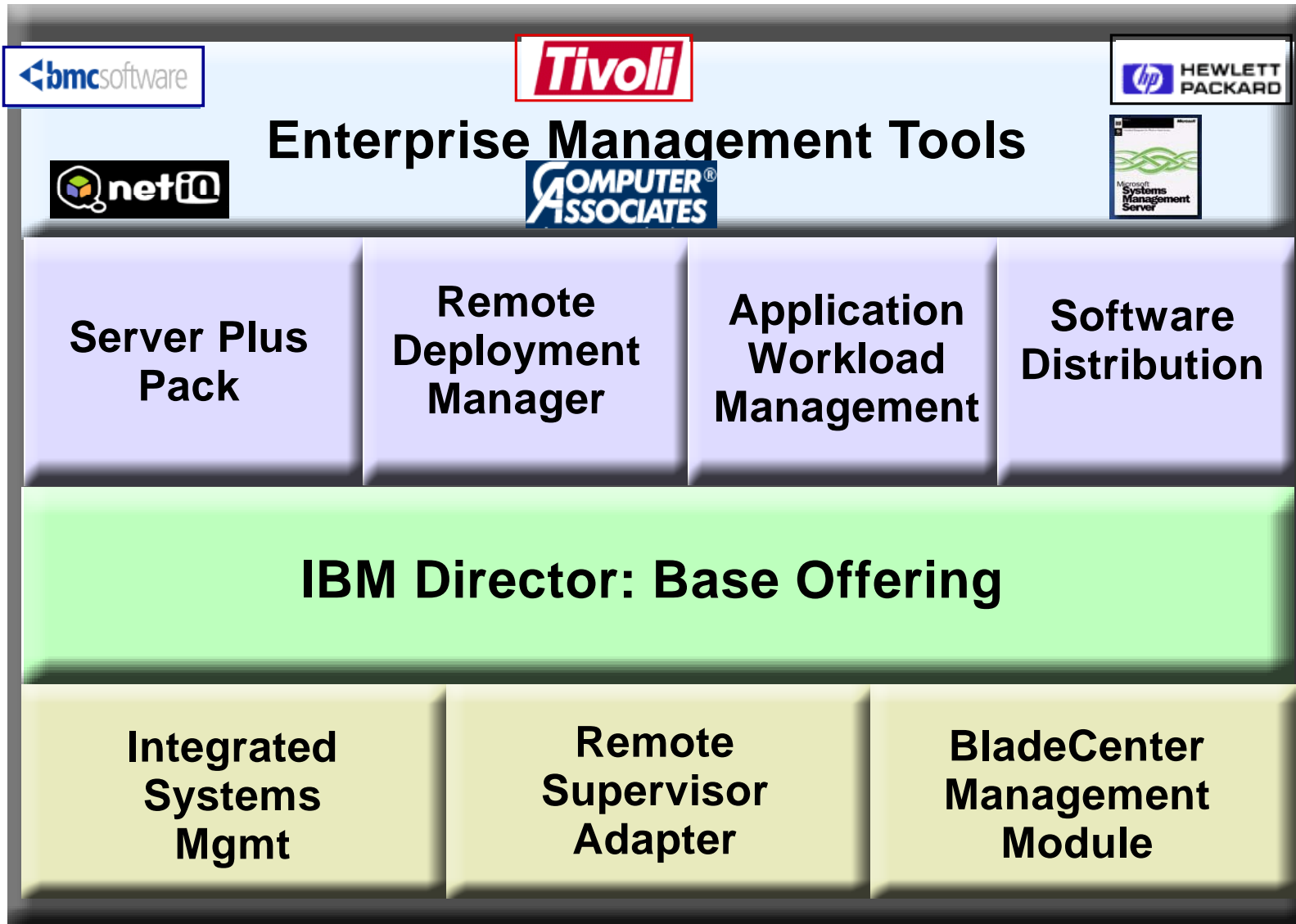
# System Management



**ON** DEMAND BUSINESS™

© 2006 IBM Corporation

# Systems Management Portfolio

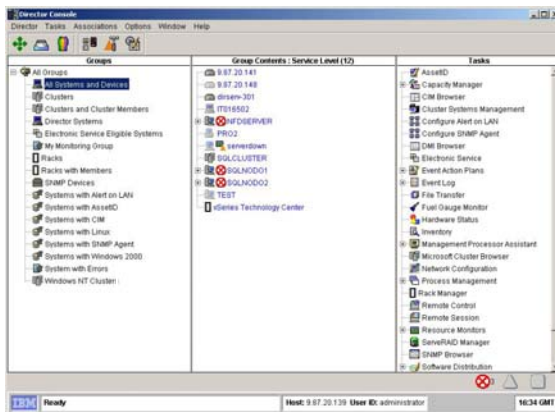


# BladeCenter management

## 1. Web Interface



## 2. IBM Director console

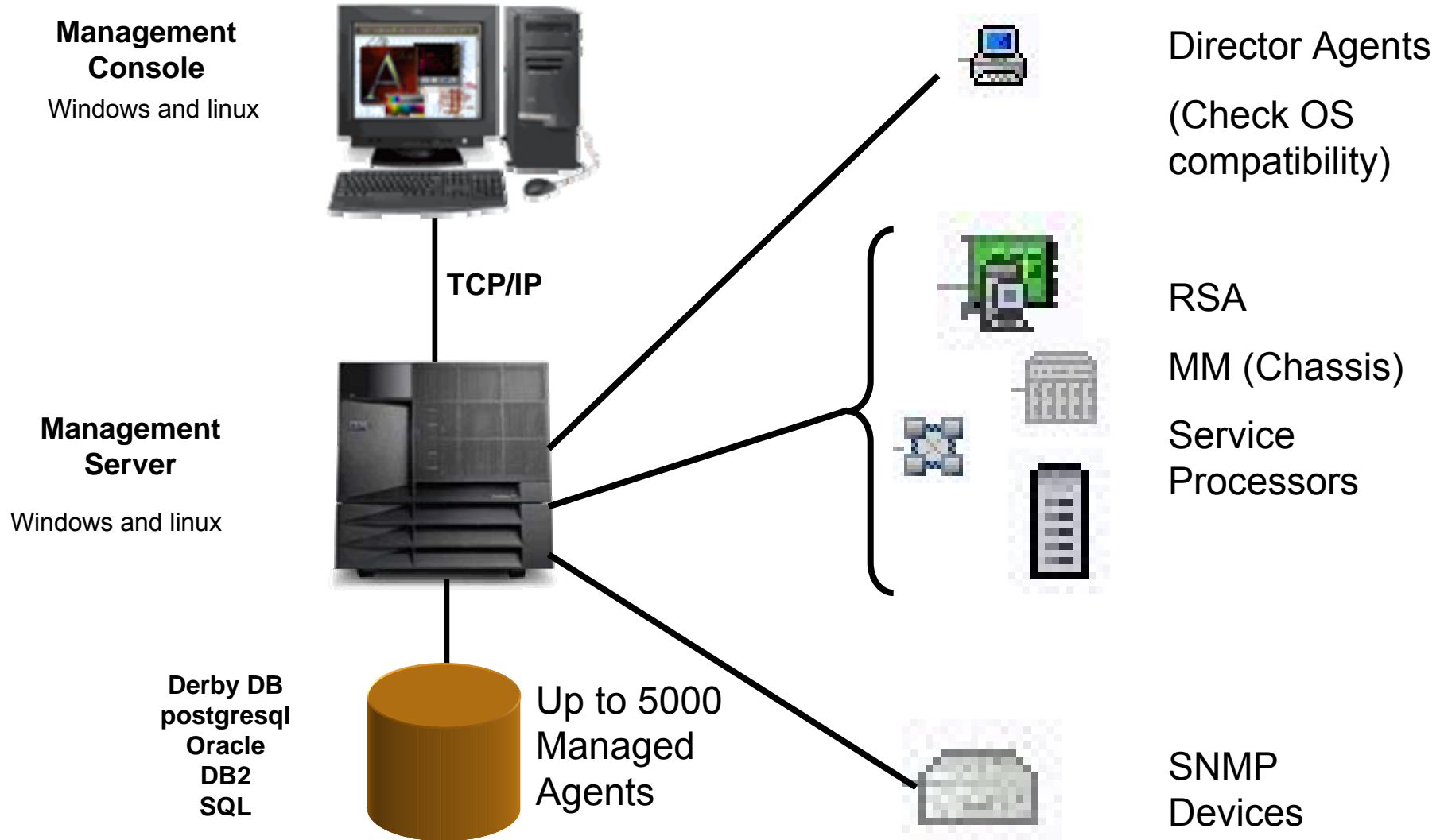




## What is IBM Director?

- **IBM Director helps customers do the following:**
  - ▶ Find all of their systems on their network
  - ▶ Determine if their systems are working properly
  - ▶ Configure and deploy new systems
  - ▶ Optimize systems
  - ▶ Keep system firmware and drivers up to date
- **Manages cross all STG platforms**
  - ▶ System x, System p, System i, and System z, selected storage
- **Manages both blades and non-blades – a single console!**
- **Easy to use, graphical interaction with both blades and non-blades**

