






Building a Better Infrastructure With IBM Middleware on System p

POWER Hardware Improves Utilization
and Reduces Costs

At the Heart of IBM Power™ Systems is the POWER Processor

2001 POWER4™	2003 POWER4+™	2004 POWER5™	2006 POWER5+™	2007 POWER6™	Future* POWER7™	<i>General Purpose Processors</i>
						

PowerPC 405 	PowerPC 440 	Cell 	Cell 	Cell +* 	<i>Specialty Engines</i>
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Game Systems **Blades** **Entry Level to High-end Servers** **High Performance Computers**

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

The POWER processor is used in everything from game systems to special purpose high performance computers.

- ▶ Largest UNIX systems market share
- ▶ 50% of automobiles worldwide
- ▶ All of the top three game consoles
 - Playstation 3, Xbox 360, Wii
- ▶ 47% of world's fastest computers (Top500)

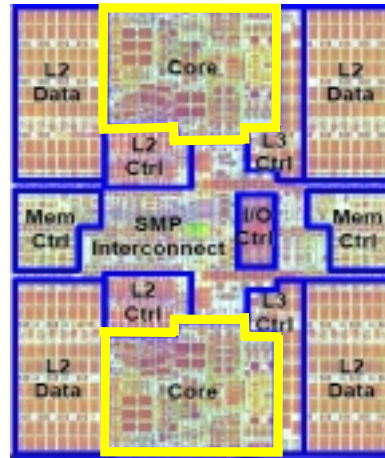
Quiz: What Does the Acronym **POWER**, Represent?

- A. **P**ackets **O**f **W**ebSphere **E**ngineered **R**equests
- B. **P**erformance **O**ptimized **W**orkloads **E**ngineered **R**esilient
- C. **P**rocessor **O**ptimized **W**ith **E**nergy **R**eduction
- D. **P**erformance **O**ptimized **W**ith **E**nhanced **R**ISC
- E. **P**rogrammatic **O**ctal **W**avelengths **E**lectromagnetically **R**efined

POWER Architectural Concepts - Multicore

- Why multicore?
 - ▶ Laws of physics catching up with single core processors, it is no longer a matter of simply increasing speed to increase performance
 - ▶ Chip manufacturing density enables more than one central processing unit (CPU) to be placed on a single chip or socket
- Each central processing unit is referred to as a “core”*
- Each core presents itself as an independent physical processing unit

Dual core POWER6 Processor



* CPU = core

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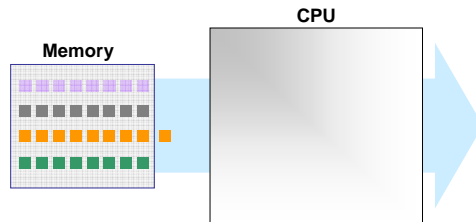
5

Processor Concepts - Single Thread Execution

Four instruction threads in memory, waiting to be executed

The processor fetches instructions from a single thread and continues to execute instructions from that thread until a decision is made to execute another thread

Popular design, but branches and data fetches cause idle CPU cycles



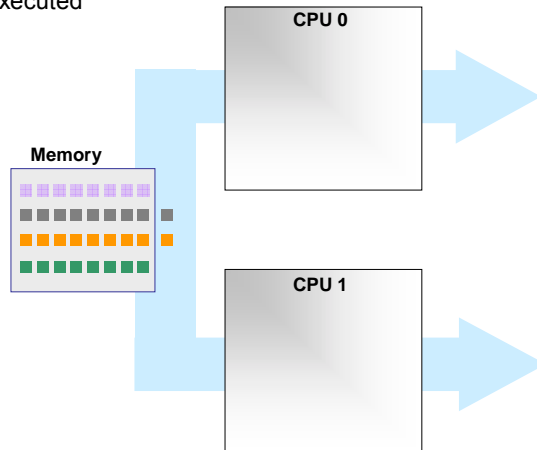
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Processor Concepts – Symmetric Multiprocessing (SMP)

