Boonnarong Rujanakraikan – IT Specialist , IBM Thailand
May/11/2010

Power your planet.

Reduce Costs and Create a More Dynamic Infrastructure by Consolidating Workloads on Power Systems

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As The World Gets Smarter, Demands On IT Will Grow

Smart supply chains

Intelligent oil field technologies

Smart food systems

Smart healthcare

Smart energy grids

Smart retail

1 Trillion

Devices will be connected to the internet by 2011

25 Billion

Global trading systems are under extreme stress, handling billions of market data messages each day

10x

Digital data is projected to grow tenfold from 2007 to 2011.

70¢ per $1

70% on average is spent on maintaining current IT infrastructure versus adding new capabilities

IT infrastructure must grow to meet these demands global scope, processing scale, efficiency

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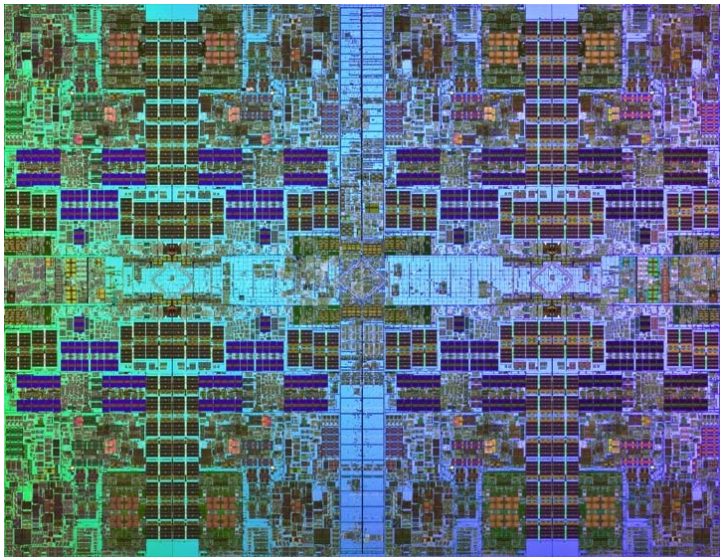
Technology leadership



- ✓4, 6 or 8 cores per socket
- ✓3.0 to 4.14 GHz
- ✓Up to 4 threads per core
- ✓Integrated eDRAM L3 Cache
- ✓Dynamic Energy Optimization

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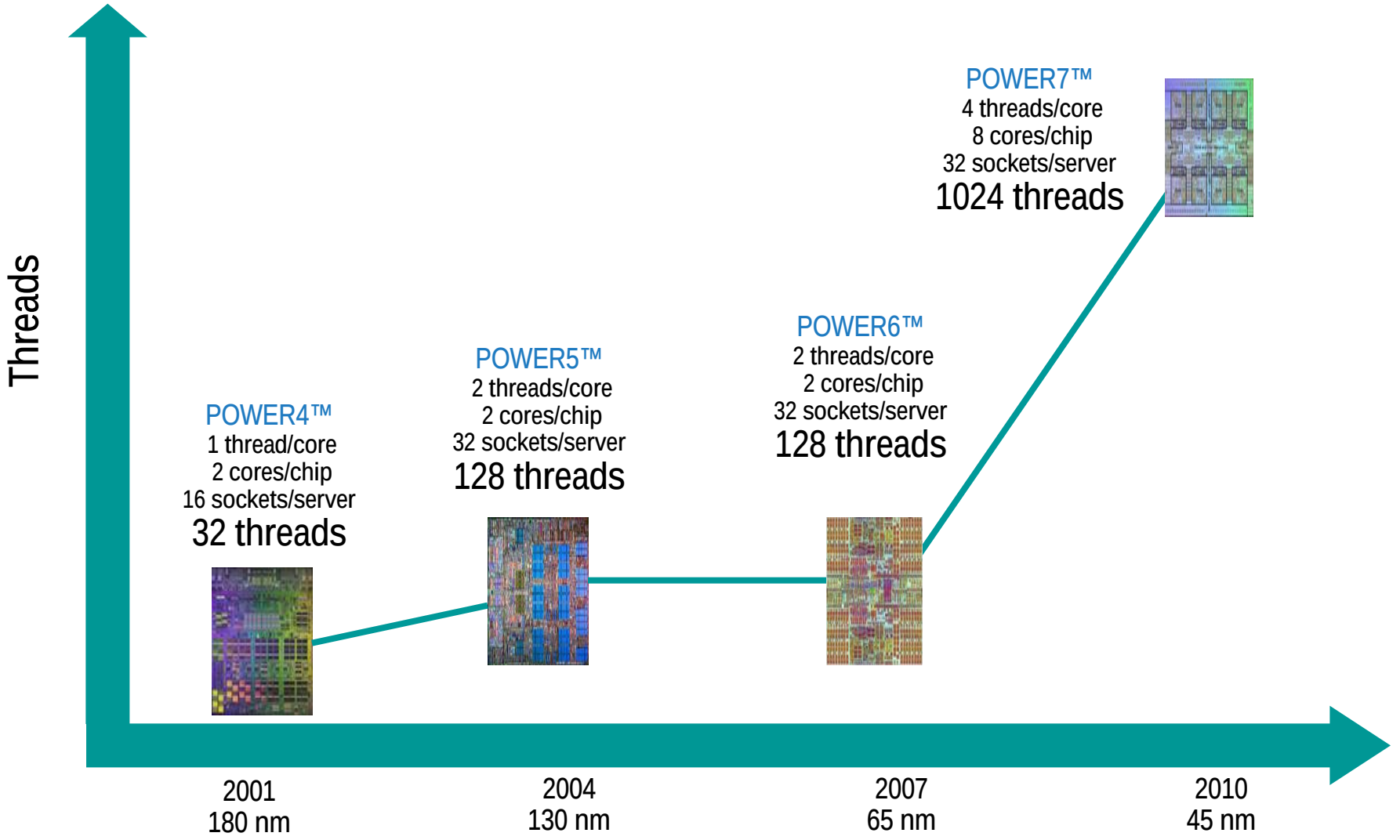
In 2010 Power Systems Brings Massive Parallelism Mainstream



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Smarter Planet Challenge – The Coming Era Of Massive Parallelism

- ✓ Chip densities continue to increase, enabling more processor cores per chip
- ✓ More processor cores on a chip mean more execution threads available in a server

- ✓ **Challenge** – Exploit new hardware servers with massive threads without redesign to parallelize applications

- ✓ **Solution** – Middleware that **transparently** leverages massively parallel threads, leaving applications unchanged

Our vision

Designed, integrated systems and solutions
are part of the transformational story
of the next decade.