# IBM Director architecture





Systems and Technology Group

# How IBM Director works



**ON** DEMAND BUSINESS™

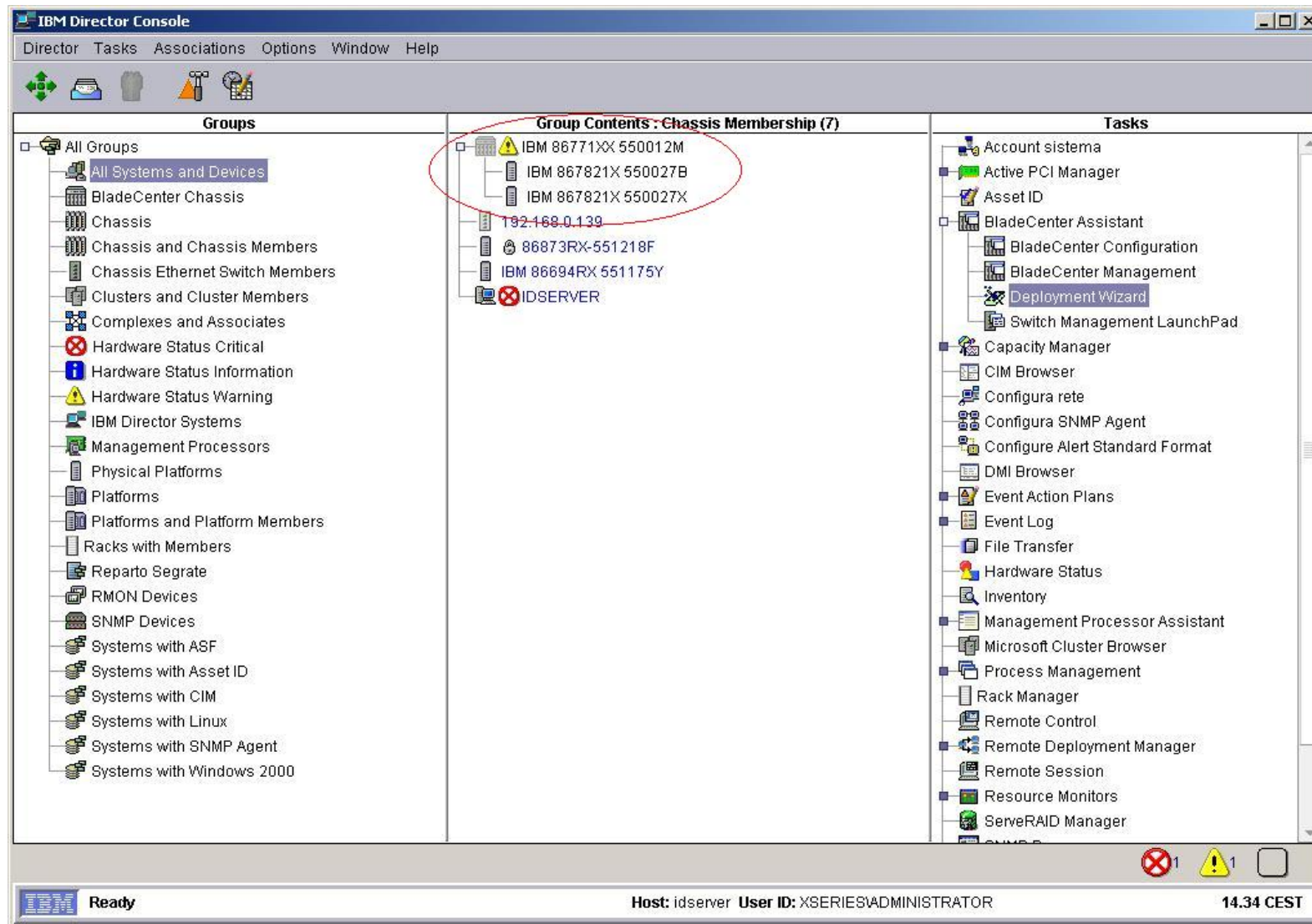
© 2006 IBM Corporation

# IBM Director Console - BladeCenter Management

The screenshot displays the IBM Director Console interface with the following components:

- Groups Panel (Left):** A tree view showing various system categories such as "All Groups", "BladeCenter Chassis", "Chassis", and "Systems with Windows 2000".
- Group Contents Panel (Middle):** Titled "Group Contents: Chassis Membership (7)", it lists several server models including "IBM 86771XX 550012M", "IBM 867821X 550027B", and "IDSERVER". A red circle highlights the top three entries.
- Tasks Panel (Right):** A list of management tasks including "Account sistema", "Active PCI Manager", "BladeCenter Assistant", "BladeCenter Configuration", "BladeCenter Management", "Deployment Wizard", "Capacity Manager", "CIM Browser", "Event Action Plans", "Event Log", "File Transfer", "Hardware Status", "Inventory", "Management Processor Assistant", "Microsoft Cluster Browser", "Process Management", "Rack Manager", "Remote Control", "Remote Deployment Manager", "Remote Session", "Resource Monitors", and "ServerRAID Manager".
- Cartoon Figures:** Three cartoon men in suits holding megaphones are positioned around the interface, one pointing towards the Group Contents panel and two towards the Tasks panel.
- Status Bar (Bottom):** Shows "IBM Ready", "Host: idserver User ID: XSERIESADMINISTRATOR", and "14.34 CEST".

# IBM Director Console - BladeCenter Management





Systems and Technology Group

# How RDM\* works

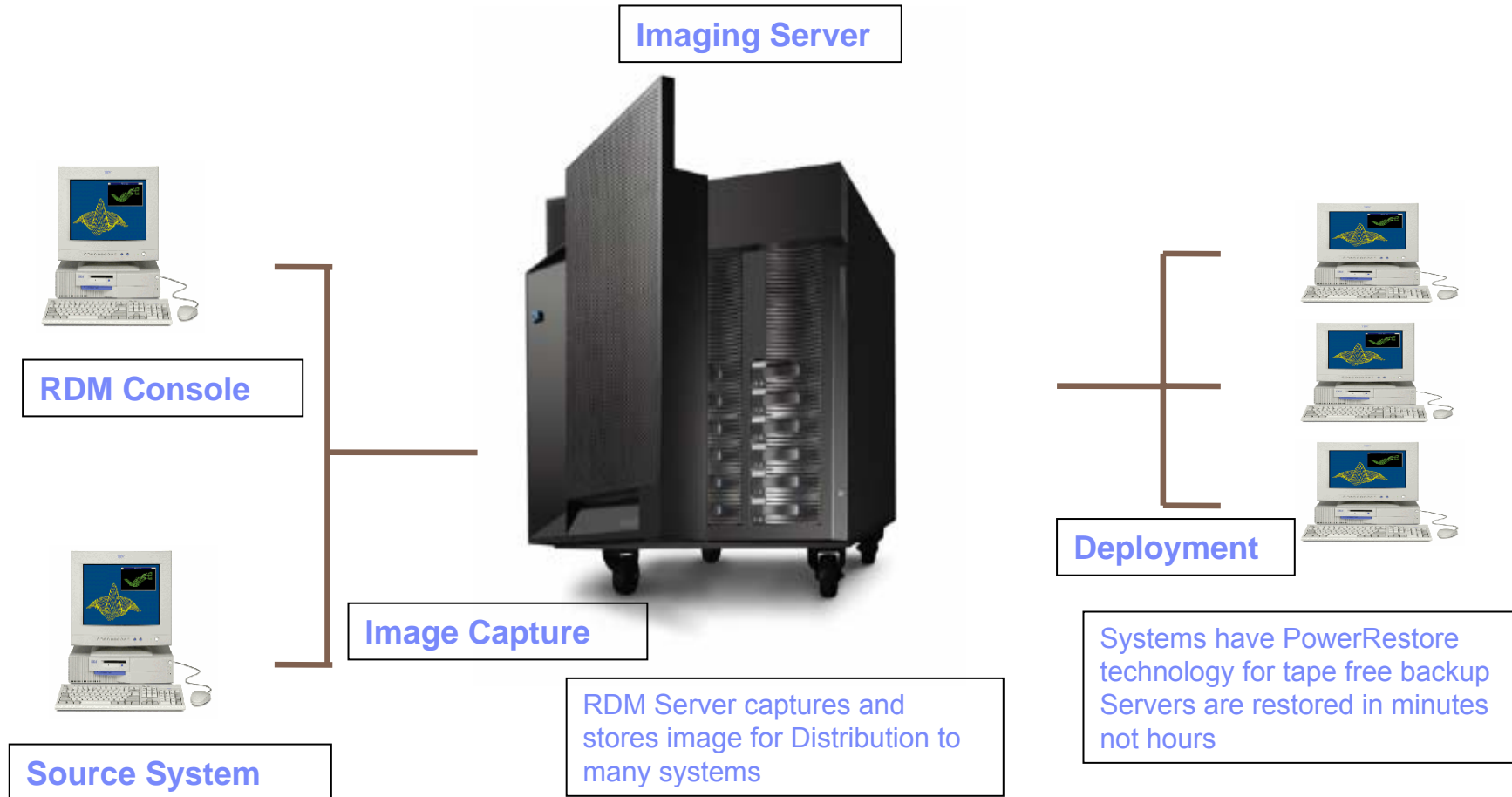


\* Remote Deployment Manager

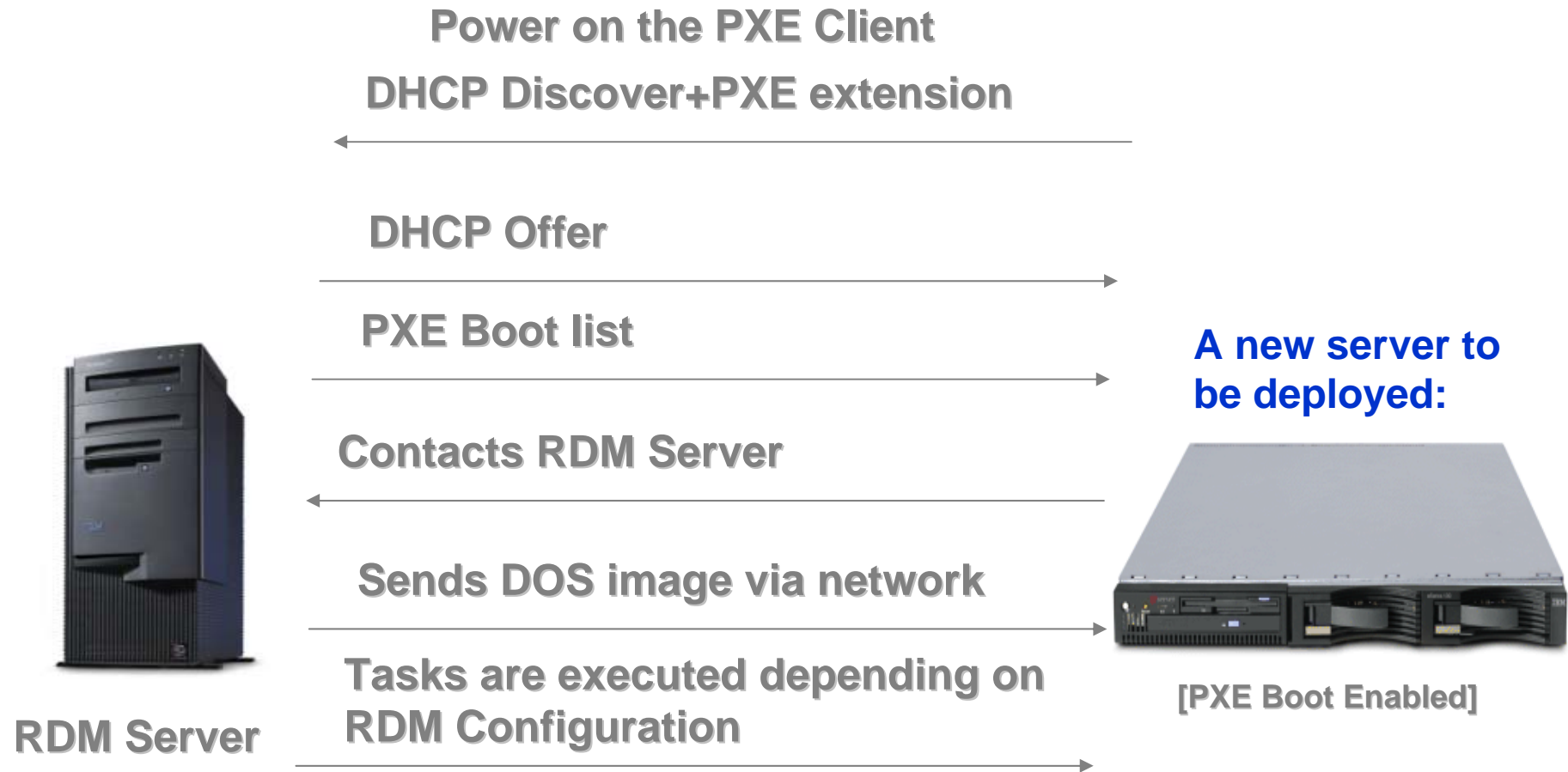
**ON** DEMAND BUSINESS™

© 2006 IBM Corporation

# Remote Deployment Manager - Clone Installation Techniques



# How RDM works







Systems and Technology Group

# IBM's Opteron portfolio ..just announced..

**ON** DEMAND BUSINESS™

© 2006 IBM Corporation

# Innovation for Business Performance Computing

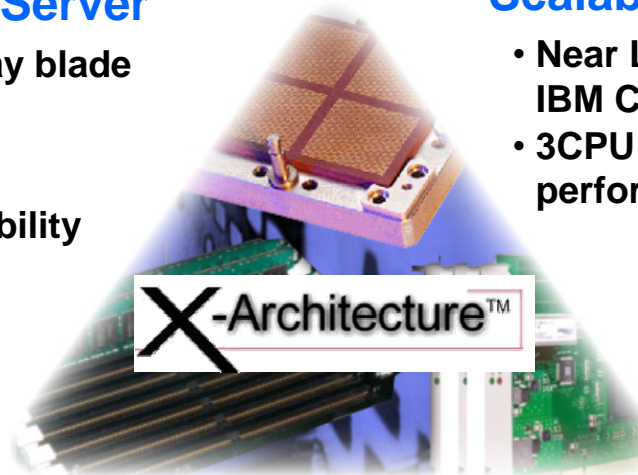
Unique IBM innovation with the **AMD architecture** delivers performance advantage