Four instruction threads in memory, waiting to be executed

Each processor fetches instructions from a single thread

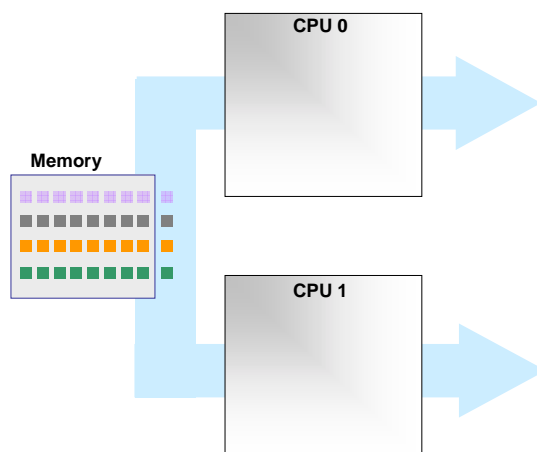


- Achieves higher overall throughput by utilizing all available CPUs
 - ▶ Operating system assigns threads to CPUs
 - ▶ Still single thread execution with idle cycles within each CPU
- System p is architecturally engineered to exploit full SMP function up to the largest number of processors

POWER Architectural Concepts – Simultaneous Multithreading (SMT)

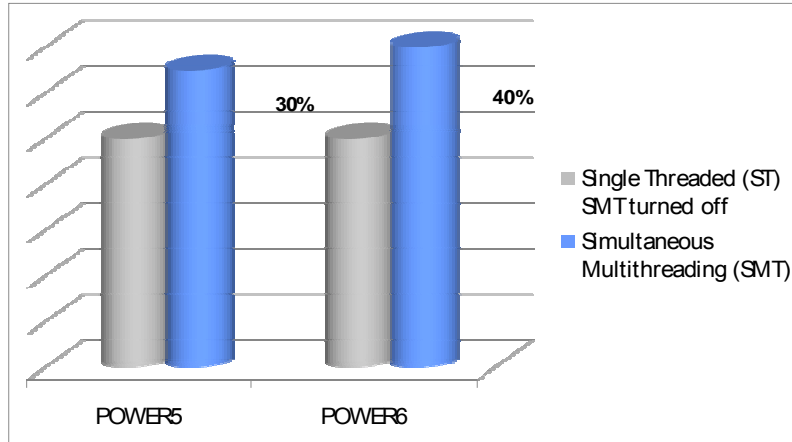
Four instruction threads in memory, waiting to be executed

Each processor presents itself as two virtual processors to the operating system and fetches instructions from two threads.



- Instructions from both threads are executed in each processor concurrently
- Utilizes unused CPU cycles

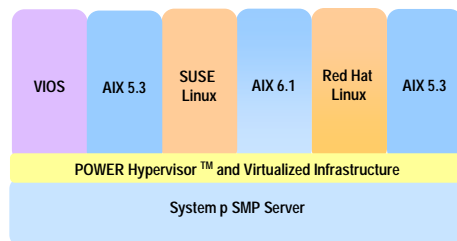
Simultaneous Multithreading (SMT) Delivers More Processing Power



- Net result
 - ▶ Better performance and processor utilization increases throughput and response time, depending on workload

System p Architectural Concepts – Server Virtualization

- Run multiple operating system images on a single platform
 - ▶ Like having several separate servers running simultaneously
- Each image runs in a logical partition
- The POWER Hypervisor™ shares the underlying physical resources dynamically among the partitions