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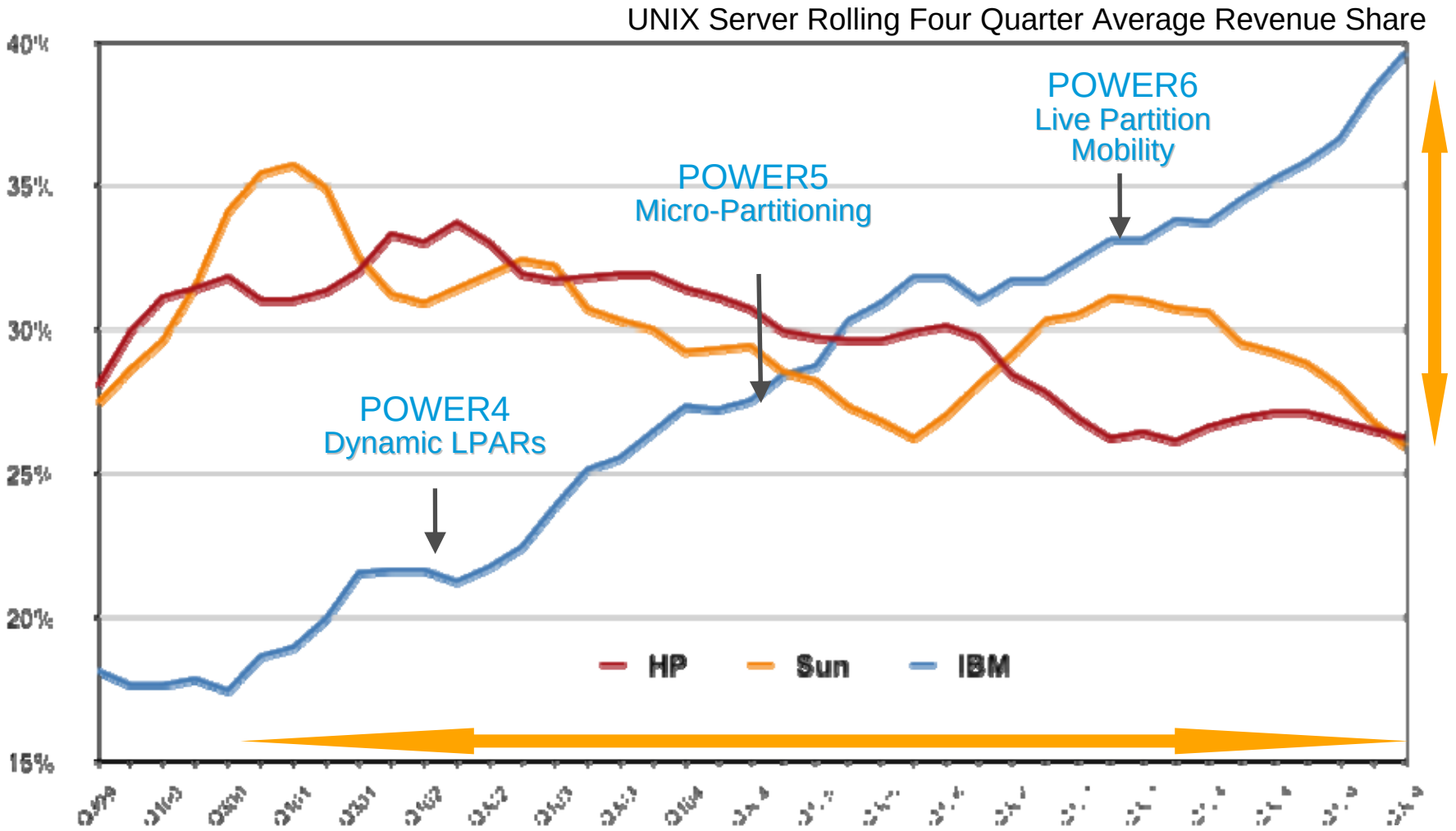
Customers are moving to higher value

…as shown by the largest shift of customer spending in UNIX History



Source: IDC Quarterly Server Tracker Q309 release, November 2009

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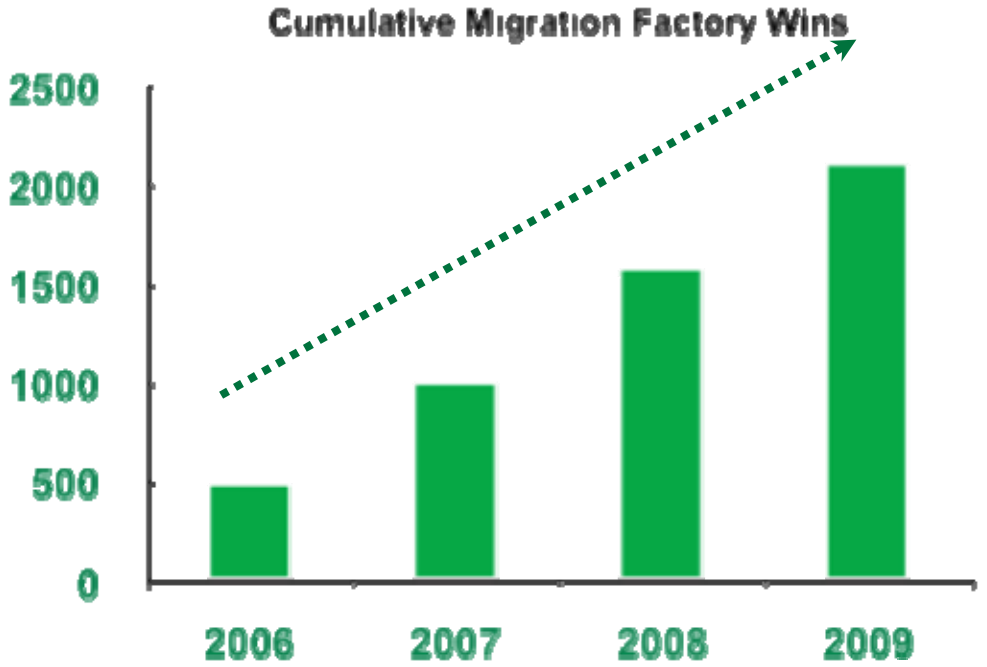
2,100

successful Power Migration Factory migrations to date.
There were over 500 Power migrations during 2009, with more than 90% from Sun and HP customers (including x86 consolidation). In 4Q09 alone, Power achieved nearly 200 competitive migrations.



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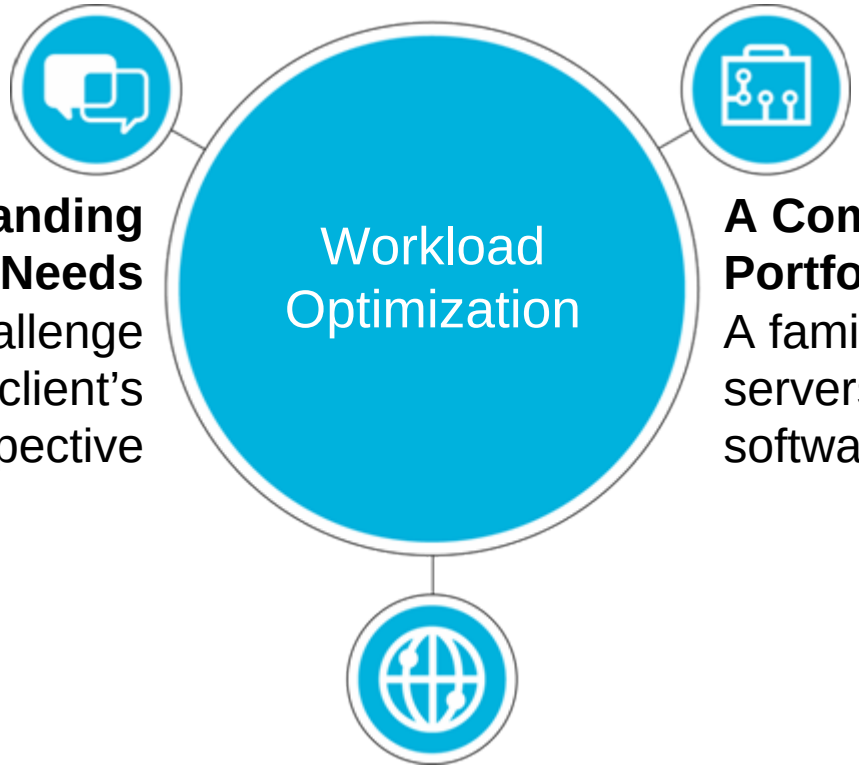
IBM Systems & Technology lay the foundation



Deep Understanding of Client Needs
Approach challenge from the client's perspective

A Comprehensive Portfolio
A family of "fit-for-purpose" servers, storage & system software

