



The
'marvelous'
Ein Systemüberblick
und
zukünftige
AlphaSystem

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AlphaSysteme
Hewlett-Packard GmbH

The new AlphaServer GS1280 & ES47/80 Series



A new Family of AlphaServer Systems Built from Reusable Components....

Common Components

3 Basic Components



EV7 2P CPU Module **2 I/O Subsystems**

Build 2 System Building Blocks



2P and 8P System Drawers

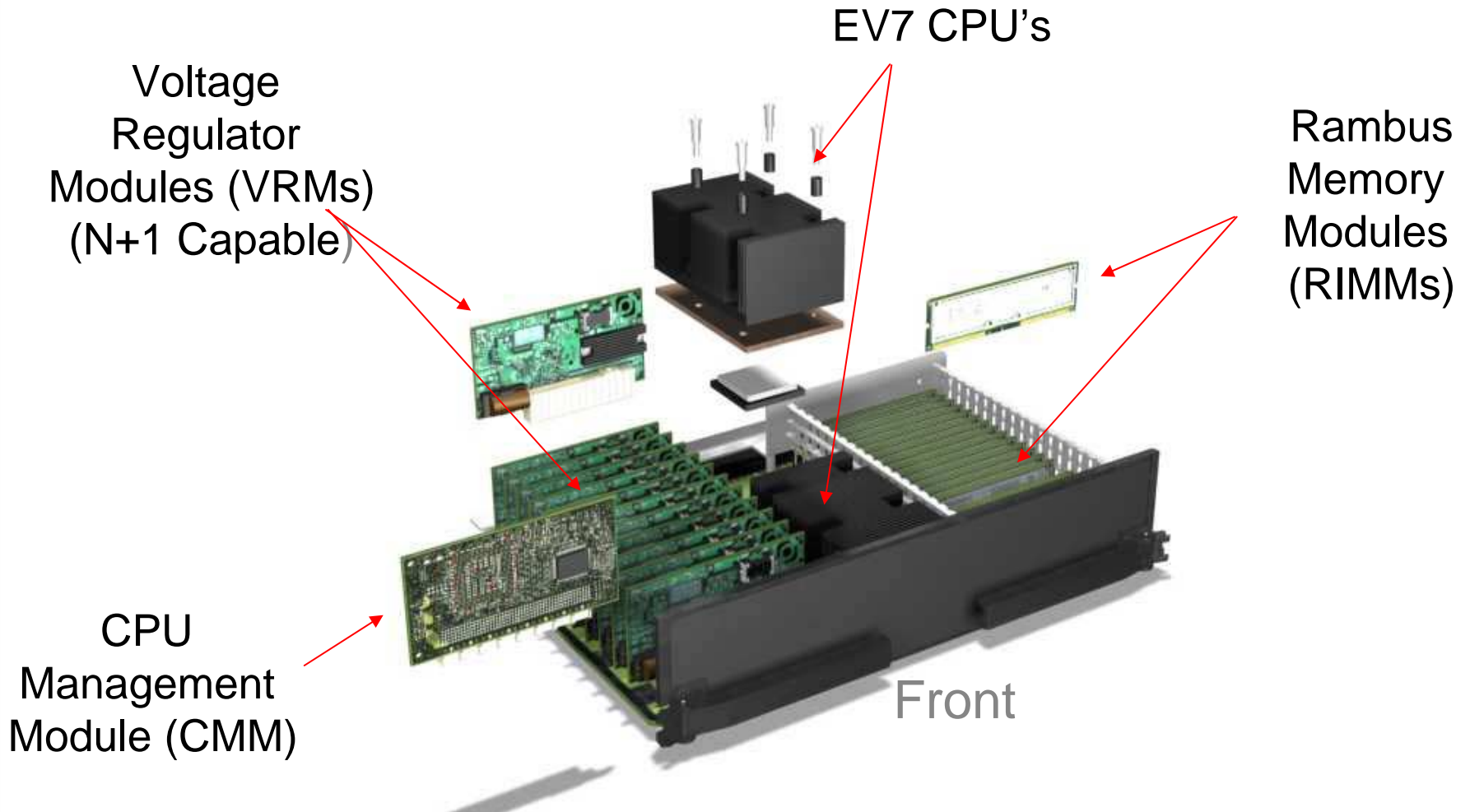
With common system
management across the
entire family



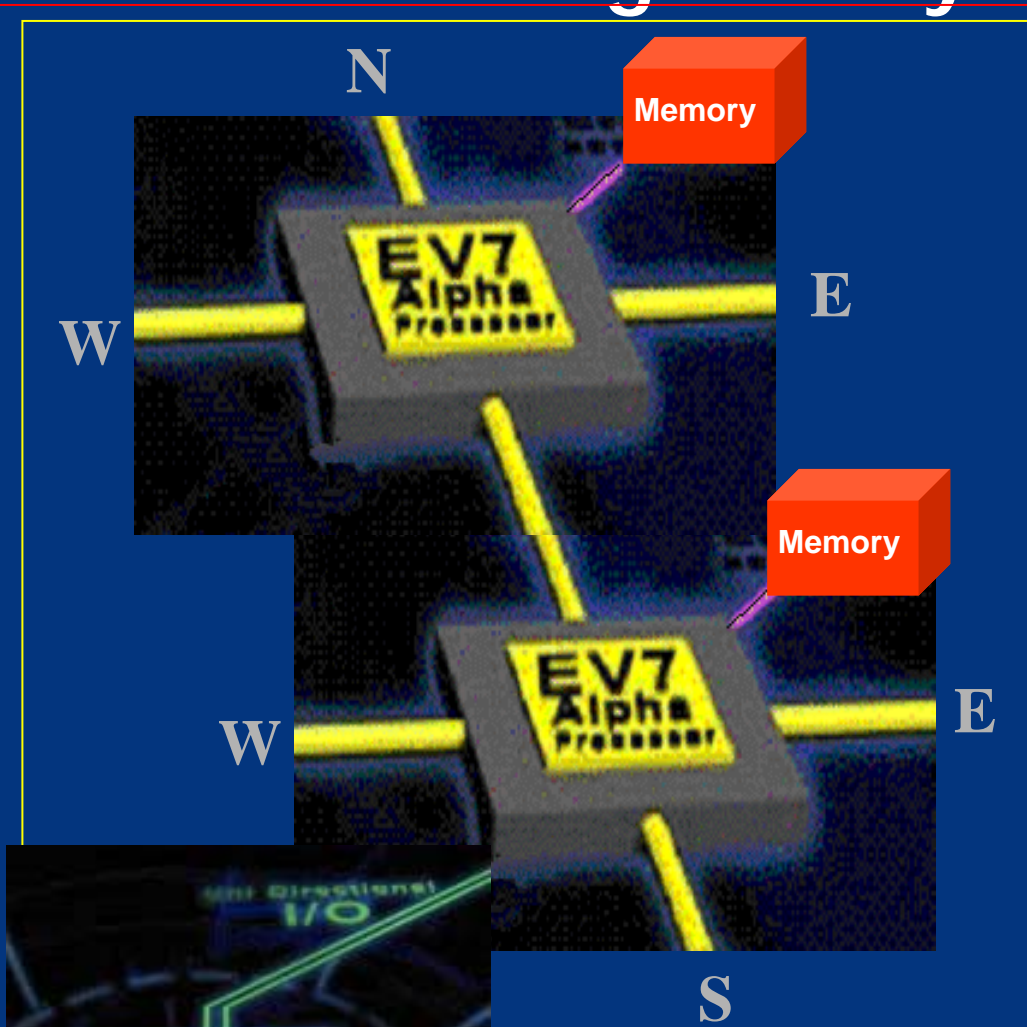
**Building a broad range of HP
AlphaServer systems !**



Dual Processor Building Block Module



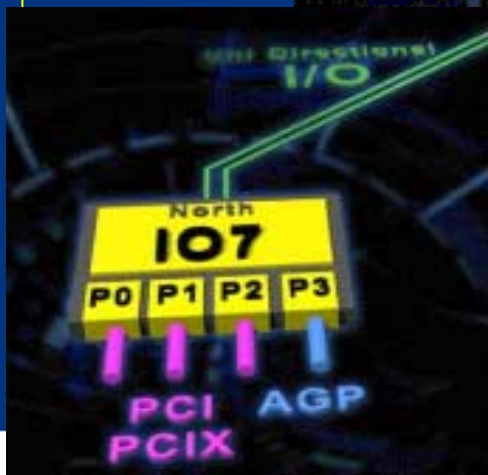
Building a 2P system



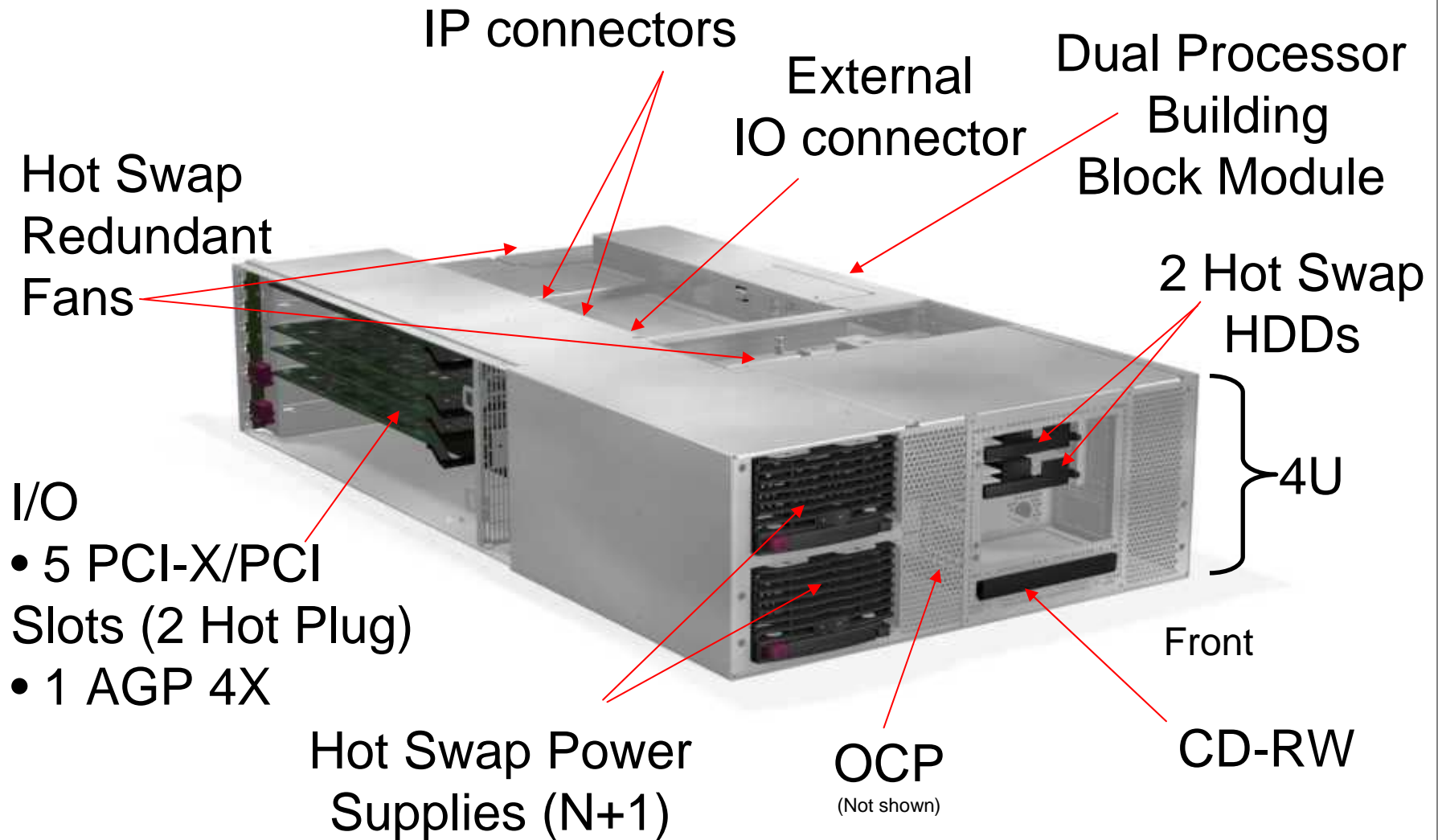
Dual CPU module



2P Module



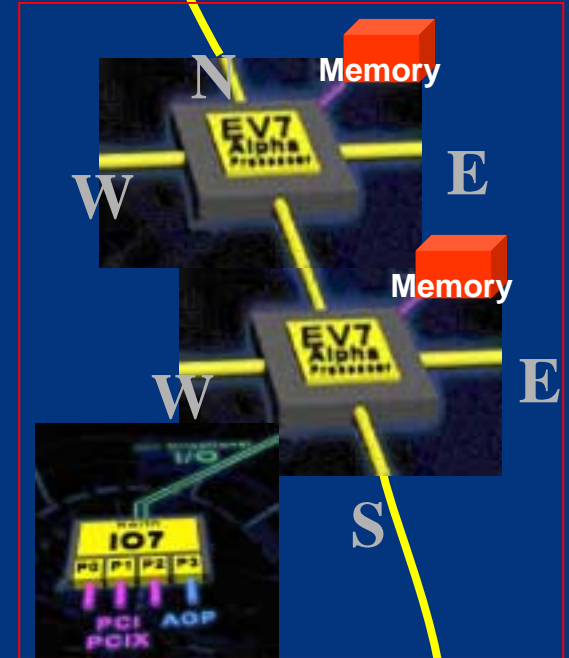
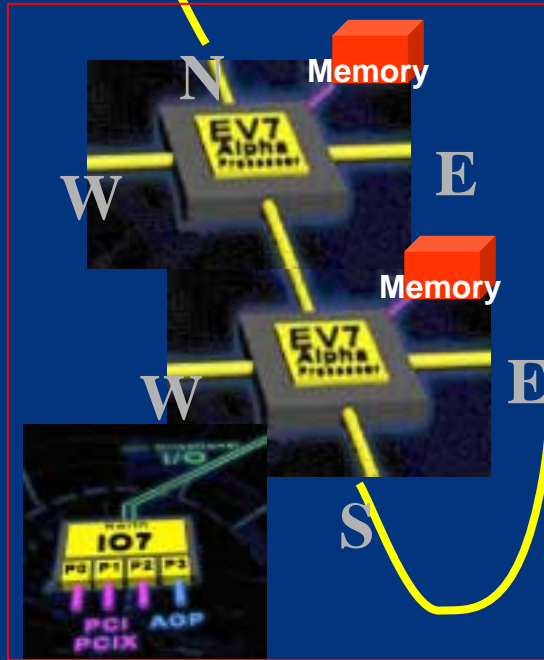
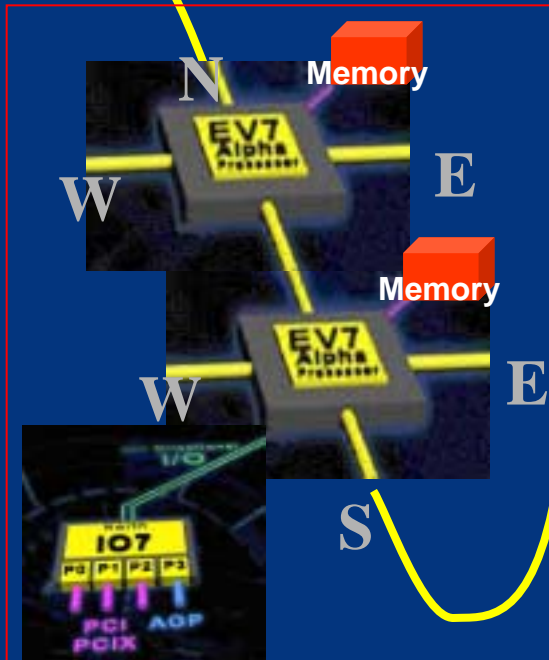
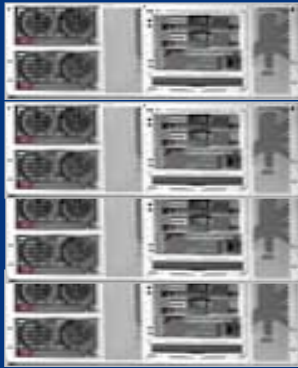
Dual Processor Building Block Drawer: ES47



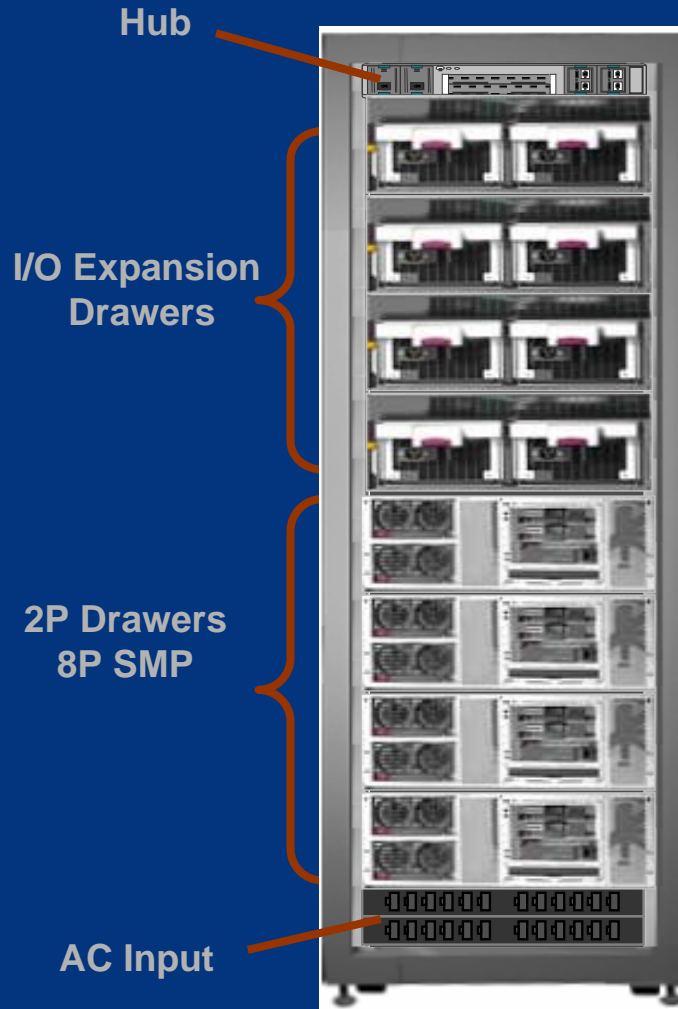
Dual processor building block



Building an ES80



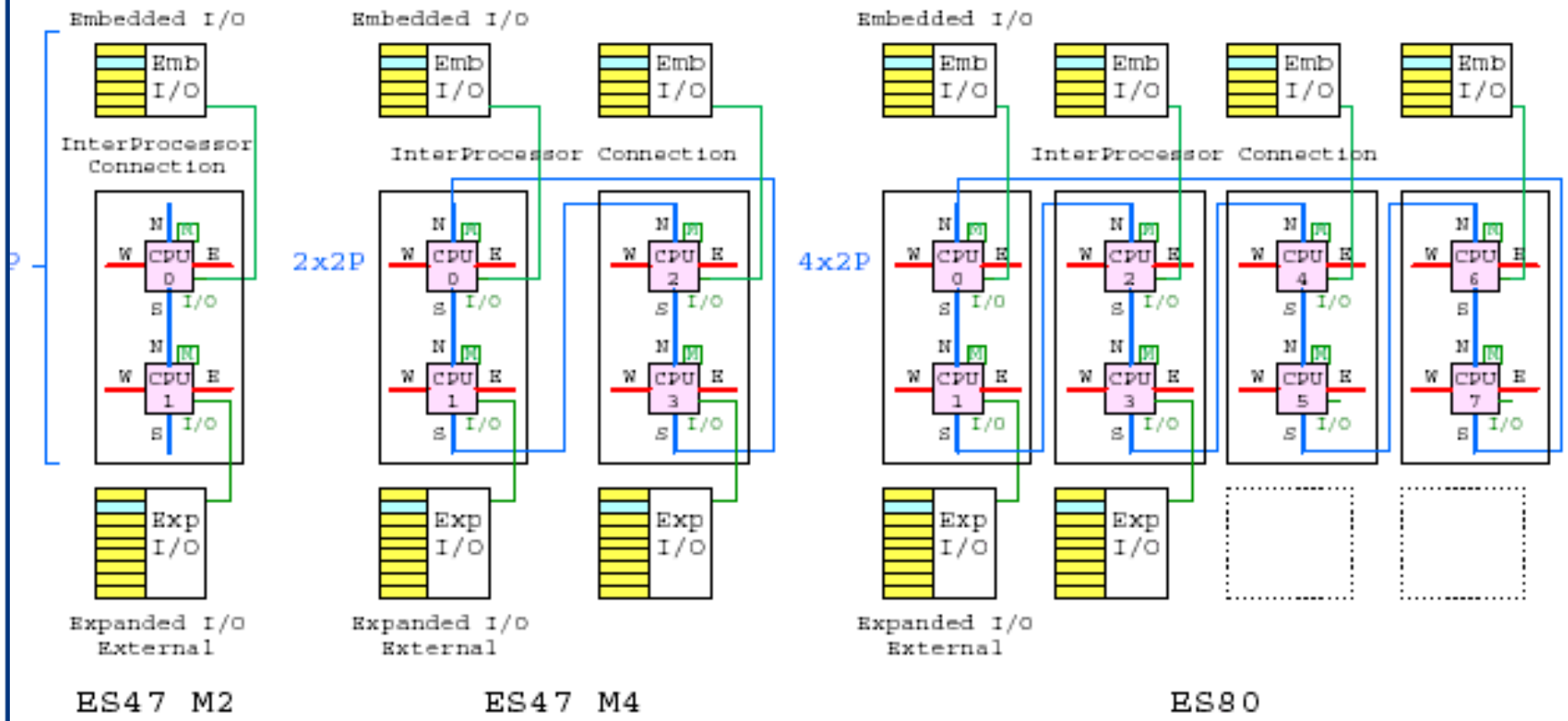
8P SMP System and I/O Expansion using 2P Building Blocks