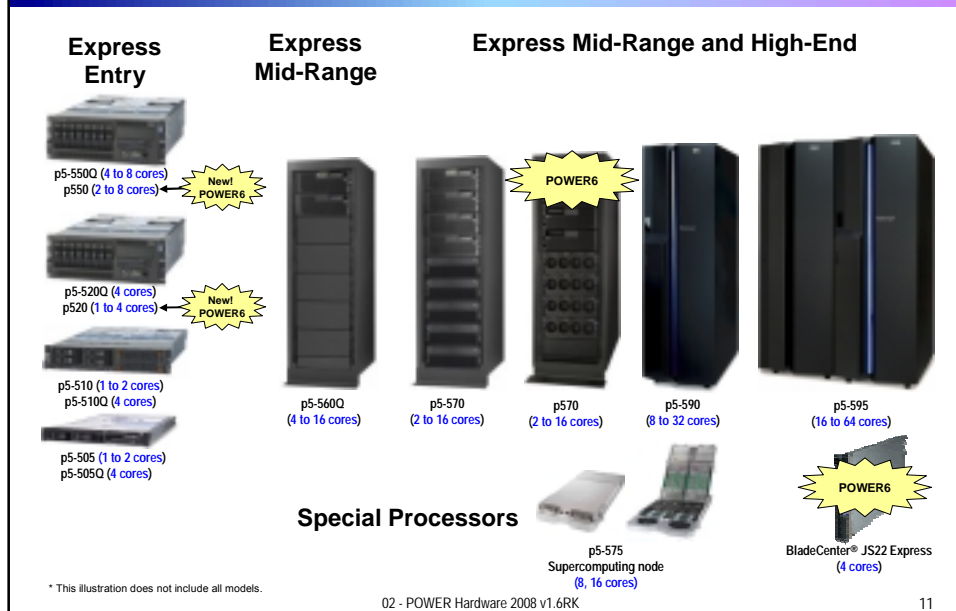
Dynamically shared physical resources in a single platform

We will discuss virtualization and consolidation in more detail later today.



IBM

IBM Power™ Systems Has a Complete Line of System p Servers for Your Data Center *



The diagram illustrates the IBM Power Systems product line, categorized into three main groups: Express Entry, Express Mid-Range, and Express Mid-Range and High-End. The Express Entry group includes models p5-550Q (4 to 8 cores), p550 (2 to 8 cores), p5-520Q (4 cores), p520 (1 to 4 cores), p5-510 (1 to 2 cores), p5-510Q (4 cores), p5-505 (1 to 2 cores), and p5-505Q (4 cores). The Express Mid-Range group includes p5-560Q (4 to 16 cores), p5-570 (2 to 16 cores), and p570 (2 to 16 cores). The Express Mid-Range and High-End group includes p5-590 (8 to 32 cores), p5-595 (16 to 64 cores), and BladeCenter® JS22 Express (4 cores). Special processors shown include the p5.575 Supercomputing node (8, 16 cores). Yellow starburst callouts highlight 'New! POWER6' for the p550, p520, and BladeCenter JS22 Express models.

Express Entry

- p5-550Q (4 to 8 cores)
- p550 (2 to 8 cores)
- p5-520Q (4 cores)
- p520 (1 to 4 cores)
- p5-510 (1 to 2 cores)
- p5-510Q (4 cores)
- p5-505 (1 to 2 cores)
- p5-505Q (4 cores)

Express Mid-Range

- p5-560Q (4 to 16 cores)
- p5-570 (2 to 16 cores)
- p570 (2 to 16 cores)

Express Mid-Range and High-End

- p5-590 (8 to 32 cores)
- p5-595 (16 to 64 cores)
- BladeCenter® JS22 Express (4 cores)

Special Processors

- p5.575 Supercomputing node (8, 16 cores)

* This illustration does not include all models.

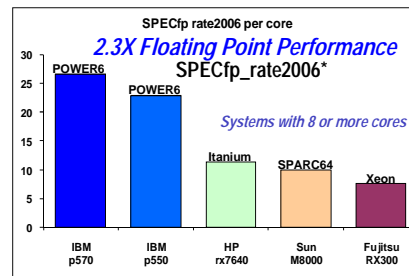
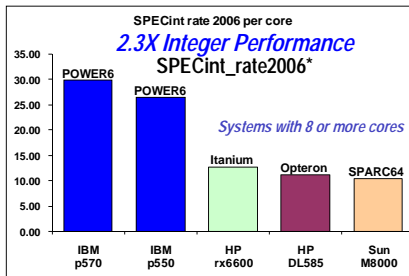
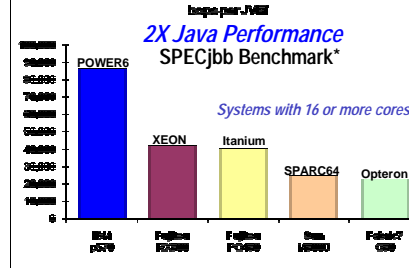
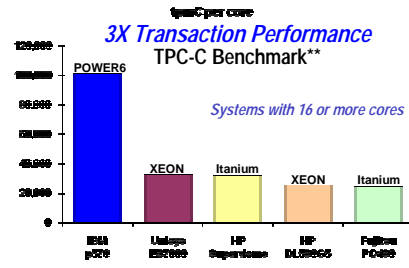
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Quiz: What Is a Grand Slam?