## “Snap-in” Scalable Blade Server

- “Expand on Demand” 2 to 4 way blade
  - Pay as you grow scalability
  - Lower deployment cost
- HT innovation for unique scalability

## Scalable Rack Server Leadership

- Near Linear Performance with unique IBM CPU Pass Thru Card
- 3CPU configuration delivers better performance for 25% less cost



## Cool Blue

- IBM strategy to manage power and cooling
- Innovation at system, rack, and datacenter level (e.g., PowerExecutive)

## Memory Innovation

- Xcelerated Memory Technology™
- The largest and fastest memory subsystem
- Up to 15% performance advantage for large memory applications

## I/O Leadership

- IBM eXtended I/O™ allows high performance, flexible choice of HTX, PCI Express, and PCI-X
- Slotless RSA II and RAID
- Investment protection

# IBM's Opteron Portfolio

IBM delivers a complete portfolio of Opteron – based systems offerings

1<sup>st</sup> Tier One Next Generation AMD CPU Servers

## Business Performance Computing

## Technical & Finance

### HPC

**System x & BladeCenter**

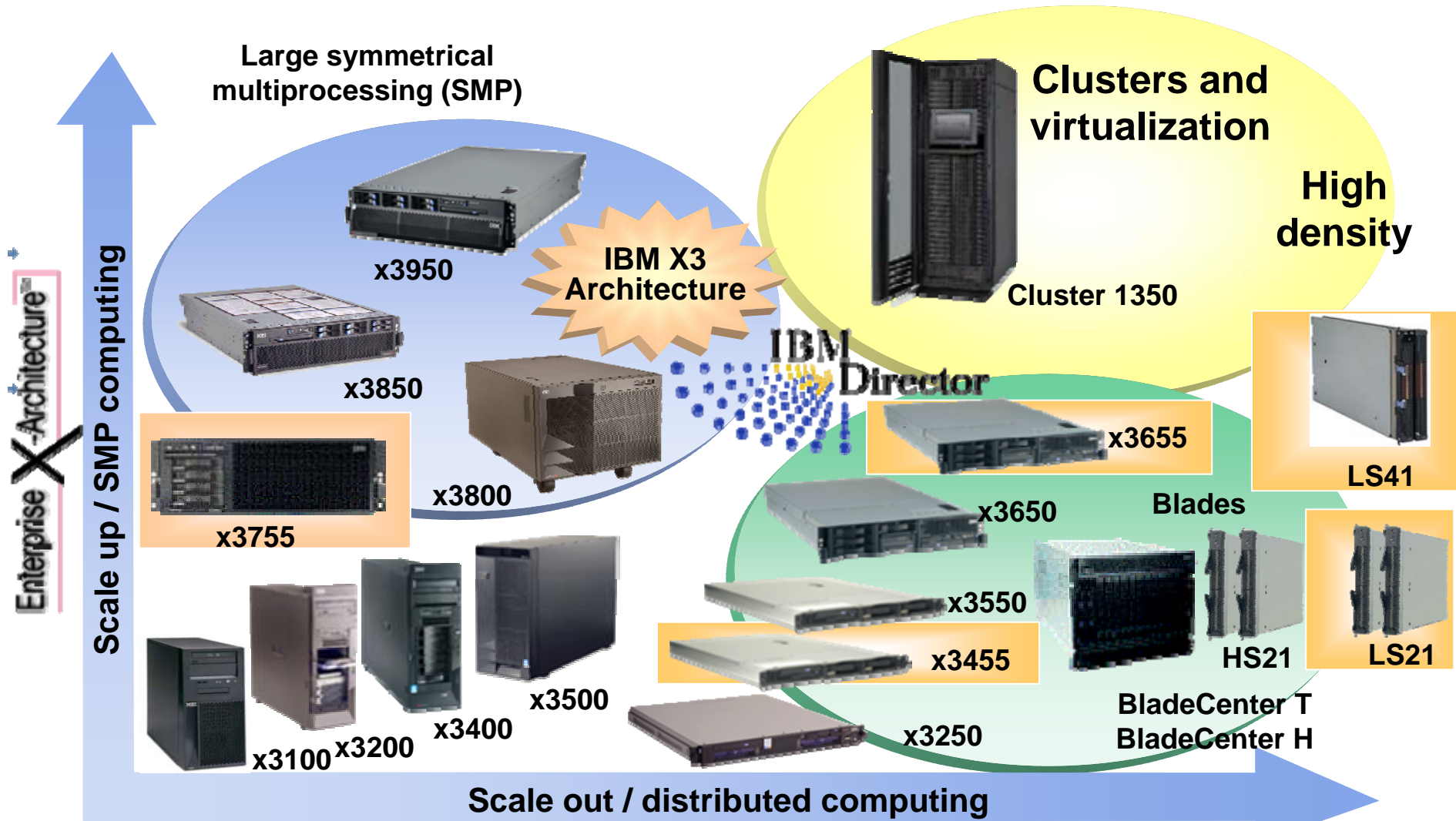
- x3655  
2 Socket 2U
- LS41  
4 Socket Blade
- x3755  
4 Socket 4U
- LS21  
2 Socket Blade
- x3455  
2 Socket 1U

**2003**      **2004**      **2005**      **2006**

eServer 325      eServer 326      eServer 326m

Intellistation APro      LS20 Blade

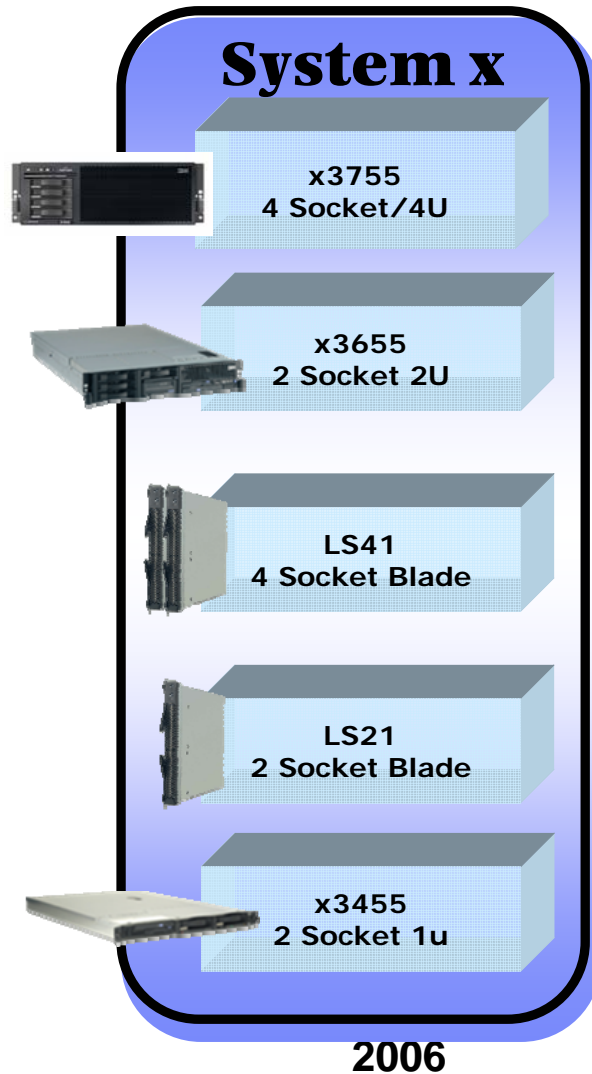
# System x Portfolio is the Most Comprehensive in the x86 Industry



Source: IDC

# IBM's Opteron portfolio

*IBM will have a complete portfolio of Opteron – based server offerings*



- For mid-market, large-enterprise clients, ideal for scientific computing, such as weather simulations and crash test analysis; four-socket rack system gives clients outstanding price performance

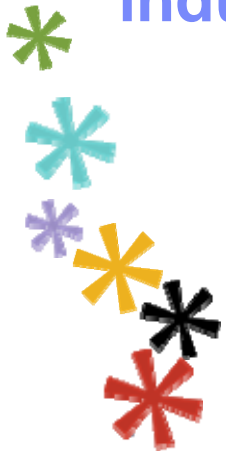
- Business performance server, ideal for database/ERP, business intelligence, IPTV and Video on Demand applications; two-socket, 2U rack server delivers versatile performance

- Enterprise-class scalable 2- to 4-way blade; ideal for ERP, data marts, data warehouses, SQL databases and HPC clusters.

- Enterprise-class 2-way blade optimized for performance computing; ideal for financial services, scientific, high-performance computing, SQL databases.

- High-performance compute node, ideal for scientific and technical computing, database and Linux clusters; two-socket 1U cluster node for high-performance environments.

