Technology Update

HP 9000

Partition Continuum

Itanium

HP-UX

Linux

Windows

servers

HP-UX product family

high-end	Superdome
mid-range	rp7410 rp8400
entry-level	rp2400 rp5400 *Itanium* rx2600 *Itanium* **Coming rx4640 – 3u** rx5670

hp server naming decoder ring
numeric digits

hp server aadddd

00 - 90 relative capacity & "newness" (upgrades, etc.)

Unique number for each architecture to ensure different systems do not have the same numbering across architectures

1-9 identifies family and/or relative positioning

rp2400 Series
rp2430
rp2470

(1 and two-way)

a closer look at the rp2430 and the rp2470

	hp server rp2430 for the best entry price	hp server rp2470 for the best performance
processors	1 way PA-8700 650MHz	1-2 way PA-8700 650MHz or 750MHz
relative OLTP performance*	*0.45	*1.00
memory	up to 2GB SDRAM	up to 8GB SDRAM
bandwidth	1.9 GB/s system and memory buses, 1.3 GB/s I/O bus	1.9 GB/s system and memory buses, 1.9 GB/s I/O bus
pci slots	2 (64-bit, 66 Mhz)	4 (64-bit, 66 Mhz)
internal storage	up to 146 GB	up to 146GB
operating system	HP-UX 11.0, HP-UX 11i	HP-UX 11.0, HP-UX 11i

*relative OLTP performance: relative to rp2470 (750MHz) 27,000 OLTP estimate
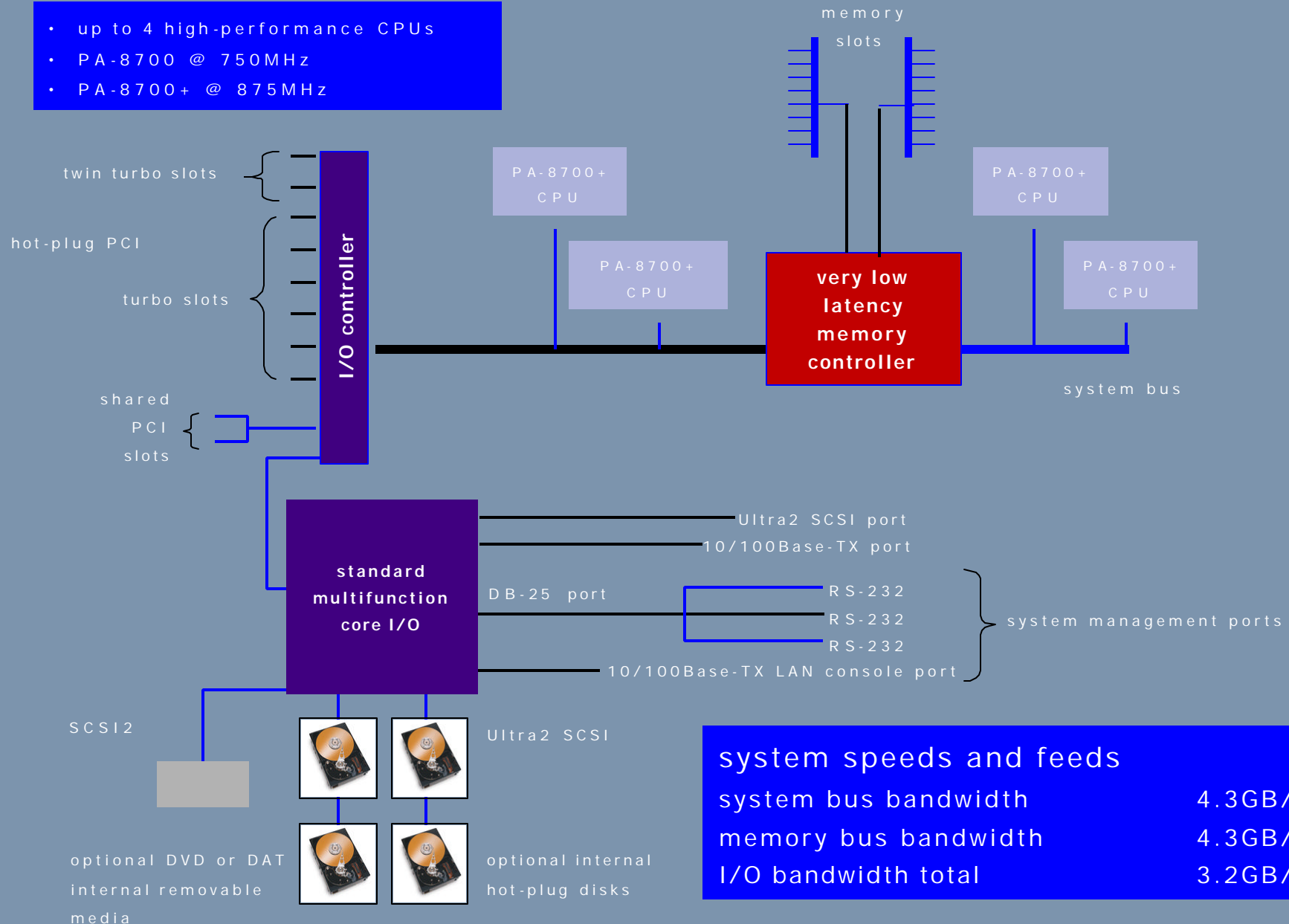
hp server rp5430
hp server rp5470
hp server rx5670
4-way

(1 and 2-way already
covered)

rp5470 architecture

- up to 4 high-performance CPUs
- PA-8700 @ 750MHz
- PA-8700+ @ 875MHz

memory slots

twin turbo slots

hot-plug PCI

turbo slots

I/O controller

PA-8700+ CPU

PA-8700+ CPU

very low latency memory controller

PA-8700+ CPU

PA-8700+ CPU

system bus

shared PCI slots

standard multifunction core I/O

Ultra2 SCSI port

10/100Base-TX port

DB-25 port

RS-232

RS-232

RS-232

system management ports

10/100Base-TX LAN console port

SCSI2

Ultra2 SCSI

optional DVD or DAT internal removable media

optional internal hot-plug disks

system speeds and feeds

system bus bandwidth	4.3GB/s
memory bus bandwidth	4.3GB/s
I/O bandwidth total	3.2GB/s

a closer look at the rp5430 and rp5470

	hp server rp5430 for the best entry price	hp server rp5470 for the best performance
processors	1-2 way PA-8700, 750MHz or PA-8700+ 875MHz	1-4 way PA-8700, 750MHz or PA-8700+ 875MHz
relative OLTP performance*	*0.9	*1.6
memory	up to 8GB SDRAM	up to 16GB SDRAM
bandwidth	4.3 GB/s system & memory buses, 2.3GB/s I/O bus	4.3 GB/s system & memory buses, 3.2GB/s I/O bus
pci slots	6 (4 turbo, 2 twin turbo)	10 (6 turbo, 2 twin turbo, 2 shared)
internal storage	up to 292GB	up to 292GB
operating system	HP-UX 11.0, 11i for PA-8700 HP-UX 11i only for PA-8700+	HP-UX 11.0, 11i for PA-8700 HP-UX 11i only for PA-8700+

*relative OLTP performance: relative to rp5470 (550MHz) 34,288 tpm-c benchmark

delivering on our promise

"investment protection only hp can deliver"

rp5400

rp5430

rp5450

rp5470

PA-8500
PA-8600
PA-8700

Itanium 2-based server

rx5670

the world's only in-box upgrade from an existing RISC server to an Itanium 2-based server!

"Madison" Platform – 4way (rx4640 – "Mt. Diablo")

- 4-way, 4U form-factor
  - 2X density over rx5670
- 7 PCIX slots total
  - All point-to-point, no sharing
  - All customer-usable (core I/O separate)
- 24 DIMM slots
  - 1GB and 2GB DIMMs available
- Availability: 2Q03

rp7410 8-way

**(8 processor
1 and 2-way,
and 8-way
already covered)**

Hewlett-Packard introduces
the hp server rp7410

rp7410—
the technology

winning physical specifications

- high density (10U form factor)
- rack-optimized and stand-alone
- optimum power requirements
- fits into 3rd-party racks
- optimum upgrade/service time
- front and back server access
- sophisticated cable mgmt.

unmatched system features

- 2- to 8-way industry-leading PA-8700 CPUs at 650 ,750 , and 875MHz
- high-end cell board architecture
- hardware and virtual partitions
- 32-GB main memory
- 15 PCI slots and 2 core I/Os
- 4 internal hot-plug HDDs
- 1 internal hot-plug removable media peripherals
- 2N hot power supply solution

high availability

- hot-plug cell boards
- OLAR PCI cards
- doorbell PCI card functionality*
- N+1 OLR fans
- 2N OLR power supplies
- failover system console functionality*
- ECC on all CPU, memory and bus paths
- CPU and memory deallocation
- memory chip-kill-like technology
- EMS monitor/diagnostic
- 2N input power – dual grid support

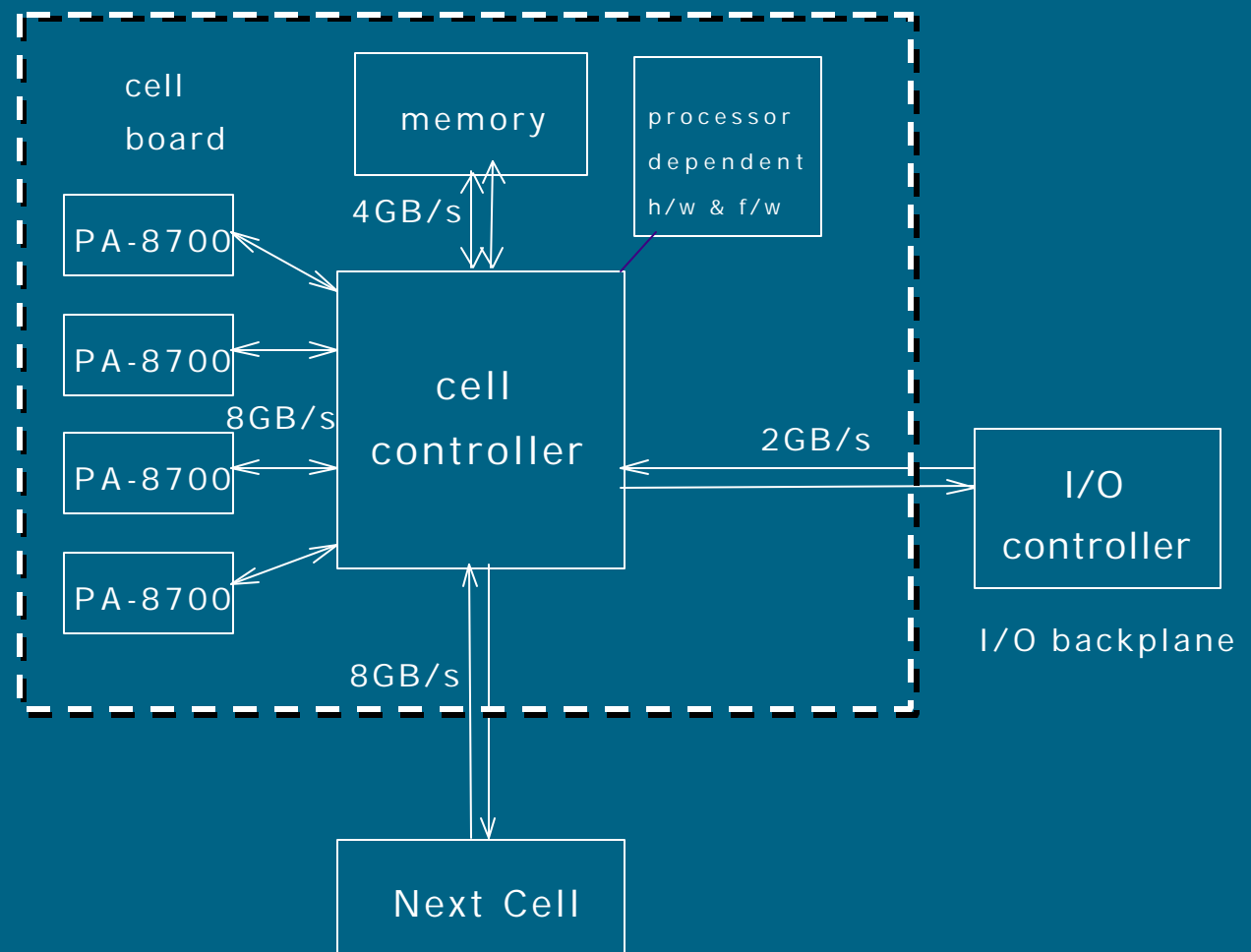*estimated availability mid/02

rp7410 system architecture building blocks: cell board

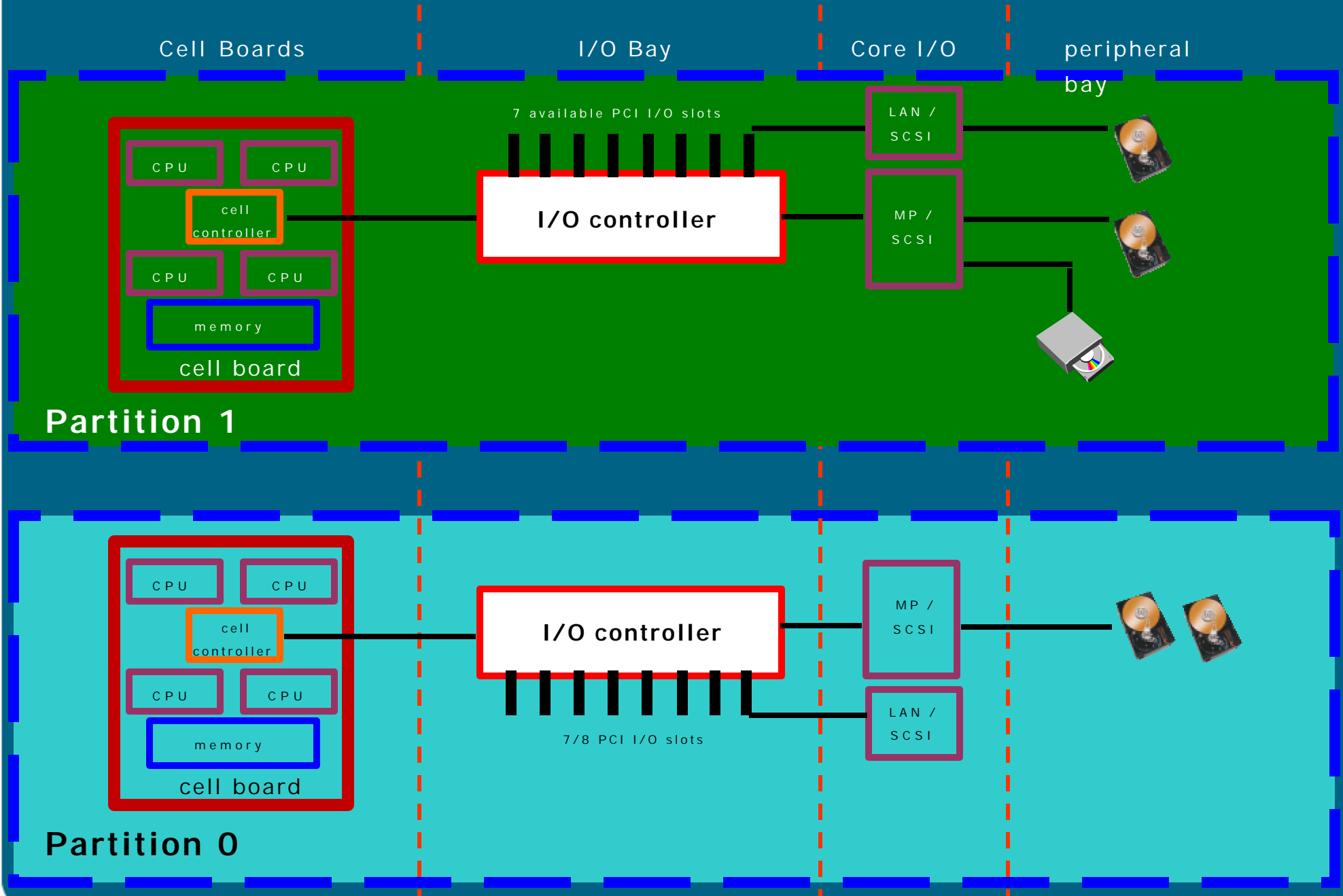rp7410 is a
cell-based system

Interchangeable with
the rp8400 cell

a cell consists of:

- 4 CPUs
- 2 to 16 GB of
  memory with
  128-MBit DRAMs)
- link to PCI I/O slots
  and adjacent cell

cell
board

memory

processor
dependent
h/w & f/w

4GB/s

PA-8700

PA-8700

cell
controller

8GB/s

2GB/s

PA-8700

I/O
controller

PA-8700

8GB/s

I/O backplane

Next Cell

rp7410 system architecture - Partitioned

Cell Boards   I/O Bay   Core I/O   peripheral bay

Partition 1

CPU   CPU

cell controller

CPU   CPU

memory

cell board

7 available PCI I/O slots

I/O controller

LAN / SCSI

MP / SCSI

Partition 0

CPU   CPU

cell controller

CPU   CPU

memory

cell board

I/O controller

7/8 PCI I/O slots

MP / SCSI

LAN / SCSI

rp7410

evolution in hp's 8-way leadership

better performance and functionality with a flexible growth path!

|	rp7400	rp7410
partitions	virtual	virtual and hardware
I/O	12 PCI slots	15 PCI slots
core I/O	1	2 with fail-over capabilities
memory	32 GB	64 GB*
aggregated bandwidth	20 GB/s	32 GB/s
serviceability/ accessibility	requires all-sides access	front access no tools
depth	35 inch.	29 inch.
architecture	bus architecture	high-end cell-board
power solution	N+1 solution	2N+1 dual grid solution
internal peripherals	2 HDDs	4 HDDs and 1 removable

hp rp7410: built to scale

q2 2002
- PA-8700
- hp-ux 11i
- 8-way
- 32GB RAM
- 15 I/O slots
- configurable partitions
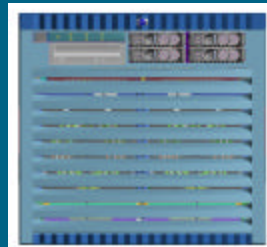
2H02
- PA-8700+
- New I/O cards
- 64GB RAM
- vPars
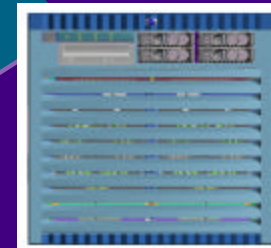
2003
- IItanium
- PA-8800
- 16 CPUs
- PCI-X
- Linux
- Windows
- dynamic partitioning

rp8400 16-way— the technology
(8 processor 1 and 2-way, 4 way, and 8-way already covered)
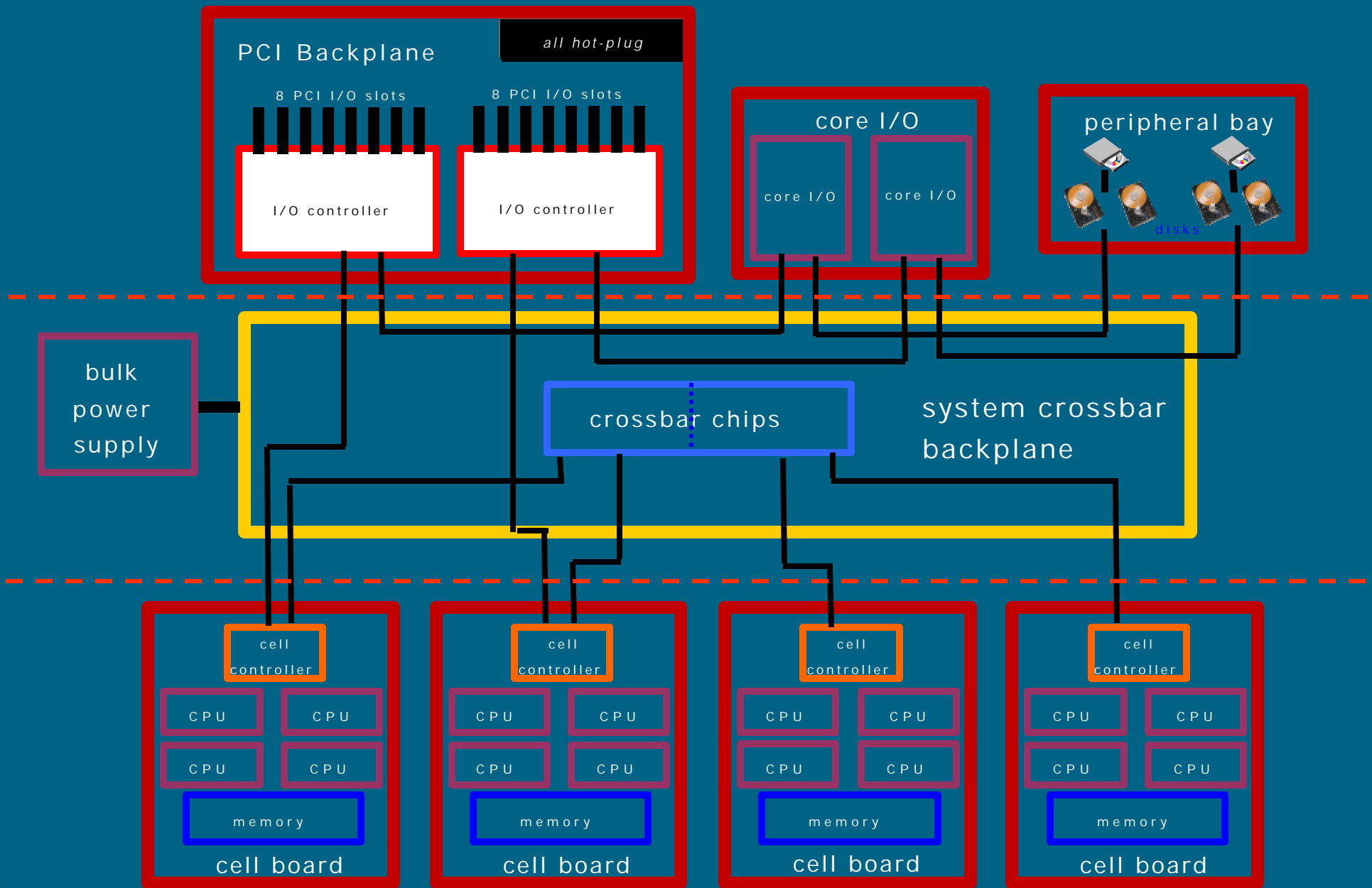

winning physical specifications

- high density (17U form factor)
- rack-optimized and stand-alone
- optimum power requirements
- fits into 3rd-party racks
- optimum upgrade/service time
- front and back server access
- sophisticated cable mgmt.

unmatched system features

- 2- to 16-way industry-leading PA-8700 CPUs at 650,750 and 875 MHz
- superdome high-end cell board architecture
- hardware and virtual partitions
- 64-GB main memory
- 16 PCI slots and 2 core I/Os
- 4 internal hot-plug HDDs
- 2 internal hot-plug removable media peripherals
- 2N+1 power supply solution

high availability

- hot-plug cell boards
- OLAR PCI cards
- doorbell PCI card functionality*
- N+1 OLR fans
- 2N+1 OLR power supplies
- failover system console functionality*
- ECC on all CPU, memory and bus paths
- CPU and memory deallocation
- memory chip-kill-like technology
- EMS monitor/diagnostic
- 2N input power – dual grid support

*estimated availability 1H02

rp8400 system architecture

PCI Backplane

all hot-plug

8 PCI I/O slots

8 PCI I/O slots

I/O controller

I/O controller

core I/O

core I/O

core I/O

peripheral bay

disks

bulk power supply

crossbar chips

system crossbar backplane

cell controller

cell controller

cell controller

cell controller

CPU	CPU
CPU	CPU

memory

cell board

CPU	CPU
CPU	CPU

memory

cell board

CPU	CPU
CPU	CPU

memory

cell board

CPU	CPU
CPU	CPU

memory

cell board

hp rp8400 Directions

- 16-way
- PA8700

- 16-way
- higher-speed PA8700

- 16/32-way
- PA-8800

- 16/32-way Madison Itanium chip

- 16/32-way PA-8800+

2004

2002

Non-disclosure MUST be signed before viewing

Features subject to change

HP Confidential

hp superdome family

16-way rp8400

2 to 16 CPUs
4 to 64 GB RAM
24 to 48 PCI slots
1 to 4 nPartitions

32-way

4 to 32 CPUs
8 to 128 GBs RAM
24 to 48 PCI slots
1 to 4 nPartitions

64-way

8 to 64 CPUs
16 to 256 GBs RAM
48 to 96 PCI slots
1 to 8 nPartitions

64-way with I/O
Expansion Cabinet

8 to 64 CPUs
16 to 256 GBs RAM
48 to 192 PCI slots
1 to 16 nPartitions

Flexible specification options to scale with your business needs

hp superdome

Performance & scalability
- single cabinet:
    - 32, 64 CPUs
    - 64, 128, 256 GBs
- 48, 96, 192 PCI slots
- HP-UX 11i OS
- management, security and e-services software

Partitioning continuum
- hp hyperplex
- nPartitions (up to 16)
- virtual partitions
- resource management

Utility technology & pricing
- iCOD
- utility pricing

High availability
- N+1 OLR fans
- N+1 OLR power supplies
- dual power source
- OLAR CPU, memory
- OLAR PCI I/O cards
- parity protected I/O data paths
- ECC on all CPU and memory paths
- dynamic processor resilience
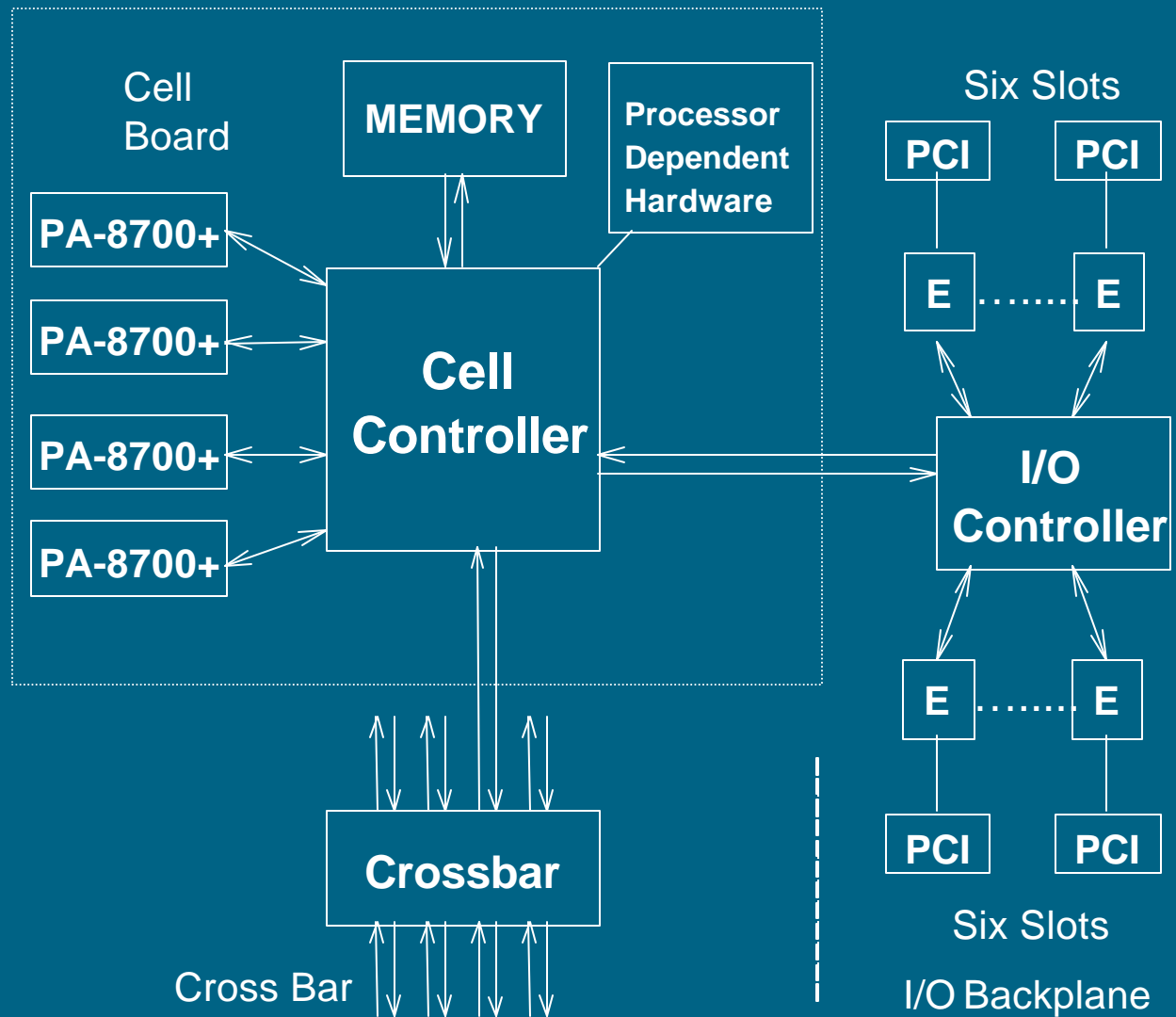- dynamic memory resilience

Built for the future
- initial release: PA-8700
- future releases: PA-RISC & Itanium
- Multi-OS: HP-UX, Linux and Windows

superdome cells

superdome is a cell-based hierarchical cross-bar system.

A cell consists of
➔ 4 CPUs
➔ 2 to 16GBs of Memory
➔ A link to 12 PCI I/O Slots (optional)

Cell Board

MEMORY

Processor Dependent Hardware

PA-8700+

PA-8700+

PA-8700+

PA-8700+

Cell Controller

Crossbar

Cross Bar

I/O Controller

Six Slots

PCI   **PCI**

E .... E

E .... E

PCI   **PCI**

Six Slots

I/O Backplane

Superdome Investment Protection and Upgrade Example

Partition 1
12 CPUs

Partition 2
8 CPUs

Partition 3
8 CPUs

PA8600	PA8600	PA8600
Cell 1	Cell 2	Cell 3

PA8700	PA8700
Cell 4	Cell 5

PA8700+	PA8700+
Cell 6	Cell 7

Partition 1: keep PA8600s for investment protection

Partition 3: upgrade to PA8700+ in month 4

Partition 2: upgrade to PA8700 in month 1

Can upgrade to PA8700 on line <u>one partition at a time</u> so applications running in other partitions can keep running.