Technology Leadership
Investing in future technology for differentiation and sustained leadership

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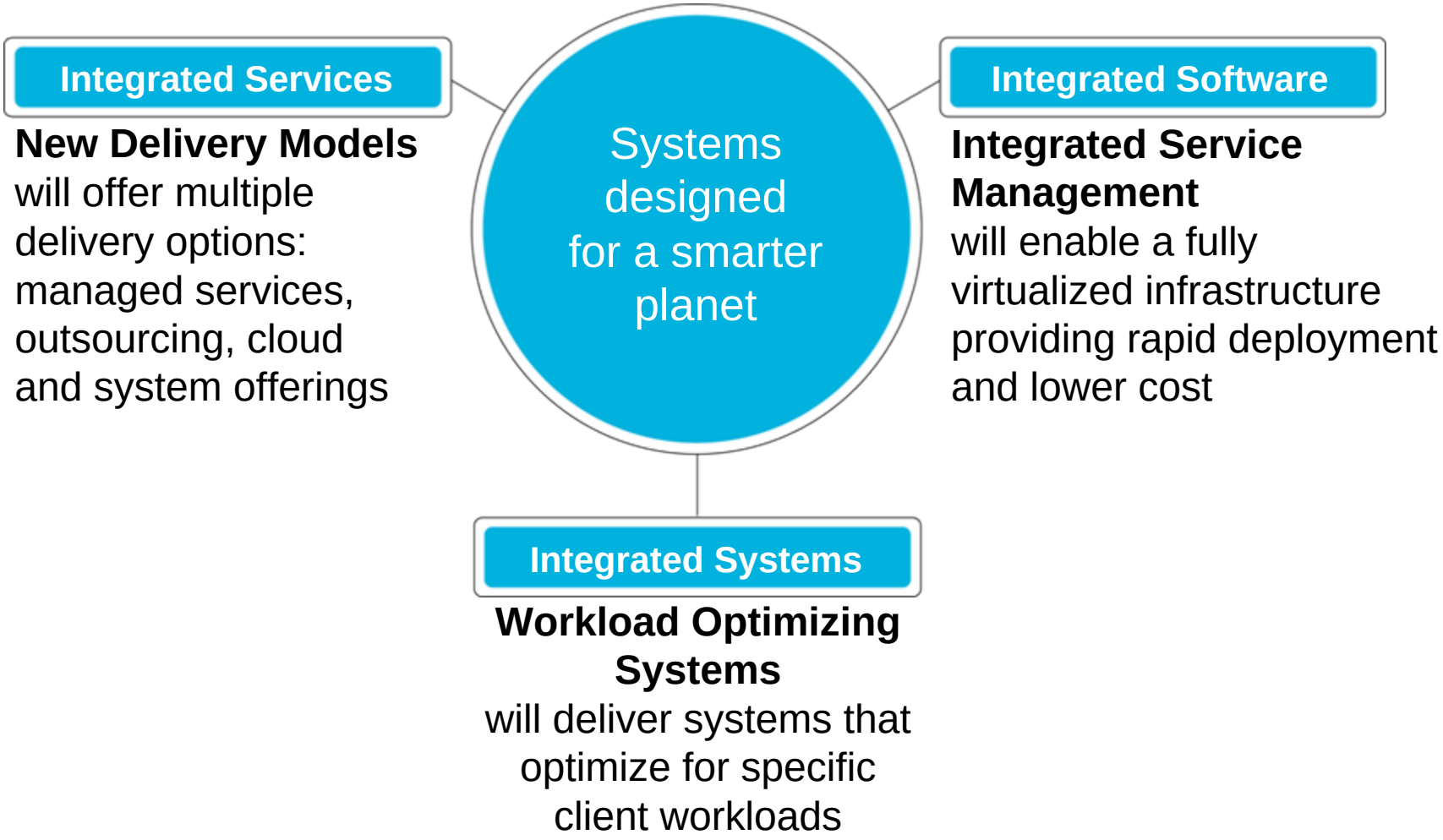
Providing an integrated solution of systems, software and services



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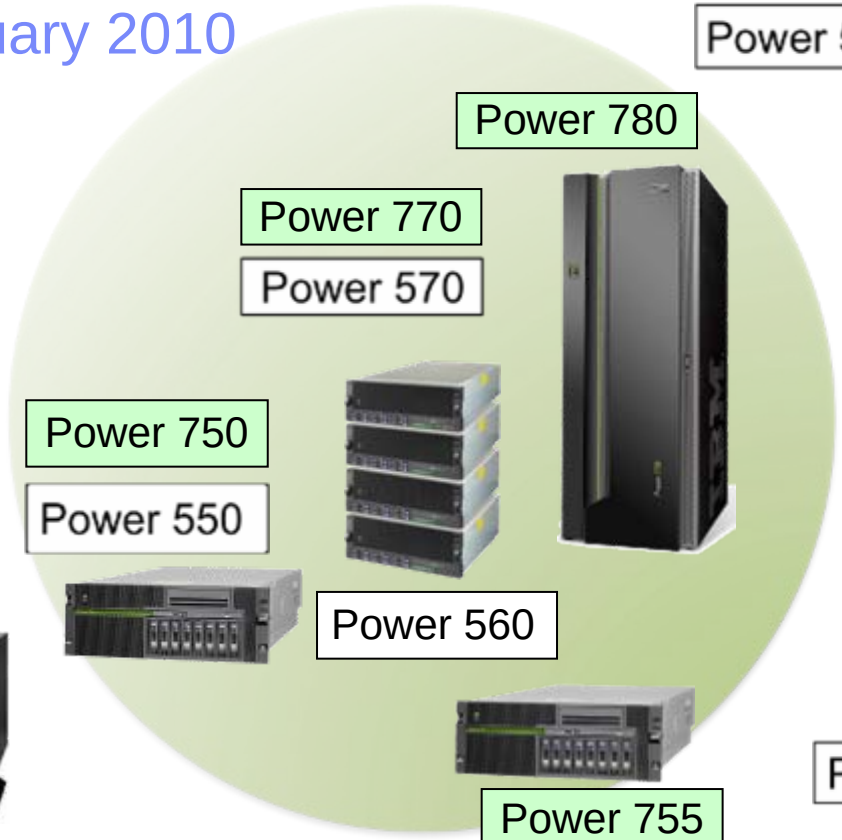
Power Systems – February 2010

- New POWER7 in middle of the line
  - Power 750 Express
  - Power 755 for HPC
  - Power 770 modular
  - Power 780 modular high-end
- POWER6 continues
  - Power 520, Blades
  - Power 550
  - Power 560
  - Power 570
  - Power 575
  - Power 595



IBM Systems Software

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Power 750 Express

- ✓4 Socket 4U
- ✓6 or 8 cores per socket
- ✓3.0 to 3.55 GHz
- ✓Energy-Star Qualified