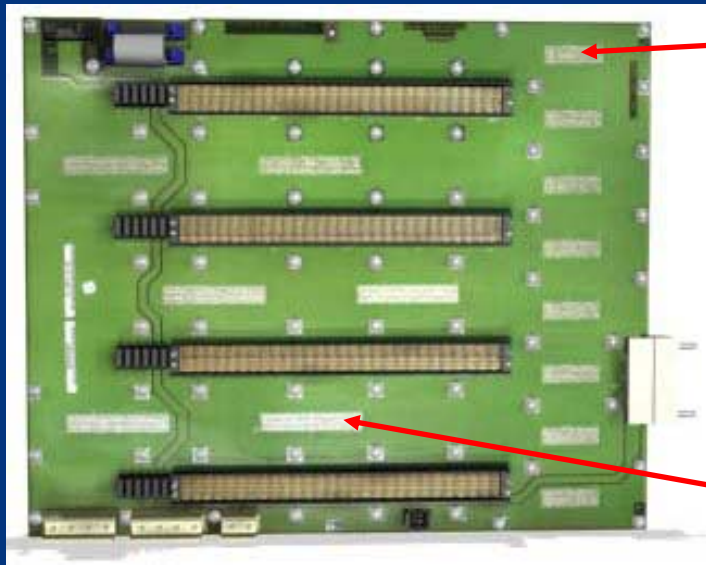
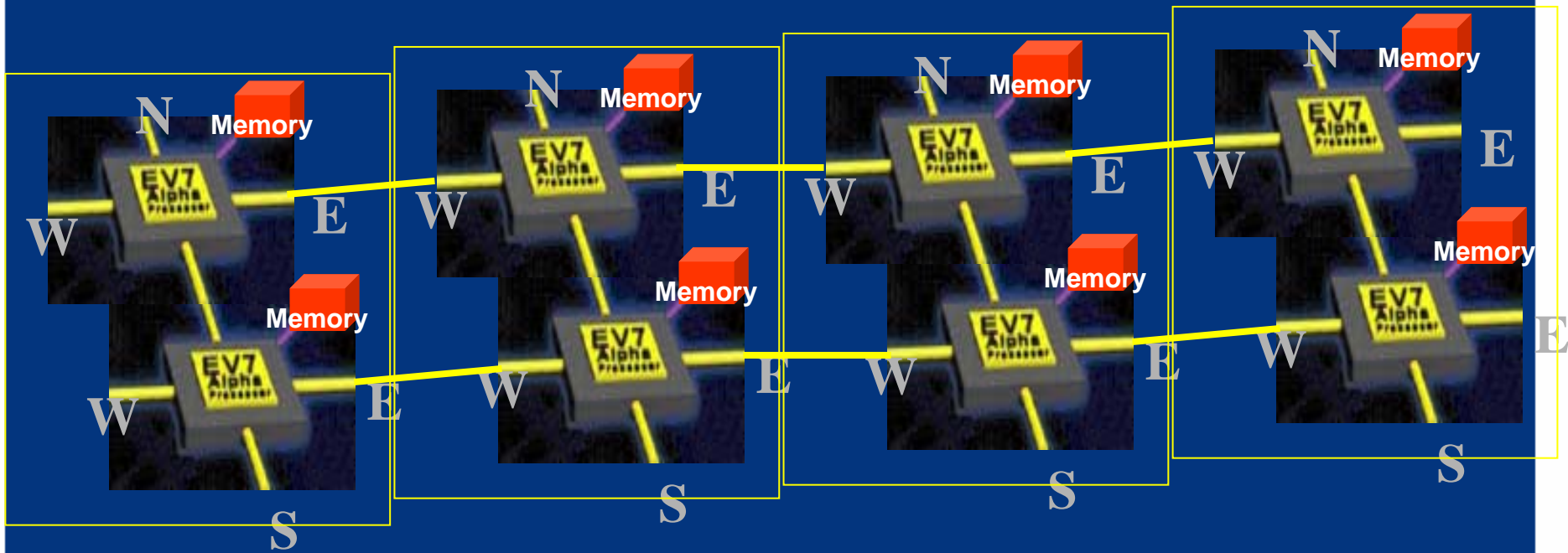
- Up to 64GB Memory
- Up to 64 PCI-X slots
- Up to 8 AGP slots

Examples of configuration ES47

HP AlphaServer ES47 Tower, ES47 M2&M4, ES80



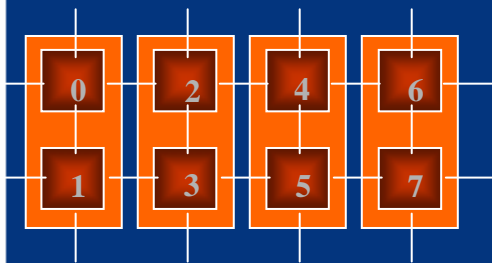
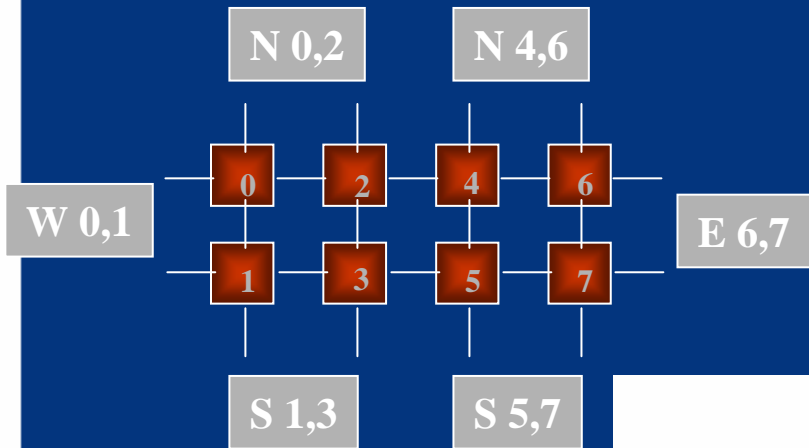
Building an 8P module



IO connectors



Inter Process connectors



Actually 4 dual CPU modules



Confidential



8P Building Block Drawer

Supports 4 dual processor building block modules

32GB maximum memory per CPU (8GB at FRS)

Up to 8 I/O expansion drawers can be supported per 8P drawer

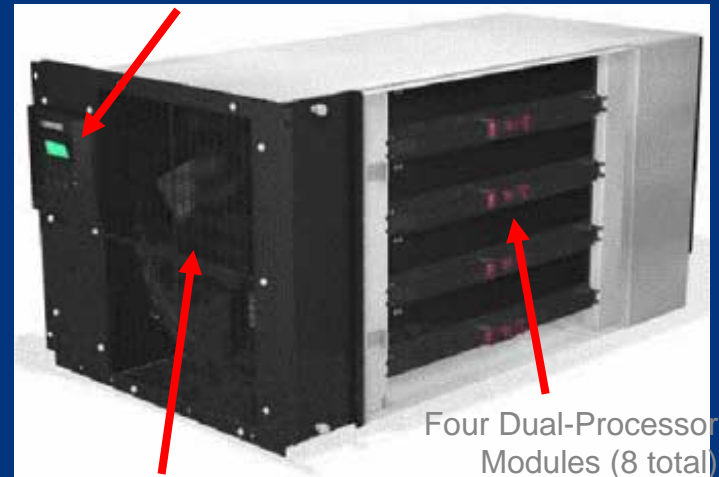
Four 8P building block drawers fit into a standard 2M rack