Superdome: built to scale

q2 2002

- PA-8700
- hp-ux 11i
- 16,32,64-way
- configurable partitions
- Mixed Cell boards

2H02

- PA-8700+
- New I/O cards
- VPars

2003

- Itanium
- PA-8800
- 128 CPUs
- PCI-X
- Linux
- Windows
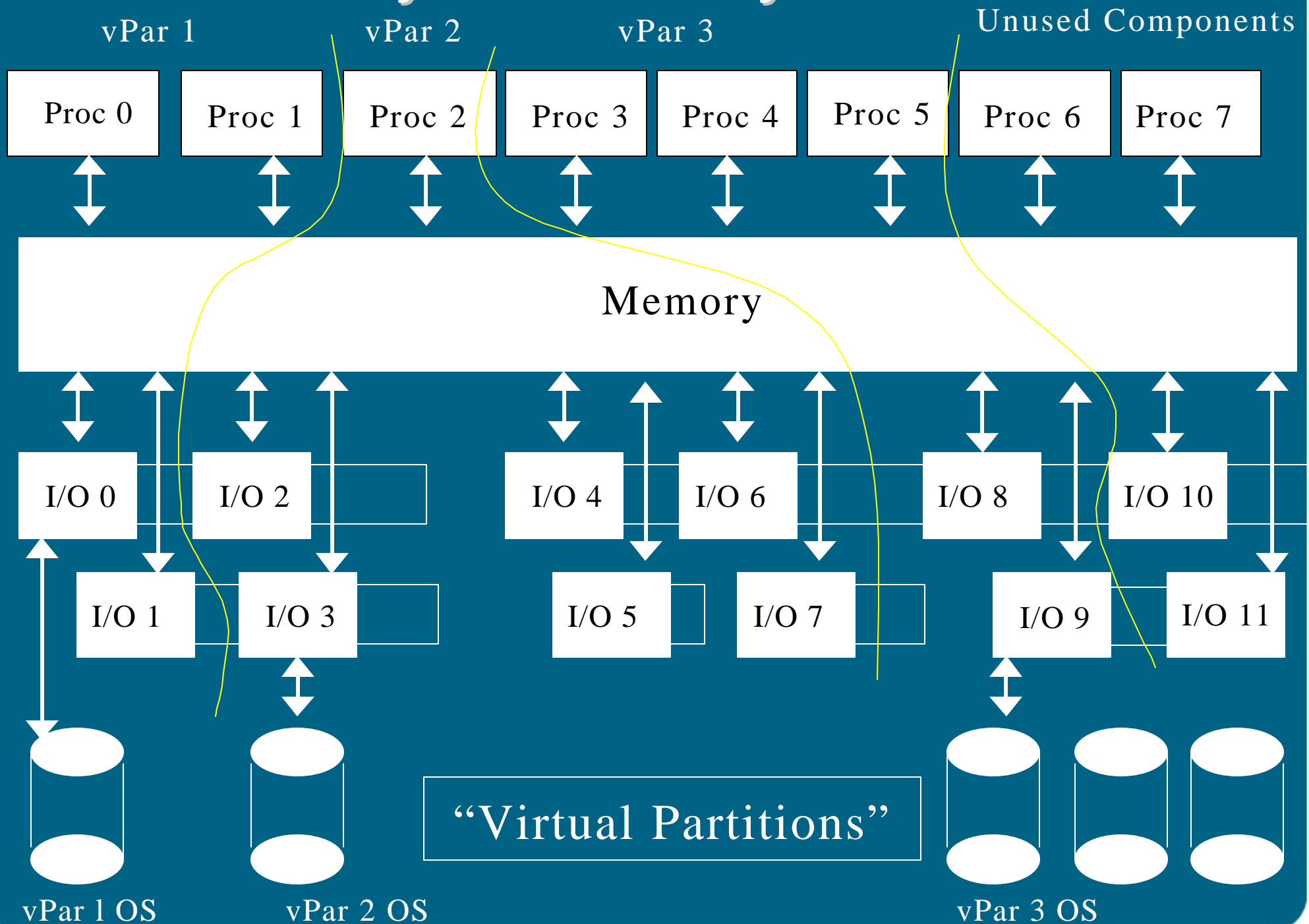- dynamic partitioning

HP Confidential

Interconnect Fabric: Crossbar Mesh

- Fully-connected crossbar mesh
  - Four crossbars
  - Four cells per crossbar
- All links have equal bandwidth and latency
  - Minimizes latency
  - Maximizes usable bandwidth
- Implements point-to-point packet filtering and routing network
  - Allows hardware isolation of all faults
- Interconnect 16 cells with 3 latency domains
  - Cell local
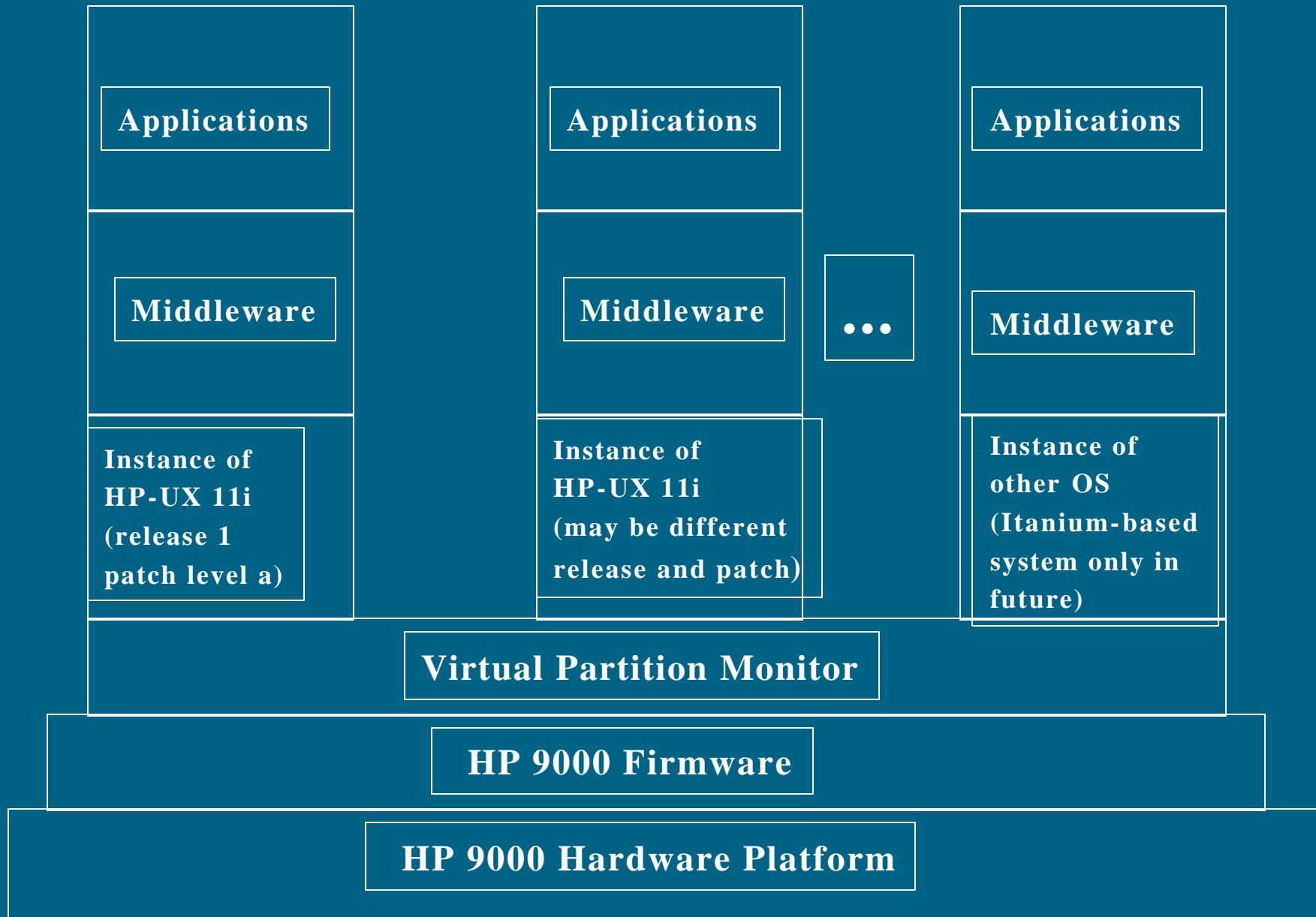 - Crossbar local
  - Remote crossbar

superdome cabinet   superdome cabinet
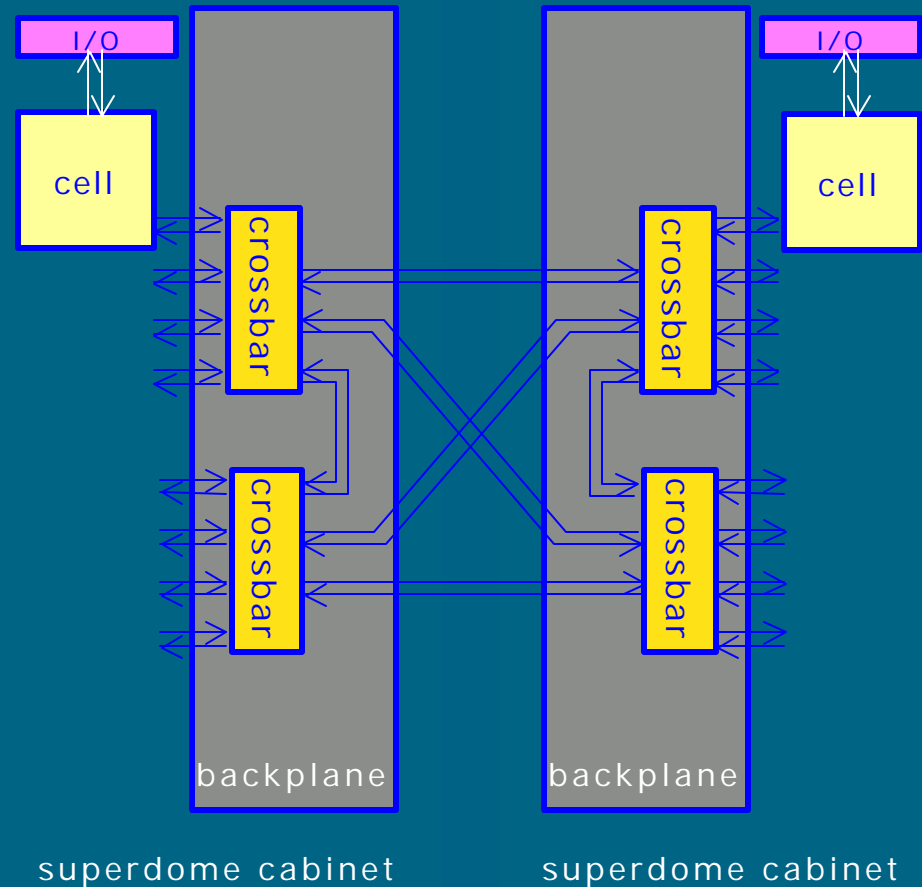
Processors	SuperDome	UE10K	S80	GS320
4	200	600	?	325
8	250	600	?	635
16	275	600	?	790
32	315	600	X	870
64	335	600	X	X

Any HP 9000 System

vPar 1   vPar 2   vPar 3   Unused Components

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

Memory

| I/O 0 | I/O 2 | | I/O 4 | I/O 6 | | I/O 8 | I/O 10 |

| I/O 1 | I/O 3 | | I/O 5 | I/O 7 | | I/O 9 | I/O 11 |

"Virtual Partitions"

vPar 1 OS   vPar 2 OS   vPar 3 OS

Virtual Partitions Software Stack

Applications	Applications		Applications
Middleware	Middleware	...	Middleware
Instance of HP-UX 11i (release 1 patch level a)	Instance of HP-UX 11i (may be different release and patch)		Instance of other OS (Itanium-based system only in future)

Virtual Partition Monitor

HP 9000 Firmware

HP 9000 Hardware Platform

rp7400 partition plan

vPar Number	0	1	2
vPar Name	Bergen	Oslo	Trondheim
CPUs	33, 37	41, 45	105, 109
Memory Ranges	0x01000000 to 0x07ffffff (112MB) 0x40000000 to 0x5fffffff(512MB)	0x08000000 to 0x0fffffff (128MB) 0x60000000 to 0x9fffffff (1024MB)	0x10000000 to 0x17ffffff (128MB) 0xA0000000 to 0xdfffffff (1024MB)
I/O Paths (LBAs)	0/0 0/4	0/8 1/10	0/5 1/4
Boot Path	0/0/2/0.6.0	0/8/0/0.5.0	1/4/0/0.5.0
Console	0/0/4/0 (Virtual)	Virtual	Virtual
Kernel Image	/stand/vmunix	/stand/vmunix	/stand/vmunix
Autoboot	On	On	On

partitioned rp7400 block diagram

Legend:
- controlled by vPar Monitor
- partition 0 (bergen)
- partition 1 (oslo)
- partition 2 (trondheim)
- reserved/unassigned resources
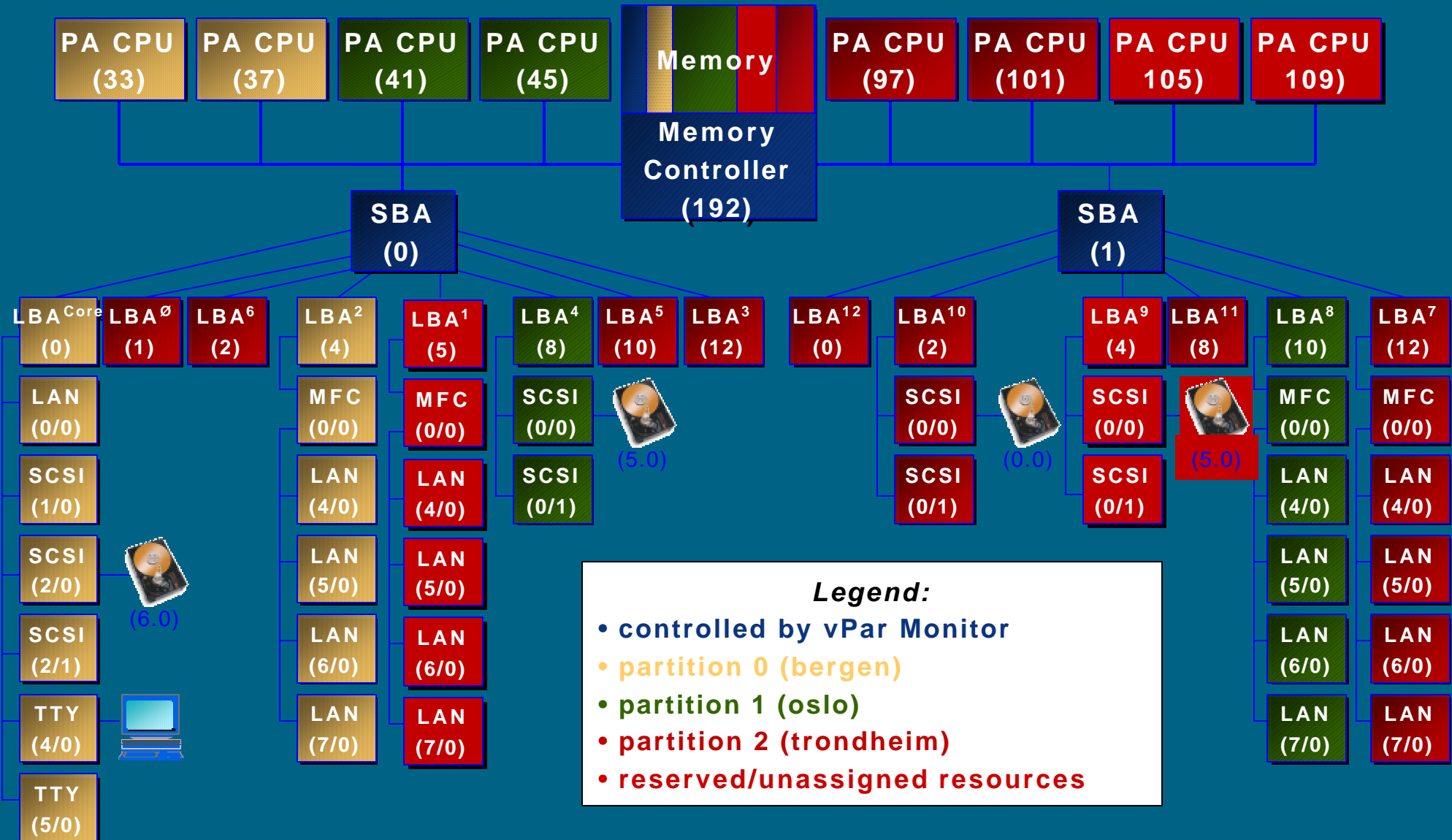
configuration & management commands

- *vparcreate* – create a new partition definition, with or   without resources

- *vparremove* – destroy an existing partition definition

- *vparmodify*
  - add resources to an existing partition
  - remove resources from an existing partition
  - modify the attributes (e.g. boot path) of an existing partition

- *vparboot* – load and launch an operating system within an   existing partition