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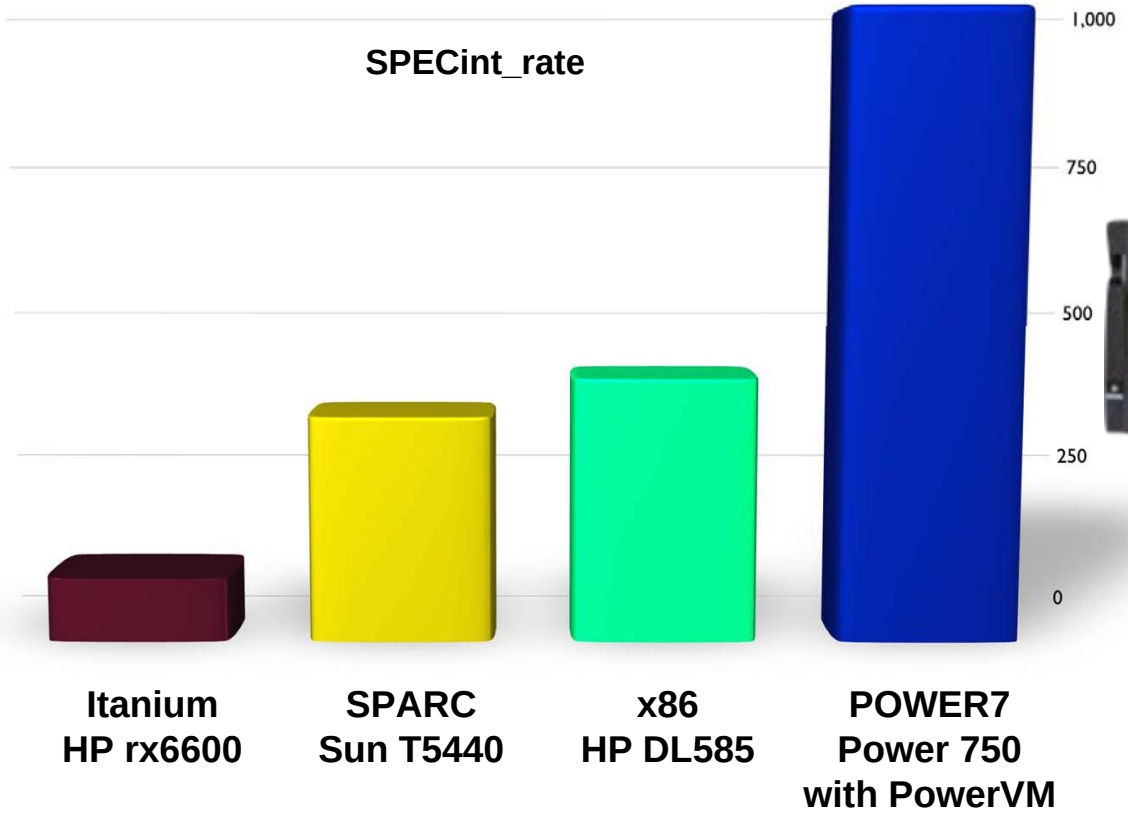
The highest performing 4-socket system on the planet

POWER7 continues to break the rules with more performance



Power 750

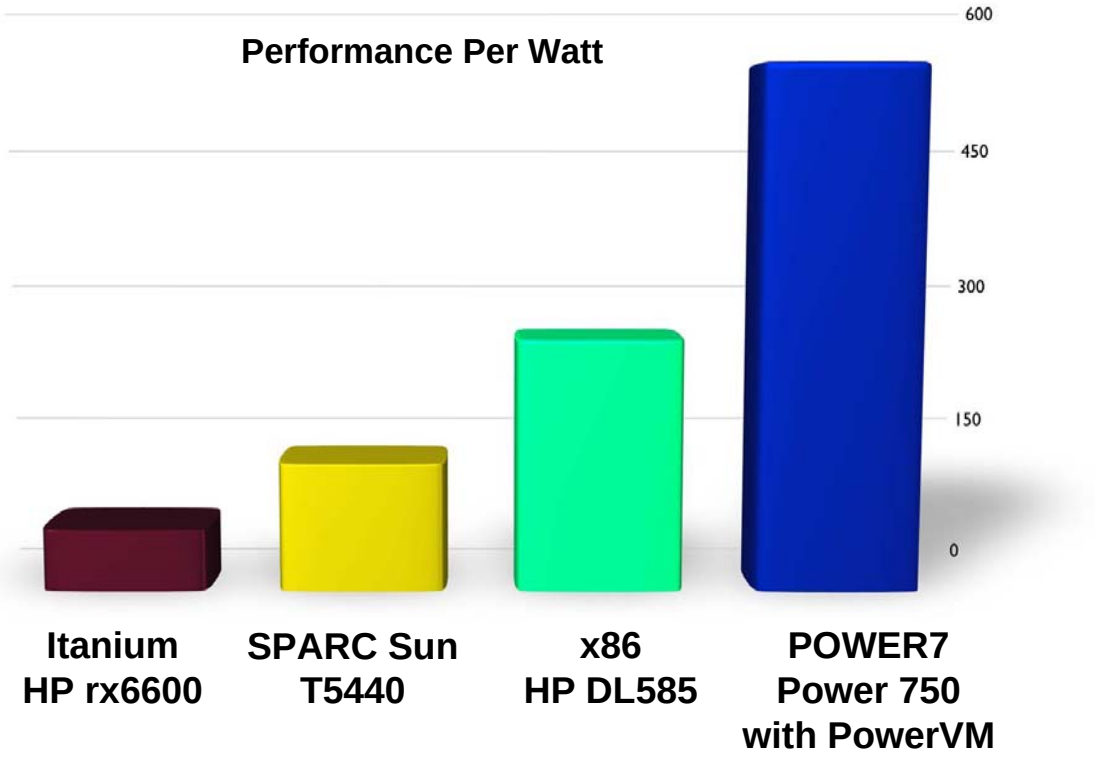
© 2010 IBM Corporation

The most energy efficient 4-socket system on the planet

The first Energy Star certified RISC system

Power 750

Most energy efficient systems



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More SAP performance than any 8-socket system in the industry

Comparable to a 128-core, 32-socket Sun M9000

15,600 SAP users on SAP SD 2 Tier

Power 750 Express with DB2

- Best SAP 2-Tier Results for 2, 4 , 8 and 16 sockets.
- See SAP Benchmarks chart for detail or SAP website http://www.sap.com/solutions/benchmark/sd2tier.epx

© 2010 IBM Corporation

Lower TCA

At equal capacity for two 32 core IBM Power 750 Express systems compared to two HP DL785 G6‘s and nine HP DL380 G6 systems leveraging the higher utilization and virtualization efficiency capabilities of Power.

The IBM Power 750 Express configuration saves 75% of the space, 90% of the network connections, and 72% of the systems to manage.

US$447,969

US$387,760

Source: Capacity based on IBM Sizing of typical ERP landscape and IBM estimates of system utilization. Pricing from www.hp.com

© 2010 IBM Corporation

92 to 1

Number of Sun SPARC Enterprise T2000's that can be consolidated into a single IBM Power 750 4 socket system saving 95% of the cores for software licensing, 97% on floor space, and 95% on energy.

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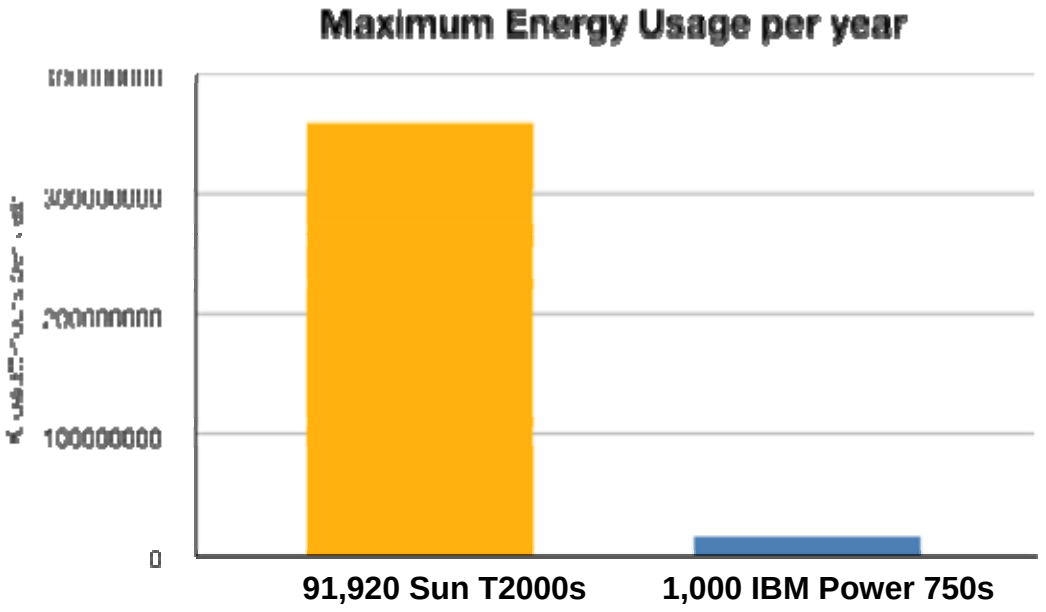
345 million kilowatt-hours

used yearly by the 91,920* Sun SPARC Enterprise T2000 servers shipped since 2005 above what would be used yearly if consolidated into 1,000 IBM Power 750s at the rate of 92 to 1.