- A. In tennis, a singles player or doubles team that wins all four Grand Slam event titles in the same year.
- B. In baseball, a Grand Slam is a home run with all of the bases occupied.
- C. In computing, a Grand Slam is being the performance leader in four major benchmarks at the same time.
- D. A breakfast item on the menu at Denny's restaurant.
- E. All of the above

IBM System p with POWER6 "Grand Slam" for Major Workloads

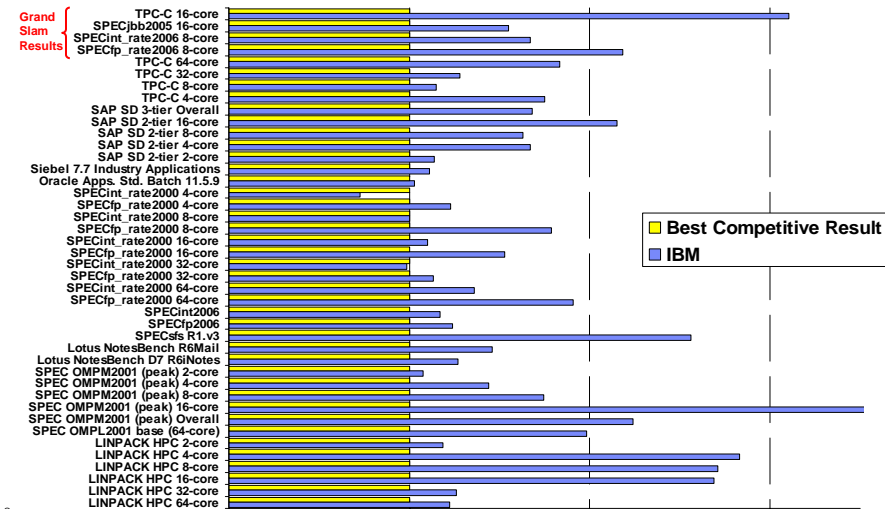


* Source: www.spec.org/
** Source: www.tpc.org/

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Not Just a Grand Slam, It Is a "Slam Dunk," System p Versus The Best Competitive Result



Source:
<http://www.spec.org>
<http://www.tpc.org>
<http://www.sap.com/benchmark/>
<http://performance.siebel.com/performanc.html?PDFS%20%20.htm>
 For a complete list of all #1 POWER results, go to <http://ibm.com/systems/o/benchmark>

All results are as of 02/01/08.

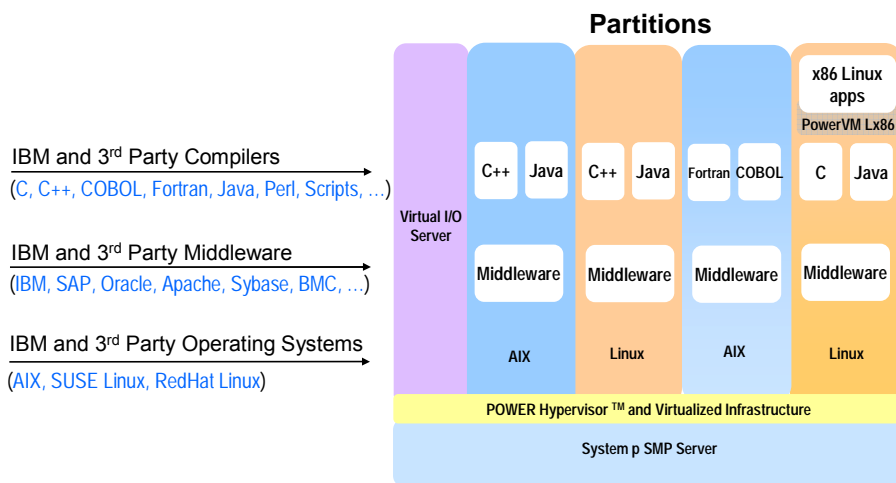
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System p with POWER6 Delivers More Than Just Lightning Fast Processor Speed