Integrated Server Management

N+1 cooling

N+1 48V power supplies power the 8P drawer

Operator Control Panel

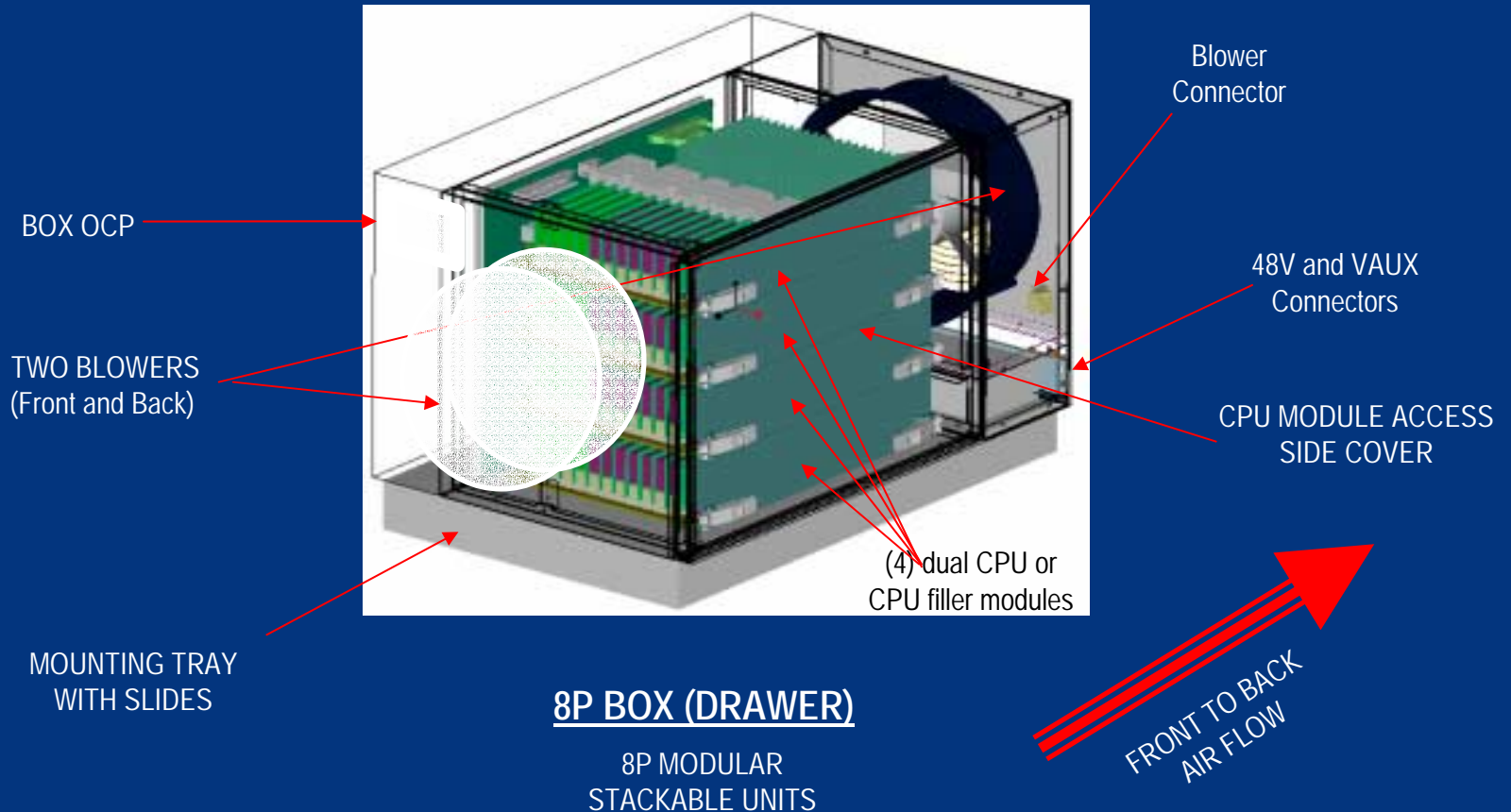


Redundant Fans



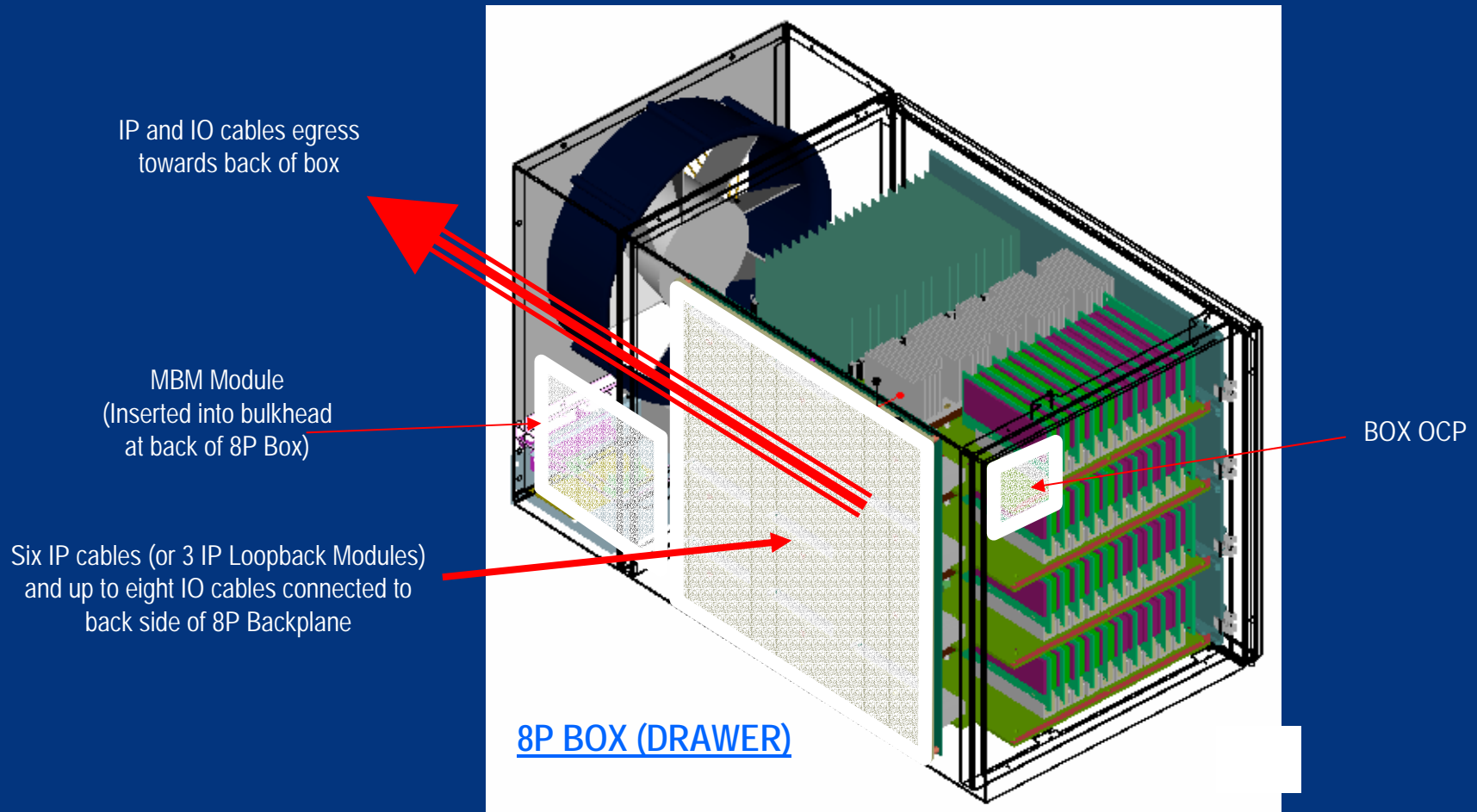
Marvel Rack Configurations & Cables

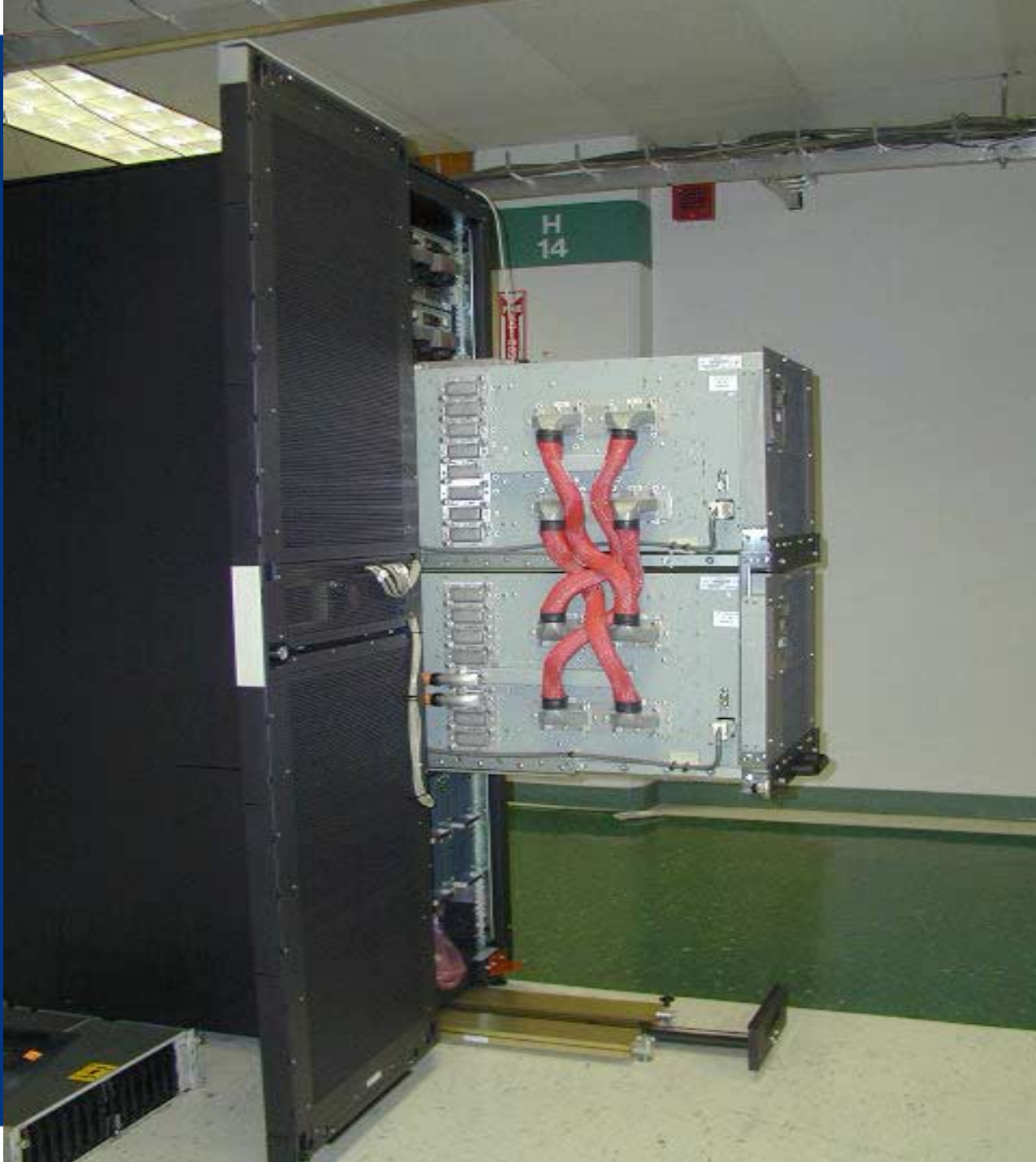
8P Box, Right Side View



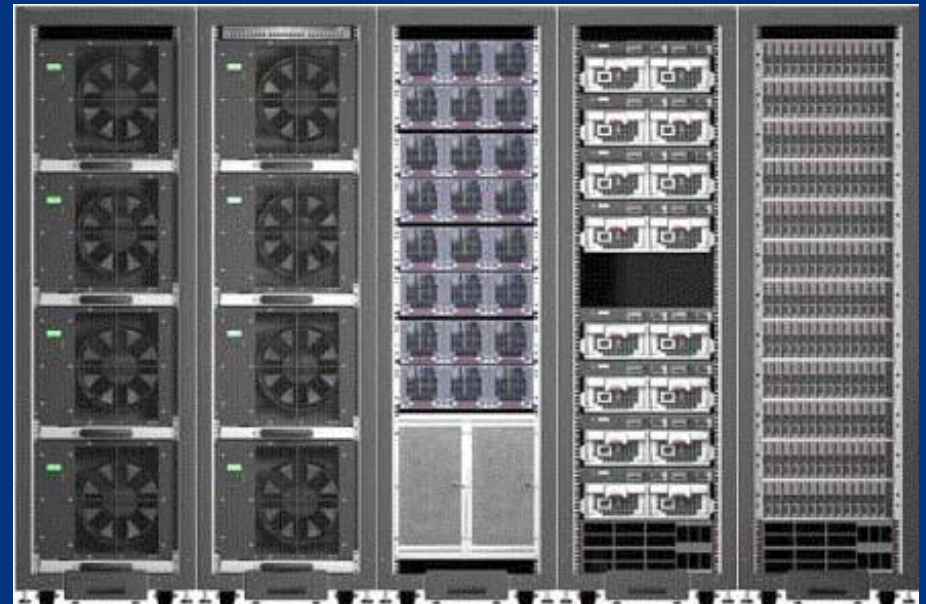
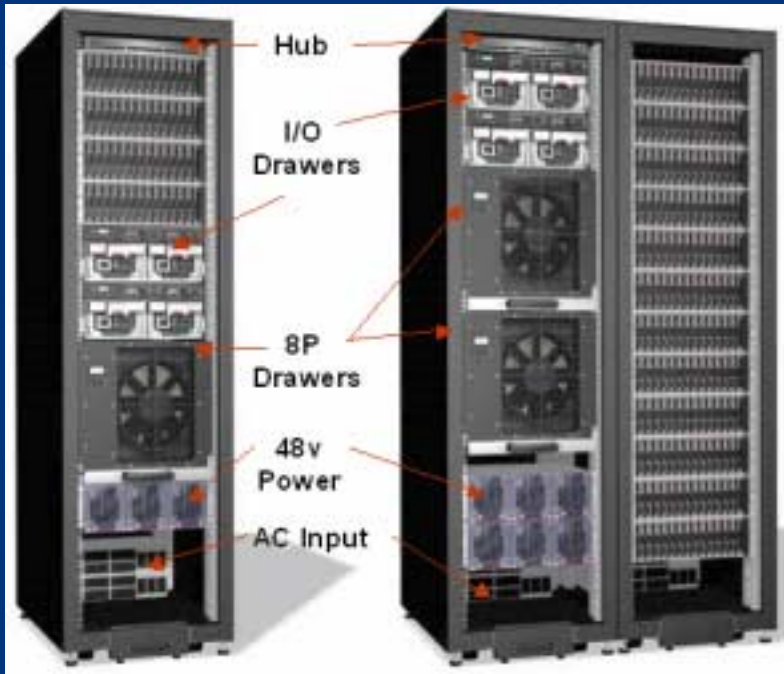
Marvel Rack Configurations & Cables

8P Box, Left Side View





8P, 16P and 64P+ Expandable Systems using 8P Building Block Drawers



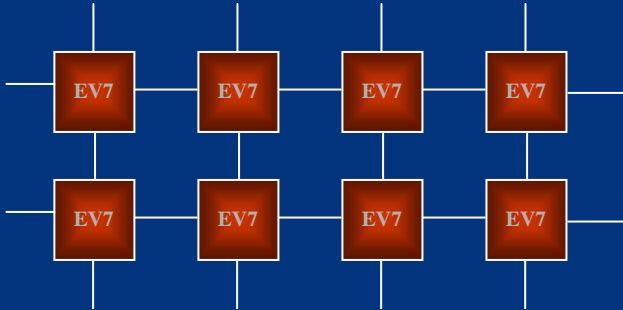
- **8-16 Processors**
- **up to 128 GB Memory**
- **Up to 192 PCI-X slots**
- **Up to 16 AGP slots**

- **up to 64 and more Processors**
- **up to 1TB Memory**
- **Up to 1536 PCI-X slots**
- **Up to 128 AGP slots**

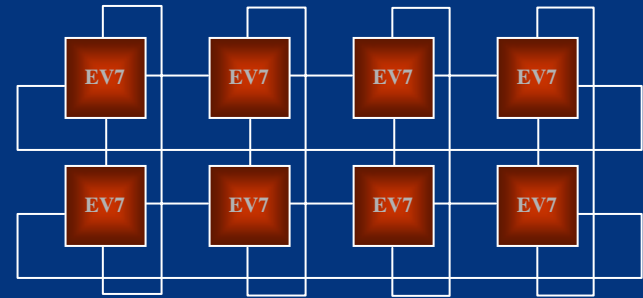
8P building blocks for many CPUs

8P building block

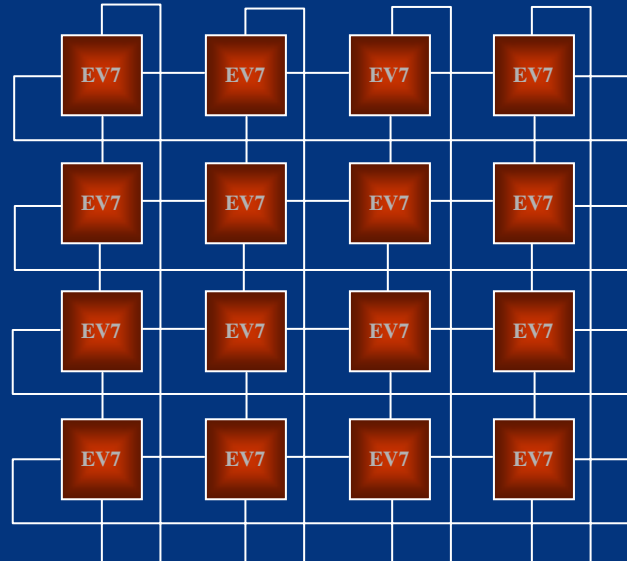
Note proto-torus topology



8P usage



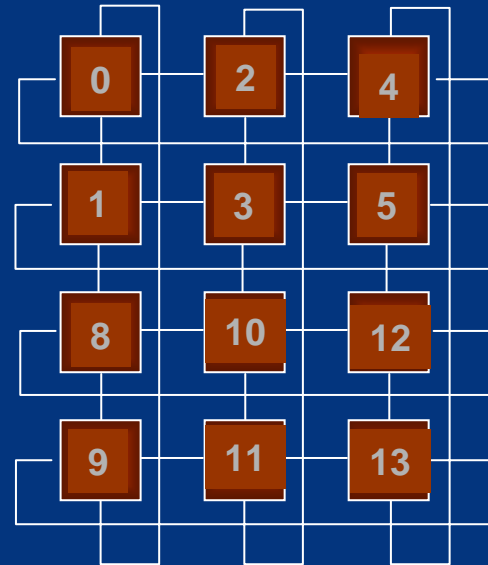
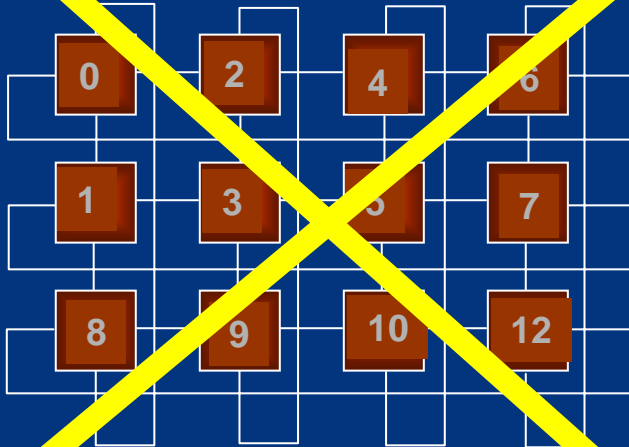
16P usage ... and so on



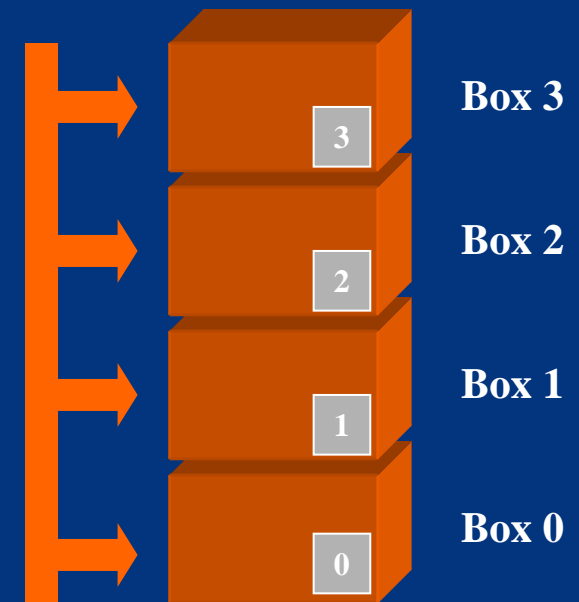
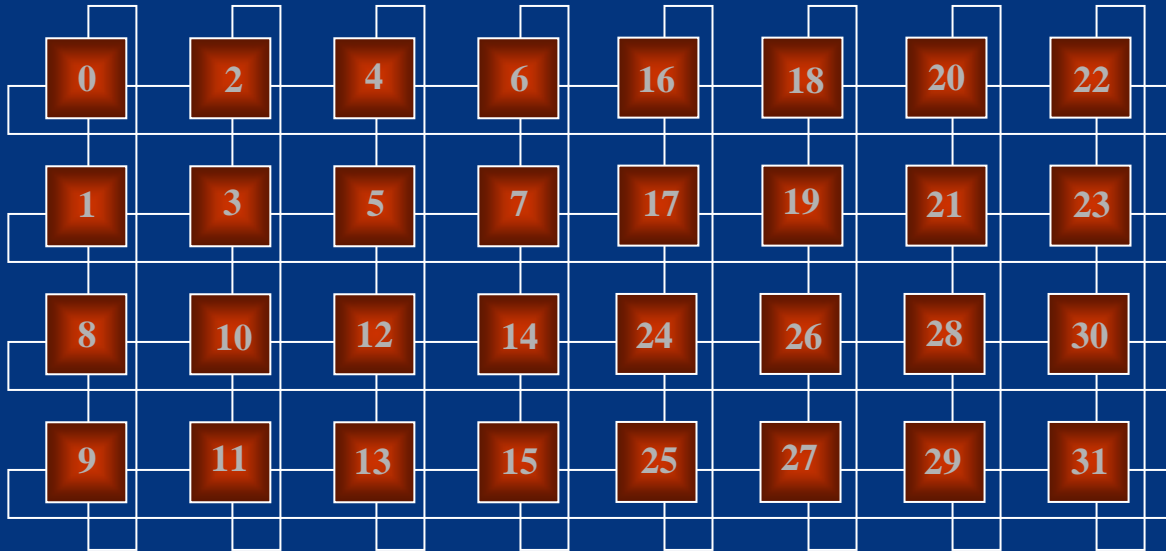
*Mid to high end scaling
64+ CPUs*

A 12 CPUs example

Which one is correct?