# Confidently gain competitive advantage with industry-leading performance, reliability and control



*x3755 – Low cost, large memory HPC node*



*LS41 - Scalable enterprise blade server*



*x3455 - High Performance Compute Node*



*x3655 - Business Performance Server*



*LS21- High performance blade server*



# IBM System x3455

## High Performance Compute Node

- ***Fastest, leanest compute node on the planet***
  - ▶ ***Exceptional performance for highly computational, memory intensive apps; optimized to improve interconnect latency***
- ***Ideally suited for HPC clusters, Linux or MSFT***
  - ▶ ***Preconfigured and pre-tested Linux clusters with e1350***
  - ▶ ***Small business Microsoft clusters and DB***

Target apps:

- Scientific and Technical Computing
- Digital Rendering
- Electronic Design



# IBM System x3655

## Business Performance Server

- ***The perfect mix of IBM mainframe-inspired reliability and application performance***
  - ▶ ***IBM eXtended I/O™ allows breadth and flexibility with I/O and systems management***
  - ▶ ***PowerExecutive™ and Predictive Failure Analysis™ ensure confidence in your critical business data***

Target apps:

- Web Serving
- Business Intelligence
- IPTV, VoD
- Security





## AMD Opteron LS21 for IBM BladeCenter *High Performance 2-Socket Blade*

- ***Leverages Innovative BladeCenter Design and Ecosystem***
  - ▶ ***Open and flexible***
  - ▶ ***Centralized management, more efficient power and cooling***
  - ▶ ***Largest selection of blade options available in the industry***
- ***Ideal for Financial Services and high performance clusters***
  - ▶ ***Exceptional performance for highly computational, memory intensive applications***

Target apps:

- Scientific and Technical Computing
- Financial Services
- Security



# AMD Opteron LS41 for IBM BladeCenter

## *Scalable, Enterprise Performance Blade*

- ***The Industry's first "snap-in" scalable blade***
  - ▶ *Scales from 2-socket to 4-socket configuration in mere seconds*
- ***Leverages Innovative BladeCenter Design and Ecosystem***
  - ▶ *Open and flexible*
  - ▶ *Centralized management, more efficient power and cooling*
  - ▶ *Largest selection of blade options available in the industry*
- ***Optimized for scalable enterprise workloads and large databases***
  - ▶ *Outstanding multi-processor performance in a compact blade form factor*
  - ▶ *Scalable design with 2/4 socket configuration allows pay-as-you grow flexibility*

Target apps:

- Scalable Enterprise Workloads
- Data Marts/Data Warehouses
- Scientific and Technical Computing



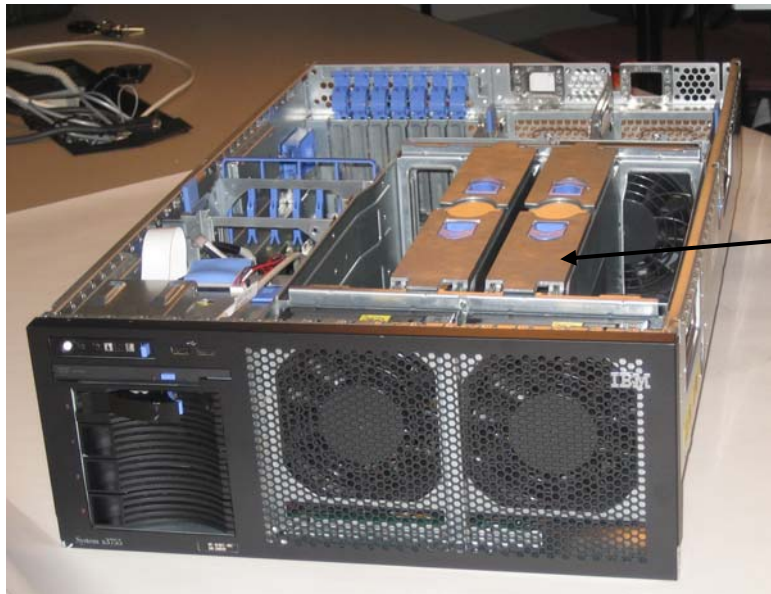
## IBM System x3755

### *Ultimate HPC 4-socket Performance*

- ***Superior performance for high performance computing applications***
  - ▶ ***Leadership Performance / Watt***
  - ▶ ***Leadership Price / Performance***
  - ▶ ***Flexible CPU configurations – supporting a 3 CPU config***
- ***Memory scalability and performance***
  - ▶ ***Largest, fastest memory capacity***
- ***Leadership I/O performance through unique HTx design***

Target apps: Scientific & Technical Computing, Financial Analysis





# x3755 unique features

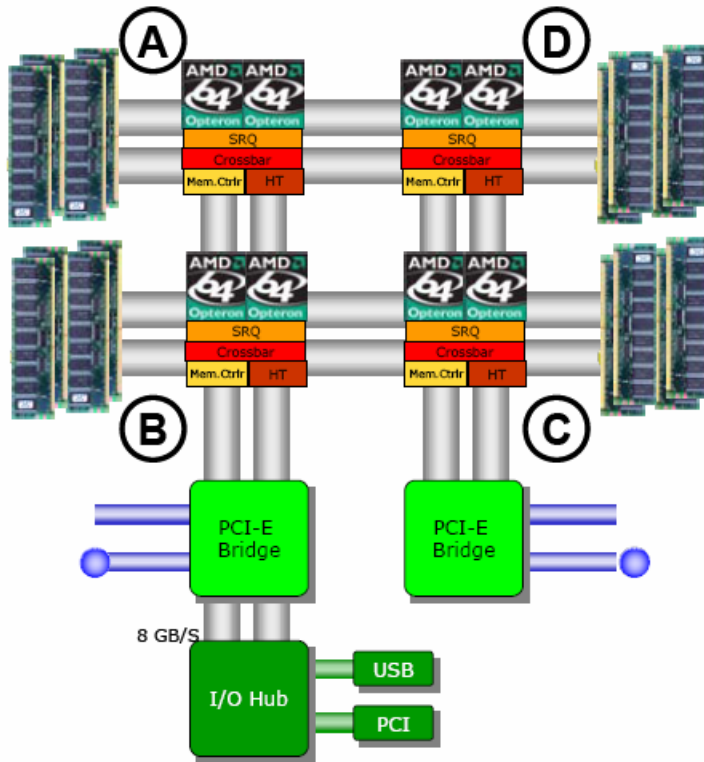
**Just Announced:**  
 15 Aug 2006  
 G.A. 15 Sep 2006



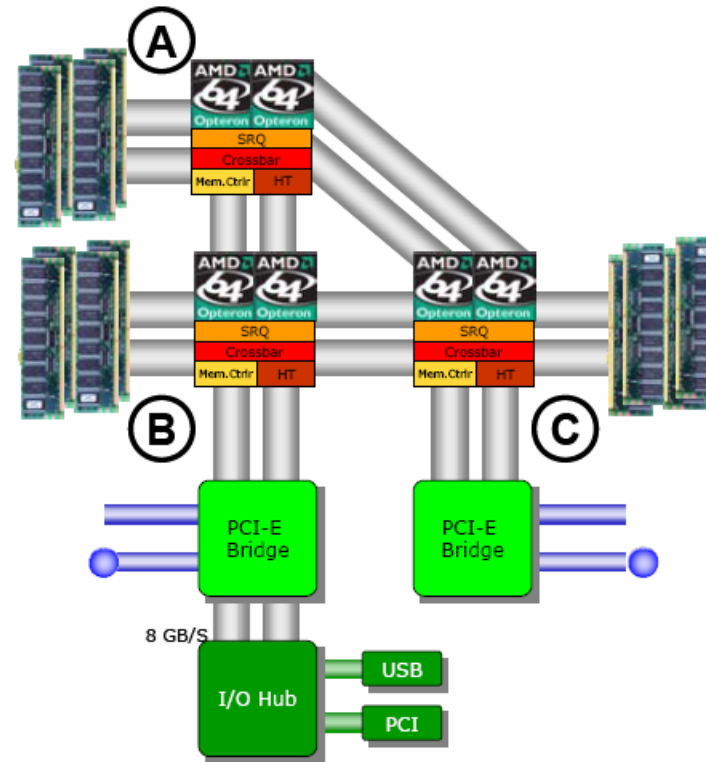
**Processor Card**  
 (Up to 4 CPU Opteron Dual Core 8220 - 2.8GHz)

| Feature                        | Function  | Benefit   |
|--------------------------------|---|---|
| <b>Flexible Configurations</b> | <b>Supports 3 CPU configuration with no performance degradation</b> | <b>Allows customers to upgrade at a pace they are comfortable with. Competition can not support a 3 CPU configuration with similar performance advantage.</b> |
| <b>Memory Performance</b>      | <b>Support all 8 DIMMS running at 667MHz</b>                        | <b>Provides high speed memory access for improved application performance. Competition has limitation of running 4 DIMMS at 667Mhz or 8 DIMMs at 533Mhz.</b>  |
| <b>Memory Availability</b>     | <b>Supports 128GB of internal memory</b>                            | <b>For memory intensive applications we can support 2X the amount of memory compared to Sun</b>   |
| <b>High Performance I/O</b>    | <b>Features support for HTx I/O adapters</b>                        | <b>Provides the fastest I/O capability for interconnects and math accelerators. Sun is not expected to have this feature</b>                                  |