- *vparreset* – stop/reset a partition

- *vparstatus*
  - display one or more partition definition(s) in human readable form
  - check the status of one or more partitions and/or the monitor

virtual partition manager (vparmgr): GUI for managing virtual partitions

- Create, modify and delete virtual partitions (vpars)*
- Display assigned resources, attributes, and status of vpar
- Display vpar event log and samlog
- Boot and reset a vpar
- Direct invocation of task screens
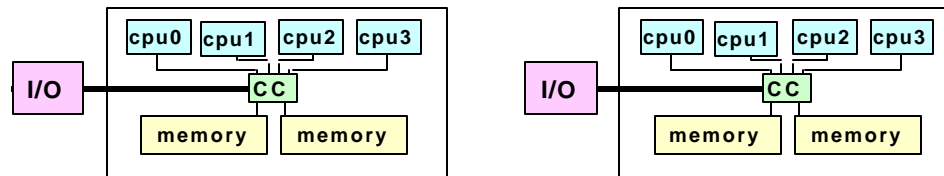- Preview create/modify vpar command lines prior to execution
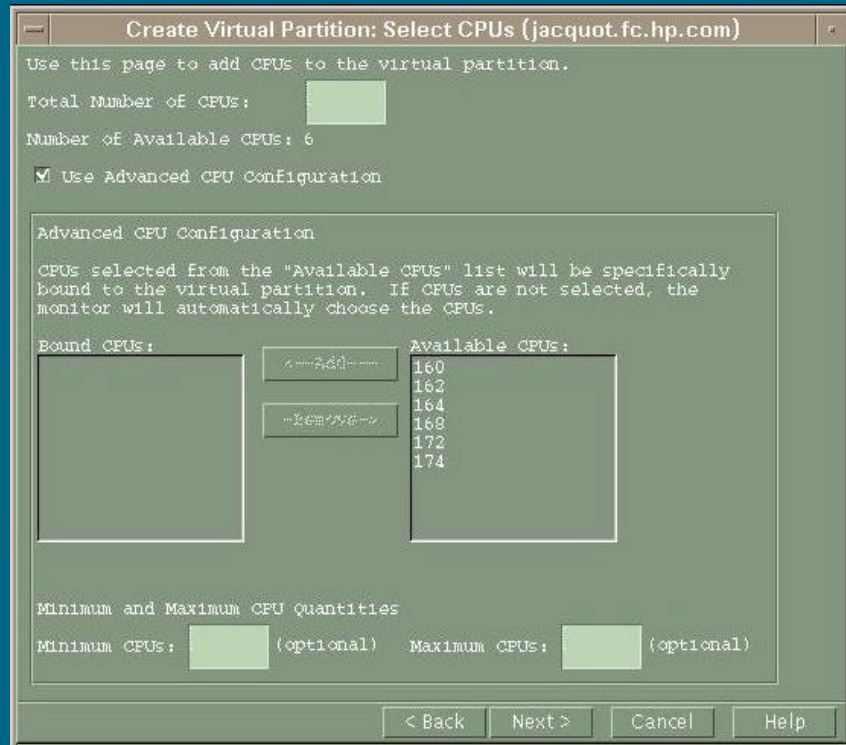
✓ *parmgr is vPar aware!*

(it doesn't do vPars configuration at this point, but the 2 are planned to be integrated in the future)

Pitney Bowes SuperDome Architecture Present

Superdome A

Cell 1 / Par 2	BvApp-Qa1	BvDB-Q1	Cell 0 / Par 0
	Doc-DB-D4		
Cell 2 / Par 4 / IOX	BizW-D1	Info-DB-D1 / Met-DB-P2 / Met-DB-D1	Cell 3 / Par 5 / IOX
	SF-DB-D1		
Cell 4 / Par 1	BvApp-D1	BVVPARD1 / Web-ApD1 / Web-ApQ1 / Web-ApQ2	Cell 5 / Par 3
	Info-Ap-D1		
Cell 6 / Par 6 / IOX	BizWDB-Q1	Siebel-Q1	Cell 7 / Par 7 / IOX

Legend:
- ICOD 750Mhz | EMPTY
- ICOD 550Mhz | VPAR
- MC/SG

Superdome B

Cell 2 / Par 4 / IOX	OracleP1	BizWApp1	Cell 0 / Par 0
	W-AP-P1	Siebel-P1 / W-DB-P1	Cell 1 / Par 3 / IOX
Cell 4 / Par 1	Biz WDB-P1		Cell 5 / Par 1
Cell 6 / Par 2 / IOX	DatWDB-P1	Met-DB-P1 / Ecom-DB-P1	Cell 7 / Par 6 / IOX

Superdome C

Cell 2 / Par 4 / IOX	Credit-Prod	Credit Dev	Cell 0 / Par 0
		Info-Ap-P1	
			Cell 1 / Par 3 / IOX
Cell 4 / Par 1	W-App-Q1		Cell 5 / Par 1
	W-DB-Q1		
Cell 6 / Par 2 / IOX			Cell 7 / Par 6 / IOX

HP Partitioning- vPars within nPars

• nPartitions provide electrical hardware isolation - separate systems, I/O, boot, CPU, memory etc.

• vPars are software isolated (OS, middleware, apps) for different customers, different OS tuning - each tailored by number of CPUs, amount of RAM, amount of I/O per customer and application mix

• electrical h/w isolation

• s/w isolation
• *dynamic reconfiguration*
• *single CPU granularity*
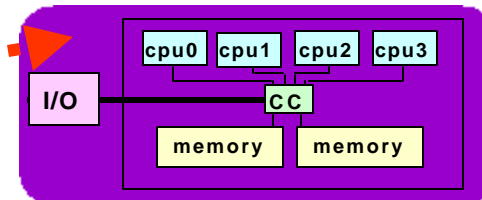• *low to high servers*
• *resources not tied to physical configuration*

nPartition 1 "test"- *HPUX 11i + latest patch*

I/O | cpu0 cpu1 cpu2 cpu3 | CC | memory memory

I/O | cpu0 cpu1 cpu2 cpu3 | CC | memory memory

vPar 1
HPUX 11i + batch

I/O | cpu0 cpu1 cpu2 cpu3 | CC | memory memory

vPar 2
HPUX11i + web

I/O | cpu0 cpu1 cpu2 cpu3 | CC | memory memory
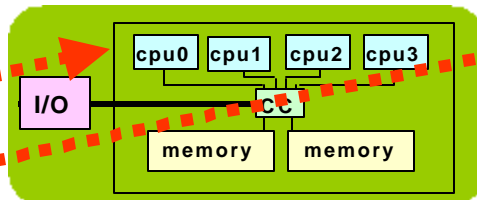
vPar 3
HPUX 11i, large I/O buffer cache

I/O | cpu0 cpu1 cpu2 cpu3 | CC | memory memory

I/O | cpu0 cpu1 cpu2 cpu3 | CC | memory memory
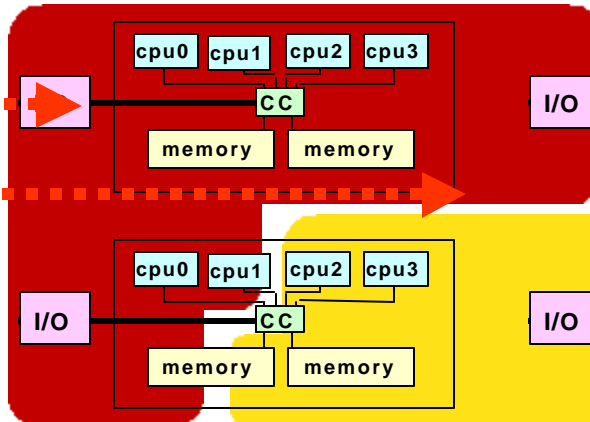
vPar 4
HPUX 11i, tuned for large memory

I/O | cpu0 cpu1 cpu2 cpu3 | CC | memory memory

I/O | cpu0 cpu1 cpu2 cpu3 | CC | memory memory
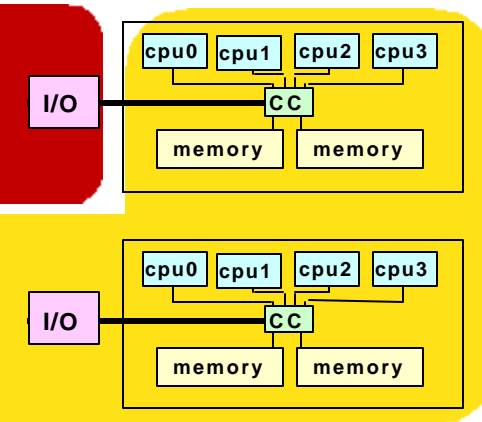
nPartition 2 "development"

hp partitioning continuum for an always-on internet infrastructure

PRM with psets
resource partitions
within a single OS
image

hard partitions with multiple nodes	**hard partitions** within a node	**virtual partitions** within a hard partition	
hp hyperplex	nPartitions	virtual partitions	PRM (process resource manager)
– complete hardware and software isolation – node granularity – multiple OS images	– hardware isolation per cell – complete software isolation – cell granularity – multiple OS images	– complete software isolation – CPU granularity – dynamic CPU migration – multiple OS images	– dynamic resource allocation – share (%) granularity – one OS image

hp-ux wlm (workload manager)
–automatic goal-based resource allocation via set SLOs

isolation
highest degree of separation

flexibility
highest degree of dynamic capabilities

vPars w/ WLM: automatic goal-based resource allocation between vPars based on SLOs

Dynamic adjustment of resources by migration of CPUs between vpars when required

WLM

WLM Rules Sets

Business need defines the relative priority and response time for the various applications

Dept. B App 2	Dept. B App 1	Dept. A App 1
HP-UX Rev Z	HP-UX Rev Y	HP-UX Rev X

Dynamic feedback from vpars regarding load and response times
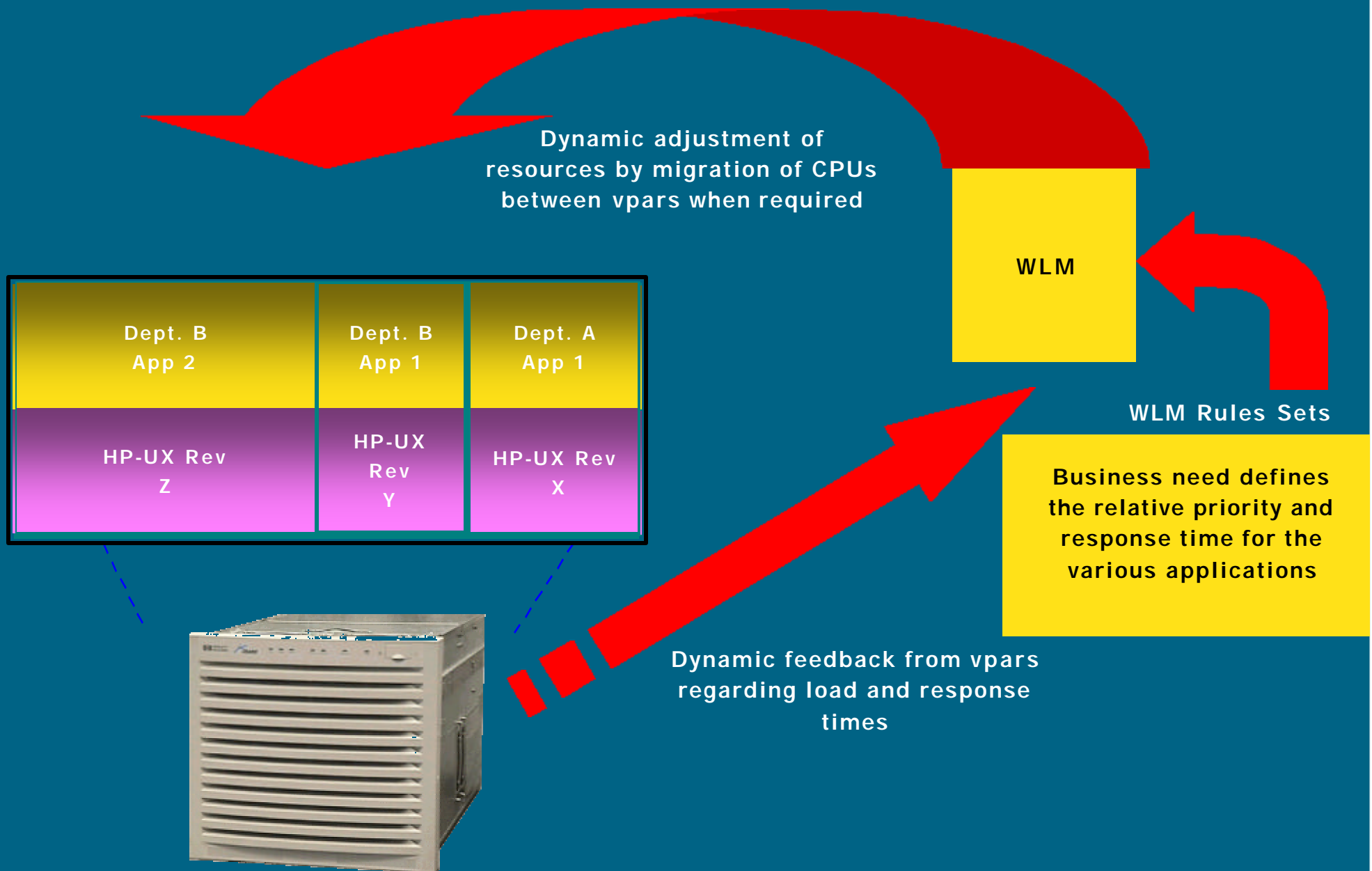
HP's Itanium Strategy

processor evolution
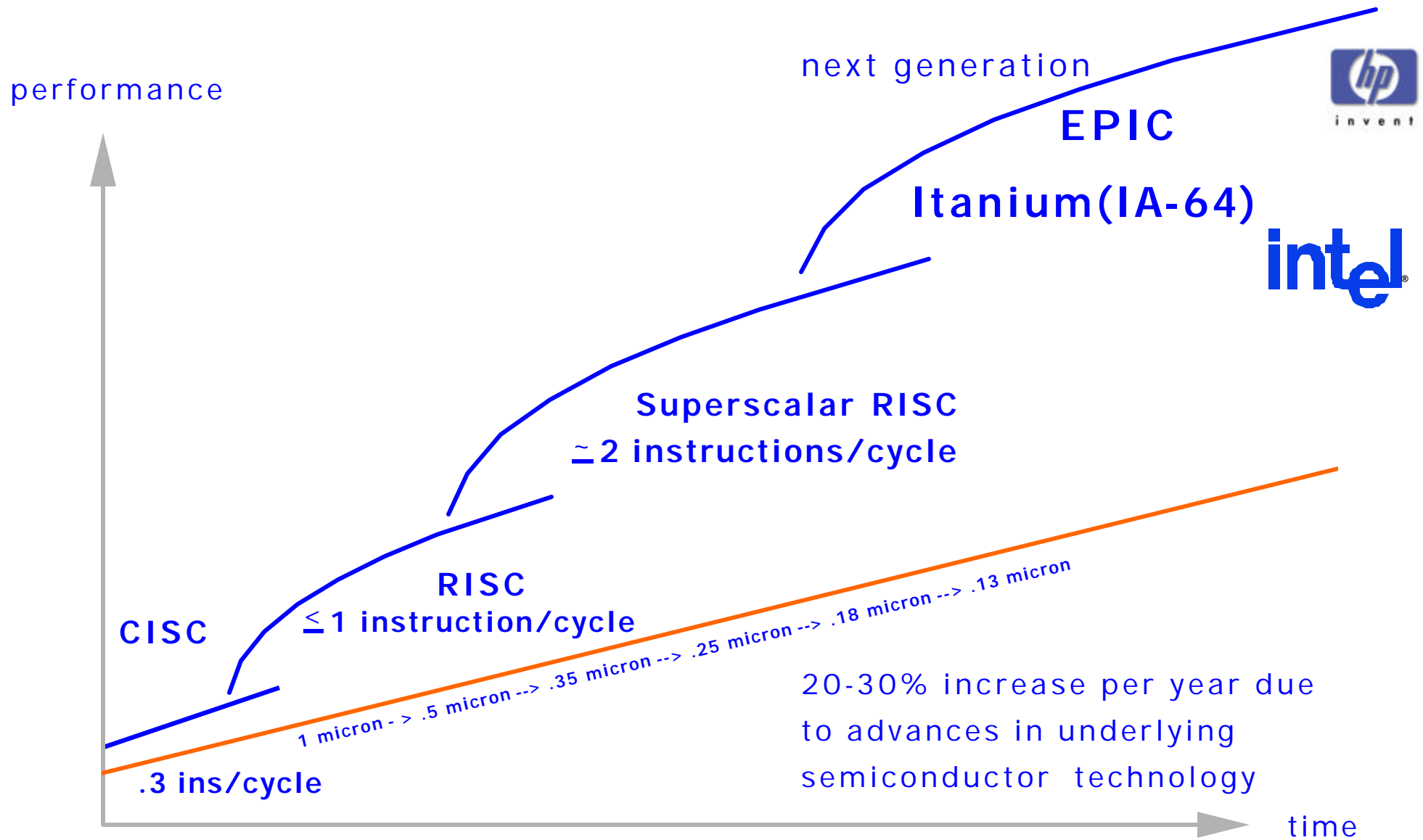
performance

next generation

EPIC

Itanium(IA-64)

hp invent

intel®

Superscalar RISC
≃ 2 instructions/cycle

RISC
≤ 1 instruction/cycle

CISC

1 micron -> .5 micron --> .35 micron --> .25 micron --> .18 micron --> .13 micron