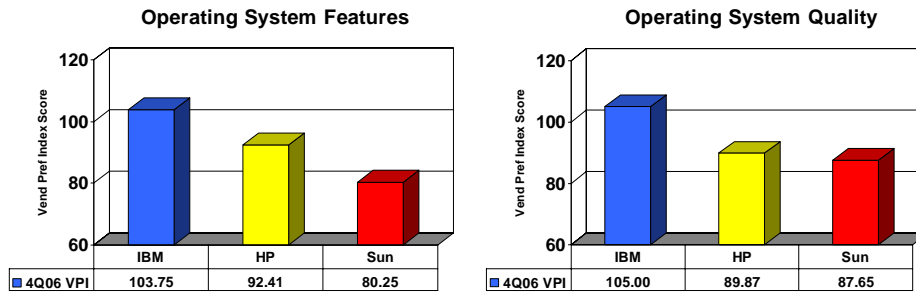
- Breaks the 4 GHz milestone within the same energy envelope as POWER5™
- On-chip power efficiency intelligence for dynamic power savings
- Balanced design with highest system bandwidth
- Integrated hardware accelerators for specialized performance
- Designed for continuous availability

System p Supports Standard Programming Interfaces In a Flexible Ecosystem



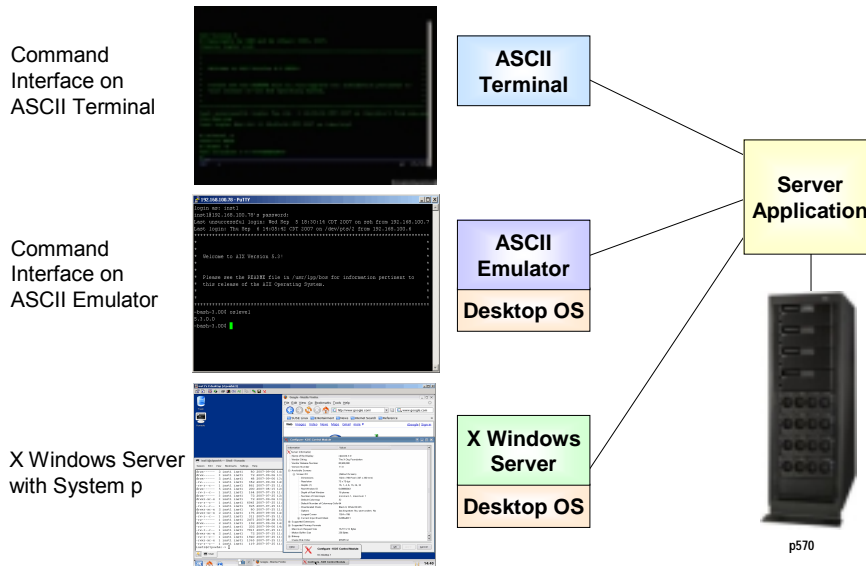
Survey of 277 Enterprise Customers Rank AIX the Best