# x3755 CPU flexibility



Ordinary 4P Opteron System



IBM's x3755 with Memory Pass Through

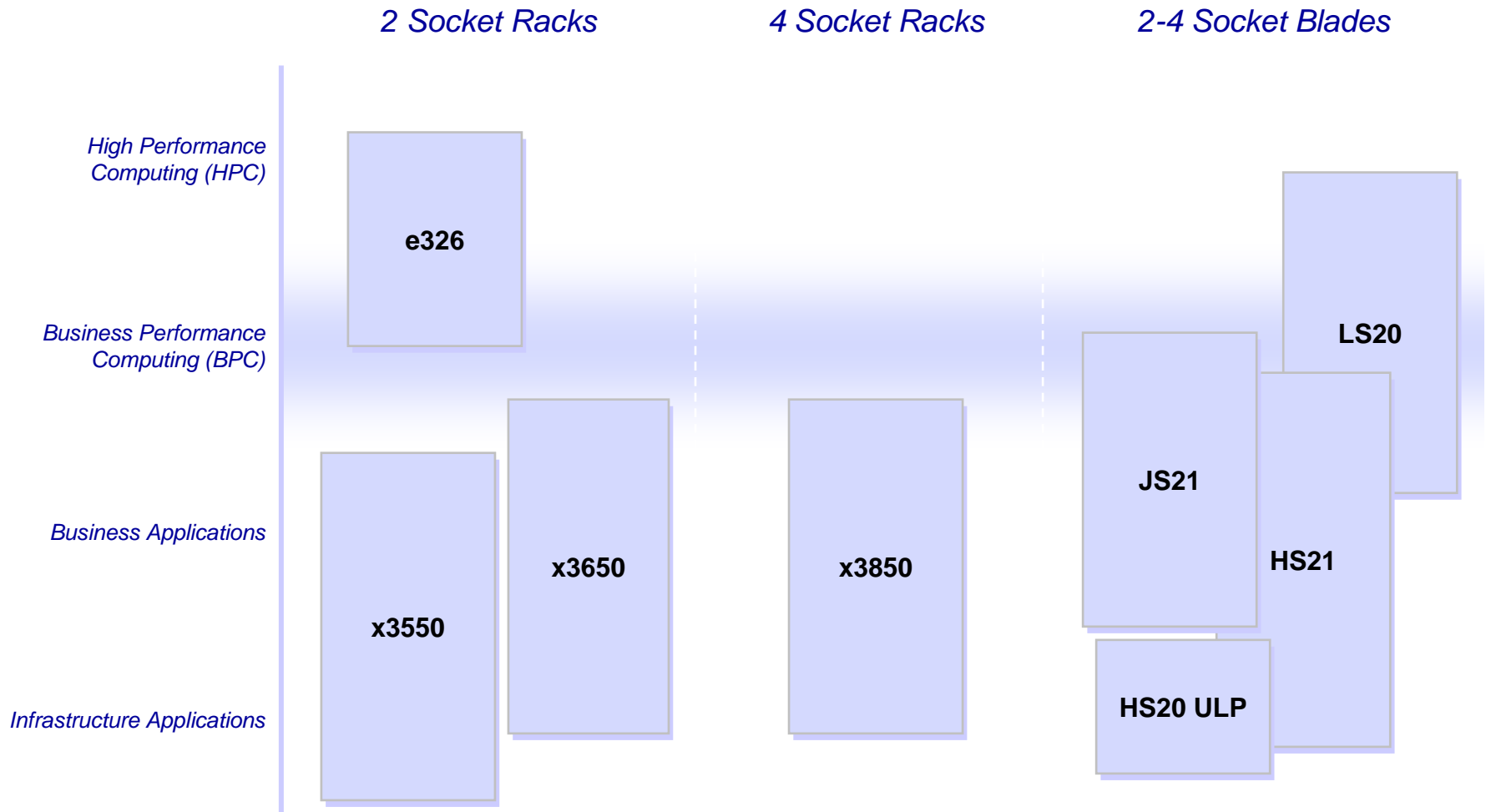
## HTx Adapters

- **Pathscale**
  - ▶ Interconnect
  
- **Clearspeed**
  - ▶ Math accelerator



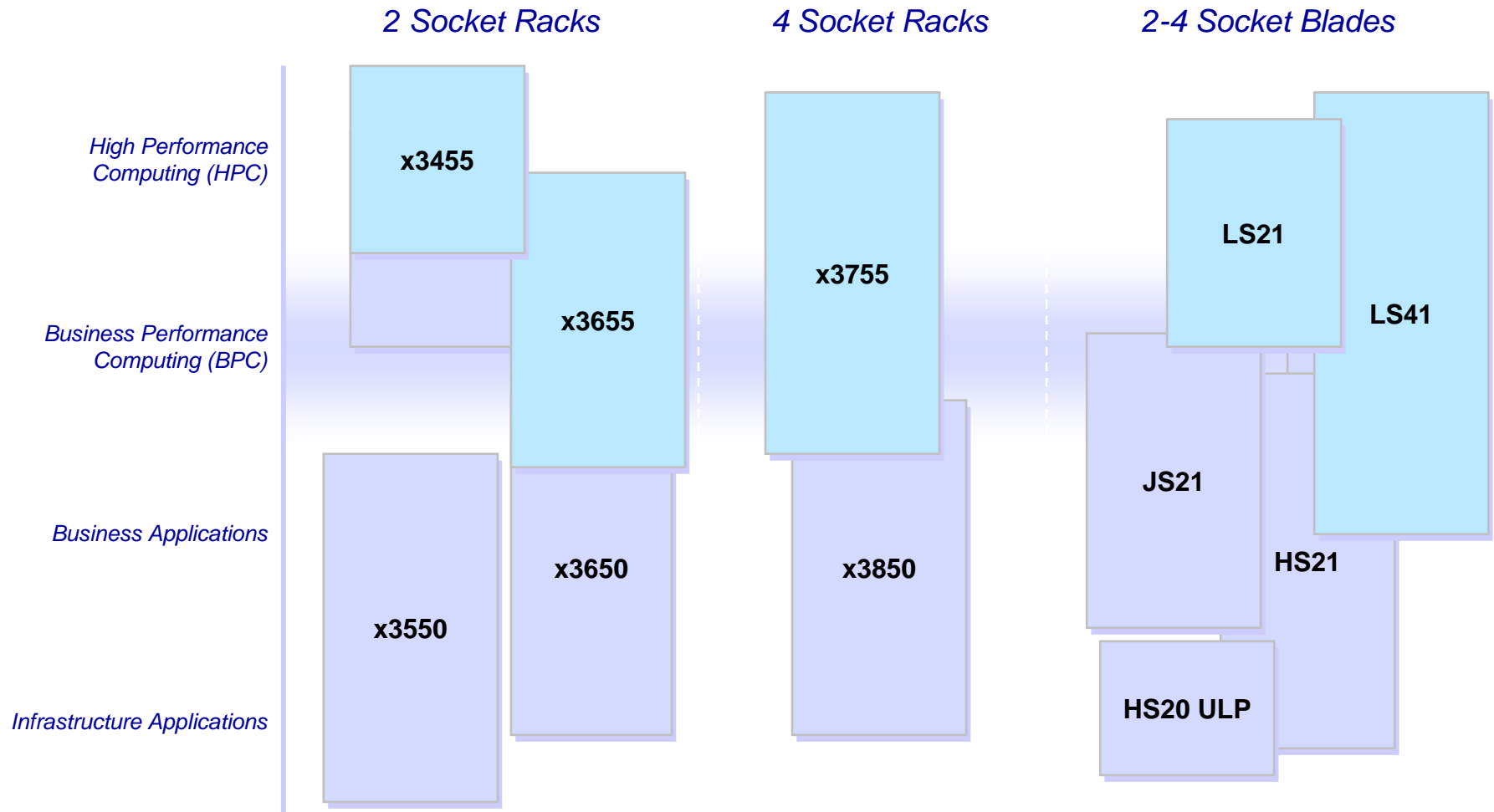
# Creation of a Complete Portfolio

**A System x and BladeCenter product line from HPC to Infrastructure**



# Creation of a Complete Portfolio

**A System x and BladeCenter product line from HPC to Infrastructure**



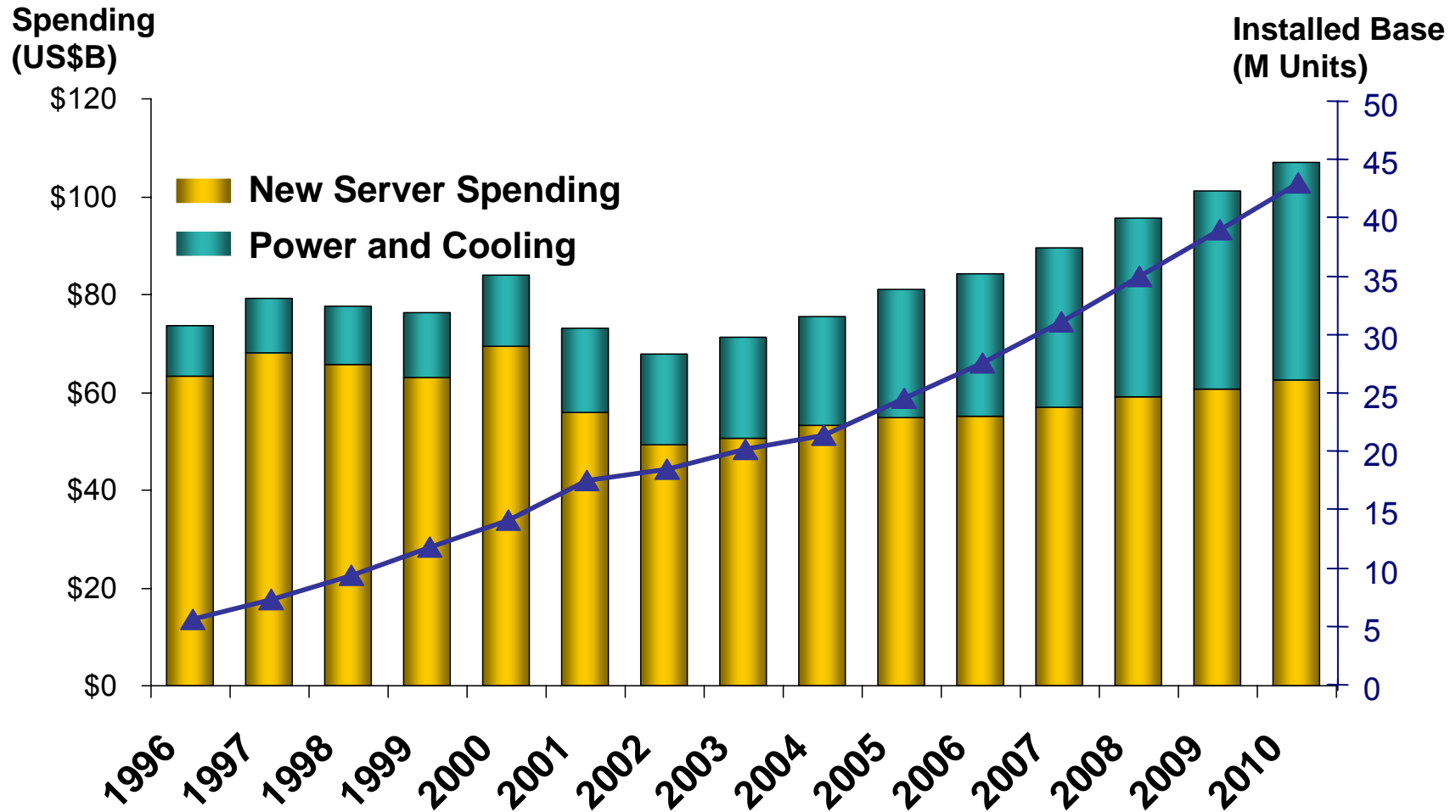


## Energy innovation – CoolBlue

- IBM systems architecture, chip design and software
- PowerExecutive™
- Rear Door Heat Exchanger
- Calibrated Vector Cooling
- 90% efficient power supplies
- Power Configurator
- Thermal Analyzer



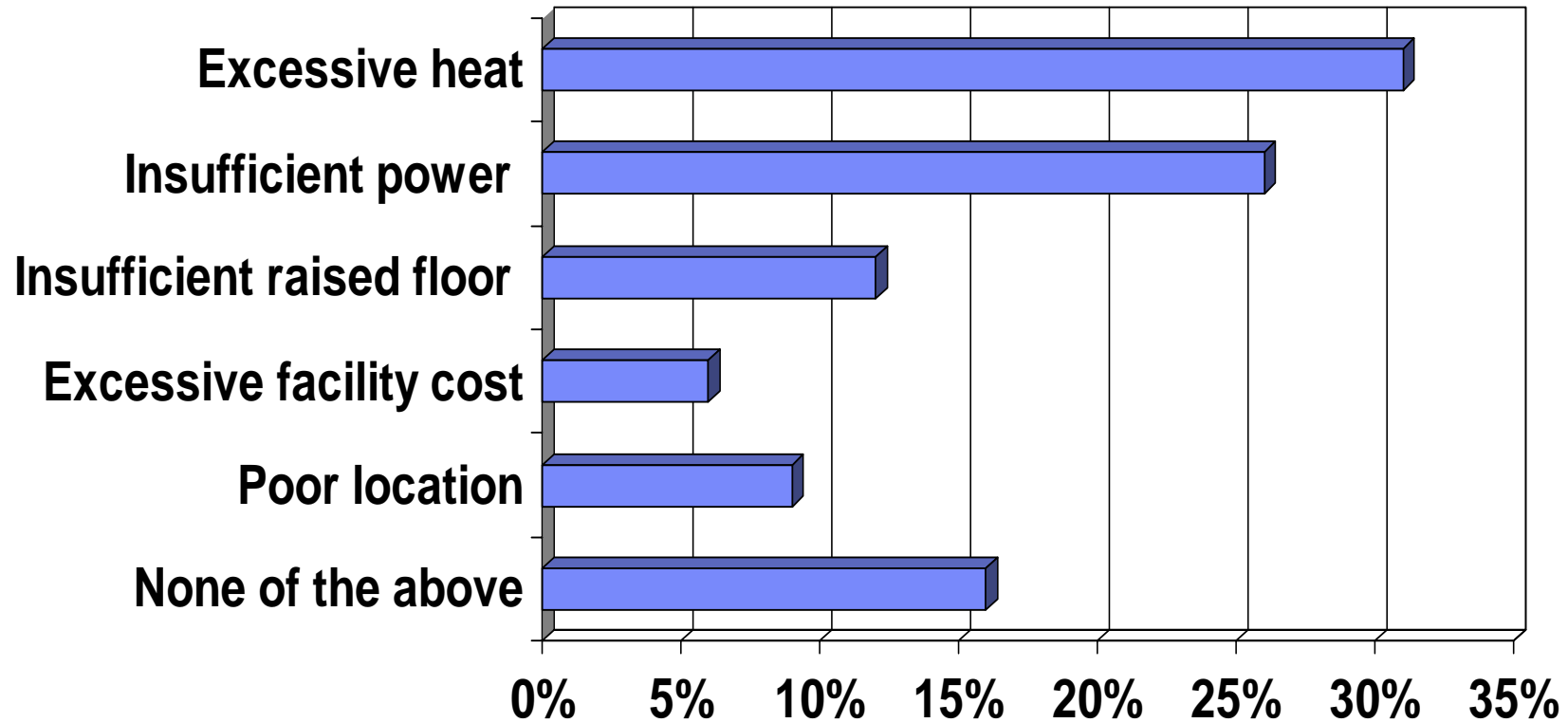
# Worldwide Server Market (IDC)