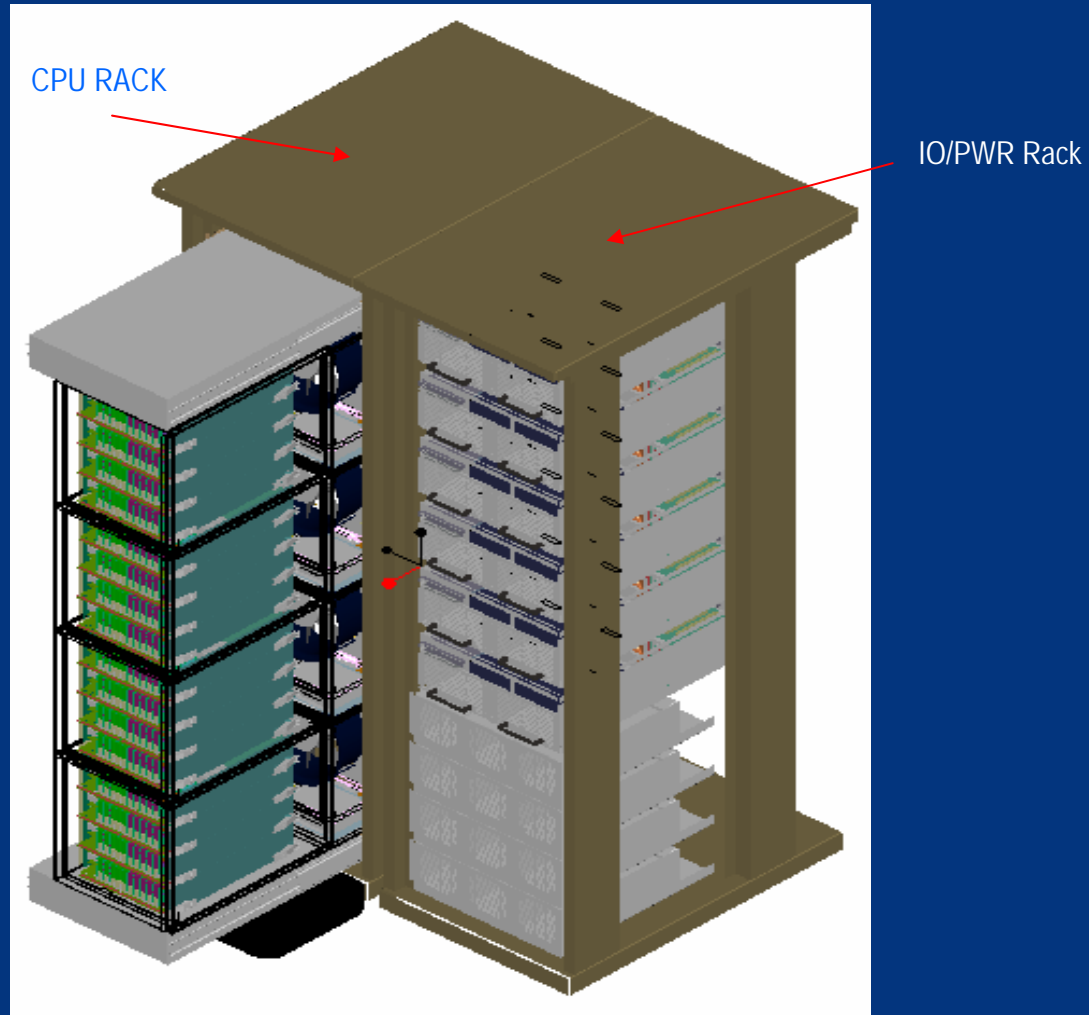


Building a 32P system from 8P building blocks

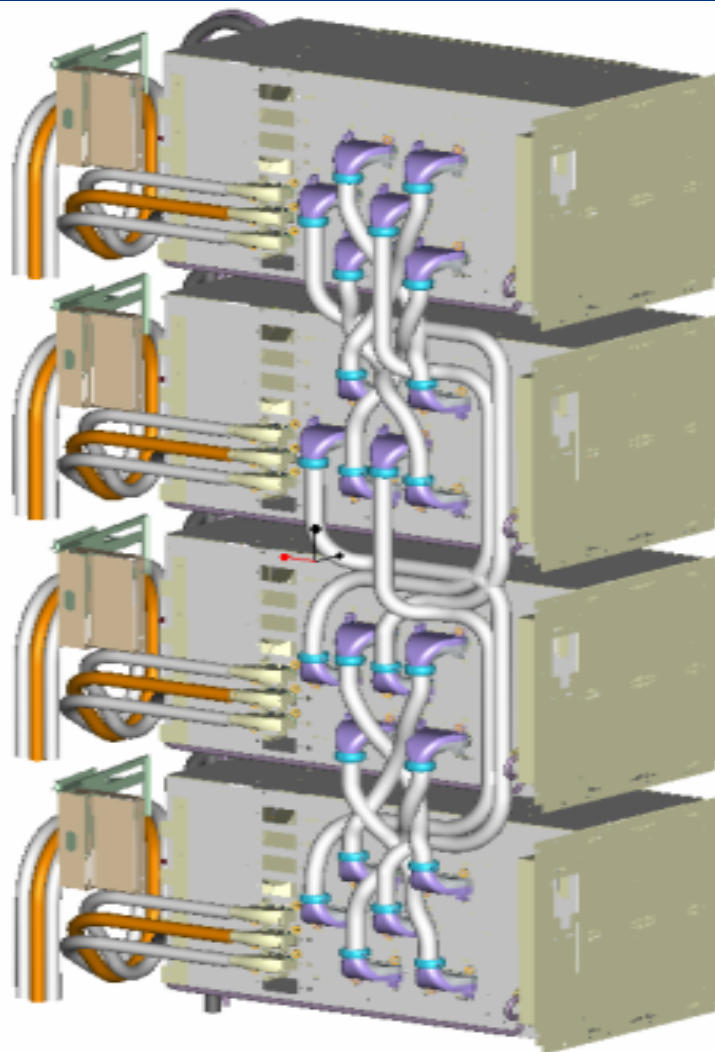


Marvel Rack Configurations & Cables

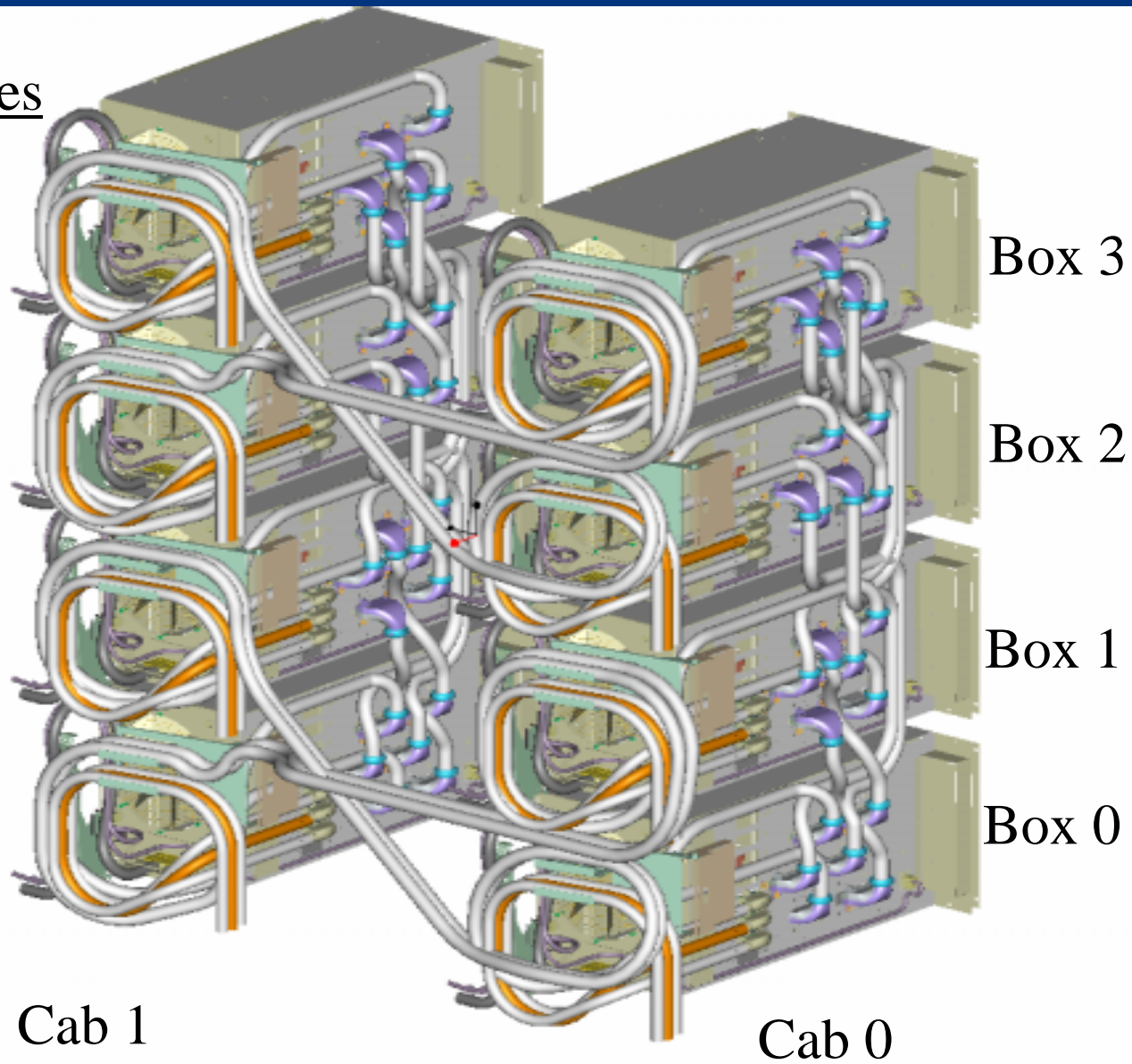
32P System



32P IP Cables



64P IP Cables



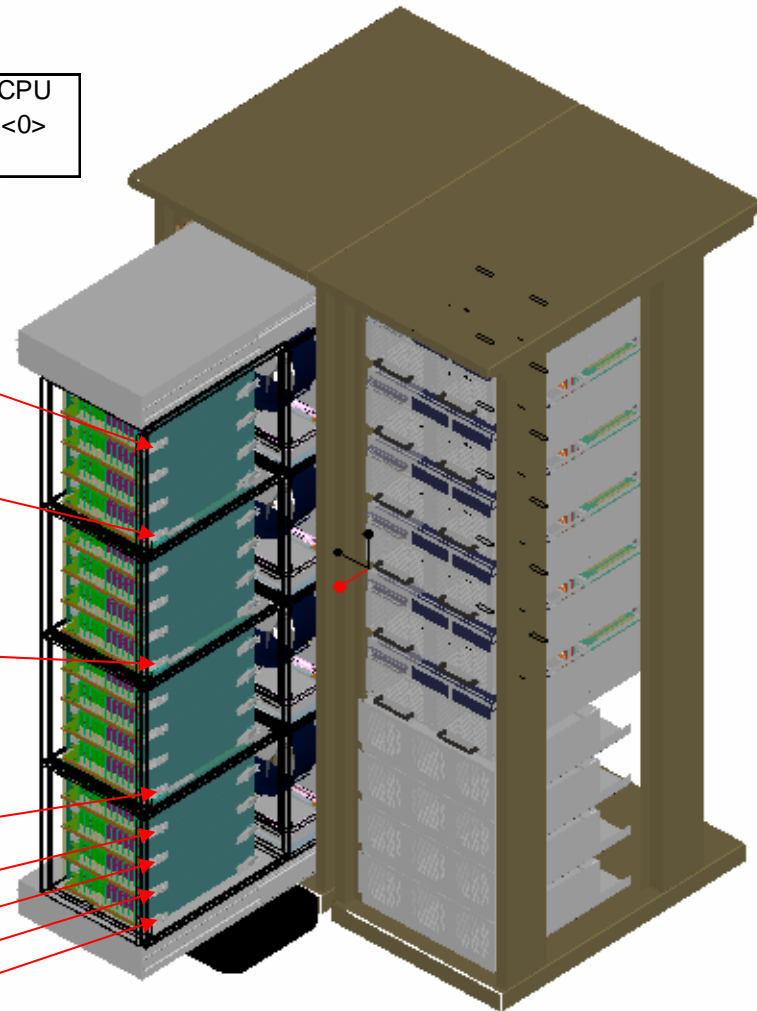
Marvel Rack Configurations & Cables

32P System, CPU Module Numbering

RACK	RACK	RACK	BOX	BOX	CPU	CPU	CPU
0	0	0	<1>	<0>	<2>	<1>	<0>

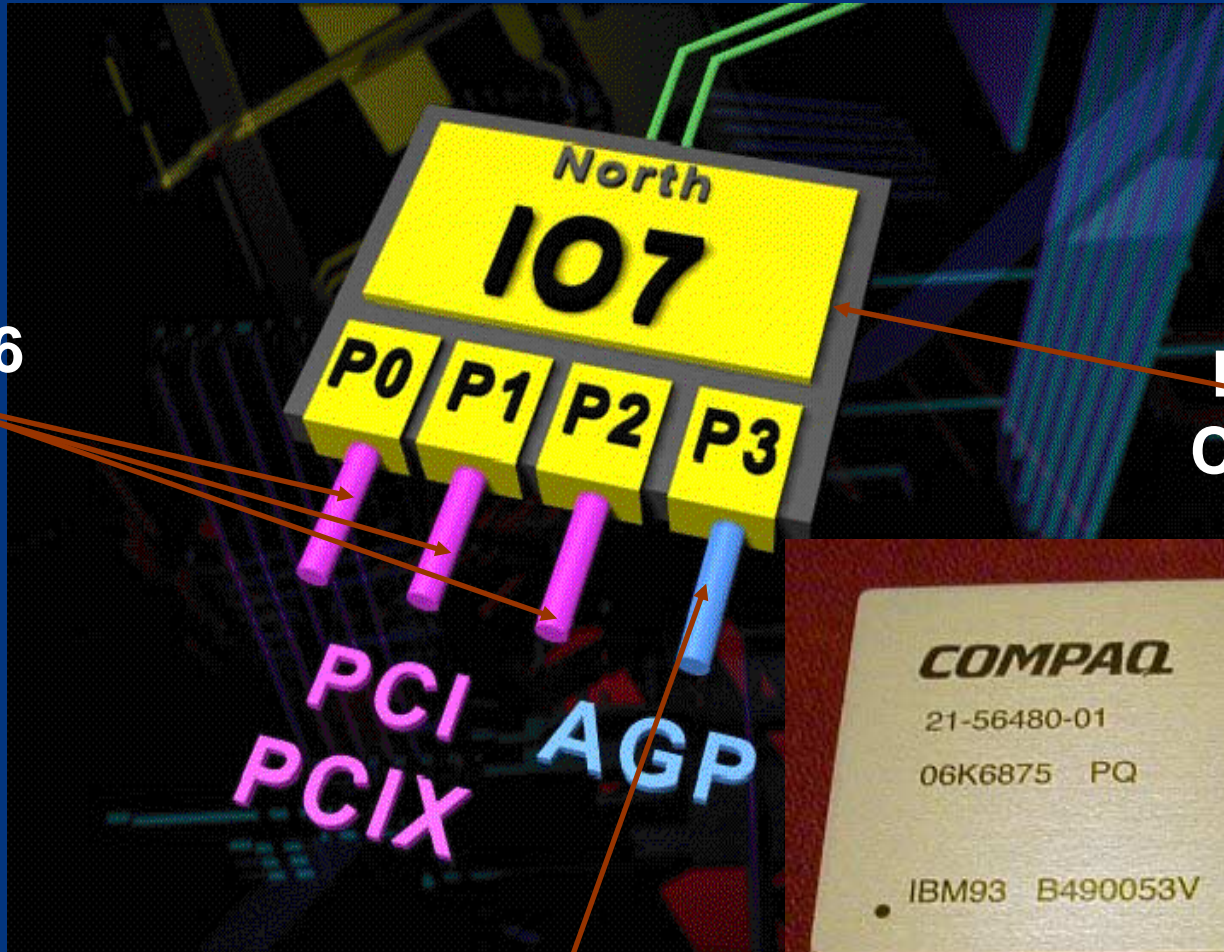
0	0	2	4	6	2
	1	3	5	7	
1	0	2	4	6	3
	1	3	5	7	

- BOX 3, CPU 4,5
- BOX 3, CPU 6,7
- BOX 3, CPU 0,1
- BOX 3, CPU 2,3
- BOX 2, CPU 4,5
- BOX 2, CPU 6,7
- BOX 2, CPU 0,1
- BOX 2, CPU 2,3
- BOX 1, CPU 4,5
- BOX 1, CPU 6,7
- BOX 1, CPU 0,1
- BOX 1, CPU 2,3
- BOX 0, CPU 4,5
- BOX 0, CPU 6,7
- BOX 0, CPU 0,1
- BOX 0, CPU 2,3



IO7 I/O Controller Chip

IO Port – 3.2GB/Sec
(1.6 GB/s x2)



PCI-33,66
or PCIX-
50,66,
100,133

Hot Plug
Controller



AGP 4X

Where and how many?

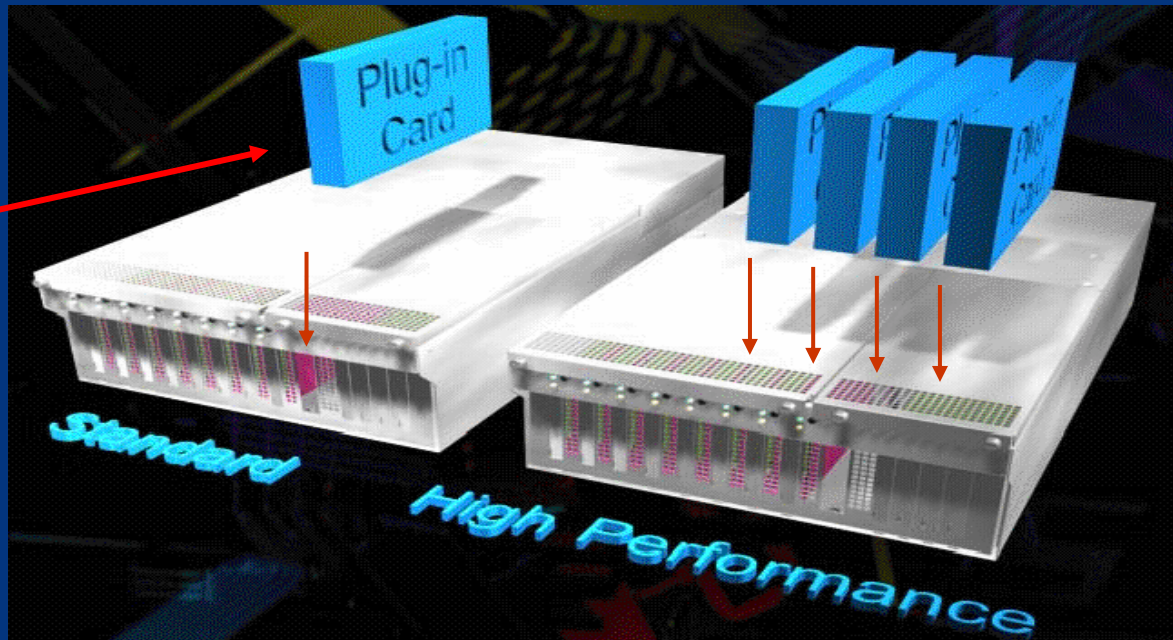
One in the 2P box



None in the 8P box



External I/O Expansion Drawers



Standard IO Drawer

Optimized for PCI slot Connectivity

3 PCI-X Busses / 11 PCI-X Slots

- 6 - Hot-Plug PCI-X 66MHz
- 2 - Hot-Plug PCI-X 133MHz
- 3 - Non Hot Plug PCI

1 AGP 4x Bus / Slot for Graphics

High Performance IO Drawer

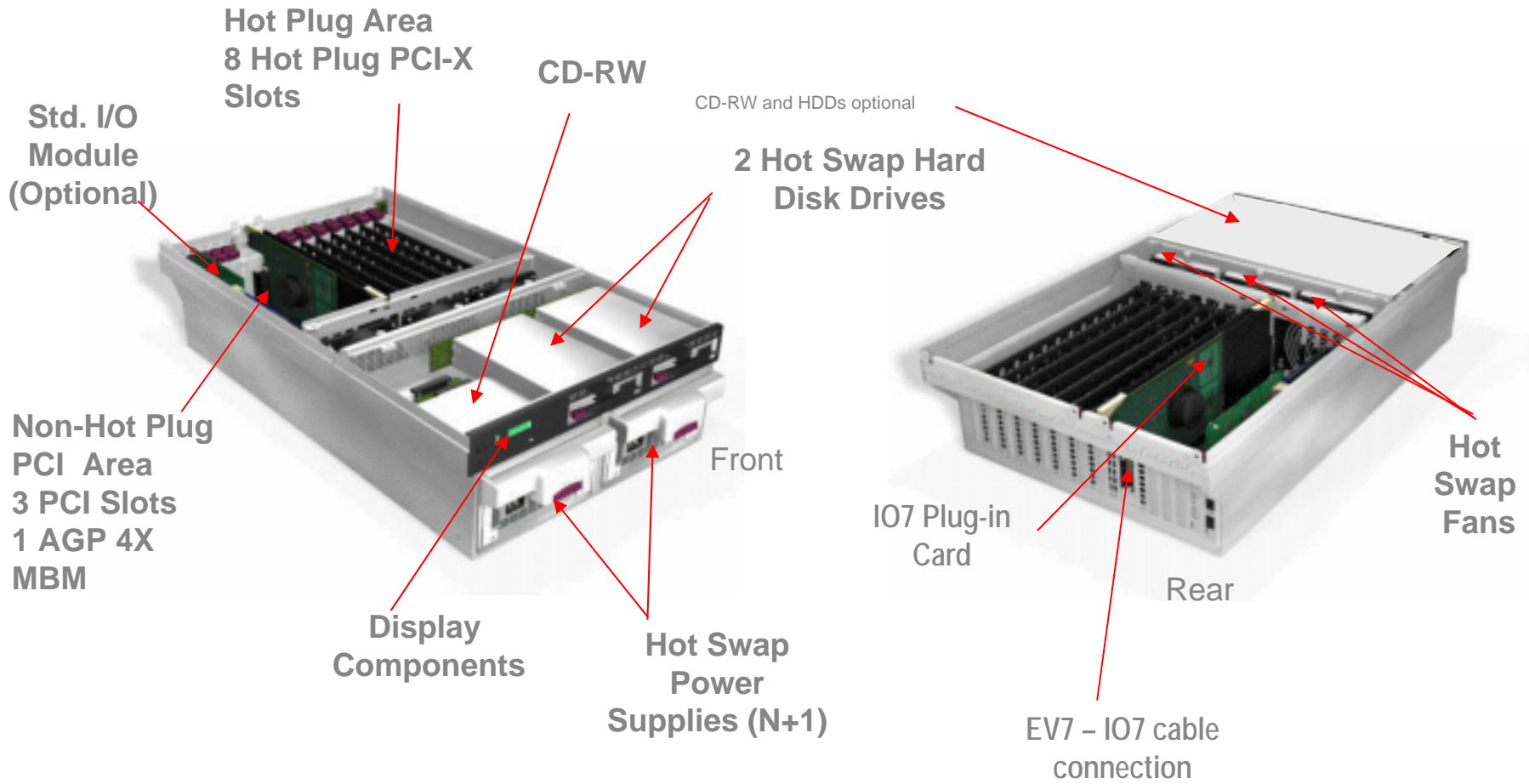
Optimized for Bandwidth and Configuration Flexibility