20-30% increase per year due to advances in underlying semiconductor technology

.3 ins/cycle

time

CPU architectures

RISC (reduced instruction set computing)

- Pipeline stages run in parallel

1 2 3 4 5 6 7 8..
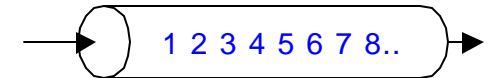
Superscalar RISC

- Multiple parallel pipelines

- Hardware schedules instructions

  and evaluates potential conflicts

- code parallelisation at runtime

1 2 3 4 5 6 7 8..
1 2 3 4 5 6 7 8..
1 2 3 4 5 6 7 8..
1 2 3 4 5 6 7 8..
1 2 3 4 5 6 7 8..
1 2 3 4 5 6 7 8..
1 2 3 4 5 6 7 8..
1 2 3 4 5 6 7 8..
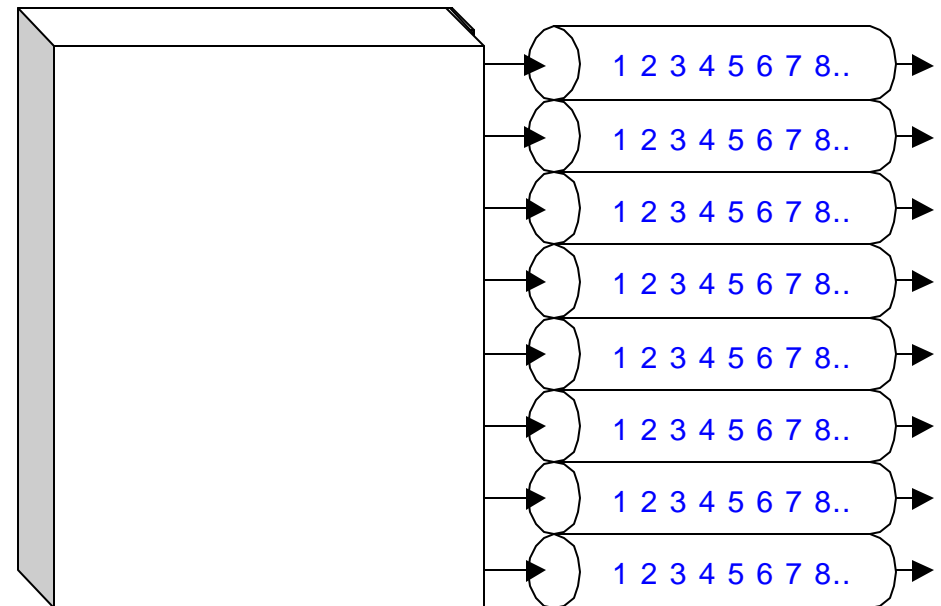
**Scheduler area grows as the
square of the number of pipelines**

CPU architectures

RISC (reduced instruction set computing)

• Pipeline stages run in parallel

1 2 3 4 5 6 7 8..

EPIC

(explicit parallel instruction comp.)

• Compiler schedules instructions and guarantees independence

• very large number of parallel pipelines possible

• code parallelisation at compiling

EPIC compiled source code

....
....
...

1 2 3 4 5 6 7 8..
1 2 3 4 5 6 7 8..
1 2 3 4 5 6 7 8..
1 2 3 4 5 6 7 8..
1 2 3 4 5 6 7 8..
1 2 3 4 5 6 7 8..
1 2 3 4 5 6 7 8..
1 2 3 4 5 6 7 8..
1 2 3 4 5 6 7 8..
1 2 3 4 5 6 7 8..
1 2 3 4 5 6 7 8..
1 2 3 4 5 6 7 8..
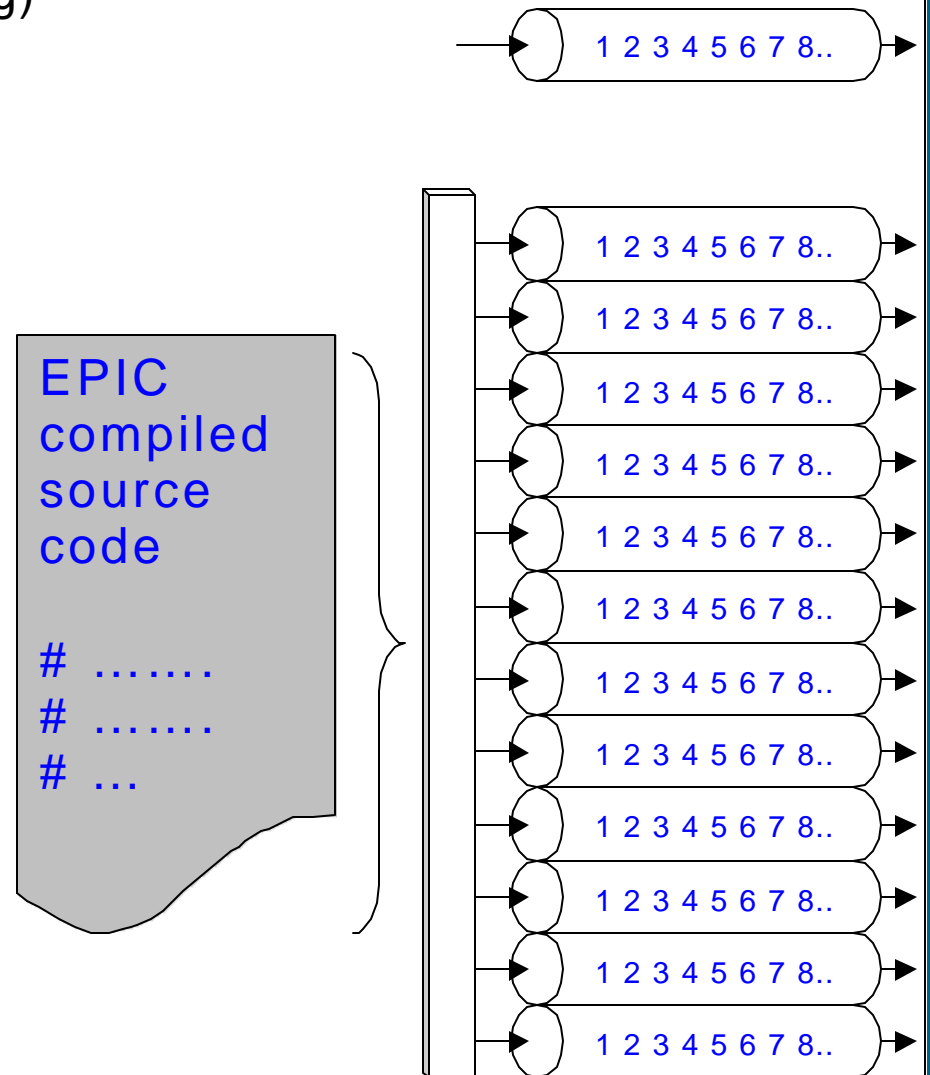
hp and Intel Itanium processor roadmap

increase performance

Future

Itanium performance curve

Montecito

EV79

Madison

PA-8900

EV7

Itanium 2

PA-8800

PA-8700

EV68

Itanium

performance

TBA

TBA

PA-8600

TBA

PA-8500

Pentium 4

PA-8200

Xeon

PA-RISC and IA-32 performance curve

hp and Intel co-developers of the EPIC architecture

PA-8000

Pentium III

'96   '98   '00   '02   '04   future
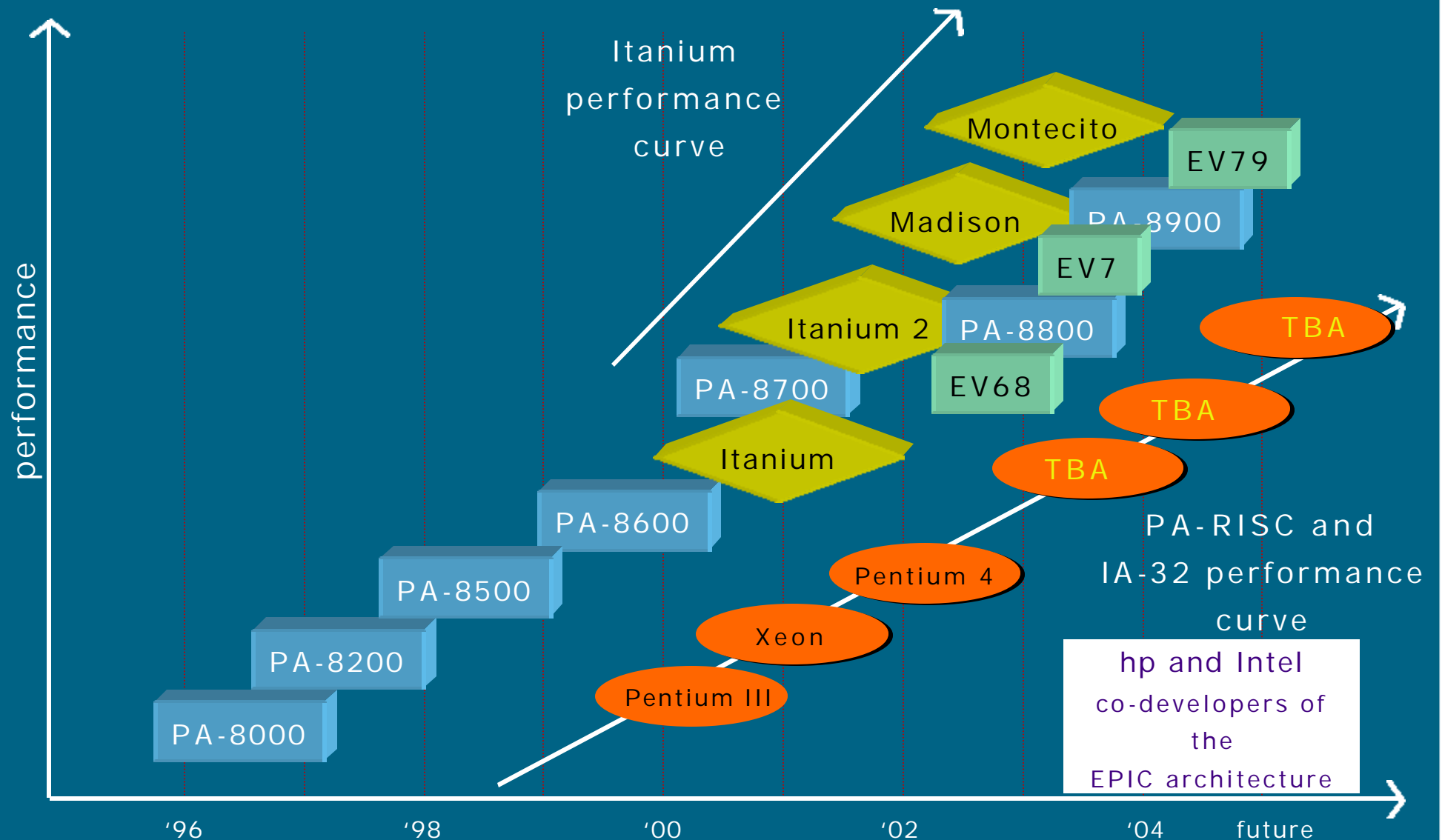
Making multi-operating systems work

OpenVMS

We are investing in

- HP-UX
  - Incorporate the best of Tru64 UNIX functionality into HP-UX
- Windows®
  - Lead the migration to .NET®
- Linux
  - Contribute IP to Linux community
- OpenVMS
- Non-Stop Kernel

Multi-OS capabilities

- IT virtualization technologies
- Security
  - Single sign-on
- High-availability
- Common management
  - One system management environment

HP's Architecture Evolution Provides Unique Customer Benefits

Windows

LINUX

HP-UX

OpenVMS

Itanium
(includes instruction set architecture
jointly developed by HP & Intel)

Compatible with Today's HP Servers

Easy Upgrade

HP-UX

PA-RISC

Win **LINUX**

INTEL

http://www.hp.com/go/ia-64
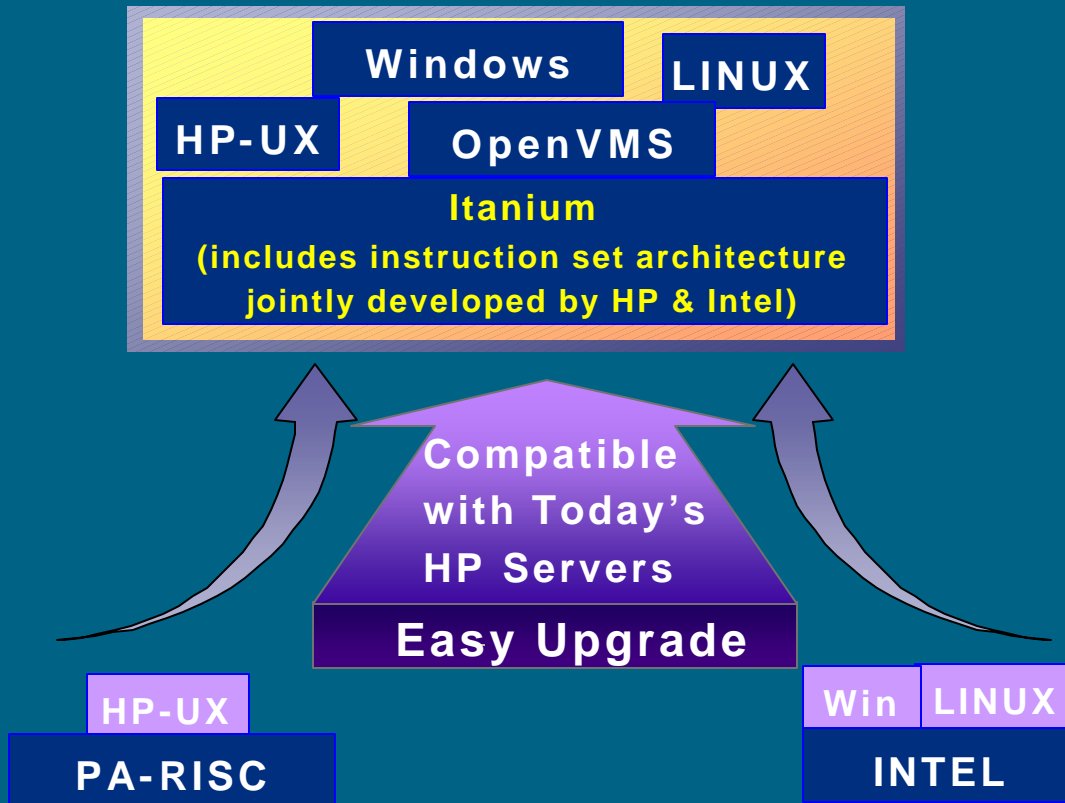
- 5-year joint collaboration and R&D effort
- EPIC architecture leverages HP's 10-year compiler technology experience
- Binary compatibility for HP-UX applications
- HP-UX 11 engineered for IA-64
- Over 50,000 IA-64 applications
- HP-UX: An investment protection path to optimal performance and mission-critical Enterprise computing

Micro-Architectural Enhancements

Itanium™ Processor

System Bus
64 bits wide
133MHz/266 MT/s
2.1 GB/s

Width
2 bundles per clock
4 integer units
2 load or stores per clock
9 issue ports

Caches
L1 – 2X16KB - 2 clock latency
L2 – 96K – 12 clock latency
L3 - 4MB external –20 clk
      11.7 GB/s bandwidth