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

# What is the greatest facility problem with your primary data center?

Gartner 2006

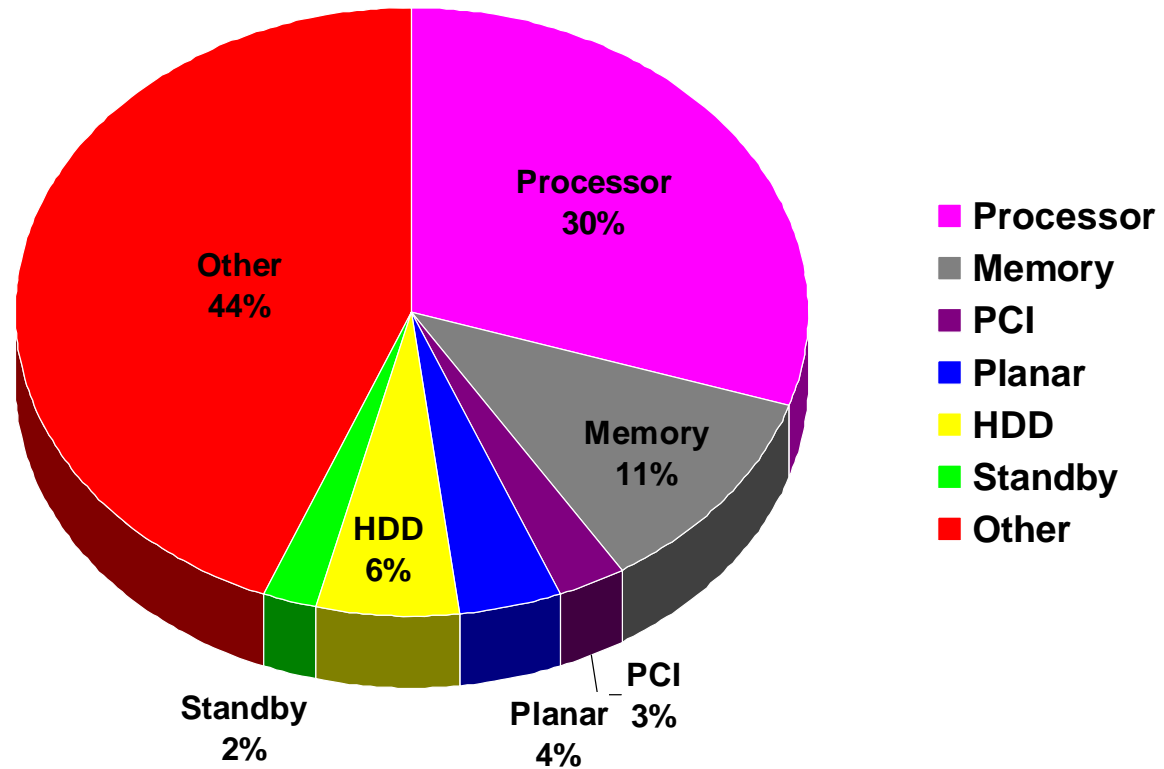


# What's using the power?

- The processor power growth is the largest single contributor but there are many other areas- the more you pack into a server the more power it needs!

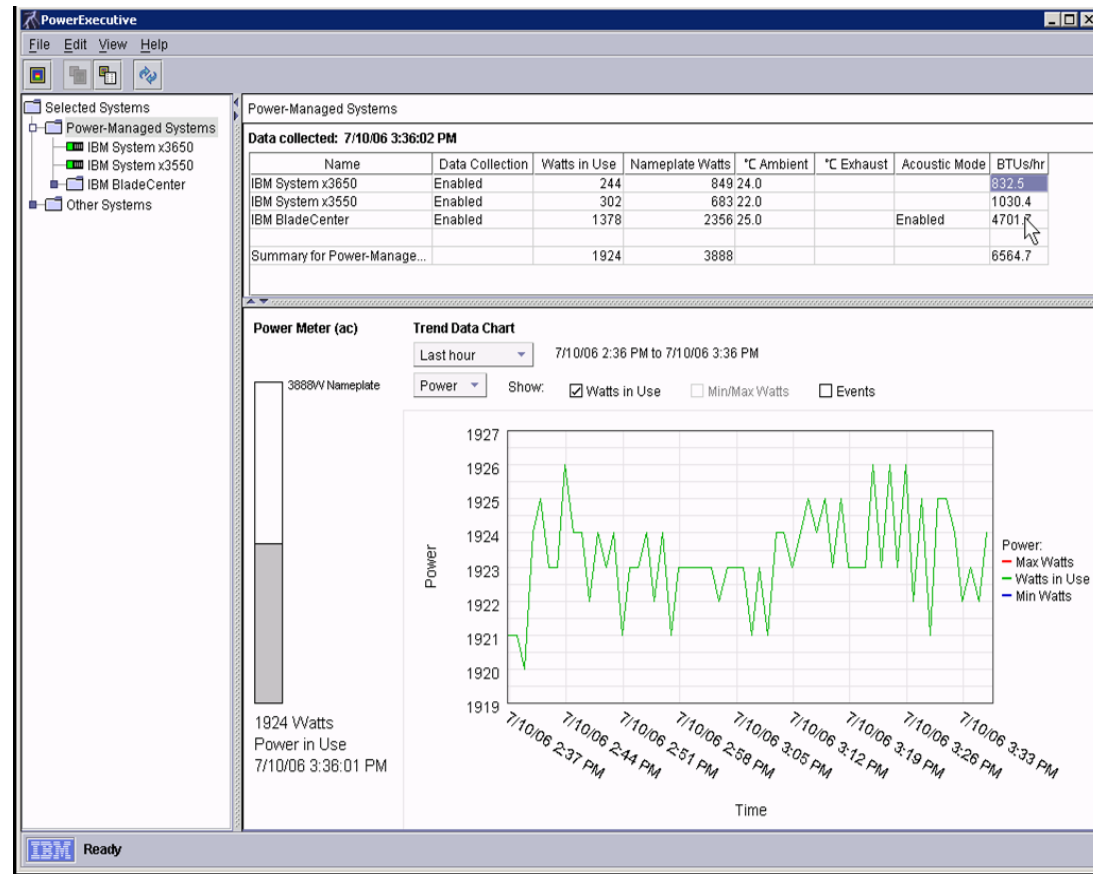
## OTHER?

- AC to DC Transitions
- DC to DC Deliveries
- Fans and air movement



# PowerExecutive™ : Proactive Management and Control

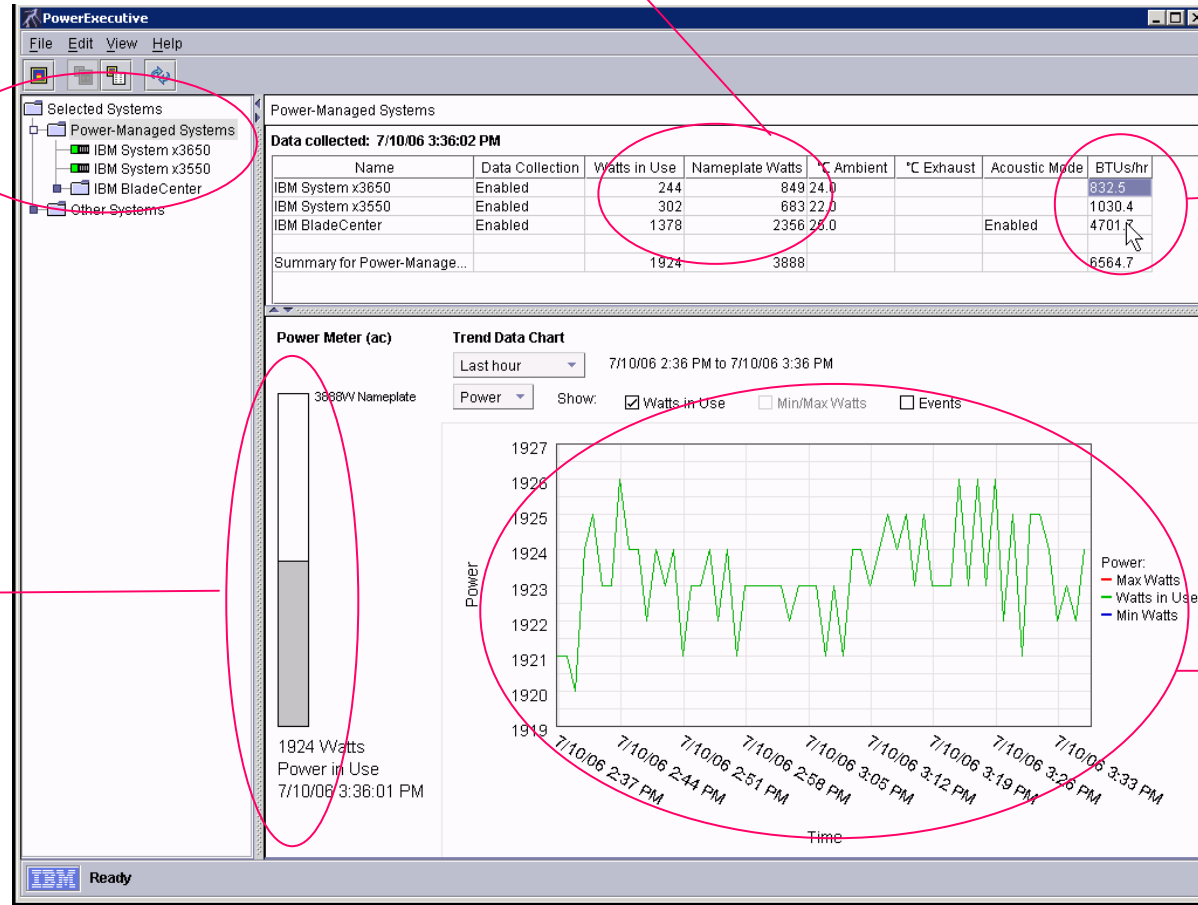
- **Optimize and manage datacenter power and cooling!**
  - ▶ Intelligence and control to manage datacenter server power utilization
  - ▶ Combination of: Hardware, system logic, and group management tools
- **Take the guess work out of datacenter power management**
  - ▶ Actual power draw! Not conservative “label/spec power” estimates
- **More accurate data center planning helps maximize datacenter performance**
  - ▶ Power control capability enable datacenter robustness within fixed power envelope (2H 2006)