That's enough electricity to supply 34,500 homes for a year.



Source: IDC Server Tracker; Wikipedia estimate of average annual household energy use of 10,000 kwH

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83%

savings on energy costs with 28% more performance at a fraction of the price using a single **IBM Power 750** instead of a 64-core HP Integrity Superdome.

Superdome or Super Power?

Shown to actual scale

HP Integrity Superdome 64c

- 1.6GHz dual-core Itanium2 in a 30”x77.2”x48” frame
- Maximum energy requirement of **11,586 Watts**
- **SPECint_rate2006: 824**

IBM Power 750 Express

- 4 socket, 32 Core 4Ux19” wide
- POWER7 Processors
- Maximum energy requirement of **1,950 Watts**
- **SPECint_rate2006: 1060**

See Power 750 server compared to HP Integrity Superdome substantiation detail.
Source: SPECiint_rate2006. For the latest SPEC benchmark results, visit http://www.spec.org.

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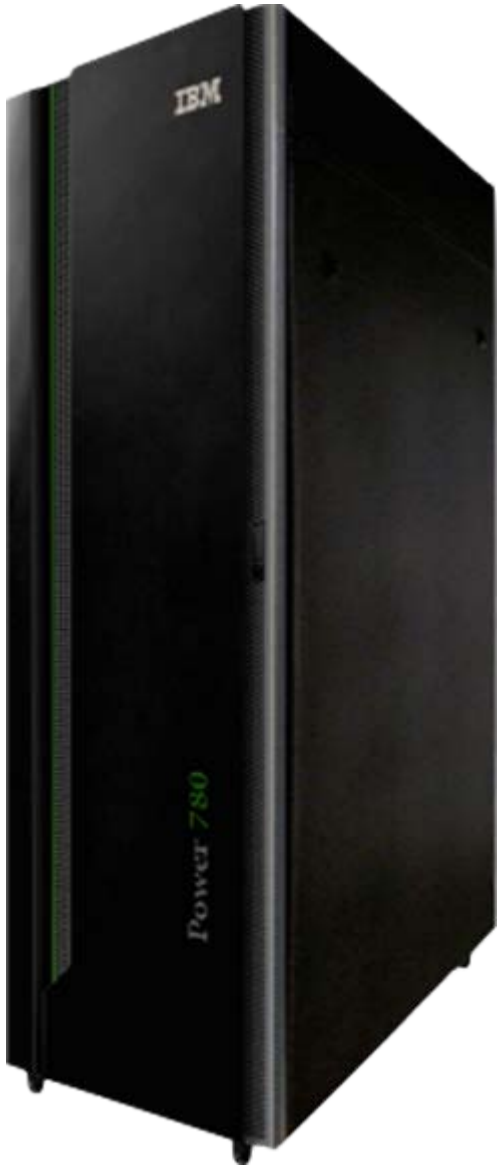
Power 770

- ✓12 or 16 core 4U Nodes
- ✓Up to 4 Nodes per system
- ✓3.1 and 3.5 GHz
- ✓Capacity on Demand
- ✓Enterprise RAS

© 2010 IBM Corporation

Power 780

- ✓New Modular High-End
- ✓Up to 64 Cores
- ✓TurboCore
- ✓3.86 or 4.14 GHz
- ✓Capacity on Demand
- ✓Enterprise RAS
- ✓24x7 Warranty
- ✓PowerCare



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8 to 1

Number of HP Integrity Superdome 64-core systems utilized at 30% that can be consolidated into a single IBM Power 780 modular high-end system utilized at 80% saving 87% of the cores for software licensing, reduces floor space required from 80 square feet to just 7.6, and reduces energy costs by 92%.

Super Power indeed.

© 2010 IBM Corporation

84%

Reduction in energy usage moving from POWER5 to POWER7.

Savings extend to floor space, software license costs, and maintenance. Increase your performance and capacity.

POWER5 570 systems
64 cores @ 1.9 GHz
30% utilization

4 → 1

Power 770
24 cores @ 3.5 GHz
60% utilization

50% effective capacity increase

84% reduction in energy usage

~$250K maintenance savings over 3 years

> $1M savings in software licensing

With room to spare to consolidate x86 workloads

© 2010 IBM Corporation

Power your planet.

Workload-Optimizing Systems

+

AIX Linux

AIX - the future of UNIX

Total integration with i

Scalable Linux ready for x86 consolidation

PowerVM

Virtualization without Limits

- ✓ Drive over 90% utilization
- ✓ Dynamically scale per demand

POWER7 BUILT ON Power

Dynamic Energy Optimization

- ✓ 70-90% energy cost reduction
- ✓ EnergyScale™ technologies

PowerHA

Resiliency without Downtime

- ✓ Roadmap to continuous availability
- ✓ High availability systems & scaling

IBM Systems Director

Management with Automation

- ✓ VMControl to manage virtualization
- ✓ Automation to reduce task time

Smarter Systems for a Smarter Planet.

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Power is Workload Optimization

Power Systems offers balanced systems designs that automatically optimize workload performance and capacity at either a system or VM level

- ✓ **TurboCore**™ for max per core performance for databases
- ✓ **MaxCore** for incredible parallelization and high capacity
- ✓ **Intelligent Threads** utilize more threads when workloads benefit
- ✓ **Intelligent Cache** technology optimizes cache utilization flowing it from core to core
- ✓ **Intelligent Energy Optimization** maximizes performance when thermal conditions allow
- ✓ **Active Memory™ Expansion** provides more memory for SAP
- ✓ **Solid State Drives** optimize high I/O access applications

Workload-Optimizing Features make POWER7 #1 in Transaction and Throughput Computing

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Power is Resiliency without Downtime

PowerHA SystemMirror for AIX and i provide active/standby datacenter and multi-site disk clustering solutions for resiliency

PowerHA pureScale provides active/active high performance data transfer, cluster coordination, and centralized locking and is built-into DB2 pureScale

PowerVM Live Partition Mobility enables planned system downtime without application downtime

© 2010 IBM Corporation

Power is Dynamic Energy Optimization

POWER7 delivers up to 3 - 4X the performance with less energy than POWER6

Increased consolidation drives higher utilization and more energy savings

EnergyScale™ intelligently and dynamically optimizes performance for energy efficiency

IBM Systems Director Active Energy Manager helps lower energy usage per system and across systems

© 2010 IBM Corporation

Power is Management with Automation

Physical assets & virtual resources at your fingertips with easy health monitoring & reporting, as well as updates & optimization

VMControl™ for automation of virtualization management to minimize time to provision images and manage system pools

Server and virtualization management integrated with network and storage management for complete resource control

Easy integration with enterprise service management tools from Tivoli as well as other third party providers