8 PCI-X Busses (133MHz) / 8 Hot-Plug Slots

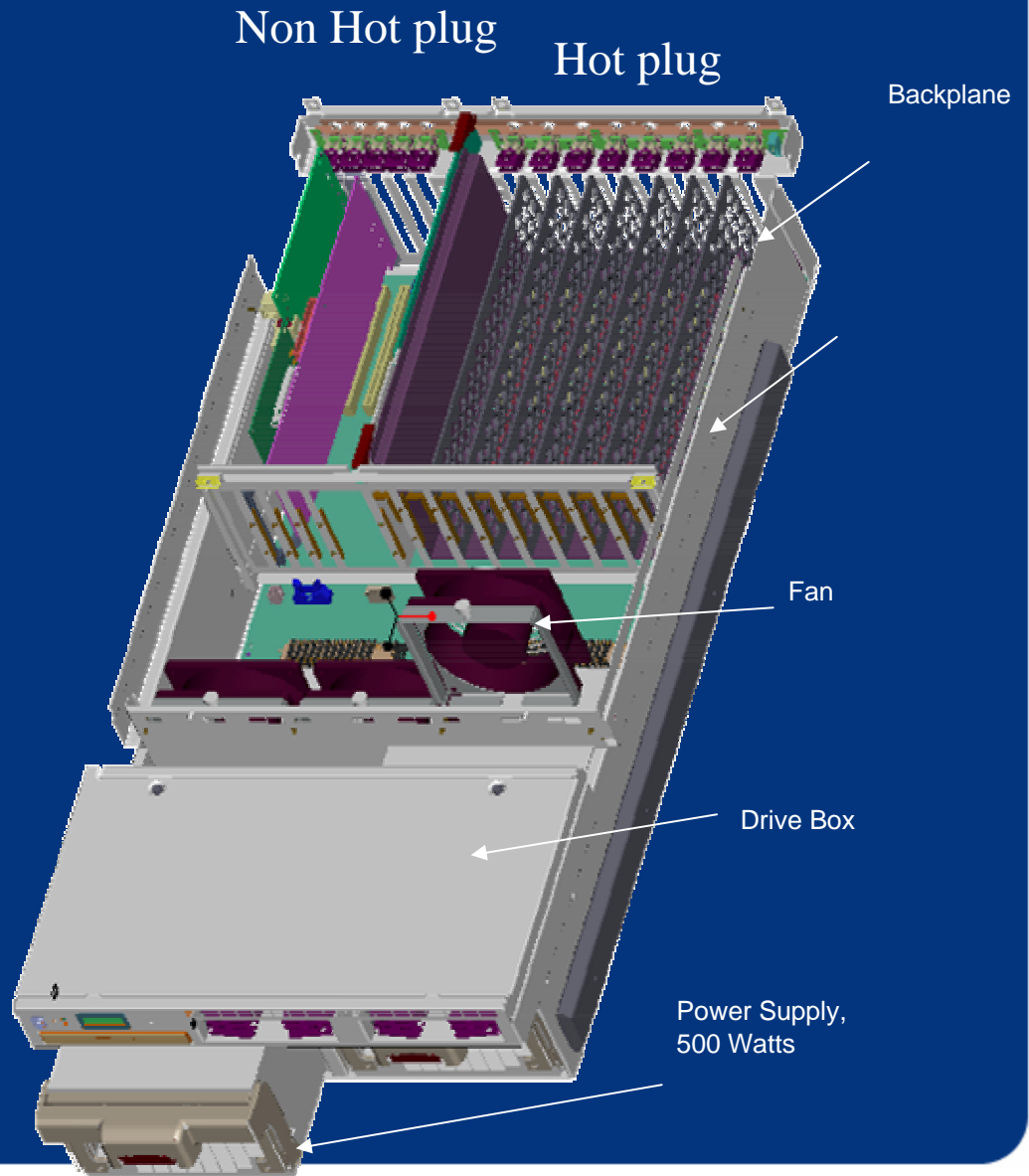
- Single slot/bus design maximizes bandwidth and isolation

Attachment to 4 processors, up to 4 separate partitions

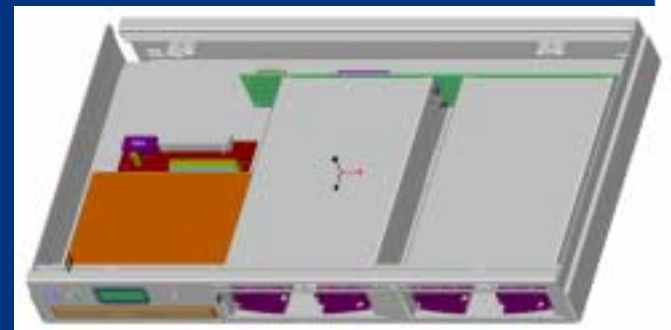
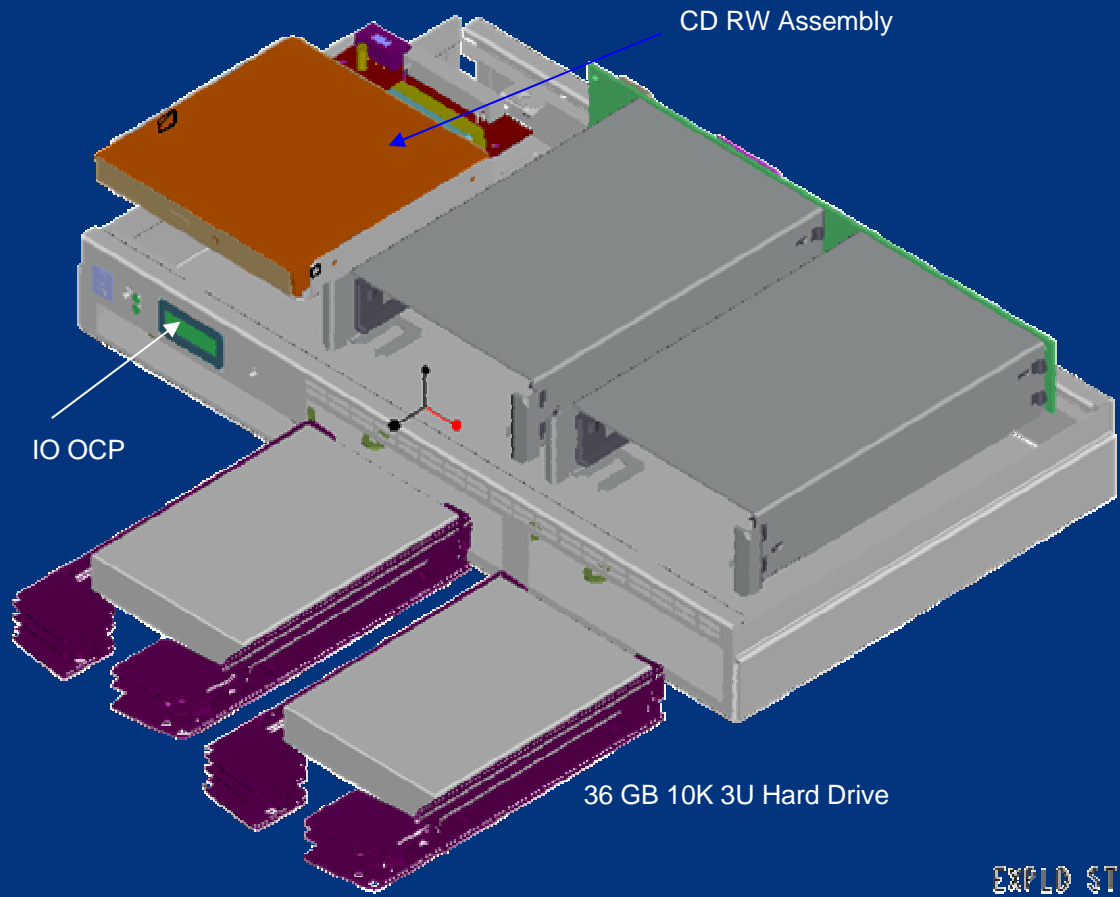
External I/O Expansion Building Block Drawer



IO Subsystem Main Chassis



IO Subsystem Media Box



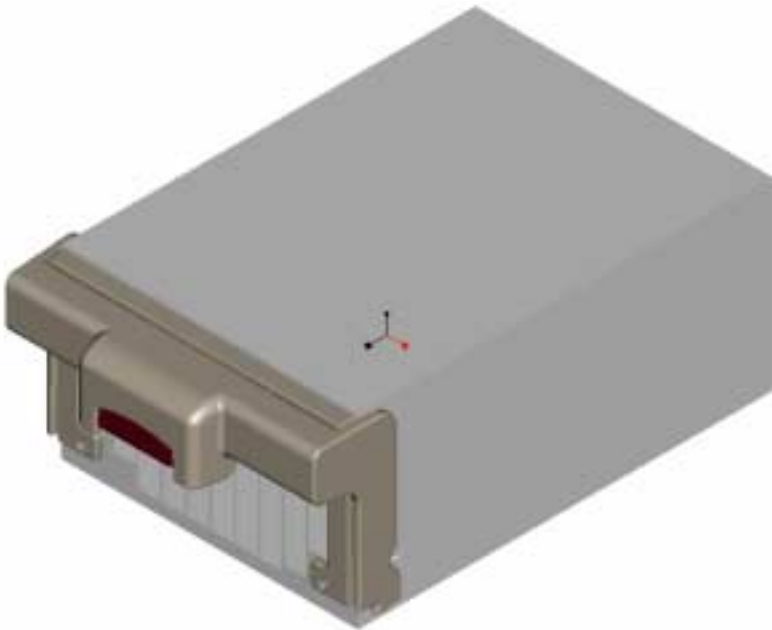
IO Subsystem Power Supply

Features

- Wide-range AC Input Voltage (90V-264V)
- Power Factor Corrected (Harmonics)
- Hot Swappable

Ratings

- 500W Total
 - 300W of 5V and 3.3V Combined Total
 - 3.3V - 75A
 - 5.0V - 50A
 - 12V - 16A
 - -12V - 1.2A
 - 12VAUX - 2A



IO Subsystem

Standard I/O Module

Standard I/O 64 bit PCI/PCIX Modules

- Features
- SCSI-III (160MB/SEC)
- ATA/ATAPI-5 IDE (100MB/SEC)
- USB 2.0 (60MB/SEC)
- PCI-PCI Bridge on 54-30334-01
- PCIX-PCI Bridge on 54-30530-01

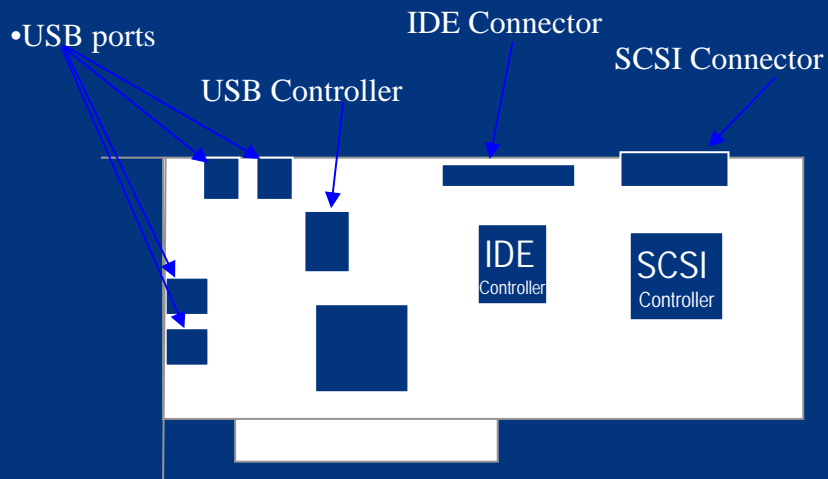
IO Subsystem

Standard I/O Module

Wide SCSI-III drive support up to 8 drives.

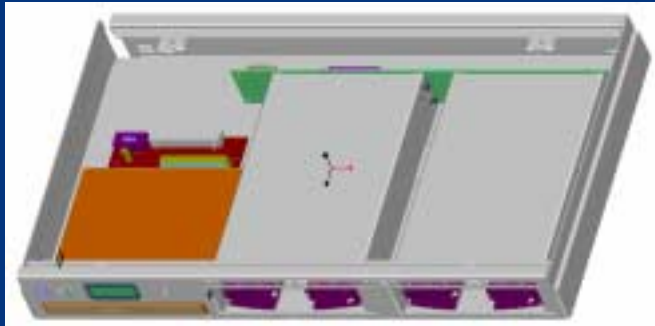
USB support for Storage box and external peripherals (such as Keyboard and Mice)

IDE single Drive or CD support



IO Subsystem I/O OCP Module

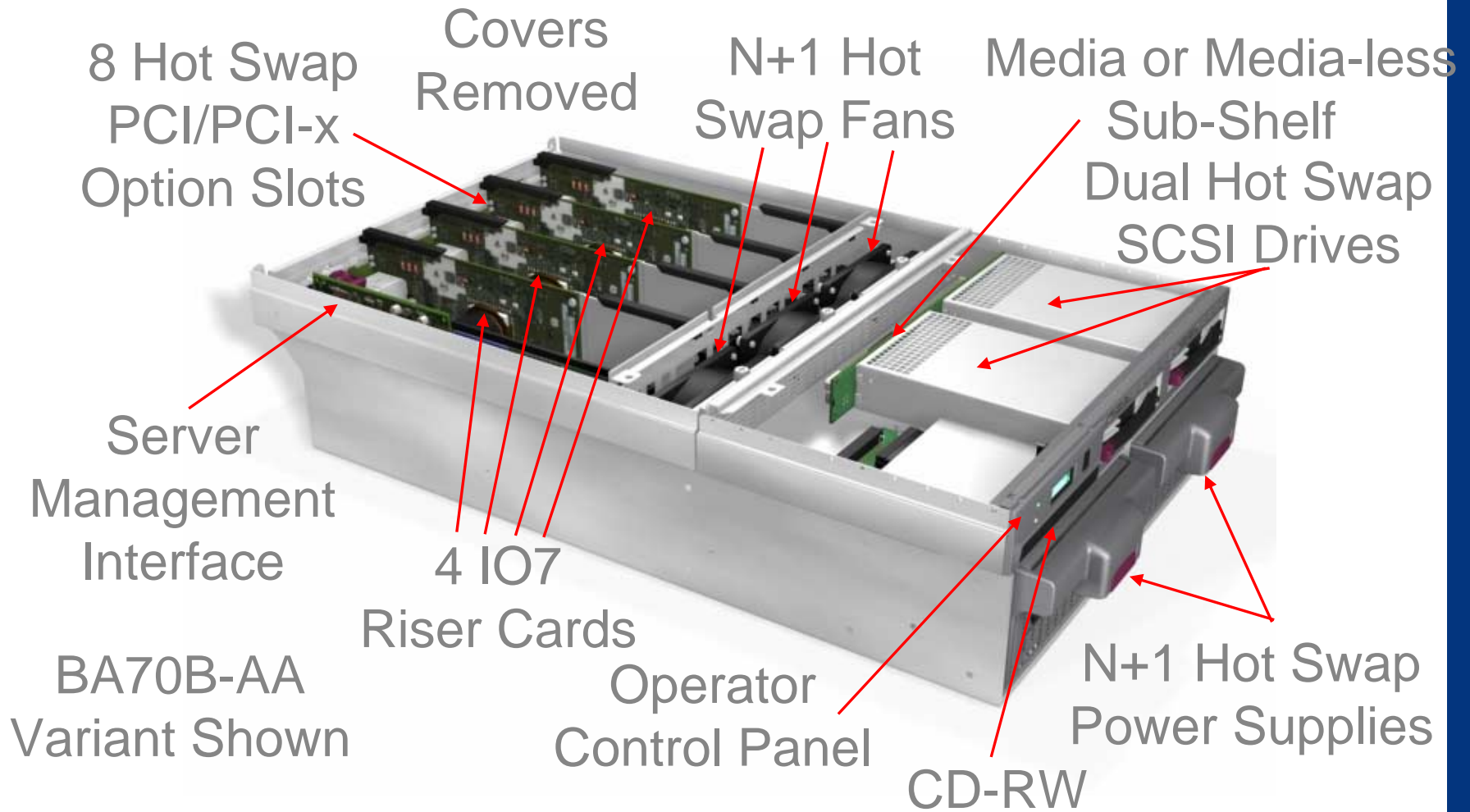
Sits in drive bay above
CD-RW drive



Has LCD, LED's, and
pushwheel

- LCD allows plain English messages to communicate problems
- LED's indicate state of PCI box
- Pushwheel is set to identify box in the rack

High Performance I/O Shelf



High Perf. I/O Building Block

High performance features

- Contains from 1 to 4 IO7 riser cards
- Each IO7 riser card supports two
- point-to-point PCI-x 133 MHz bus slots
- All slots are Hot Swappable
- Up to four IO7-to-EV7 links to provide the highest possible bandwidth back to EV7 processors



BA70B-AA

Restrictions

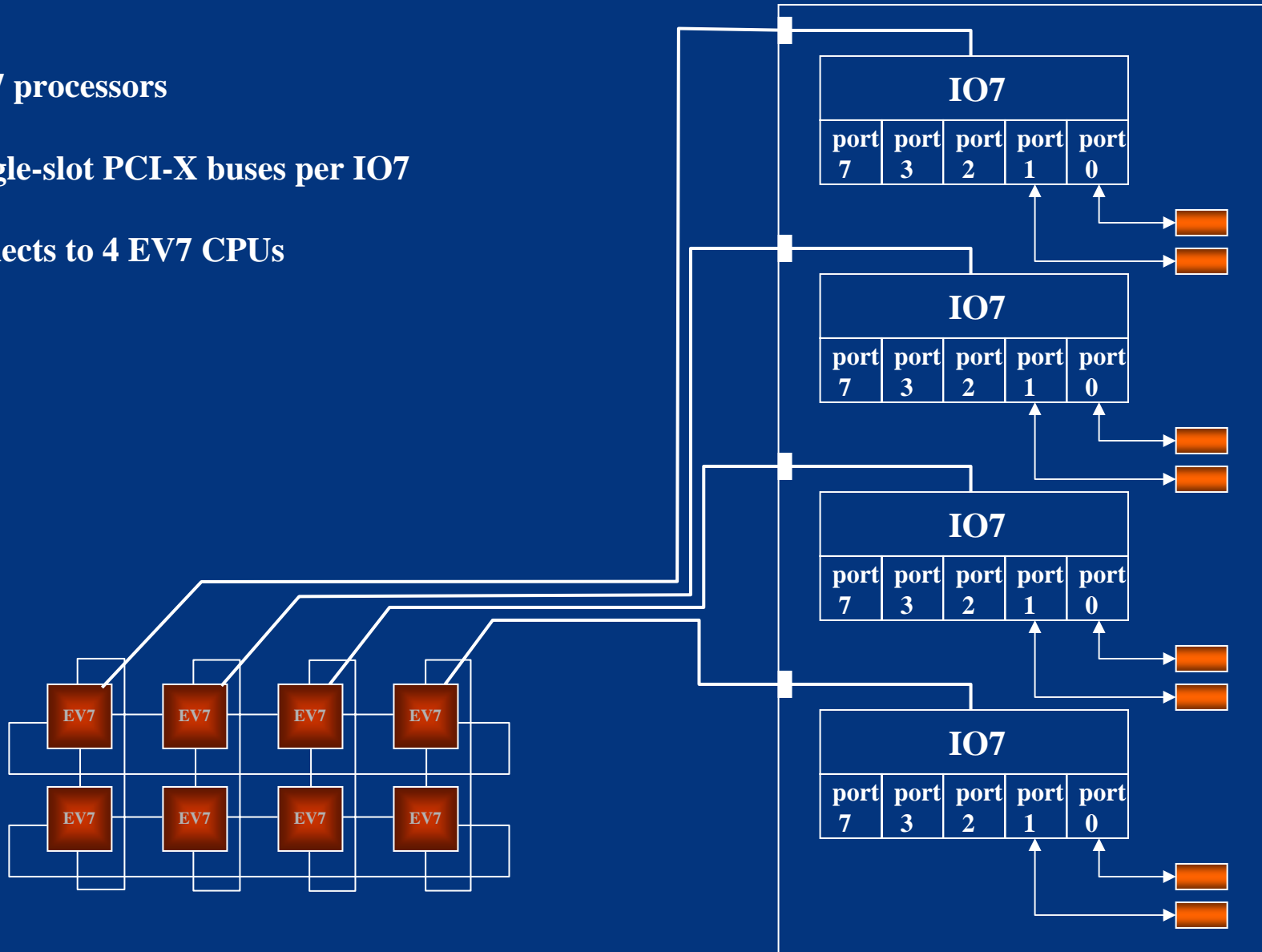
- No support for AGP cards
- 1.6 GB/s up & 1.6 GB/s down (full duplex)
- The -AA variants include media, and therefore a PCI standard I/O module, which consumes one of the 8 slots