# PowerExecutive™ in action!

Compare actual vs. nameplate power at system level

Manage power at the rack level



Track heat emitted

Compare rack actual power vs. label power

Trend power use over time

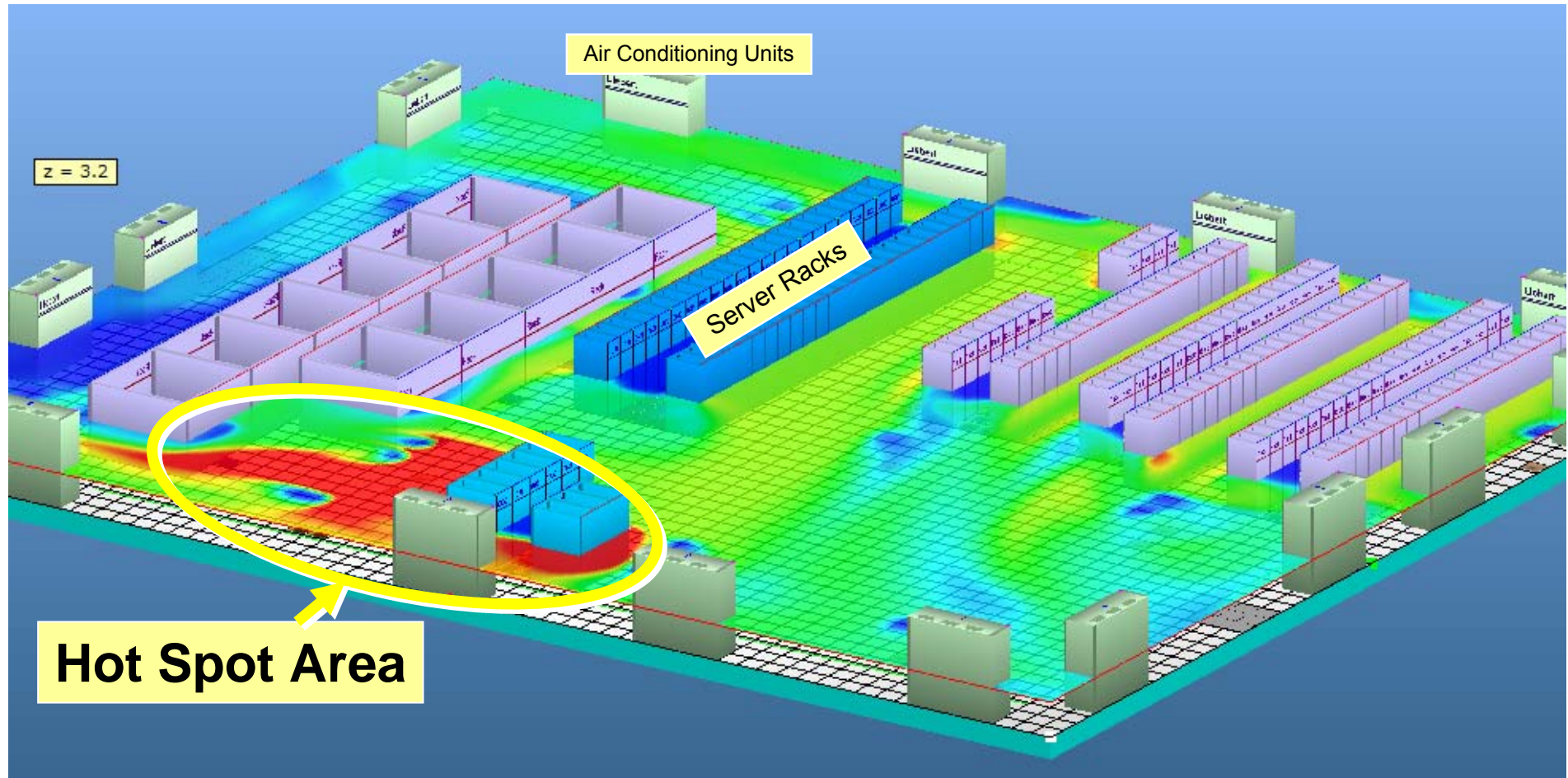
# Power Executive: supported systems landscape

| IBM PowerExecutive™ |  |  |  |  |
|---------------------|--|--|--|--|
|                     | Metering   | Power Trend Analysis                                     | Power Capping  | CPU Power Management                                     |
| IBM Blades          | HS20 8843, LS20, JS21 8844, HS20 7981                    | HS20 8843, LS20, JS21 8844, HS20 7981                    | HS20 8843, LS20, JS21 8844, HS20 7981                    | HS20 8843, LS20, JS21 8844, HS20 7981                    |
|                     | Available Now  | Available Now  | Expected Availability 4Q06**                             | Expected Availability 1Q07**                             |
| IBM Servers         | Rack Mounted servers x3450 and x3650. Then x3655, x3755. | Rack Mounted servers x3450 and x3650. Then x3655, x3755. | Rack Mounted servers x3450 and x3650. Then x3655, x3755. | Rack Mounted servers x3450 and x3650. Then x3655, x3755. |
|                     | Available Now  | Available Now  | Expected Availability 4Q06**                             | Expected Availability 1Q07**                             |
| HP Power Regulator  |  |  |  |  |
| HP Blades           | None   | None   | None   | None   |
| HP Servers          | None   | None   | None   | None   |
| Dell                |  |  |  |  |
| Dell Blades         | None   | None   | None   | None   |
| Dell Servers        | None   | None   | None   | None   |

\*\*All statements regarding IBM's future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

# IBM Technology

## *Eliminating Hot Spots in Datacenter*

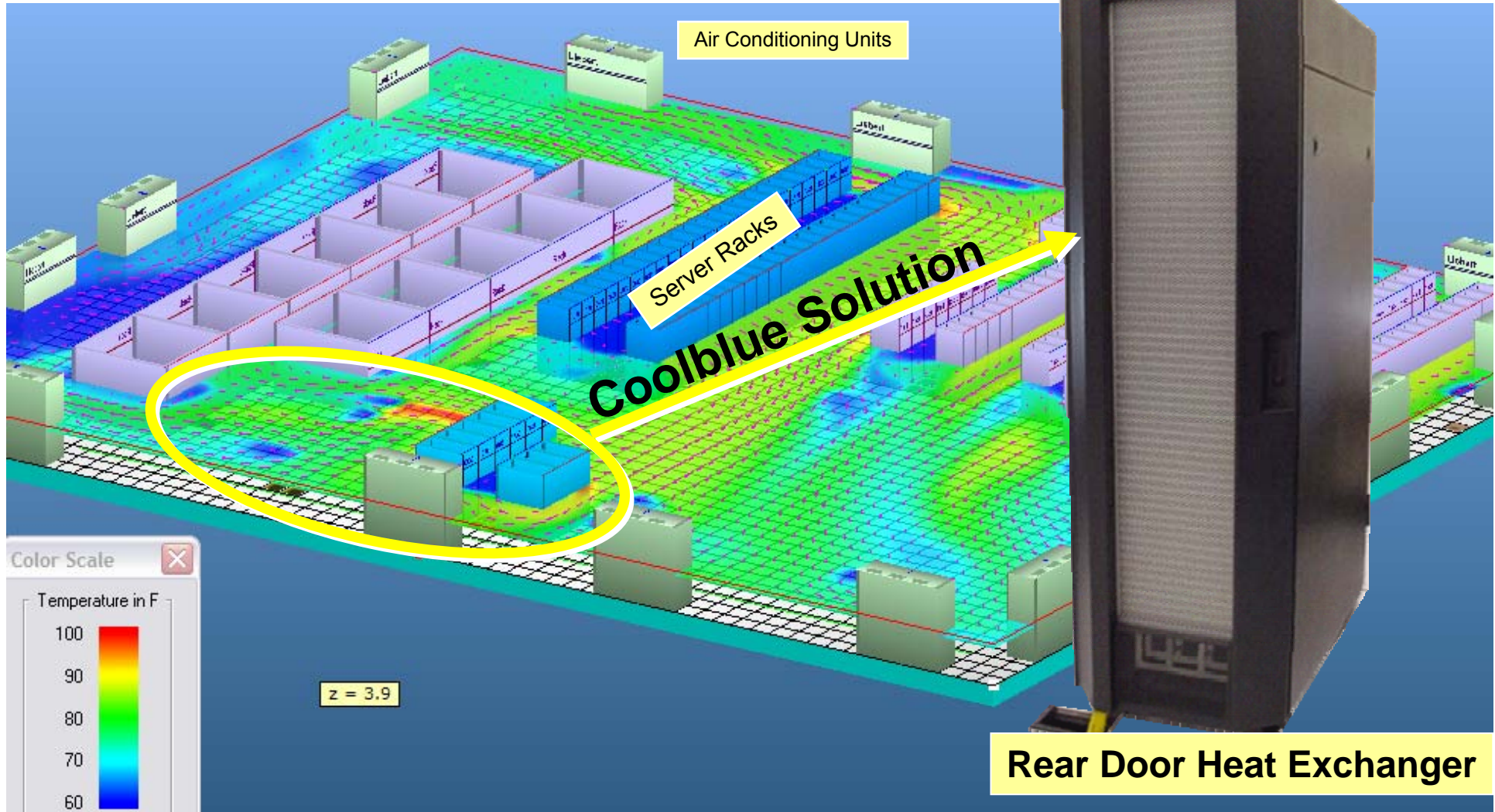


CoolBlue



# IBM Technology

## Eliminating Hot Spots in Datacenter



## Energy innovation – CoolBlue

- IBM systems architecture, chip design and software
- PowerExecutive™
- Rear Door Heat Exchanger
- Calibrated Vector Cooling
- 90% efficient power supplies
- Power Configurator
- Thermal Analyzer



## Special notices

This document was developed for IBM offerings in the United States as of the date of publication. IBM may not make these offerings available in other countries, and the information is subject to change without notice. Consult your local IBM business contact for information on the IBM offerings available in your area.

Information in this document concerning non-IBM products was obtained from the suppliers of these products or other public sources. Questions on the capabilities of non-IBM products should be addressed to the suppliers of those products.

IBM may have patents or pending patent applications covering subject matter in this document. The furnishing of this document does not give you any license to these patents. Send license inquires, in writing, to IBM Director of Licensing, IBM Corporation, New Castle Drive, Armonk, NY 10504-1785 USA.

All statements regarding IBM future direction and intent are subject to change or withdrawal without notice, and represent goals and objectives only.

The information contained in this document has not been submitted to any formal IBM test and is provided "AS IS" with no warranties or guarantees either expressed or implied.