IBM® Systems Director

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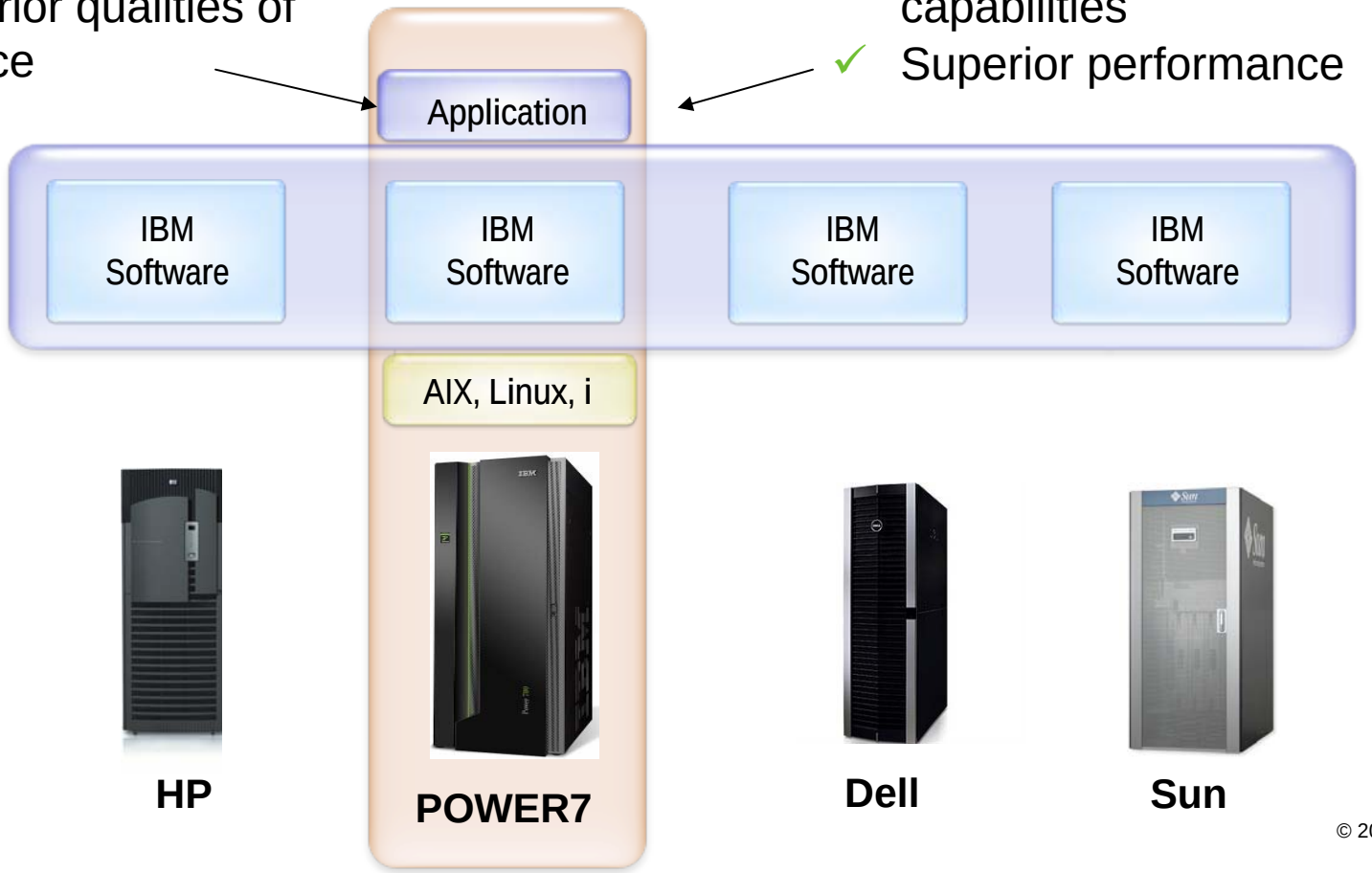
IBM Software On Power Systems – Massive Parallelism For Smarter Planet Solutions

POWER7 Hardware

- ✓ Massively parallel – up to 1024 threads
- ✓ Superior qualities of service

IBM Software on POWER7

- ✓ Exploits parallel threads
- ✓ Smarter Planet capabilities
- ✓ Superior performance



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Breakthroughs In Software

- ✓ IBM Software automatically exploits the threads available on POWER7 to optimize performance and deliver best value

Results

- ✓ Simplify web facing application deployment
- ✓ Cost effective data base processing with massive scale
- ✓ Message backbones with huge capacity
- ✓ Simplify enterprise application infrastructure
- ✓ Reduce data center operational costs while providing more agile service

© 2010 IBM Corporation

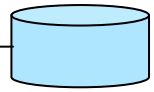
Simplify Web Facing Application Deployment

Extend WebSphere Application Server to fully exploit up to 32 threads in a single process, thereby reducing the number of images required

IBM WebSphere Application Server 7
1 JVM
AIX TL4
64 bit
32 threads

IBM Power 750 8 cores 3.55GHz

DB2 9.7.1



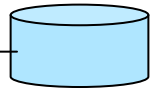
3920
Transactions/sec

- ✓**73% more work per JVM image**
- ✓Simpler configurations
- ✓Better scale for software built on application server

Competitive application server
1 JVM
Windows
64 bit
16 threads

Nehalem EP 8 cores

DB2 9.7.1



2260
Transactions/sec

Source: IBM CPO internal studies

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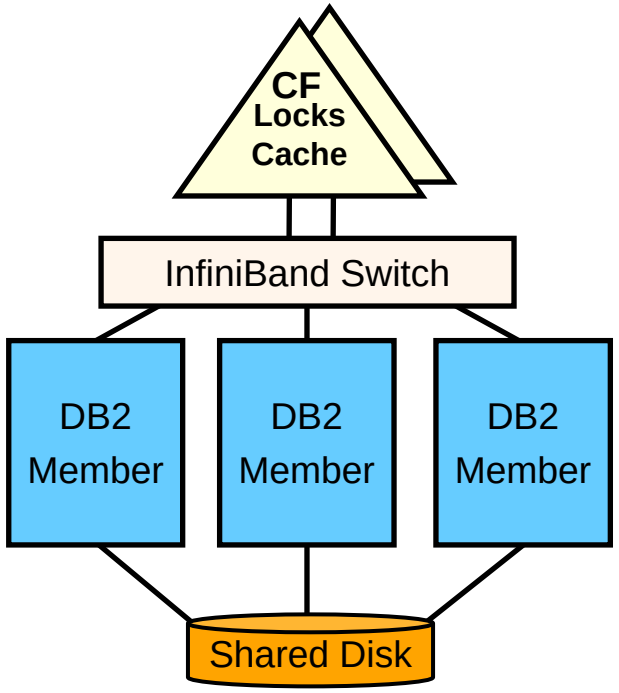
Cost Effective Data Base Processing With Massive Scale

- ✓ Unique DB2 pureScale clustering design achieves near linear scaling
  - ✓ No partitioning required
  - ✓ Available only on Power Systems
- ✓ Large clusters can harness the power of a massive number of POWER7 execution threads
- ✓ Huge capacity
  - ✓ Near Linear Scaling up to 128 members
    - 64 members: 95% of linear, 128 members: 84% of linear
  - ✓ Oracle RAC typically scales poorly beyond 4 to 8 nodes for a non-partitioned data base



IBM tests: 90% read 10% write web commerce workload
Oracle RAC scale based on analysis of HP Study of Oracle RAC
http://whitepapers.zdnet.com/abstract.aspx?docid=156911