High Performance I/O Drawer

4 IO7 processors

2 single-slot PCI-X buses per IO7

Connects to 4 EV7 CPUs

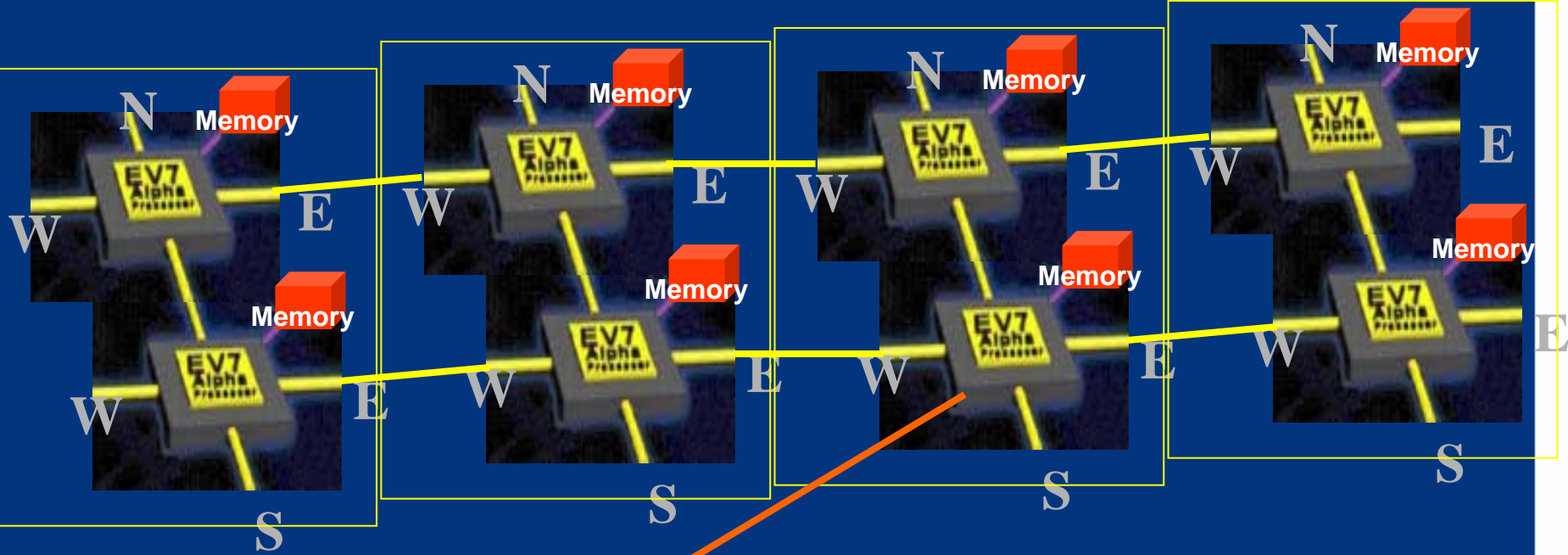


External I/O Expansion Building Block Drawers

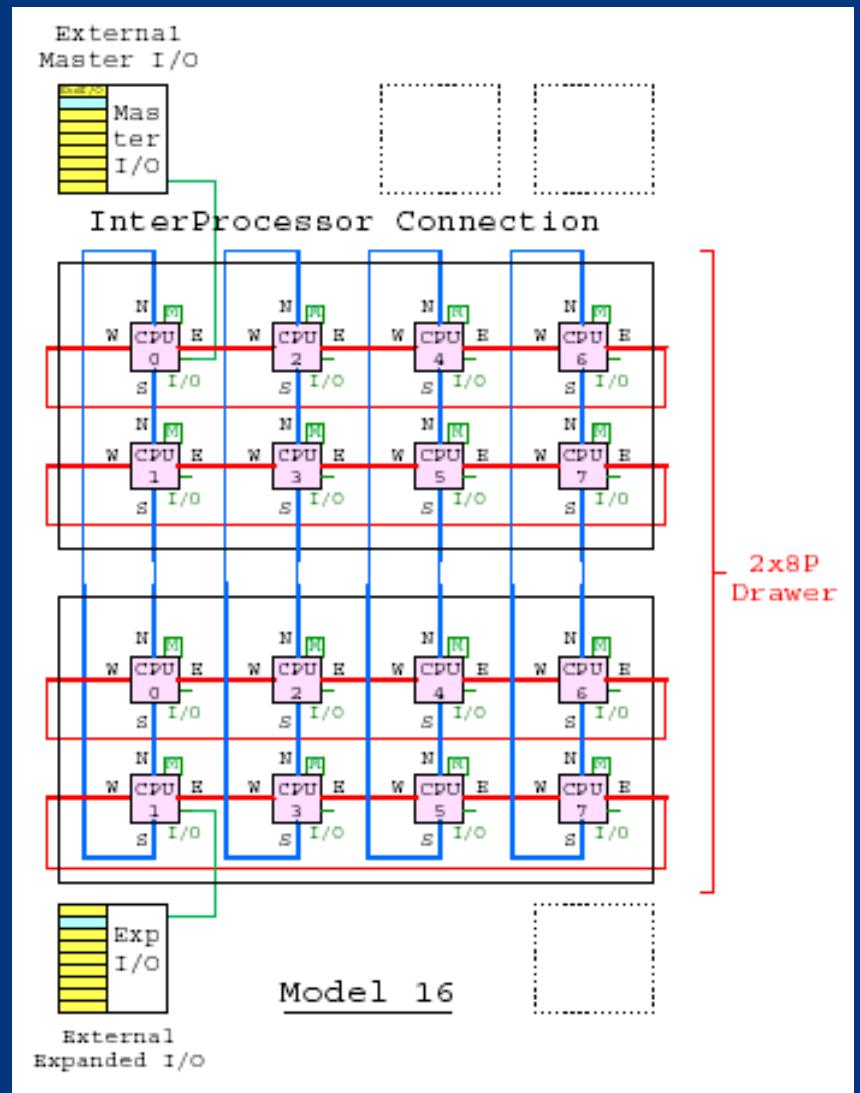


	Standard	Hi-Performance
Total Expansion Slots	12	8
PCI-X Slots		
133 MHz Hot Plug	2	8
66MHz Hot Plug	6	0
66 MHz Non-Hot Plug	1	0
PCI Slots		
33MHz (5v) Non-Hot Plug	2	0
AGP 4X	1	No
Std. I/O Module (SCSI/USB)	Opt.	No
IO7 Modules	1	Up to 4
Buses	4	Up to 8
Hot Swap Fans	Yes	Yes
Hot Swap Power	Yes	Yes
Hot Swap HDDs	Opt. - 2	No
CD-RW	Opt.	No

Building an 8P module



Example GS1280 model 16



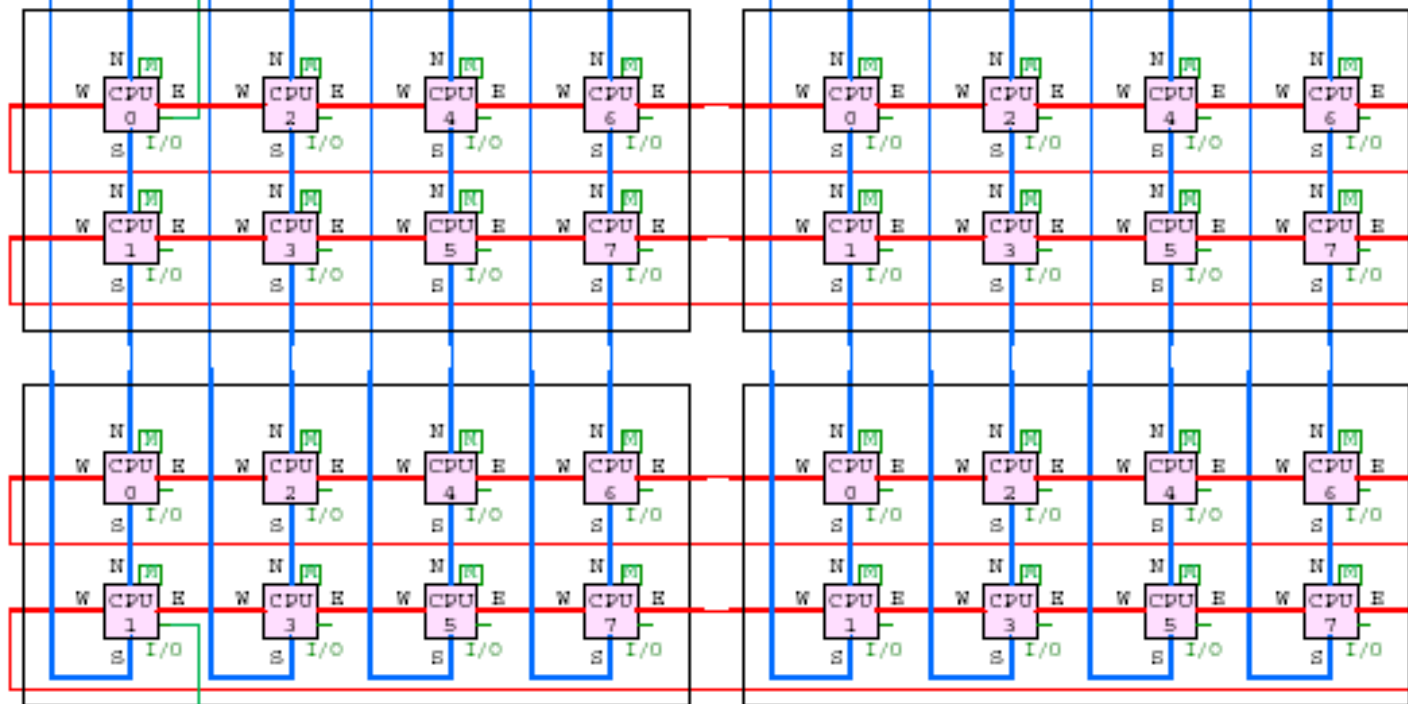
Example GS1280 model 32

External
Master I/O



HP AlphaServer GS1280 Model 32

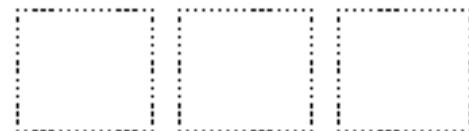
InterProcessor Connection



4x8P
Drawer



Model 32

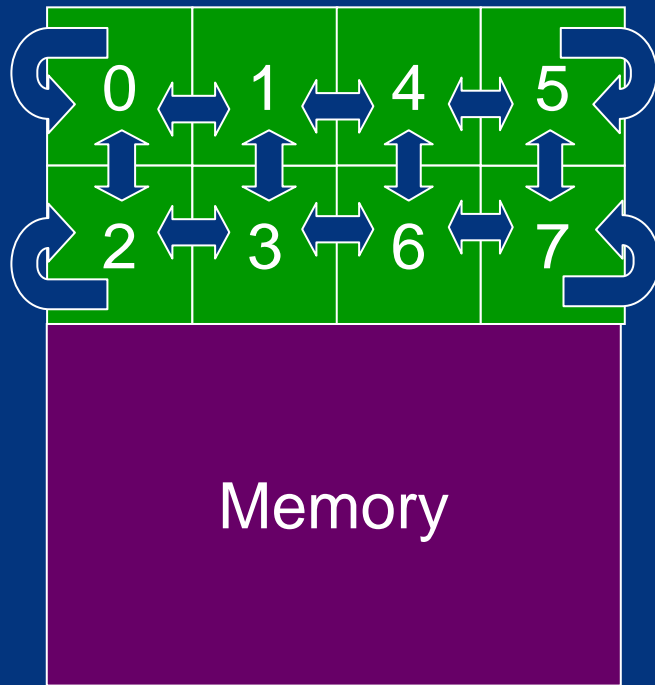


External
Expanded I/O

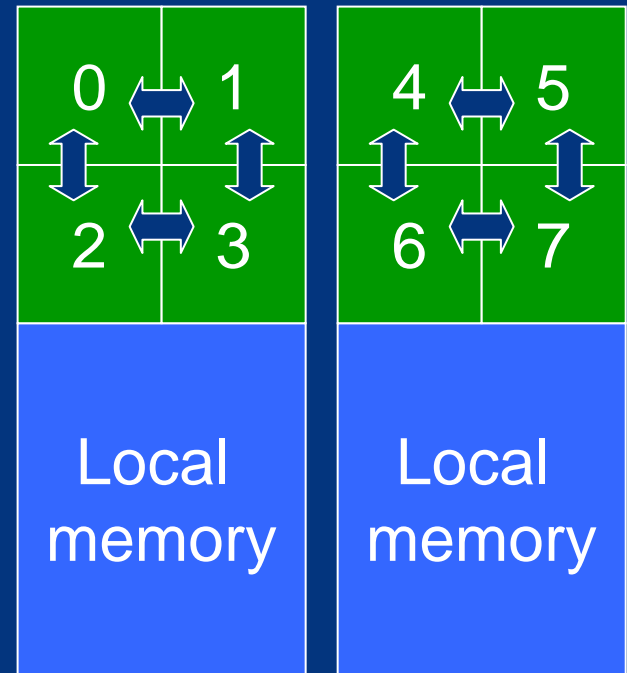


Partitioning

Partition Possibilities

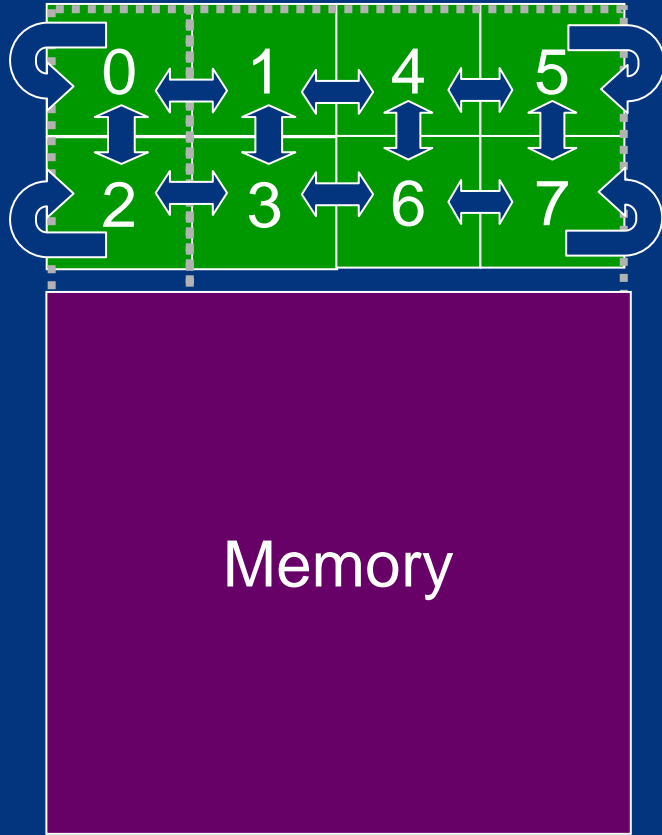


**Single SMP System
(no partitions)**

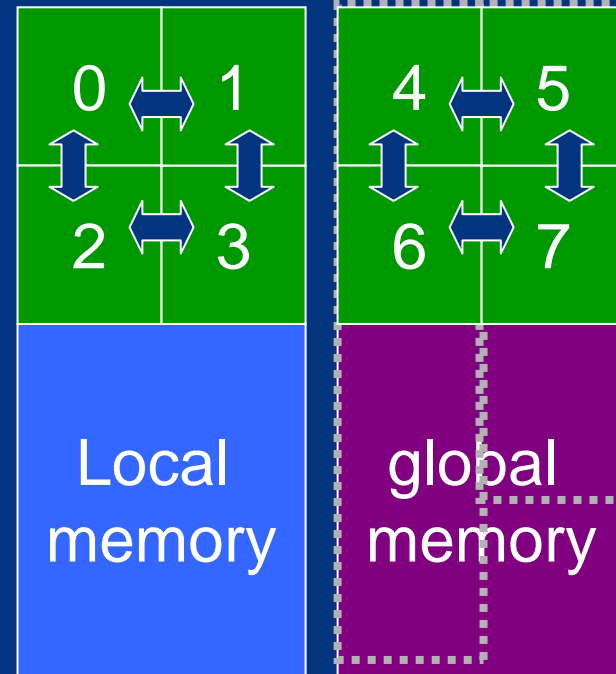


Hard Partitions

Partition Possibilities



Soft Partitions



**A hard partition
containing
2 Soft Partitions**

Flexible Partitioning Options

Hard Partitions

Support multiple independent O/S's

- *OpenVMS, Tru64 UNIX, Linux*

Mesh provides software isolation and hardware fault containment

- Unused links are electrically disabled

Partition granularity as fine as 2 CPUs



Switch-less Mesh Architecture make it possible

Soft Partitions

Integration with workload management ensures high levels of resource utilization

Dynamic resource allocation provides for a more flexible environment to satisfy SLA commitments

Fractional resource allocations

May be used in conjunction with Hard Partitions



Performance

System Performance is not just CPU Performance

CPU, of course, plus;

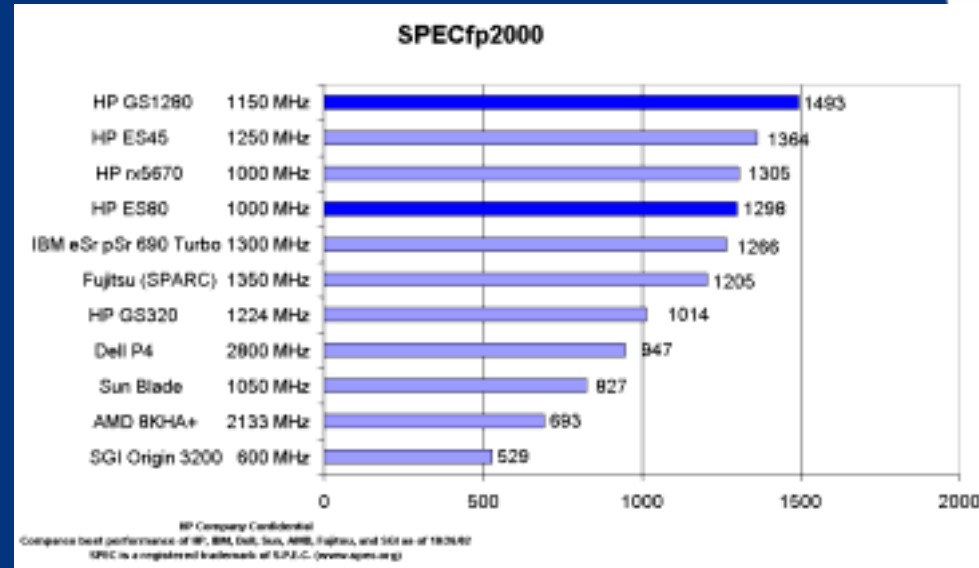
Low latency and high bandwidth memory to keep the CPU busy