All examples cited or described in this document are presented as illustrations of the manner in which some IBM products can be used and the results that may be achieved. Actual environmental costs and performance characteristics will vary depending on individual client configurations and conditions.

IBM Global Financing offerings are provided through IBM Credit Corporation in the United States and other IBM subsidiaries and divisions worldwide to qualified commercial and government clients. Rates are based on a client's credit rating, financing terms, offering type, equipment type and options, and may vary by country. Other restrictions may apply. Rates and offerings are subject to change, extension or withdrawal without notice.

IBM is not responsible for printing errors in this document that result in pricing or information inaccuracies.

All prices shown are IBM's United States suggested list prices and are subject to change without notice; reseller prices may vary.

IBM hardware products are manufactured from new parts, or new and serviceable used parts. Regardless, our warranty terms apply.

Many of the features described in this document are operating system dependent and may not be available on Linux. For more information, please check: [http://www.ibm.com/systems/p/software/whitepapers/linux\\_overview.html](http://www.ibm.com/systems/p/software/whitepapers/linux_overview.html)

Any performance data contained in this document was determined in a controlled environment. Actual results may vary significantly and are dependent on many factors including system hardware configuration and software design and configuration. Some measurements quoted in this document may have been made on development-level systems. There is no guarantee these measurements will be the same on generally-available systems. Some measurements quoted in this document may have been estimated through extrapolation. Users of this document should verify the applicable data for their specific environment.

Revised January 19, 2006

## Special notices (cont.)

The following terms are registered trademarks of International Business Machines Corporation in the United States and/or other countries: AIX, AIX/L, AIX/L(logo), alphaWorks, AS/400, BladeCenter, Blue Gene, Blue Lightning, C Set++, CICS, CICS/6000, ClusterProven, CT/2, DataHub, DataJoiner, DB2, DEEP BLUE, developerWorks, DirectTalk, Domino, DYNIX, DYNIX/ptx, e business(logo), e(logo)business, e(logo)server, Enterprise Storage Server, ESCON, FlashCopy, GDDM, i5/OS, IBM, IBM(logo), ibm.com, IBM Business Partner (logo), Informix, IntelliStation, IQ-Link, LANStreamer, LoadLeveler, Lotus, Lotus Notes, Lotusphere, Magstar, MediaStreamer, Micro Channel, MQSeries, Net.Data, Netfinity, NetView, Network Station, Notes, NUMA-Q, Operating System/2, Operating System/400, OS/2, OS/390, OS/400, Parallel Sysplex, PartnerLink, PartnerWorld, Passport Advantage, POWERparallel, Power PC 603, Power PC 604, PowerPC, PowerPC(logo), PowerPC 601, Predictive Failure Analysis, pSeries, PTX, ptx/ADMIN, RETAIN, RISC System/6000, RS/6000, RT Personal Computer, S/390, Scalable POWERparallel Systems, SecureWay, Sequent, ServerProven, SpaceBall, System/390, The Engines of e-business, THINK, Tivoli, Tivoli(logo), Tivoli Management Environment, Tivoli Ready(logo), TME, TotalStorage, TURBOWAYS, VisualAge, WebSphere, xSeries, z/OS, zSeries.

The following terms are trademarks of International Business Machines Corporation in the United States and/or other countries: Advanced Micro-Partitioning, AIX 5L, AIX PVM, AS/400e, Chipkill, Chiphopper, Cloudscape, DB2 OLAP Server, DB2 Universal Database, DFDSM, DFSORT, e-business(logo), e-business on demand, eServer, Express Middleware, Express Portfolio, Express Servers, Express Servers and Storage, GigaProcessor, HACMP, HACMP/6000, I5/OS (logo), IBMLink, IBM TotalStorage Proven, IMS, Intelligent Miner, iSeries, Micro-Partitioning, NUMACenter, ON DEMAND BUSINESS logo, OpenPower, POWER, Power Architecture, Power Everywhere, Power Family, Power PC, PowerPC Architecture, PowerPC 603, PowerPC 603e, PowerPC 604, PowerPC 750, POWER2, POWER2 Architecture, POWER3, POWER4, POWER4+, POWER5, POWER5+, POWER6, POWER6+, Redbooks, Sequent (logo), SequentLINK, Server Advantage, ServeRAID, Service Director, SmoothStart, SP, System i, System i5, System p, System p5, System Storage, System z, System z9, S/390 Parallel Enterprise Server, Tivoli Enterprise, TME 10, TotalStorage Proven, Ultramedia, VideoCharger, Virtualization Engine, Visualization Data Explorer, X-Architecture, z/Architecture, z/9.

A full list of U.S. trademarks owned by IBM may be found at: <http://www.ibm.com/legal/copytrade.shtml>.

UNIX is a registered trademark in the United States, other countries or both.

Linux is a trademark of Linus Torvalds in the United States, other countries or both.

Microsoft, Windows, Windows NT and the Windows logo are registered trademarks of Microsoft Corporation in the United States and/or other countries.

Intel, Intel Xeon, Itanium and Pentium are registered trademarks or trademarks of Intel Corporation in the United States and/or other countries.

AMD Opteron is a trademark of Advanced Micro Devices, Inc.

Java and all Java-based trademarks and logos are trademarks of Sun Microsystems, Inc. in the United States and/or other countries.

TPC-C and TPC-H are trademarks of the Transaction Performance Processing Council (TPPC).

SPECint, SPECfp, SPECjbb, SPECweb, SPECjAppServer, SPEC OMP, SPECviewperf, SPECcapc, SPECchpc, SPECjvm, SPECmail, SPECimap and SPECsfs are trademarks of the Standard Performance Evaluation Corp (SPEC).

NetBench is a registered trademark of Ziff Davis Media in the United States, other countries or both.

AltiVec is a trademark of Freescale Semiconductor, Inc.

Other company, product and service names may be trademarks or service marks of others.

Revised January 19, 2006

# Notes on benchmarks and values

The IBM benchmarks results shown herein were derived using particular, well configured, development-level and generally-available computer systems. Buyers should consult other sources of information to evaluate the performance of systems they are considering buying and should consider conducting application oriented testing. For additional information about the benchmarks, values and systems tested, contact your local IBM office or IBM authorized reseller or access the Web site of the benchmark consortium or benchmark vendor.

IBM benchmark results can be found in the IBM System p5, ~ p5, pSeries, OpenPower and IBM RS/6000 Performance Report at [http://www.ibm.com/servers/systems/p/hardware/system\\_perf.html](http://www.ibm.com/servers/systems/p/hardware/system_perf.html).

All performance measurements were made with AIX or AIX 5L operating systems unless otherwise indicated to have used Linux. For new and upgraded systems, AIX Version 4.3 or AIX 5L were used. All other systems used previous versions of AIX. The SPEC CPU2000, LINPACK, and Technical Computing benchmarks were compiled using IBM's high performance C, C++, and FORTRAN compilers for AIX 5L and Linux. For new and upgraded systems, the latest versions of these compilers were used: XL C Enterprise Edition V7.0 for AIX, XL C/C++ Enterprise Edition V7.0 for AIX, XL FORTRAN Enterprise Edition V9.1 for AIX, XL C/C++ Advanced Edition V7.0 for Linux, and XL FORTRAN Advanced Edition V9.1 for Linux. The SPEC CPU95 (retired in 2000) tests used preprocessors, KAP 3.2 for FORTRAN and KAP/C 1.4.2 from Kuck & Associates and VAST-2 v4.01X8 from Pacific-Sierra Research. The preprocessors were purchased separately from these vendors. Other software packages like IBM ESSL for AIX, MASS for AIX and Kazushige Goto's BLAS Library for Linux were also used in some benchmarks.

For a definition/explanation of each benchmark and the full list of detailed results, visit the Web site of the benchmark consortium or benchmark vendor.

|   |   |
|---|---|
| TPC   | <a href="http://www.tpc.org">http://www.tpc.org</a>   |
| SPEC  | <a href="http://www.spec.org">http://www.spec.org</a>   |
| LINPACK   | <a href="http://www.netlib.org/benchmark/performance.pdf">http://www.netlib.org/benchmark/performance.pdf</a>   |
| Pro/E   | <a href="http://www.proe.com">http://www.proe.com</a>   |
| GPC   | <a href="http://www.spec.org/gpc">http://www.spec.org/gpc</a>   |
| NotesBench  | <a href="http://www.notesbench.org">http://www.notesbench.org</a>   |
| VolanoMark  | <a href="http://www.volano.com">http://www.volano.com</a>   |
| STREAM  | <a href="http://www.cs.virginia.edu/stream/">http://www.cs.virginia.edu/stream/</a>   |
| SAP   | <a href="http://www.sap.com/benchmark/">http://www.sap.com/benchmark/</a>   |
| Oracle Applications   | <a href="http://www.oracle.com/apps_benchmark/">http://www.oracle.com/apps_benchmark/</a>   |
| PeopleSoft - To get information on PeopleSoft benchmarks, contact PeopleSoft directly |   |
| Siebel  | <a href="http://www.siebel.com/crm/performance_benchmark/index.shtm">http://www.siebel.com/crm/performance_benchmark/index.shtm</a>                     |
| Baan  | <a href="http://www.ssaglobal.com">http://www.ssaglobal.com</a>   |
| Microsoft Exchange  | <a href="http://www.microsoft.com/exchange/evaluation/performance/default.asp">http://www.microsoft.com/exchange/evaluation/performance/default.asp</a> |
| Veritest  | <a href="http://www.veritest.com/clients/reports">http://www.veritest.com/clients/reports</a>   |
| Fluent  | <a href="http://www.fluent.com/software/fluent/index.htm">http://www.fluent.com/software/fluent/index.htm</a>   |
| TOP500 Supercomputers   | <a href="http://www.top500.org/">http://www.top500.org/</a>   |
| Ideas International   | <a href="http://www.ideasinternational.com/benchmark/bench.html">http://www.ideasinternational.com/benchmark/bench.html</a>                             |
| Storage Performance Council   | <a href="http://www.storageperformance.org/results">http://www.storageperformance.org/results</a>   |

Revised January 19, 2006

# Notes on Performance Estimates

## rPerf

rPerf (Relative Performance) is an estimate of commercial processing performance relative to other IBM UNIX systems. It is derived from an IBM analytical model which uses characteristics from IBM internal workloads, TPC and SPEC benchmarks. The rPerf model is not intended to represent any specific public benchmark results and should not be reasonably used in that way. The model simulates some of the system operations such as CPU, cache and memory. However, the model does not simulate disk or network I/O operations.

rPerf estimates are calculated based on systems with the latest levels of AIX 5L and other pertinent software at the time of system announcement. Actual performance will vary based on application and configuration specifics. The IBM *@server* pSeries 640 is the baseline reference system and has a value of 1.0. Although rPerf may be used to approximate relative IBM UNIX commercial processing performance, actual system performance may vary and is dependent upon many factors including system hardware configuration and software design and configuration.

All performance estimates are provided "AS IS" and no warranties or guarantees are expressed or implied by IBM. Buyers should consult other sources of information, including system benchmarks, and application sizing guides to evaluate the performance of a system they are considering buying. For additional information about rPerf, contact your local IBM office or IBM authorized reseller.

Revised January 19, 2006