- AIX has a better history of backwards compatibility

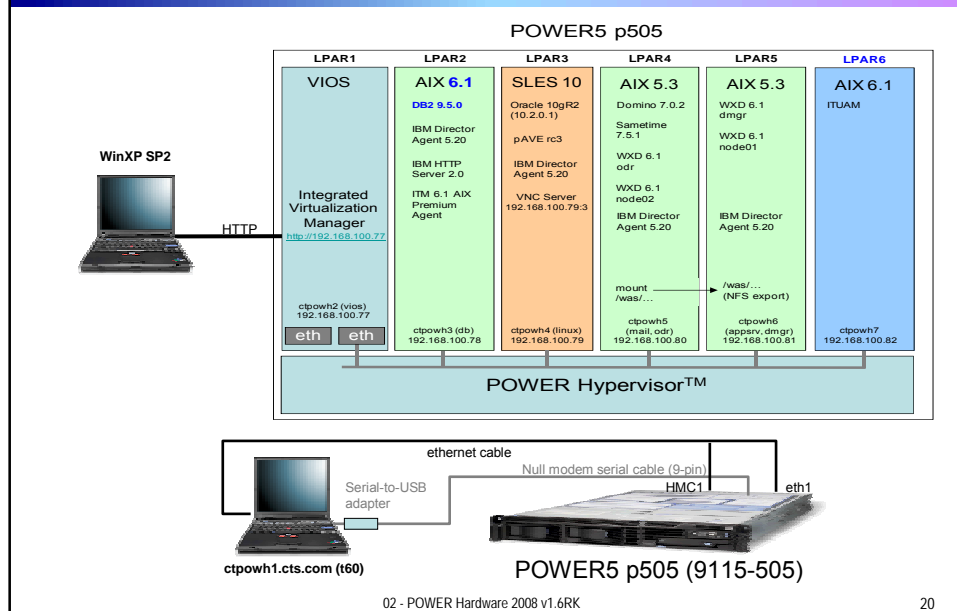


Source: Unix Vendor Preference Survey, December 2006, Gabriel Consulting Group

System p User Interfaces

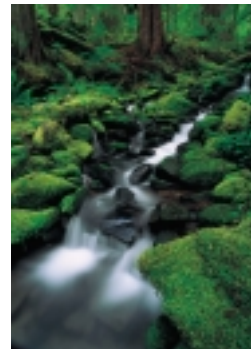


DEMO: Demonstrations in Partitions on One System p



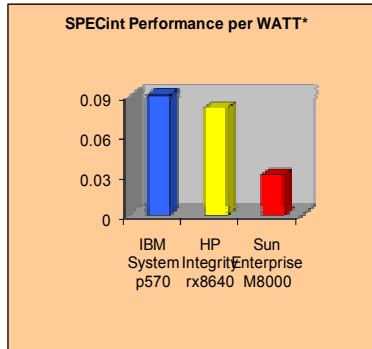
Cool Blue System p is Environmentally Friendly

- Power management functions for POWER6 chips
 - ▶ Power reduction
 - ▶ Nap mode
 - ▶ Thermal tuning
- Power management and control functions in the new System p
 - ▶ Enhanced design and implementation
 - ▶ Variable fan speed
 - ▶ Power off PCI slots when not in use
 - ▶ Rear door heat exchanger
 - ▶ System power management software
- Consolidation and Virtualization inherently reduce power requirements



Cool Blue System p Is Green

- IBM Project Green - The IBM Energy Efficiency Initiative
 1. Best practices and services
 2. Technology and management innovations
 3. Environmental responsibility
- System p570's innovative "green" design saves energy



he top 26 most energy efficient computers are Power processor based systems (Green 500)**

* Only systems where measured power is available

ource: <http://www.green500.org/>

* Performance per WATT based on dividing SPECint_rate2006 performance by vendor recommended maximum power requirement.