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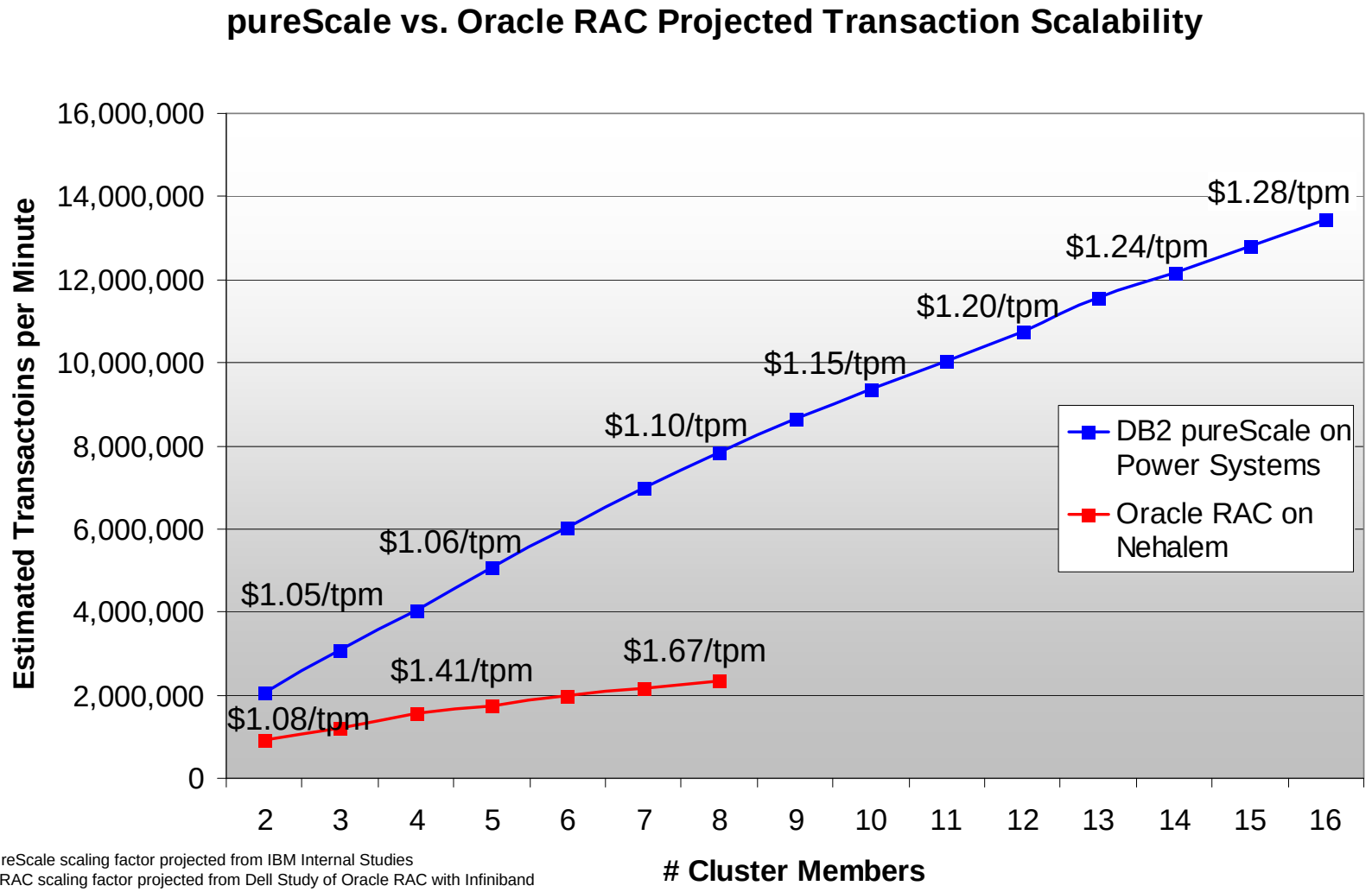
DB2 pureScale on POWER7 – Competitive Price Performance With Far More Scalability



DB2 pureScale scaling factor projected from IBM Internal Studies
Oracle RAC scaling factor projected from Dell Study of Oracle RAC with Infiniband
http://www.dell.com/downloads/global/power/ps2q07-20070279-Mahmood.pdf
Price per tpm includes 3-year total cost of acquisition of hardware, software, maintenance
Price does not include storage or networking

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Build Message Backbones With Huge Capacity

IBM Message Broker execution groups leverage available threads on POWER7

Message Workload

IBM Message Broker v7
7 Execution Groups
MQ Server 7.0.1
AIX v6.1 64 bit

IBM
Power 750 3.0 GHz
8 cores

21,808
Messages/sec

53 times faster

Message Workload

Microsoft Biztalk 2009
12 Host Instances
SQL Server 2008
MQ Server 7.0.1
Windows 32bit

Nehalem EP
8 cores

409
Messages/sec

Workload is mix of in/out, routing, transformation, transformation and routing messages

Projecting from Power 570 8 cores 4.7GHz to Power 750 8 core 3.0GHz using rPerfs

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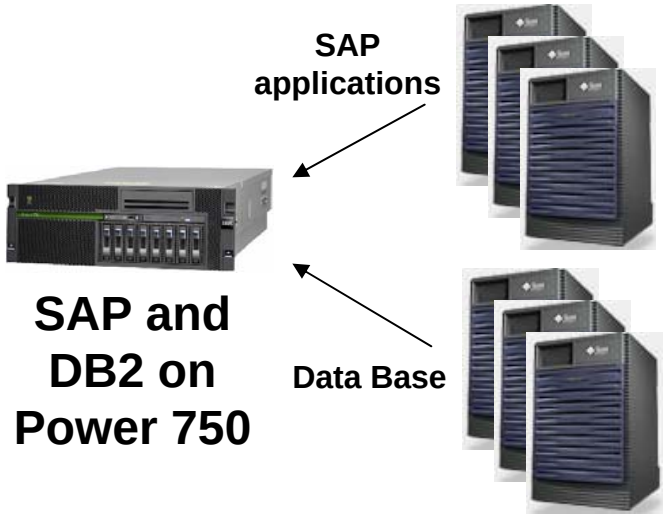
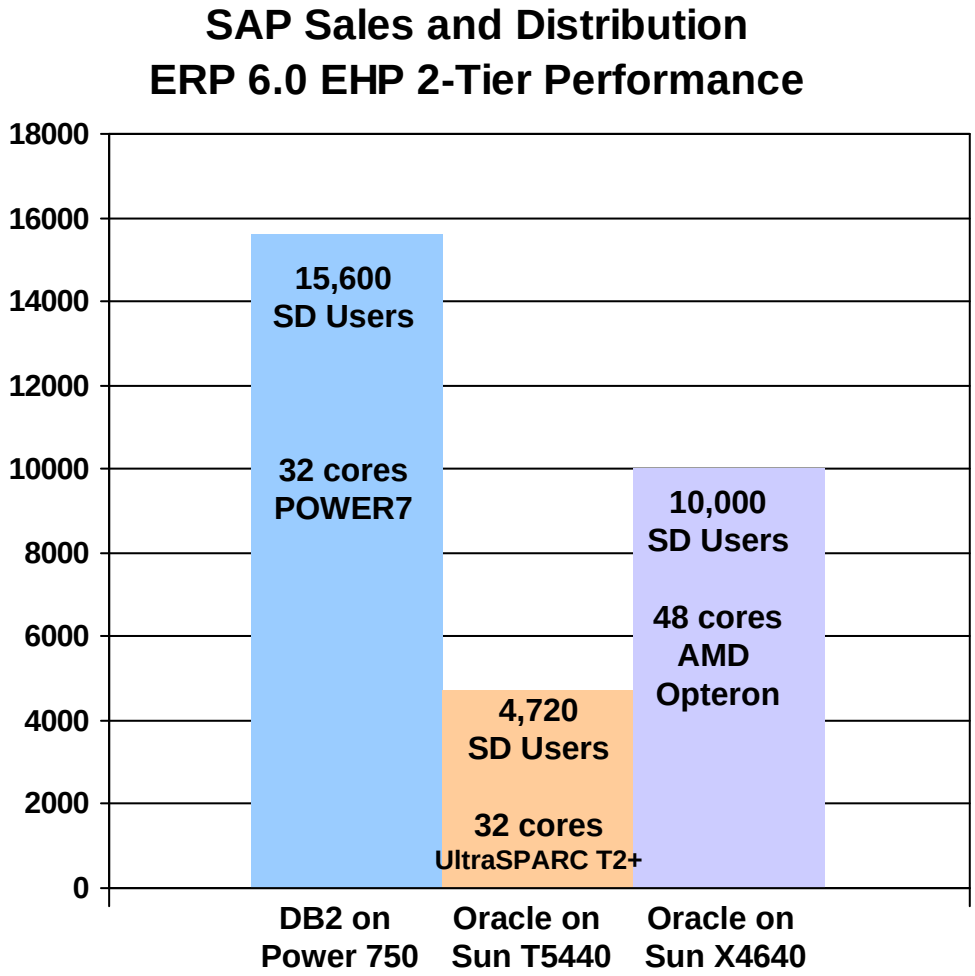
Simplify SAP Infrastructure And Reduce Costs
Case Study - Support 15,000 Users