High I/O bandwidth to keep up with memory

Low latency and high bandwidth interprocessor network to keep multiple CPUs busy

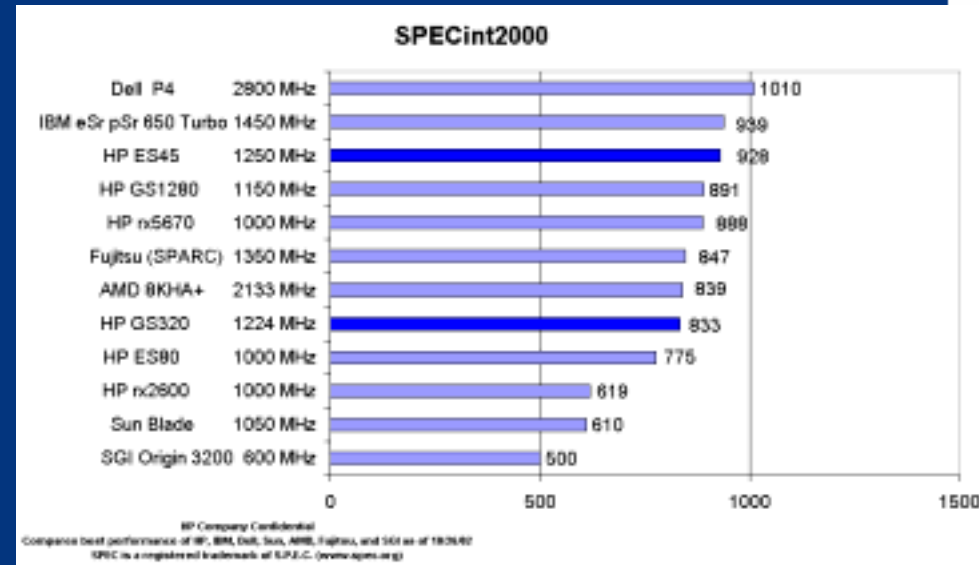
Processor Speed Floating Point

- EV7 at the top of the list
- Slightly better than ES45 at about the same clock speed
- Memory bandwidth of EV7 helps
- Good for HPTC applications



Processor Speed Integer

- Slightly slower than ES45 at about the same clock speed
- Smaller cache penalizes EV7 since benchmarks fit in most other processors' cache
- Comparable to the competition for commercial applications



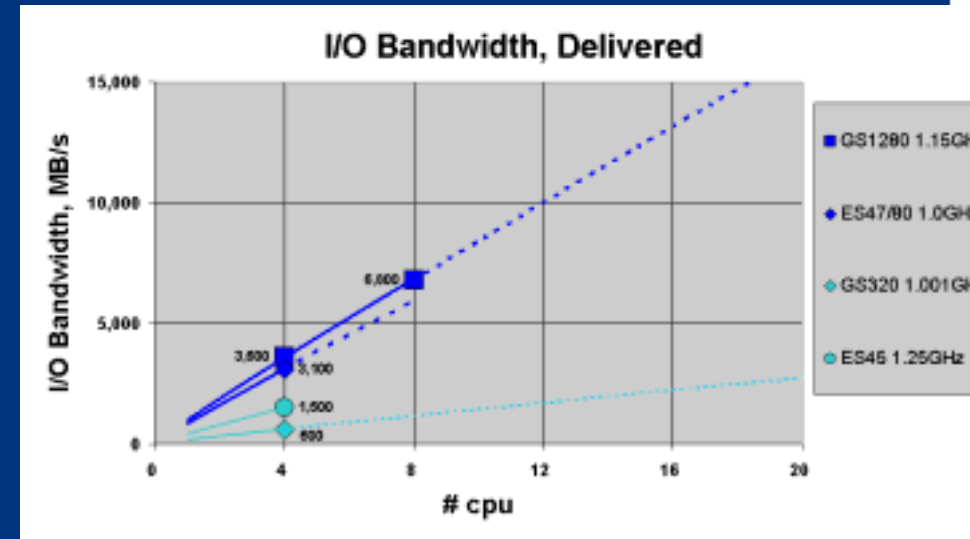
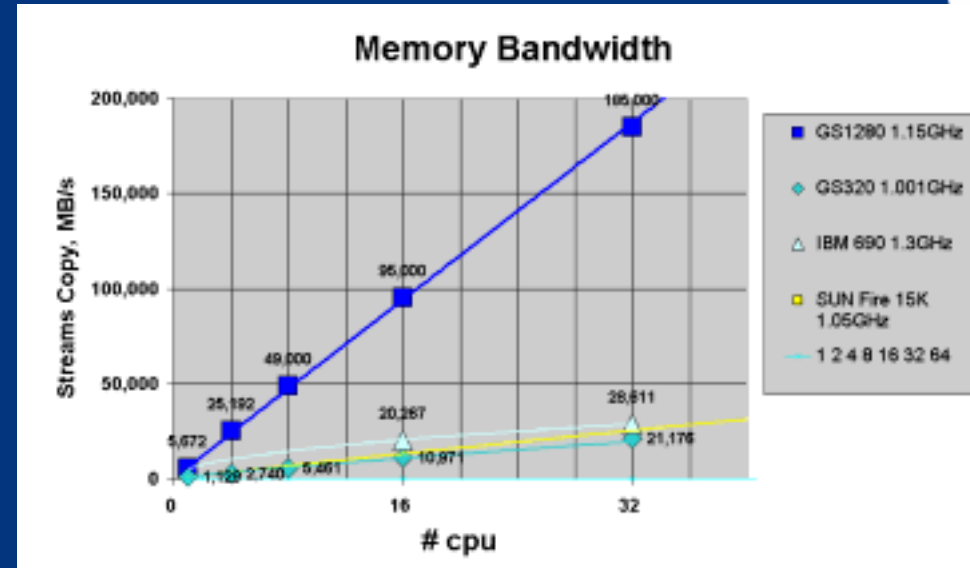
Memory Bandwidth

- EV7 systems in a different class from all the others – 7 times the nearest competitor
- Virtually linear scaling from 1 processor to 32 while competitors roll off near their top ends
- A major advantage in certain HPTC applications – **weather forecasting** and other simulation problems

Memory bandwidth of EV7 makes the difference

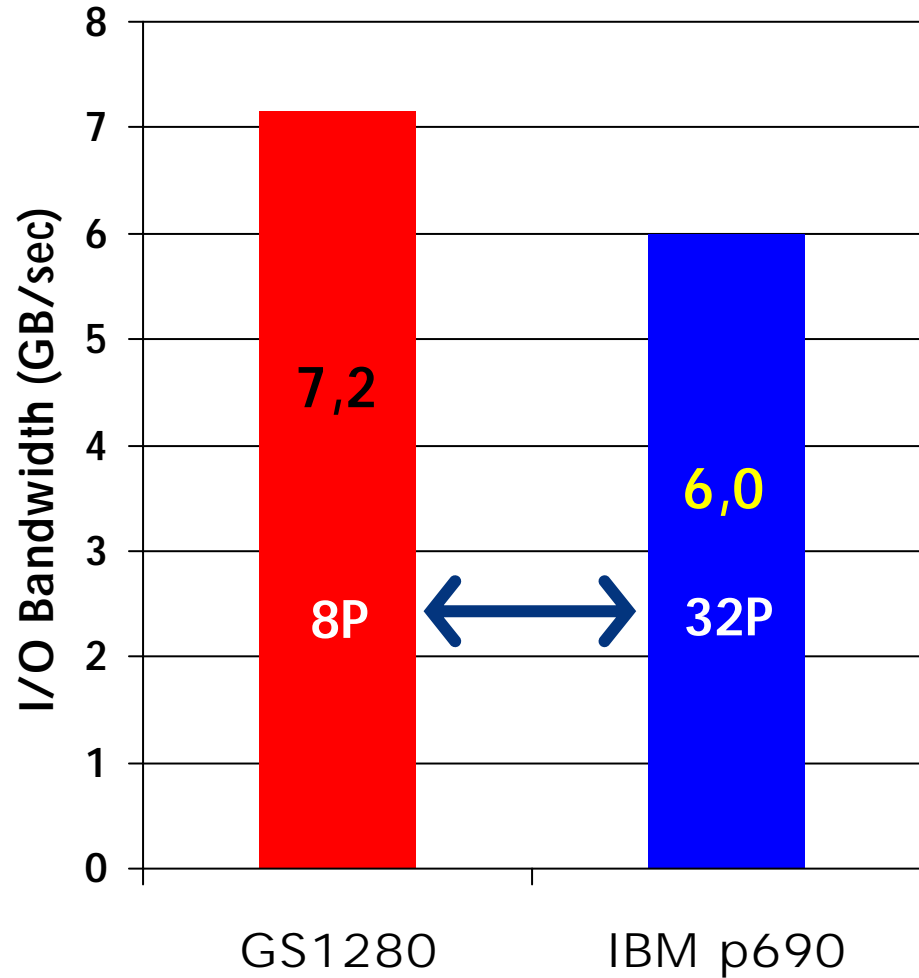
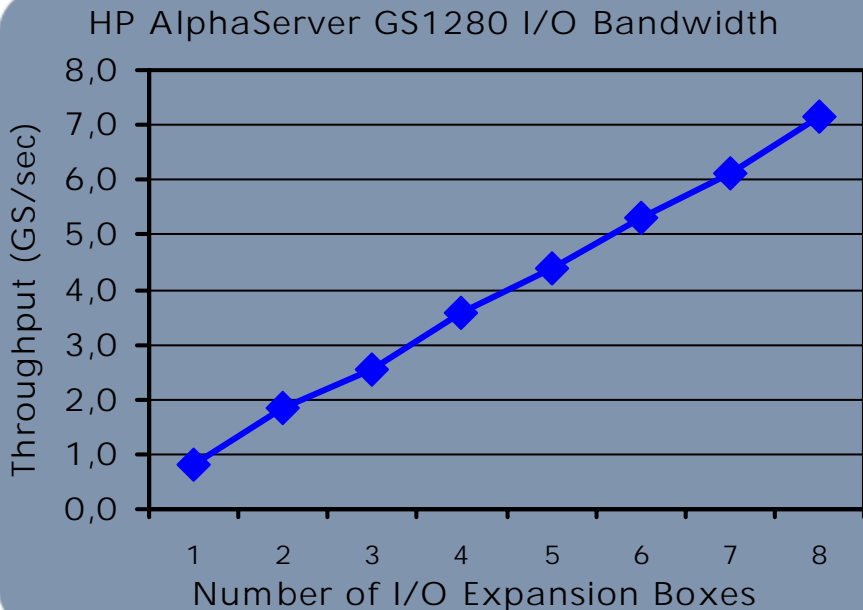
I/O Bandwidth

- ES47 has up to 3 times the I/O bandwidth per processor of the very competitive ES45
- GS1280 has 5 times the I/O bandwidth of the very respectable GS320
- I/O capacity for EV7 systems is modular; customers only pay for capacity they need.
- Large capacity and flexible configuration should prove advantageous in commercial applications



GS1280 vs p690

GS delivers incredible I/O bandwidth that scales linearly with the number of CPUs

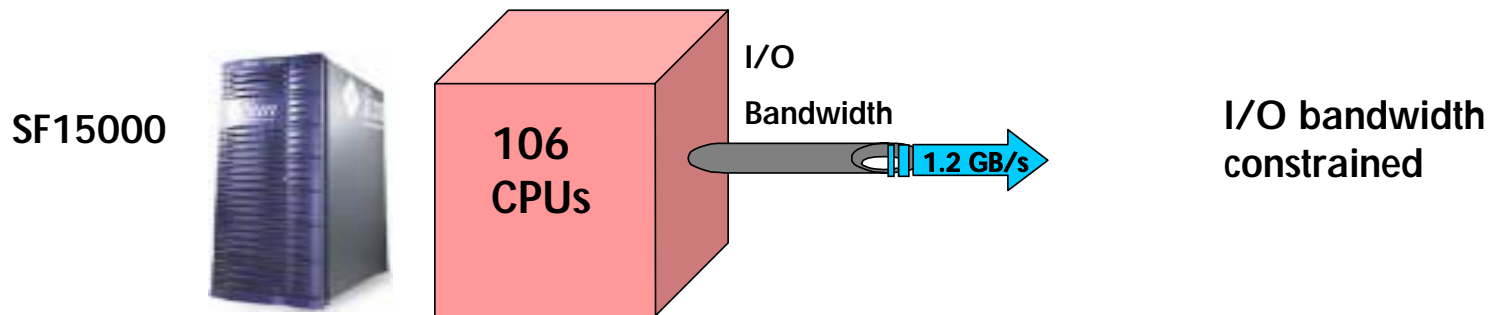
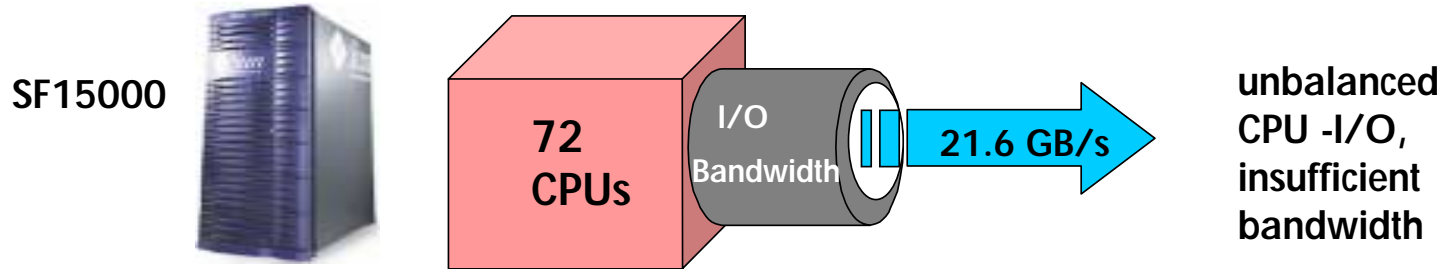
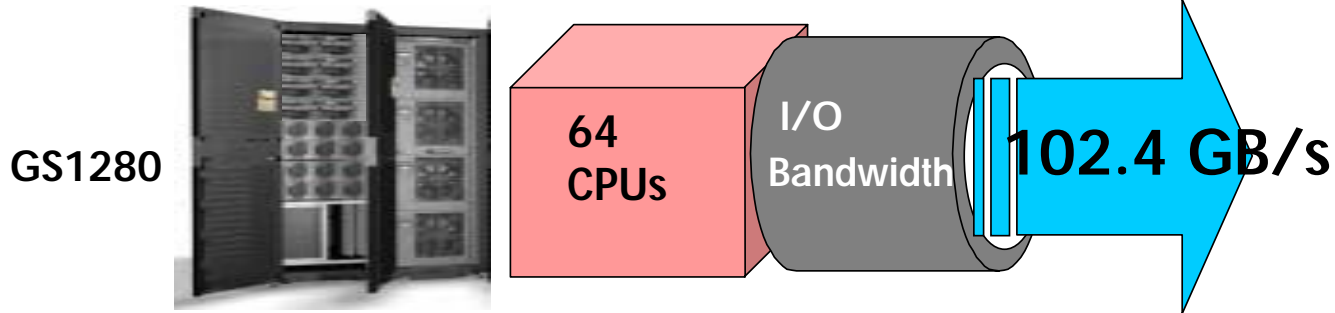


hp AlphaServer results measured
IBM results reported informally

I/O bandwidth comparison SF15K vs GS1280



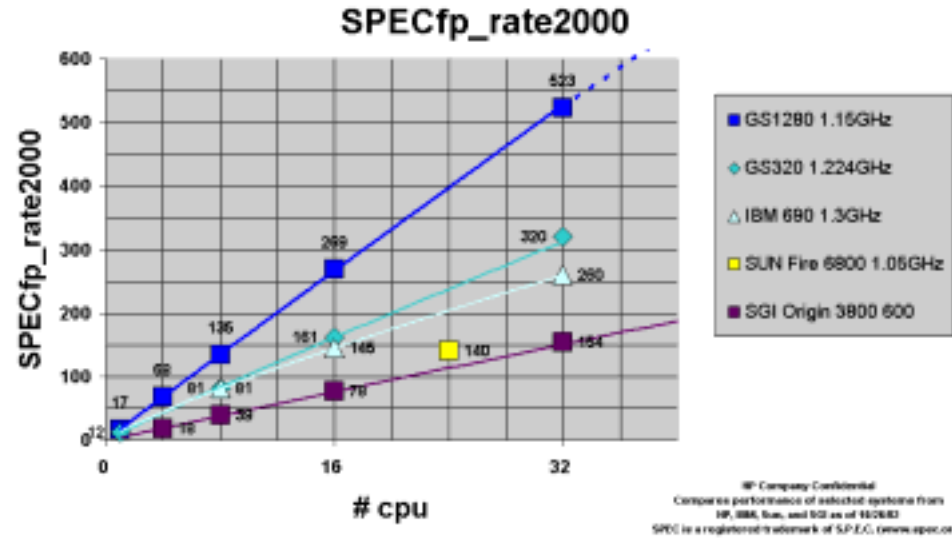
massive I/O bandwidth



System Capacity, GS1280

Floating Point

- GS1280 has twice the capacity of the IBM 690 at 32 processors
- Memory bandwidth of EV7 makes the difference
- Outstanding for HPTC applications