Addressing
44 bit physical addressing
50 bit virtual addressing
Maximum page size of 256MB

System Bus

Core
800 MHz

BSB

L3 L3

L3 L3
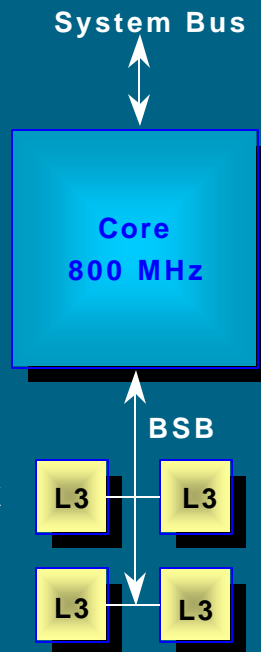
Itanium2 (McKinley) Processor

System Bus
128 bits wide
200MHz/400 MT/s
6.4 GB/s

Width
2 bundles per clock
6 integer units
2 loads and 2 stores per clock
11 issue ports

Caches
L1 – 2X16KB - 1 clock latency
L2 – 256K – 5 clock latency
L3 - 3MB – 12 clk
      32 GB/s bandwidth
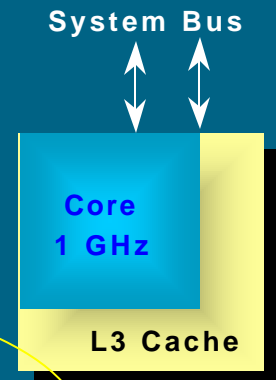
Addressing
50 bit physical addressing
64 bit virtual addressing
Maximum page size of 4GB

System Bus

Core
1 GHz

L3 Cache

HP – positioned to win with Itanium

hp is the co-inventor of Itanium, and with this unique insight, hp will offer the best Itanium training, services, and support in the industry

— hp Itanium co-invention expertise

— McKinley zx1 chipset invented by hp

— the industry's best multi-o/s strategy
  - HP-UX, Windows, Linux, NSK OpenVMS
  - hp-ux: enterprise ready Itanium Unix

— the broadest Itanium product line with the most complete solutions
  - Servers, Workstations
  - leading partnering programs
  - innovative Itanium financing programs

hp zx1 chipset unleashes the full power of Itanium 2

high memory bandwidth, low memory latency

- enables top application performance
- consistent response times
- supports more users and processes

high memory capacity

- supports DDR RAM
- enables optimum performance for large models/databases

high I/O bandwidth and capacity

- consolidate applications to reduce number of servers
- very large databases or multiple large DB
- four high-speed channels provide ~4 GB/s available bandwidth

scalability

- enables a family of systems to be tuned to meet a variety of needs
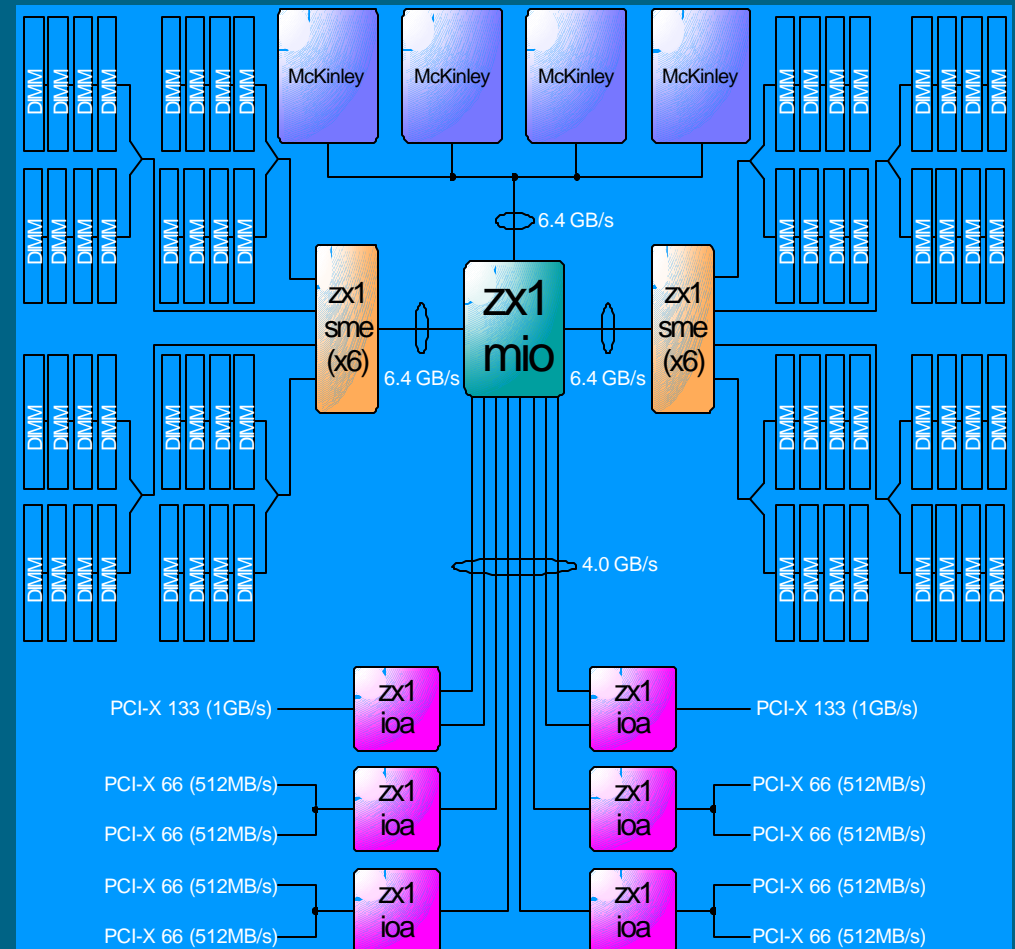
the fastest Itanium 2 platforms available today

Itanium® 2-based hp servers and workstations

hp server rx5670
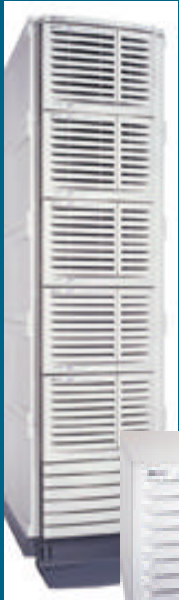
hp server rx2600

hp workstation zx6000

hp workstation zx2000

powered by hp's zx1 chipset

1-way hp workstation zx2000

2-way hp workstation zx6000

2-way hp server rx2600

4-way hp server rx5670

the fastest Itanium 2-based platforms available *building on the combined market reach of compaq and hp*

a closer look at the rx2600 and rx5670

rx2600   rx5670
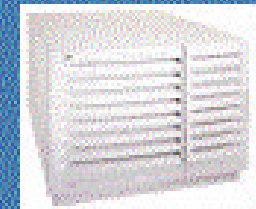
	rx2600	rx5670
processors	1-2 way 900MHz and 1 GHz IPF CPU	1-4 way 900 MHz and 1 GHZ IPF CPU
memory	up to 12GB DDR SDRAM	up to 48GB DDR SDRAM
bandwidth	6.4 GB/s system; 5.5 GB/s memory; 4.0 GB/s I/O	6.4 GB/s system; 12.8 GB/s memory; 4.0 GB/s I/O
pci-x/pci slots	4 PCI-X @ 133MHz	9 PCI-X (3 @ 133MHz, 6 @ 66MHz); 1 PCI (33MHz)
internal storage	up to 219GB	up to 292GB
operating system	HP-UX 11i ver 1.6, Linux, Windows Advanced Server LE	HP-UX 11i ver 1.6, Linux, Windows Advanced Sever LE
positioning	2-way IPF price/performance leader	4-way IPF server solutions leader

HP Itanium® 2-based systems for superior application performance

	typical IA-32 system	typical RISC system	Itanium®2-based hp system
CPU bus bandwidth	1-3 GB/s	2-4 GB/s	6.4 GB/s
I/O bandwidth	1 GB/s	2 GB/s	4 GB/s
on-chip resources	8 general registers	32 general registers	128 general registers
parallel execution	1 instruction per cycle	2-4 instructions per cycle	6 instructions per cycle

benefits:

→ faster OLTP

→ quicker web serving

→ faster secure transactions

→ better decision support performance

Why Itanium 2 Architecture?

incredible computing performance

floating point performance SPECfp2000

	2.1x	1.1x	2.1x	1.7x
Intel Itanium2 1 GHz	AMD Athlon XP 2100	IBM Power4 1.3 GHz	Intel Xeon MP 1.6 GHz	Sun Ultra SPARC III 1.05 GHz
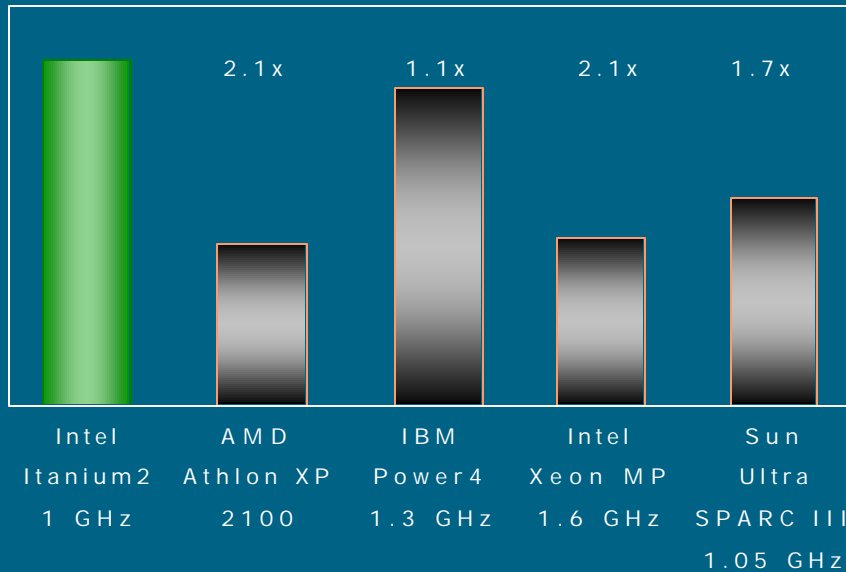
integer performance SPECint2000

	1.1x	0.9x	1.2x	1.3x
Intel Itanium2 1 GHz	AMD Athlon XP 2100	IBM Power4 1.3 GHz	Intel Xeon MP 1.6 GHz	Sun Ultra SPARC III 1.05 GHz

**hp/Intel®
Itanium® architecture
solution centers**
**an expansion of the hp/intel solution
center world-wide initiative**

- demonstrate the viability of Itanium-based solutions for enterprise customers in a multi-OS environment

- enable customer 'proof of concepts', ISV software validation, and SI support

- develop value-added customer solutions

- funded & staffed by hp and Intel

- the ideal combination of expertise, equipment, and environment in which to invent

- leveraged hp & Intel expertise

- secure dedicated resources

- higher quality solutions

- lower cost

- faster time to market

HP-UX
Update

hp-ux 11i operating environments

hp-ux 11i mission critical operating environment

hp-ux11i enterprise operating environment

HP-UX 11i Operating Environment

- hp-ux os
- network drivers
- web QoS peak
- apache w/s
- ignite/ux
- java RTE
- java JDK
- java JPI
- cifs client
- cifs server
- servicecontrol manager

- system configuration repository
- software distributor/ux
- netscape LDAPserver
- pam keberos
- ems framework
- netscape communicator

- online jfs 3.3
- mirror disk/UX
- process resource manager (PRM)
- glance plus
- openView performance agent
- single-system event and availability management
- event monitoring services (EMS) HA Monitors

- MC/ServiceGuard
- HP-UX Workload Manager
- ServiceGuard NFS Toolkit
- Enterprise Cluster Management (ECM) Toolkit

delivering values

- robust
- Integrated stack
- ease of mgmt.
  - installation
  - upgrades
  - support
  - global media
- no codewords
- simplified license management

⭐Install time reduced by 50%

HP-ux11i
Internet critical. E-services ready.
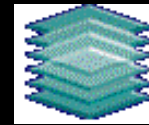
D.H. BROWN
ASSOCIATES, INC.

2002
UNIX function review

ranked #1 in all five categories:

#1 scalability

#1 reliability, availability and serviceability

#1 systems management

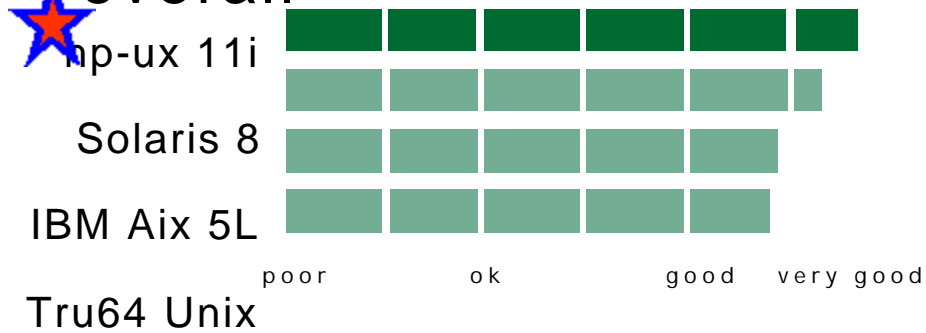#1 internet and web application services

#1 directory and security services

hp-ux 11i: the #1 unix

DH Brown 2002 Unix Function Review

HP-UX 11i

Solaris 8

IBM Aix 5L

- #1 in all 5 categories: (First time for any OS)
  - scalability
  - reliability, availability and serviceability
  - systems management
  - internet and web application services
  - directory and security services

D.H. BROWN
A S S O C I A T E S, I N C.

overall ranking (160+ functions)

D.H. Brown 2002 unix function review ratings summary

hp-ux #1 overall - hp-ux #1 in all categories - hp-ux clearly ahead of AIX and Solaris

overall

- hp-ux 11i
- Solaris 8
- IBM Aix 5L
- Tru64 Unix

poor ok good very good

scalability

- hp-ux 11i
- Solaris 8
- Tru64
- AIX 5L

poor ok good very good

internet and web application services

- hp-ux 11i
- Solaris 8
- IBM Aix 5L
- Tru64 Unix

poor ok good very good
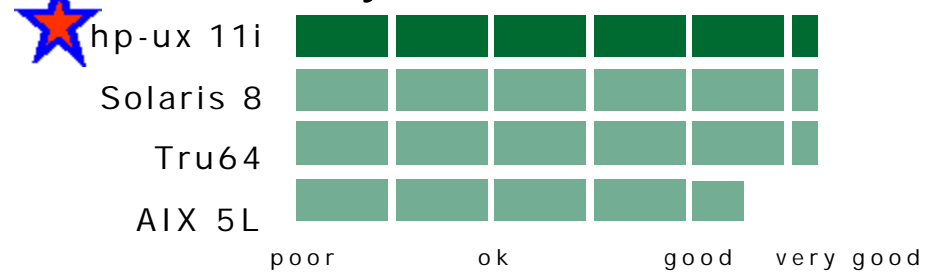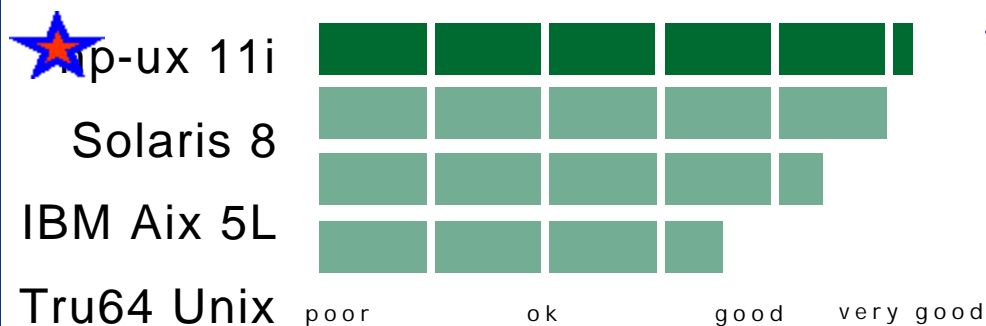
reliability availability serviceability