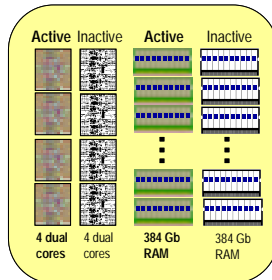
What Is System p Capacity Upgrade on Demand?



p570
2-16 cores
2-768 Gb RAM

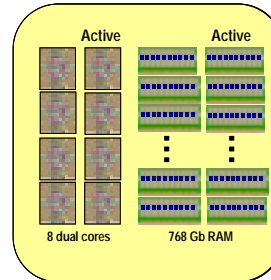
Customer orders p570* with maximum cores and memory, but with only half activated

Only pay in full for active resources and get 65% discount to cover the cost of unactivated processors



Customer determines they need additional capacity for their workload and activates** remaining processors and memory

Additional payment required for newly activated resources, total cost is the same as if all hardware was activated at the time of the original purchase



* System optional capacity options do not require purchase of a new system. Assumes appropriate storage, IO drawers, software licensing, etc. for the configuration. Only processors and memory are shown here as an illustration.

** Activation occurs via one of the optional capacity options available for System p. Not all processors or memory need to be activated at one time. This was done as an illustration

Also Four Other Capacity on Demand Options

- Capacity Upgrade on Demand (processors, memory)
 - ▶ Activate capacity permanently for non-disruptive growth
- On/Off Capacity on Demand (processors, memory)
 - ▶ Temporary capacity for fluctuating workloads
- Trial Capacity on Demand (processors)
 - ▶ Temporary capacity for workload testing or any one time need
- Utility Capacity on Demand (processor minutes)
 - ▶ Autonomic, charges based on measured workload
- Capacity Backup (processors, memory)
 - ▶ Only pay for installed disaster recovery capacity when used
 - ▶ Can be used with IBM HACMP™ V5 and HACMP/XD software (5765-F62) in failover scenarios

System p Reliability

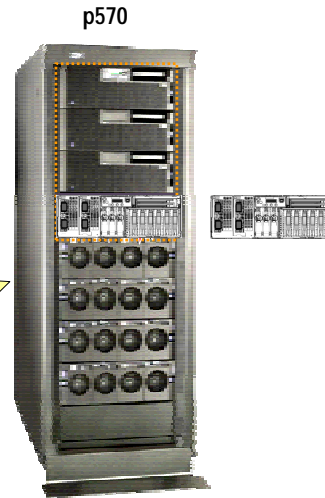
- Error detection
 - ▶ Predictive failure analysis on processors, caches, memory, I/O and DASD
- Built-in redundancy
 - ▶ Redundant power supplies, fans, service processor
- Processor instruction retry
 - ▶ Transparent retry of soft errors on application fault
- Storage protection keys
 - ▶ POWER6 storage keys will isolate data and protect against memory overlay that can cause subtle, intermittent problems
- First Failure Data Capture (FFDC)
 - ▶ Automatic

System p Serviceability

- AIX supports concurrent maintenance
 - ▶ Non-disruptive fixes to AIX
 - ▶ No downtime (reboot) required to apply fix and make it active
- Hot swappable parts replacement
- Electronic Service Agent (ESA)
 - ▶ Automatically contact IBM if problem



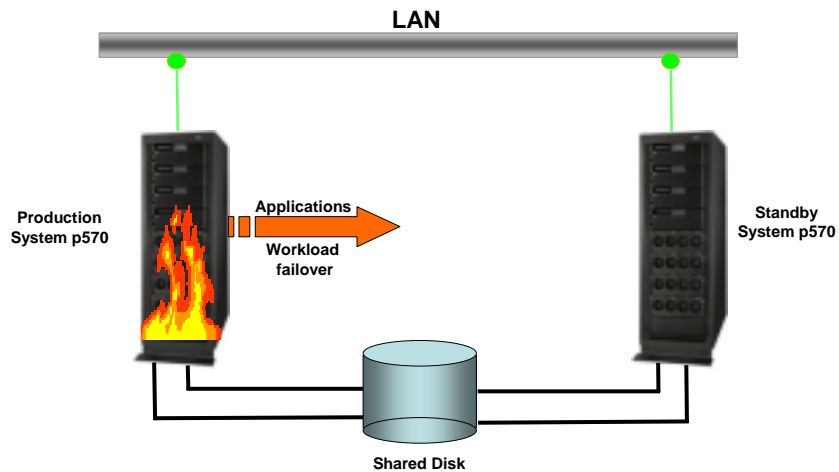
ESA runs automatically in the background!