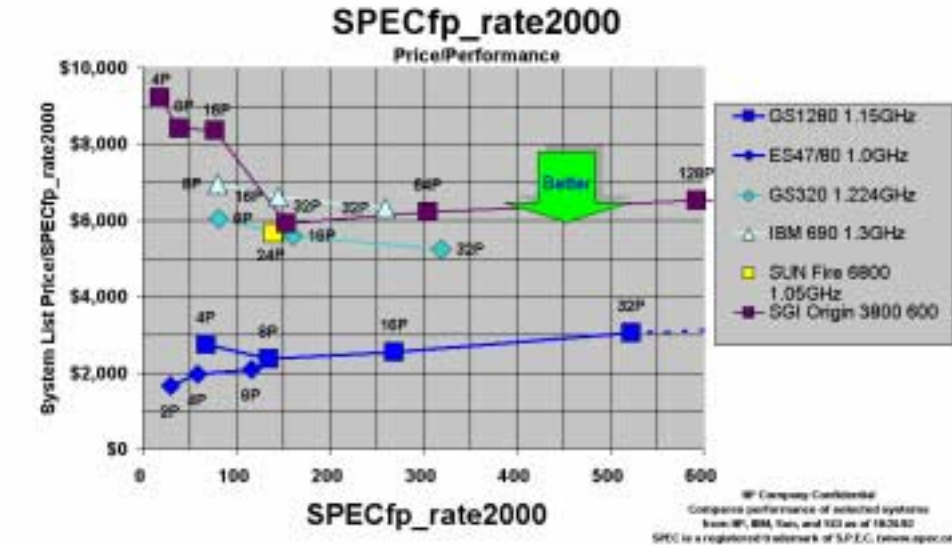


Memory bandwidth of EV7 makes the difference

Price/Performance, GS1280

Floating Point

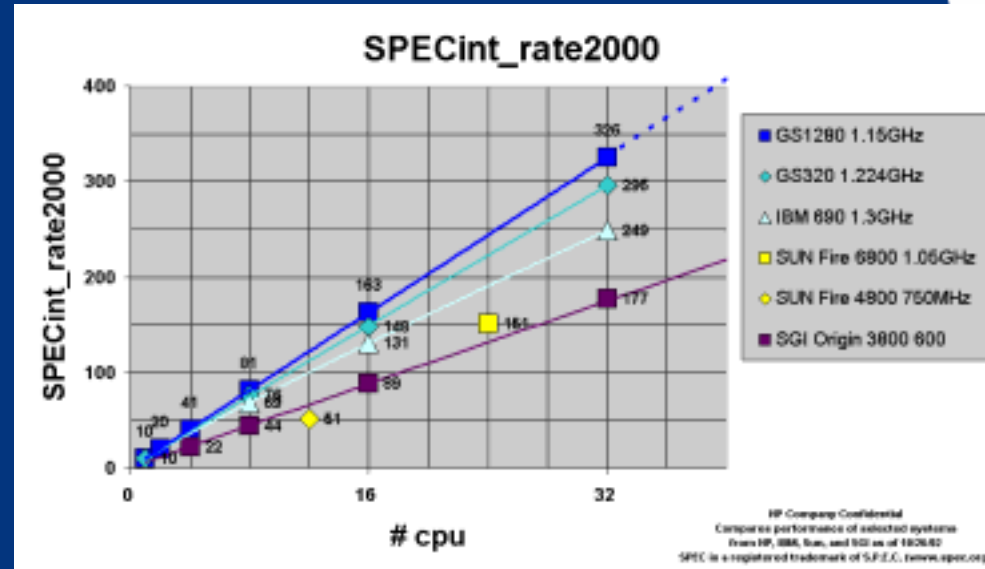
- GS1280 price/performance almost a third that of the IBM 690 and Sun Fire 6800
- GS1280 price/performance *virtually flat* for all configurations; competitive systems only achieve lowest price/performance at full configuration



System Capacity, GS1280

Integer

- GS1280 has 30% more capacity than the IBM 690 at 32 processors
- GS1280 has 65% more capacity than the SUN Fire 6800 at 24 processors

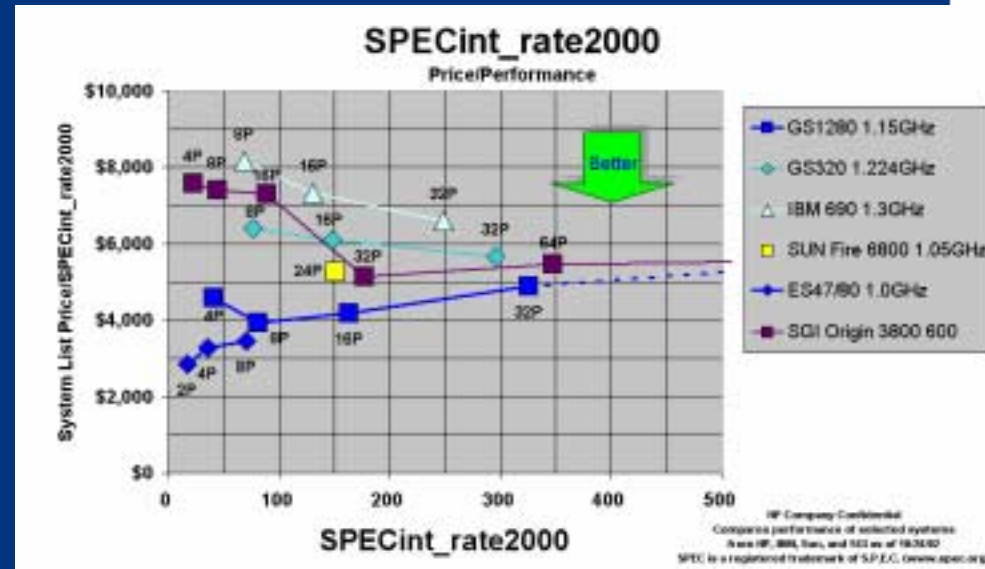


Memory bandwidth of EV7 makes the difference

Price/Performance, GS1280

Integer

- GS1280 price/performance better than SUN Fire 6800
- GS1280 price/performance $\frac{3}{4}$ to $\frac{1}{2}$ of IBM 690
- Price/performance remains flat for the full range of system configurations



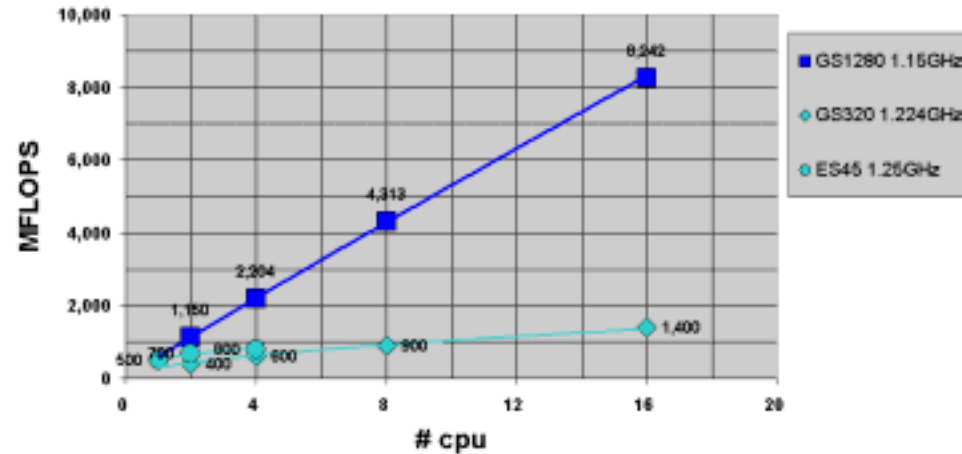
Performance for Technical Applications

Structural Mechanics
Atmospheric Simulation
Nuclear Physics
Fluid Dynamics

Simulation

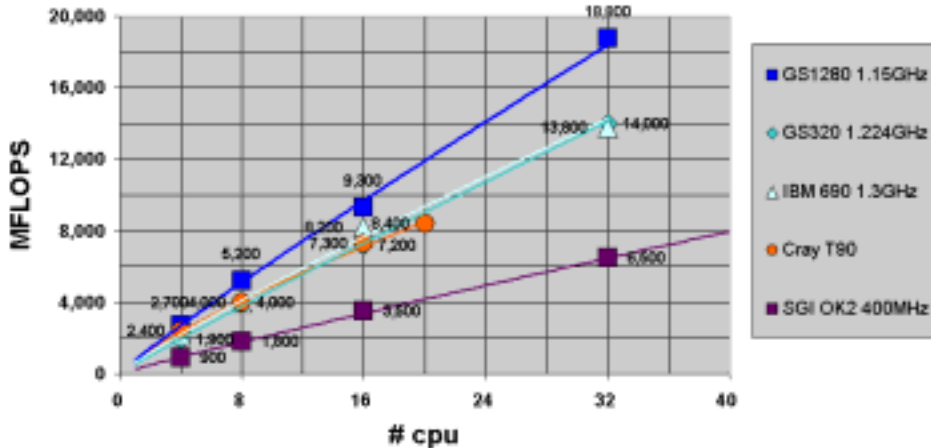
- High memory bandwidth improves relative performance for new AlphaServers on systems with more processors
- New AlphaServer performs better relatively on large problems that do not fit in cache
- Inter-processor bandwidth helps on parallel problems

Structural Mechanics: P3D



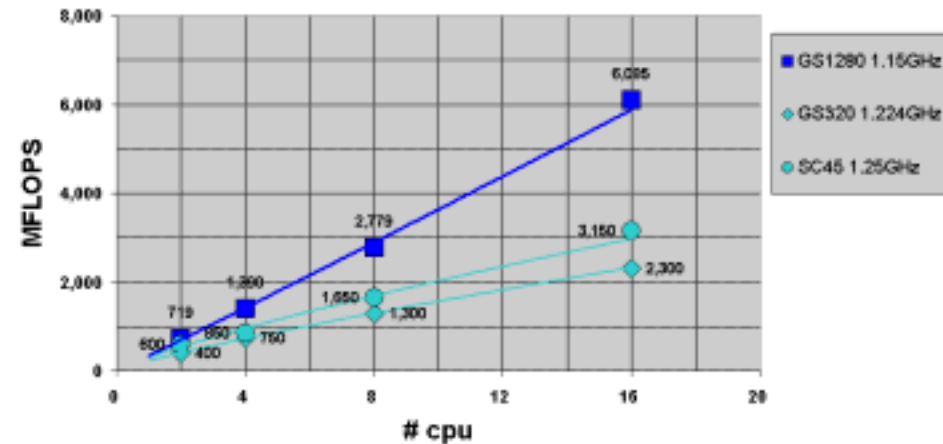
- Structural Mechanics

Weather Prediction: MM5



- Atmospheric Simulation

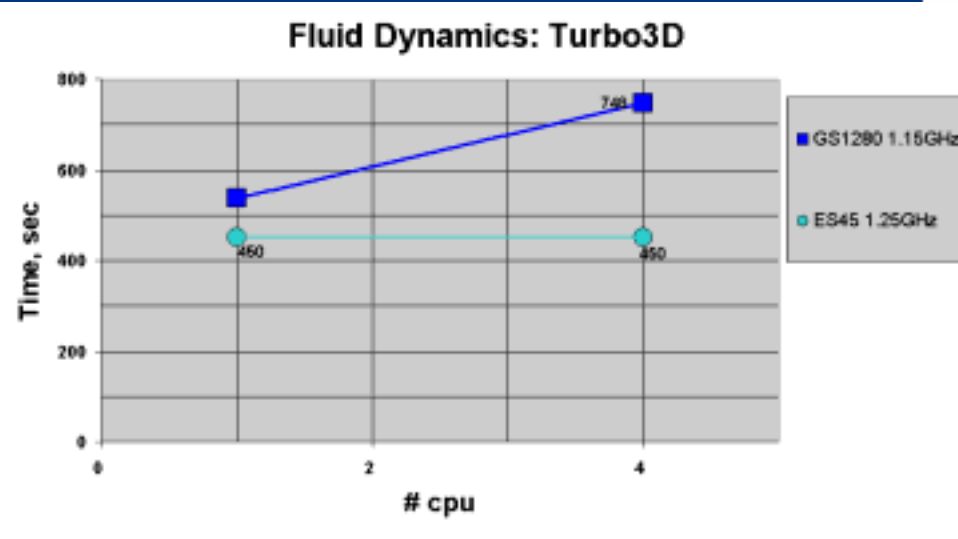
Weather Prediction: LM



- Atmospheric Simulation

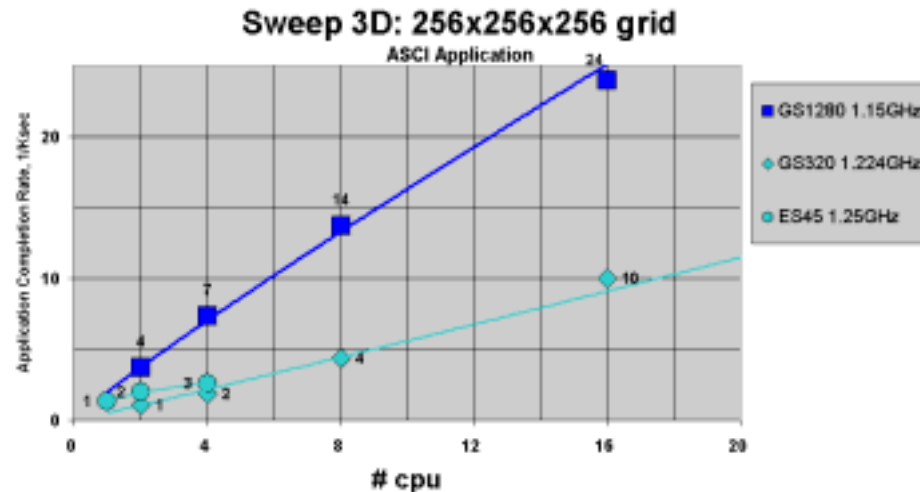
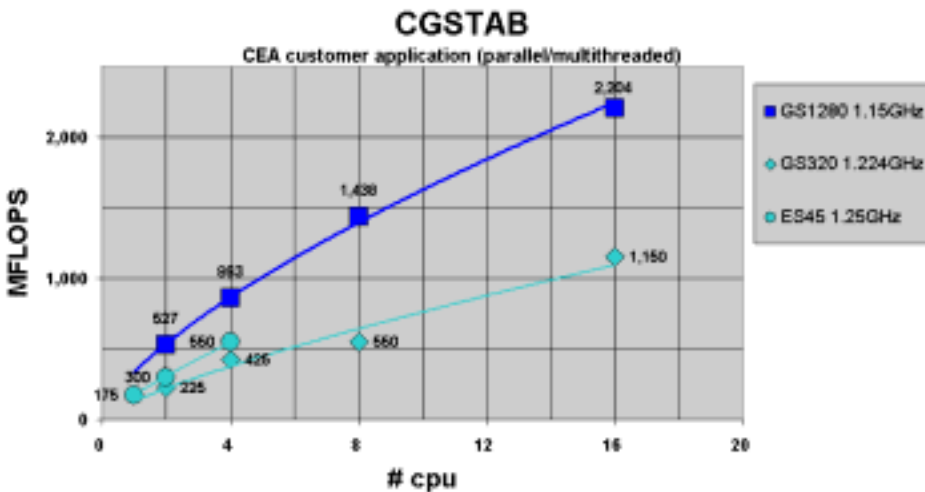
Simulation

- High memory bandwidth improves relative performance for new AlphaServers on systems with more processors
- New AlphaServer performs better relatively on large problems that do not fit in cache
- Inter-processor bandwidth helps on parallel problems



• Fluid Dynamics

Memory bandwidth of EV7 makes the difference

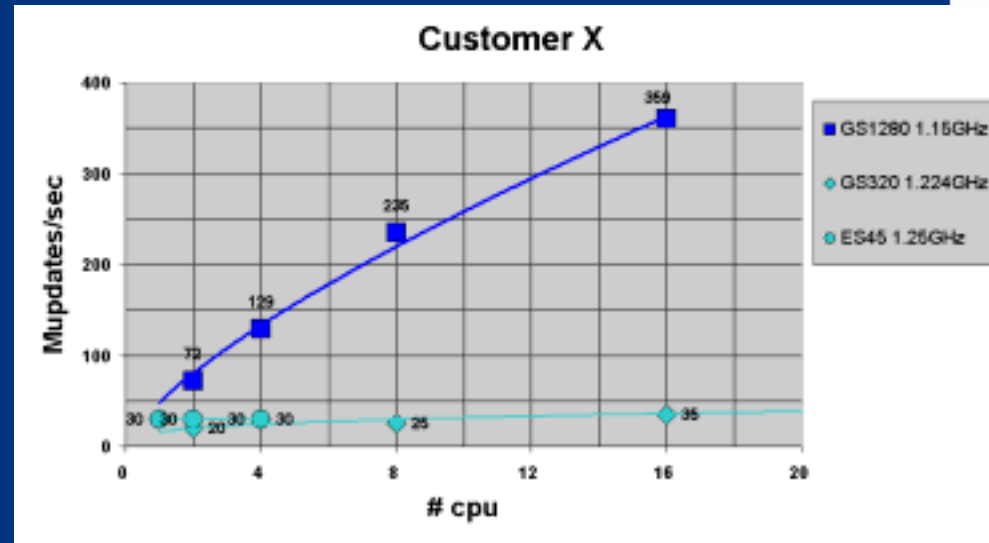


• Nuclear Physics

• Nuclear Physics

Classified Application

- GS1280 substantially faster than ES45
- 3.5 times on 4P
- Takes advantage of high memory and IP bandwidth



Better Performance for Real World Technical Applications

Data for competitive systems not generally available, but GS1280 performance increase relative to ES45 and GS320 ranges from 50% to 100% and more.

ES45 is already a performance leader for technical applications; therefore GS1280 should significantly outperform competitors in technical applications that simulate physical systems.

AlphaServer GS1280 1.15GHz

	1	2	4	8	16	32	64
SPECfp_base2000							
SPECfp_2000	1,493						
SPECint_base2000							
SPECint_2000	891						
SPECfp_rate_base2000							
SPECfp_rate2000	17		68	135	269	523	
SPECint_rate_base2000							
SPECint_rate2000	10		41	81	163	326	
SPECjbb2000	-	-	51,856	99,315	190,205		
SPECsfs97_R1 version2				91,300			
SPECsfs97_R1 version3				59,400			
TpmC, upper bound estimate	18		65	110	210	390	
TpmC, lower bound estimate	16		55	100	180	350	
Streams Copy, MB/s	5,672	-	25,192	49,000	95,000	185,000	360,000
Streams Scale							
Streams ADD							
Streams TRIAD							
Linpack 100x100							
Linpack NxN, Gflops	2	4	7	14	29	56	90

DS15 Product Definition



FRS Q4 2003

DS10/DS15 Product Comparison

	DS10	DS15
Processor	<ul style="list-style-type: none"> • 1 x 617MHz EV67 	<ul style="list-style-type: none"> • 1 x 1GHz EV68CB
Dimensions	<ul style="list-style-type: none"> • 5.1 x 17.6 x 19 inches • 13 x 45 x 48 cm 	<ul style="list-style-type: none"> • 5.1 x 17.6 x 19 inches • 13 x 45 x 48 cm
SPECint2000	<ul style="list-style-type: none"> • 364 – EV67/600 	<ul style="list-style-type: none"> • 500 est.
SPECfp2000	<ul style="list-style-type: none"> • 411 – EV67/600 	<ul style="list-style-type: none"> • 620 est.
Cache	<ul style="list-style-type: none"> • 2MB LW 205MHz 	<ul style="list-style-type: none"> • 2MB DDR 250MHz
Memory	<ul style="list-style-type: none"> • 2GB Maximum • 77MHz – 1.2GB/sec. 	<ul style="list-style-type: none"> • 4GB Maximum • 125MHz – 2GB/sec.
I/O	<ul style="list-style-type: none"> • 4 PCI slots • 64-bit/33MHz • Embedded IDE internal • External SCSI needs PCI card • 2 Embedded 10/100 	<ul style="list-style-type: none"> • 4 PCI slots @ 64-bit/33MHz or 2 slots @ 64-bit/66MHz • Embedded IDE for CD • Embedded dual U3 SCSI • Embedded dual Ethernet
Ports	<ul style="list-style-type: none"> • 2 Ethernet (10/100) • Keyboard, mouse • 2 Comm ports • Parallel port 	<ul style="list-style-type: none"> • 2 Ethernet (10/100) • Keyboard, mouse • 2 Comm ports • No Parallel port • 1 External SCSI port
Storage	<ul style="list-style-type: none"> • Internal storage cage or front access cage 	<ul style="list-style-type: none"> • 4 bays; 2 internal & 2 front access • CD-ROM
O/S Min. Rev.	<ul style="list-style-type: none"> • Tru64 UNIX V4.0f • OVMS V7.1-2 	<ul style="list-style-type: none"> • Tru64 UNIX V5.1A NHD? • OVMS V7.3-1
Enclosure	<ul style="list-style-type: none"> • 3U – Top Gun blue 	<ul style="list-style-type: none"> • 3U – Carbon Black



i n v e n t