- hp-ux 11i
- Solaris 8
- Tru64
- AIX 5L

poor ok good very good

directory and security

- hp-ux 11i
- Solaris 8
- IBM Aix 5L
- Tru64 Unix

poor ok good very good

systems management

- hp-ux 11i
- Tru64
- AIX 5L
- Solaris 8

poor ok good very good
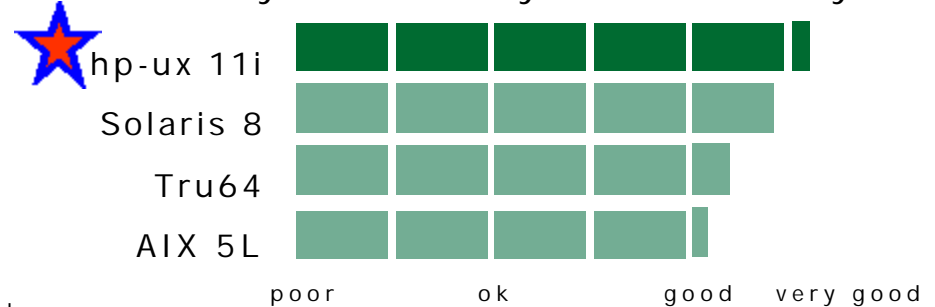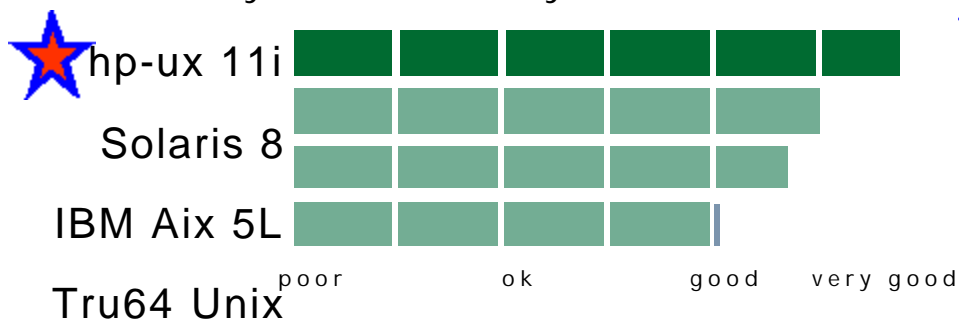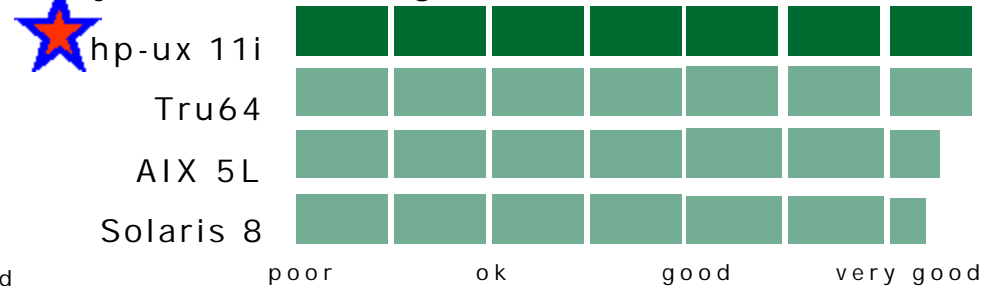
HP-ux 11i Release *Roadmap*

| 2002 | 2003 | 2004 | 2005 |

- Binary compatible w/ 11.0
- introduction of OEs
- performance leadership

- #1 rated OS by DH Brown
- VarBusiness OS of the year
- performance improvements

- open source application bundle
- security boost
- performance improvements

hp-ux 11i   #1 UNIX in the world   Internet Express

hp-ux 11i version 3
Combined PA and IPF release

PA-RISC ONLY

Itanium ONLY

PA-RISC and Itanium

hp-ux 11i version 1.6

- Mission critical
- ISV friendly
- Binary compatible w/ 11i v1.5
- hp-ux for Itanium2

hp-ux 11i version 1.5

- 1st in the industry
- hp-ux for Itanium1

- Full enterprise release
- All OEs and ISUs
- 64-way scaling
- Cell local memory
- Binary compatibility w/ 11i v1.6
- Dynamic kernel tunables
- hp-ux for Madison and beyond

- Cell OL*
- TruCluster
- AdvFS
- 128-way scaling
- vPars for IPF

Current as of Nov 25, 2002

Tru64 UNIX Clustering works this way...

Cluster Interconnect

A
E
F B

G

FC Switches

H

C

Controllers   Controllers

D

/root

/usr
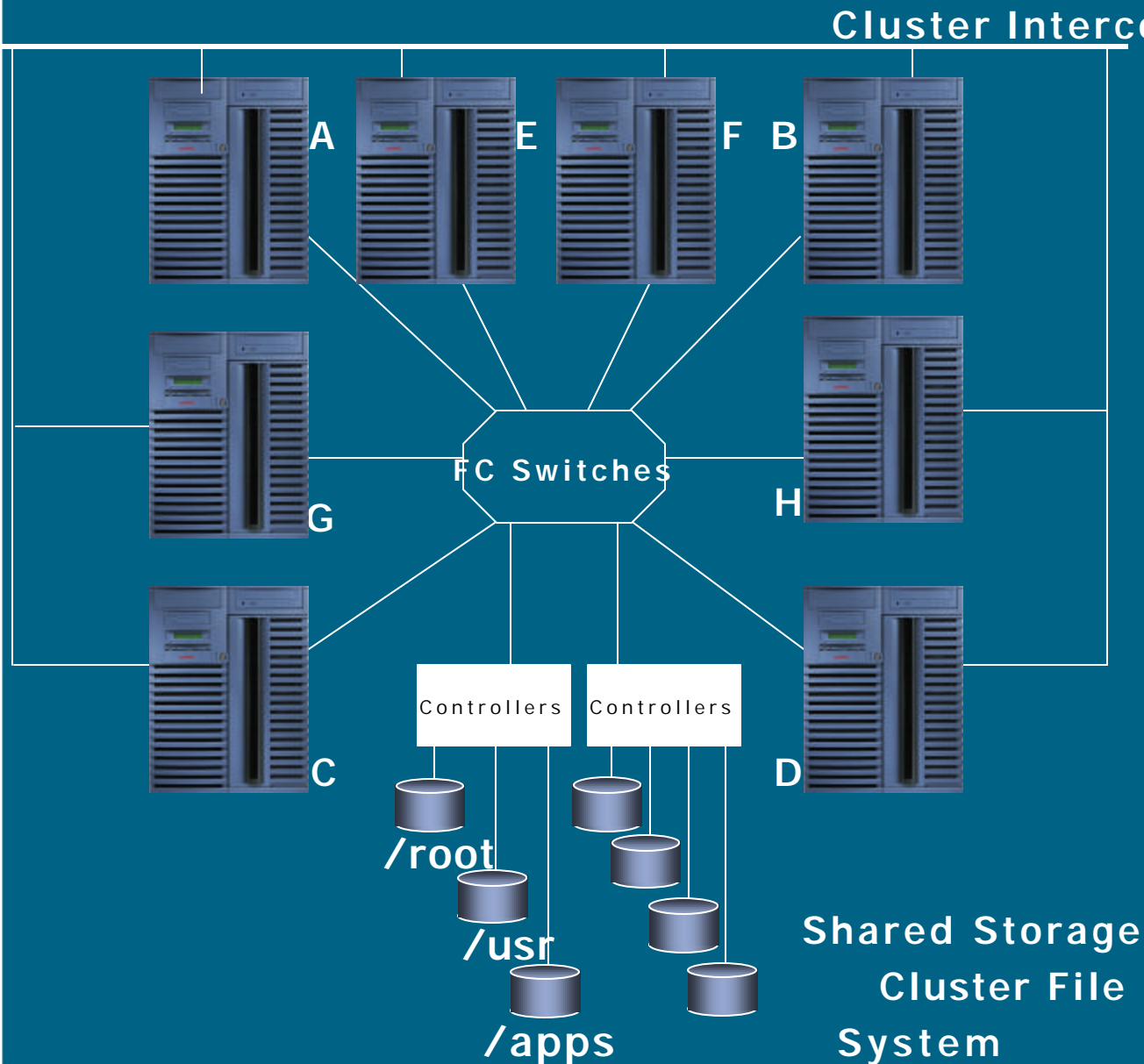
/apps

A - Install OS & patches

- Configure the storage

- Run clu_create

- Install apps & patches

- Run clu_add_member

for each node

Shared Storage

Cluster File

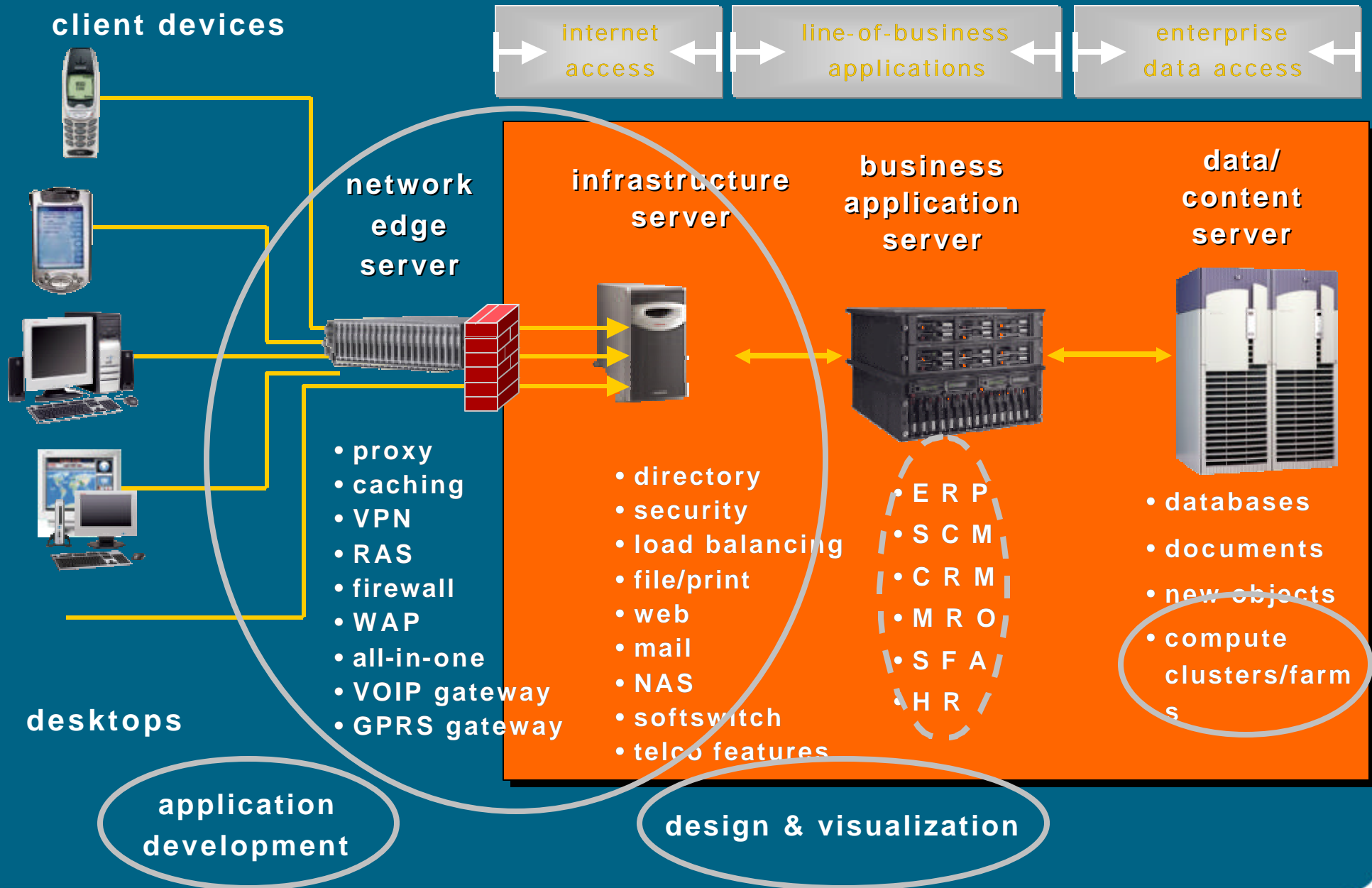**System**

What is Linux?

- Open Source operating system

- UNIX derivative

- Mature, full-featured, multi-tasking, multi-user OS

- Developed and hosted predominantly on industry-standard Intel Architectures.
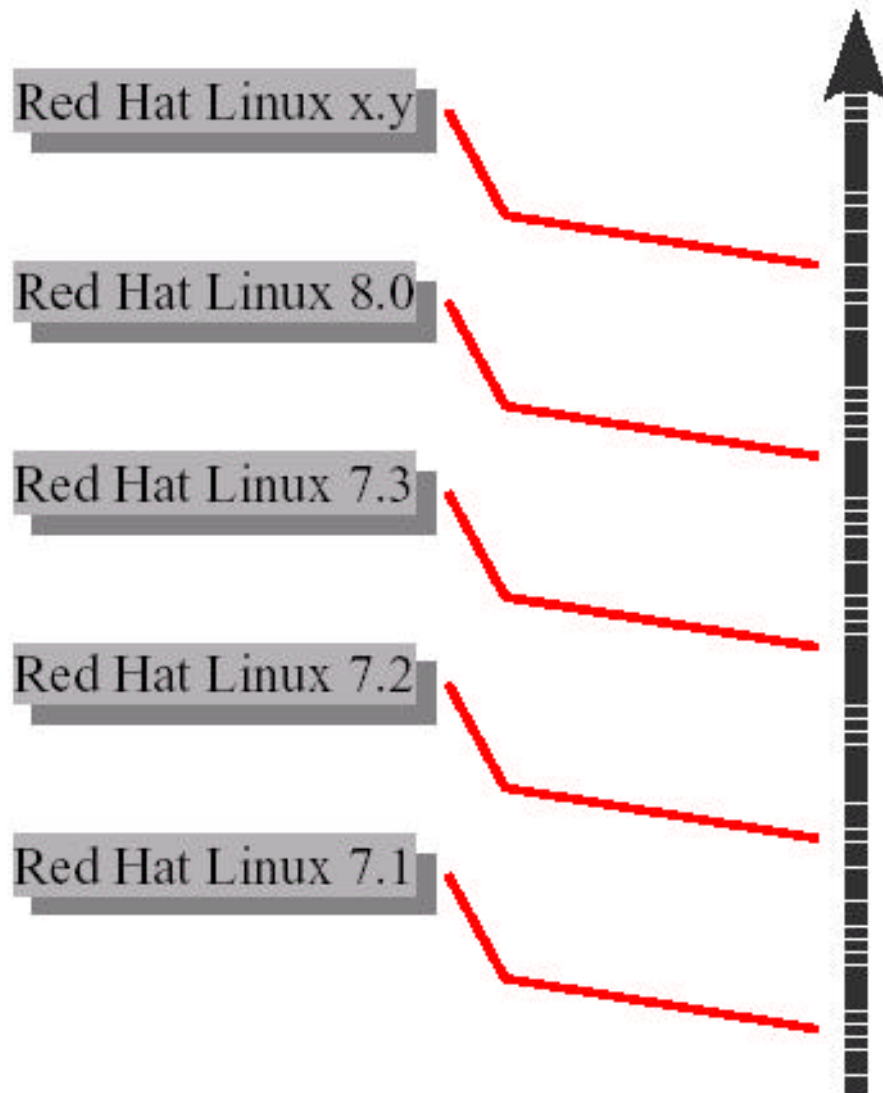
inside a Linux distribution

Linux OS

Linux Kernel "Open Source"

Linux Packages ~7000 Total

- device drivers hardware support
- development tools
- networking
- user interface localization
- file systems
- multi-media

installation & distribution tools

support

distribution specific enhancements

redhat   SuSE

CALDERA OPENLINUX   debian

Mandrake Linux

UnitedLinux

3. distribution vendor specific value-added tools and enhancements to simplify installation and support..

mainstream distributions

2. a combination of primarily open source software modules ("packages"), but may include proprietary value-added software a distribution vendor includes to ensure its Linux OS release is the latest and most complete development / production ready system.