System p High Availability Cluster Multi-Processing (HACMP) Increases Availability

- HACMP Manages Resource Groups
- Resource Groups move from one node to the other when an event happens
- Resources in a group could be one of the following
 - ▶ Applications, Disk Drives, Volume Groups, File Systems, NFS File Systems, Tape Drives, IP Addresses, Replicated Resources
- AIX and Linux support
- Ease of use enhancements in HACMP 5.4
 - ▶ Configure or upgrade an HACMP cluster on a node without disrupting the target application
 - ▶ Resource dependency graphs

System p HACMP with Failover



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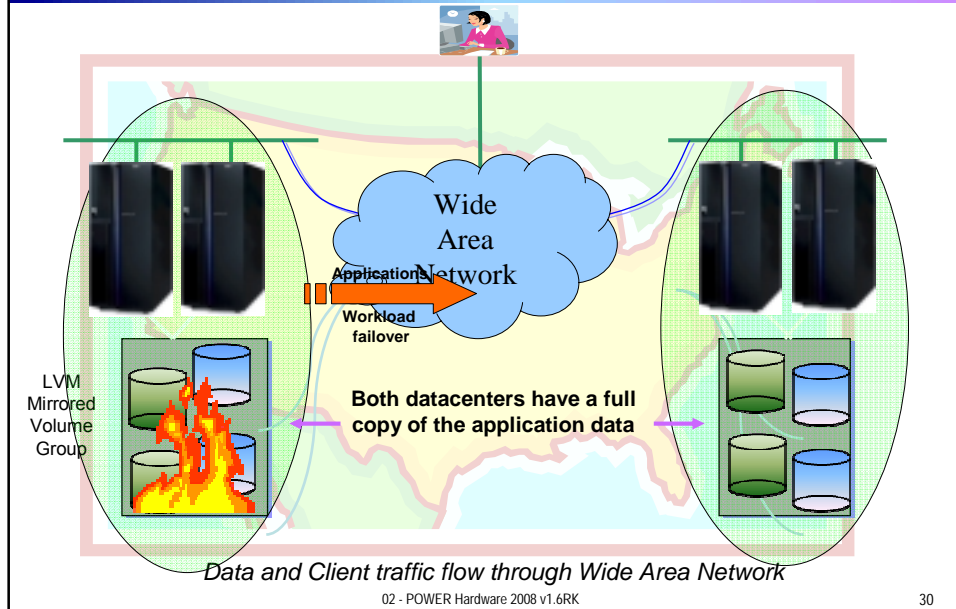
System p HACMP Extended Distance (XD) Provides Disaster Recovery

- Provides high availability and disaster recovery solutions
 - ▶ Recovers locally or moves entire application to backup site
- Integrates HACMP with unique data replication code to provide a fully automated solution
- Resources automatically failover to surviving node, no manual steps required
- Clusters
 - ▶ Campus wide – resources in multiple buildings, customer owns network
 - ▶ Metro wide – separate datacenters within same metro area, local network provider
 - ▶ Unlimited – datacenters in different states or countries, leased line networks
- Setup typically requires IBM services

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System p HACMP XD Can Provide Data Center Level Disaster Recovery



Compare the Competition

	IBM ★ System p	Sun Families	HP Families
Processor speed within a power envelope	✓	Slower	Slower
Integrated power efficiency functions	✓	Future	Future
Overall, price/performance	✓	Higher Cost	Higher Cost
Integrated hardware floating point	✓	No	No
Integrated RAS functions	✓	Partial	Partial
Single unified processor architecture	✓	No (SPARC, UltraSPARC, SPARC64)	No (Itanium, PA-RISC)
Integrated virtualization assists	✓	Only UltraSPARC T1,T2	Only With Itanium (Limited Capability)
Has gone to Mars	✓	No	No

POWER Processor Has Gone To Mars!

NASA's New Phoenix Lander



The Phoenix Lander is powered by a processor based on IBM's POWER Architecture, similar to the one used in Sony's PlayStation 3.