1. the Linux OS kernel. the source code is licensed and maintained by Linus Torvalds anyone can modify, but the maintainers decide what makes it into the kernel.

Where? ... Linux solution workloads
- where Linux products and solutions are making significant in-roads -

client devices

| internet access | line-of-business applications | enterprise data access |

network edge server

infrastructure server

business application server

data/ content server

- proxy
- caching
- VPN
- RAS
- firewall
- WAP
- all-in-one
- VOIP gateway
- GPRS gateway

desktops

- directory
- security
- load balancing
- file/print
- web
- mail
- NAS
- softswitch
- telco features

- E R P
- S C M
- C R M
- M R O
- S F A
- H R

- databases
- documents
- new objects
- compute clusters/farms

application development

design & visualization

Enterprise Release Stream

Release Stream:
- New release every 12 to 18 months
- No coordination with retail releases
- Stable ABI
- Service packs for new drivers, critical fixes
- Red Hat offering:
  - Premium response support services
  - Enteprise Red Hat Network services
  - Professional Services
  - 3-5 yr. Support window

Red

Red

Red

Red

Red

Advanced Server 3.0
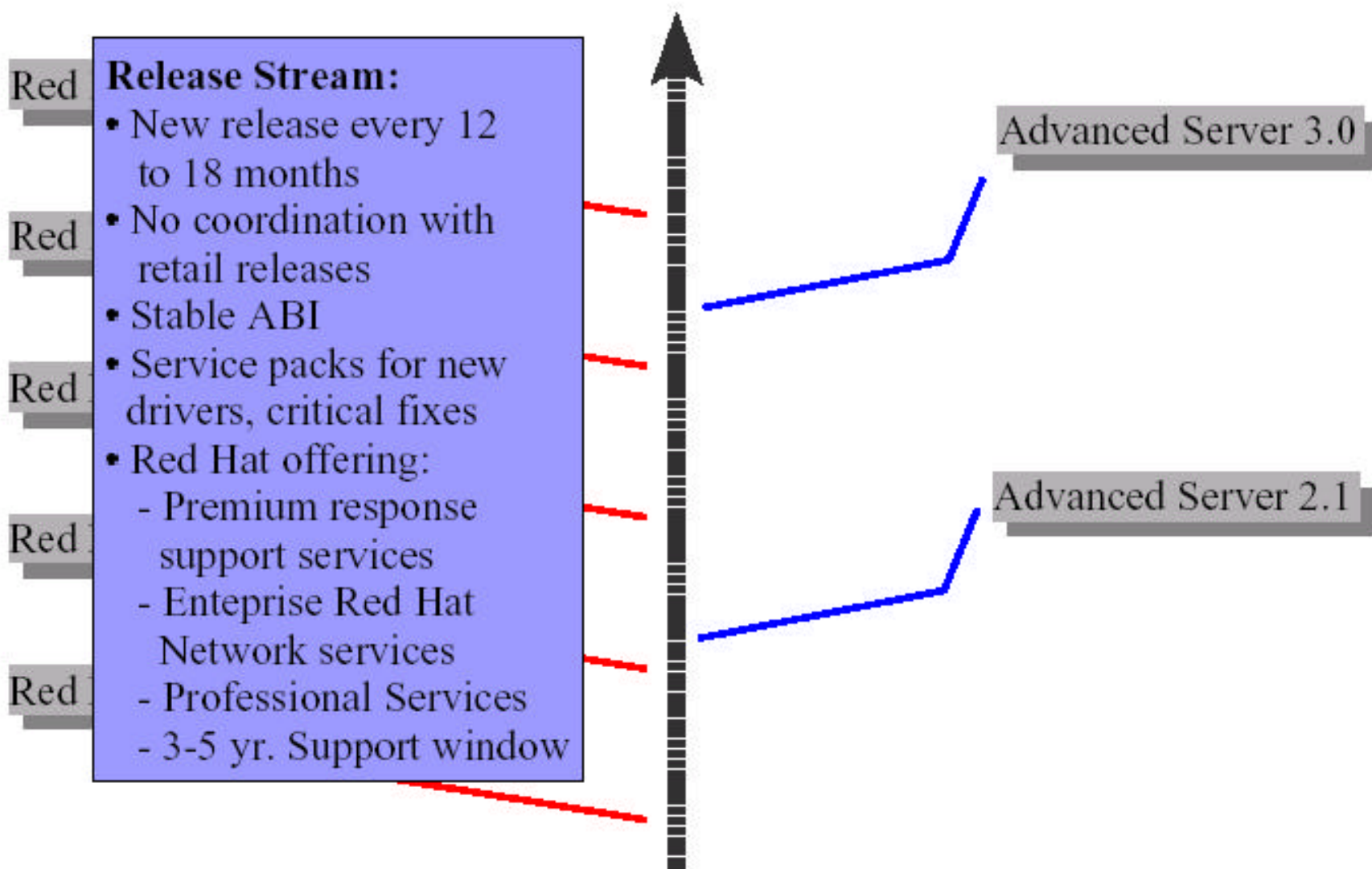
Advanced Server 2.1

Advanced Server vs. Red Hat Linux 7.3

- Target: Enterprise and Mission Critical Servers

- Enterprise-tuned release cycle (12-18 months)

- ISV/OEM Partnerships for development, testing, and certification

- Focus: RASM

- Platform: IA-32, IA-64, AMD Hammer, Z/I/P

- Enterprise Support : Premium, Response, Enterprise RHN Services, Professional Services, 3-5 Yr Support

- Target: Hobbyist, Desktop User, Students

- Rapid release cycle (4-6 months)

- Focus on Technology Delivery (not Feature Set)

- Focus: Rapid innovation

- Platform: IA-32

- Limited Support : Less Than One Year, Initial Setup

Both Products Contribute All Code Back To Community

hp Linux investment

hp is a pivotal member of the Linux community ...

- Leadership for Linux Standard Base [LSB]
- Dedicated Linux lab
- IA64 kernel maintenance
- Sponsoring member of Open Source
- Development Lab
- Linux International – sponsoring member since 1995
- Extensive support of SAMBA and
- Apache projects
- Founding member of GNOME
- Foundation and the KDE league
- Sponsor of clustering foundry
- Sponsor of handhelds.org
- Portal opensource.hp.com

Linux / HP-UX affinity

HP-UX ⬌ [penguin]
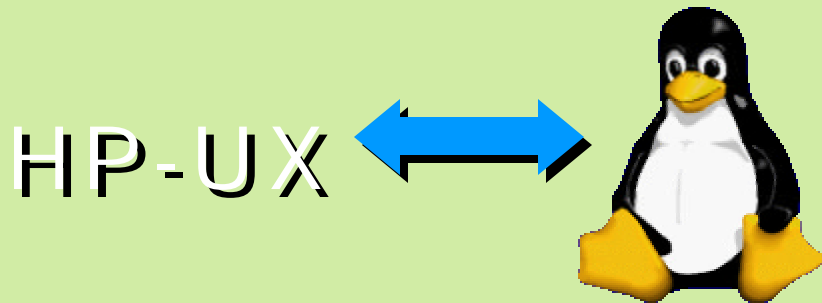
interoperability

- common look and feel
- common applications
- integrated management

application mobility

- source code (API) compatibility
- binary compatibility (ABI) - run Linux Itanium binaries on HP-UX

tools   www.hp.com/go/linuxtools

- Linux Runtime Environment Toolkit (with Linux ABIs) for HP-UX
    - LE Itanium Runtime environment
    - Linux software transition kit [STK]
    - Linux Runtime environment white paper
- Linux Porting Kit for HP-UX (Linux to HP-UX) including a collection of popular, open source tools

best-of-breed operating environments

protect investment

decision criteria	access services	application services	database services
	· applications · customization	· applications · flexibility · scalability	· applications · scalability · mission critical

Linux open source community leadership for optimized solutions spanning the enterprise: from secure Web serving to supercomputing clusters

fully-supported Windows Advanced Server LE provides #1 performance to extend Windows further into the enterprise

HP-UX 11i v1.6: leading price/performance with proven performance scalability, security, and reliability; seamless migration from RISC

with Itanium 2-based systems, Windows and Linux further extend into the enterprise and HP-UX 11i becomes more pervasive across the enterprise

hp, Microsoft, and the Linux community extend best-of-breed Itanium 2-based solutions into the enterprise

Microsoft Windows

- hp and Microsoft embrace Itanium-based solutions and support key applications, such as:
  - SQL Server database
  - SAP R/3
  - SAS core
- Microsoft business commitment
  - updated/optimized 64-bit Windows kernel specifically for Itanium 2-based processors

hp-ux 11i

- #1 UNIX as rated by D.H. Brown
- binary compatibility on HP-UX PA-RISC applications moving to Itanium architecture
- full enterprise release for Itanium architecture (hp OpenView, Online JFS, VxVM, mc/serviceguard, Apache)
- incorporation of best-in-class Tru64 functionality moving forward

Linux

- Open Source Development Lab (OSDL) enhancing Linux for data center and telco applications
- Gelato Federation enabling Linux Open Source solutions specifically for Intel Itanium architecture for academic, government, and industrial research
- Linux SDK for Itanium-based systems distributed to over 10,000 developers

Windows 2003 Advanced Server LE Update
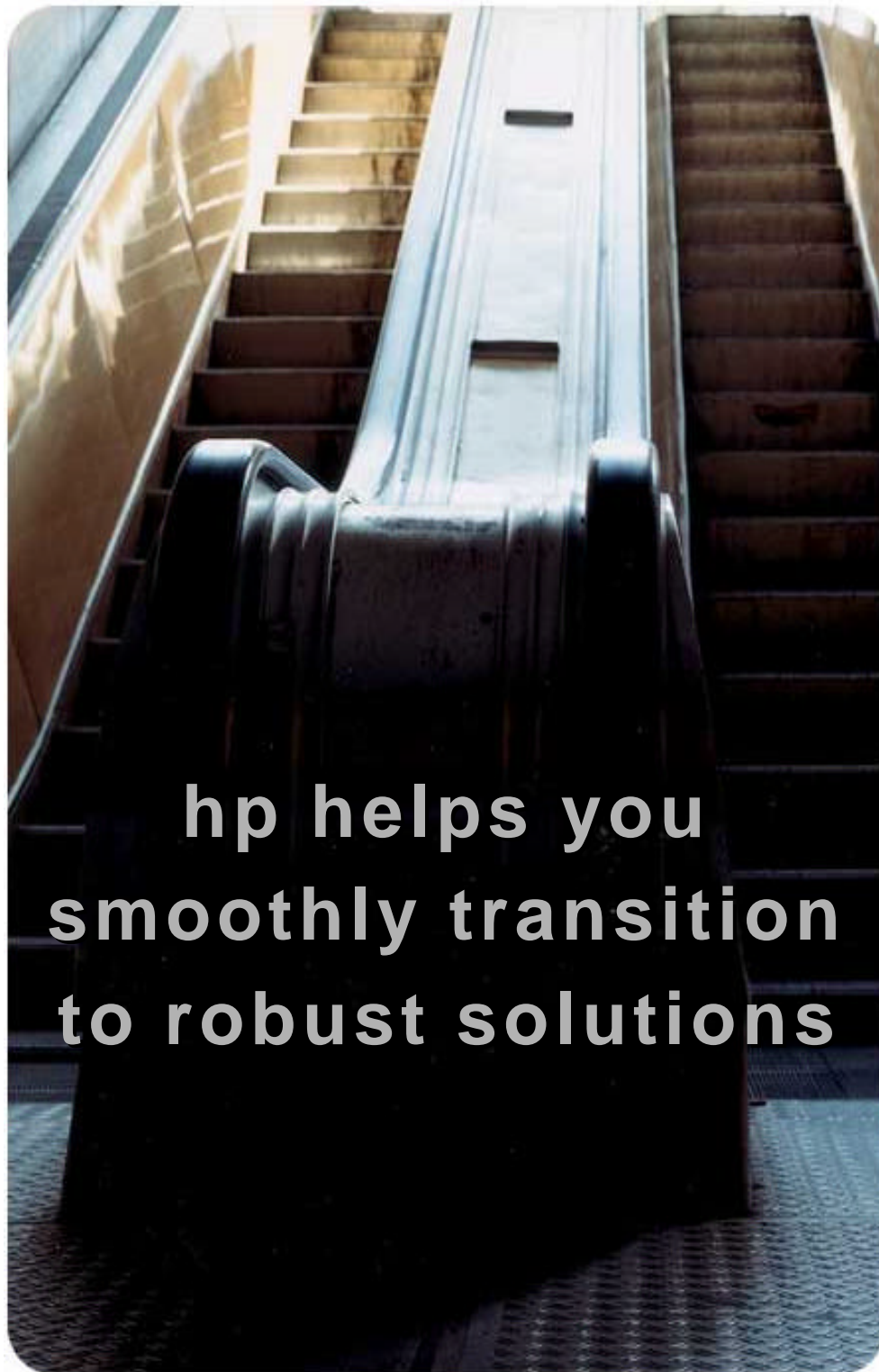
hp helps you smoothly transition to robust solutions

Seamless first step to Itanium®

- Itanium® 2-based systems are fully interoperable with IA-32 systems
- SQL server database upgrade to 64-bit no data conversion or migration is required.

Efficient development with optimized results

- reference platform for Windows application development with choice of tools, libraries, compilers from Microsoft and Intel

Proof of concepts and development

- Gain experience at Intel Solution Centers with HP Itanium ® 2-based solution proof of concepts and development

transition from 32-bit to 64-bit SQL Server seamlessly

- plug in the disks and go!
  - issue command call "sp_attach_db"
  - on-disk structure is 100% the same
- if keeping IA-32 system
  - use backup from IA-32
  - restore onto 64-bit system
- networking layer of MS SQLServer accepts input from 32 bit clients just as with 64 bit clients
- run your 32-bit application on your 32-bit server with 64-bit database server and experience benefits of Itanium 2!

hp Itanium commitment and leadership continues

32-socket

16-socket

8-socket

4-socket

2-socket
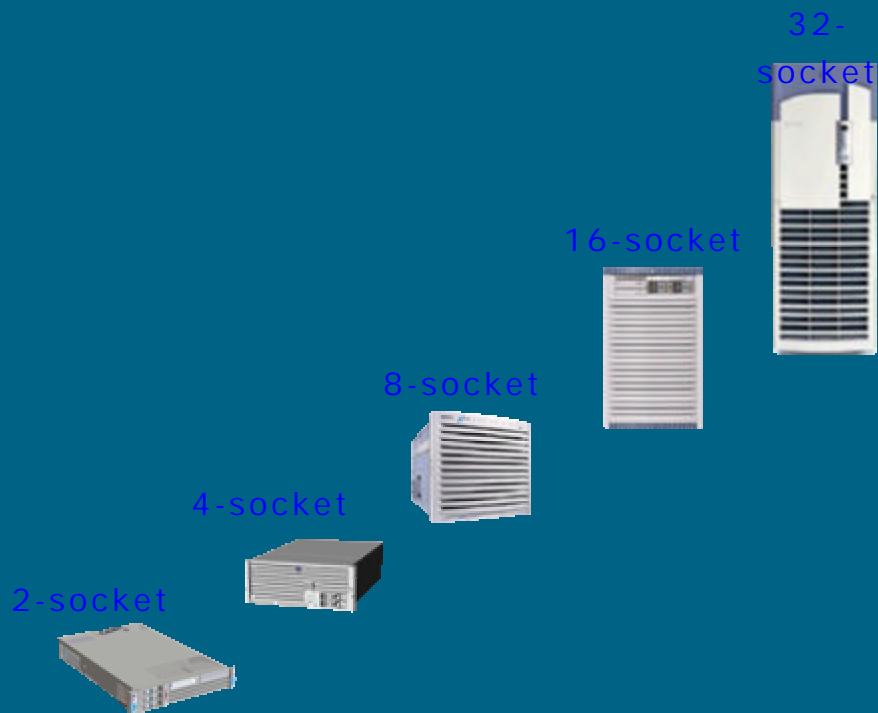
– In 2003, HP's entire family of Itanium-based servers--- including the midrange 8-way and 16-way, and the high-end Superdome 64-way will support the 64-bit version of Microsoft Windows .NET Server 2003