- ✓ Support 3.3x more users on DB2 and Power 750 than Oracle on SPARC

- ✓ **Infrastructure costs per user**
  - ✓ DB2 on Power 750 $100/user
  - ✓ Oracle on Sun T5440 $185/user
  - ✓ Oracle on Sun x4640 $123/user



IBM Power 750 certification number not available at press time and can be found at sap.com/benchmarks. IBM Power System 750, 4p / 32–c / 128 – t, POWER7, 3.55 GHz, 256 GB memory, 15,600 SD users, dialog resp.: 0.98s, line items/hour: 1,704,330, Dialog steps/hour: 5,113,000, SAPS: 85,220, DB time (dialog/ update):0.015s / 0.028s, CPU utilization: 99%, OS: AIX 6.1, DB2 9.7;
IBM Power 570 16p / 32-c / 64 –t, 256 GB memory, 14,432 SD users, POWER6 4.2 GHz, AIX 6.1, DB2 9.5, cert# 2008057
All results are 2-tier, SAP EHP 4 for SAP ERP 6.0 (Unicode) and valid as of 2/9/2010.

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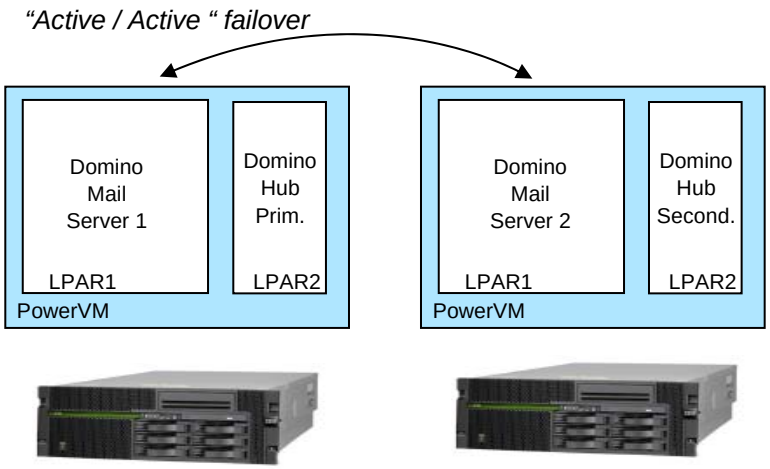
Simplify Email Infrastructure And Reduce Costs
Case Study – Support 40,000 Users

Domino 8.5 on POWER7



Domino Servers
2 x IBM Power 750 8-core, 3.0 Ghz

- ✓ 2 servers total, 20,000 mailboxes per server
- ✓ 40,000 total active users
- ✓ **$100** per user per year TCO (3 yrs)

Exchange 2010 on Nehalem

Exchange Edge Servers
2 x BL380c G6 (2 core, Xeon E5502 1.86 GHz)

Exchange Client Access Servers
4 x BL460c G6 (8 core, Xeon E5502 1.86 GHz)

Exchange Hub Servers
3 x BL460c G6 (8 core, Xeon E5502 1.86 GHz)

"Active / Active " failover style using 1 Database Availability Group

Exchange Mailbox Servers
10 x BL460c G6 (8 core, Xeon E5504 2.00 GHz)

- ✓ 19 servers total
- ✓ 10 mailbox servers, 4000 mailboxes per server
- ✓ **$166** per user per year TCO (3 yrs)

Exchange on Nehalem configuration from HP's sizing tool.
HP Sizer for Microsoft Exchange Server 2010 at
http://h20338.www2.hp.com/ActiveAnswers/us/en/sizers/microsoft-exchange-server-2010.html

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Simplify Smart Analytics Infrastructure
A New Intelligence Solution In A Power Box

IBM Smart Analytic System

- ✓ A complete, ready-to-deploy system including hardware, software, storage, and network
- ✓ System is installed, tuned, and "Data Load Ready"
- ✓ Less project risk

Faster Time To Value

- ✓ Deploy in 12 days instead of 6 months
- ✓ Focus on creating business value, not installing hardware and software

Costs less than building it yourself

- ✓ Less staff and expertise required to implement, tune, and maintain

Unique offering

- ✓ No competitor offers such an integrated analytics solution

Find out more: http://www.ibm.com/smart-analytics-system

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Reduce Data Center Costs While Providing More Responsive Service

Which platform provides the lowest TCA over 3 years?

360 cores

Requirements

Buy **45** 8-core Nehalem servers

TCA: $2.97M

45 Workloads

IBM WebSphere Application Server

64 cores

Buy **2** 32-way Power 750 (3.55GHz) servers

TCA: $1.18M

64 cores

Buy **1** 64-way Power 770 (3.1GHz) server

TCA: $1.16M

Online banking workloads, each driving **745** transactions per second

Large scale virtualization on POWER7 yields higher consolidation and lower costs

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Large Scale Of POWER7 Cuts Costs In Half

8-core Nehalem Servers

5 Network Switches

98 Cables

45 Nehalem Servers

360 Cores

Hardware + Software: $2.97M

Labor: $1.05M

Total Cost: $4.02M

IBM Smarter Systems with POWER7

2 Network Switches

10 Cables

1 Power 770
64 cores

Hardware + Software: $1.16M

Labor: $0.74M

Total Cost: $1.90M

Note: 3 year costs, labor includes management software costs

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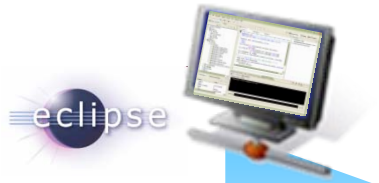
IBM Rational End-to-End Application Development Environment For Power

Rational Developer for Power



Common developer desktop delivering integrated **developer tools** for all Power operating systems and programming languages

Rational.

Rational Team Concert

Server infrastructure enables **collaborative coordination** for development teams for all Power environments

AIX i for Business Linux

Compilers

Compilers exploit new VSX machine instructions for vector performance

AIX i for Business Linux

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IBM Software And POWER7 – High Performance Yields Dramatic Cost Advantages

- ✓ When configured for optimum throughput, WAS on POWER7 is **22% lower** cost per tps than a competitive application server on an 8-core Nehalem server
- ✓ DB2 pureScale on Power 780 turbo is **38% lower** cost per tpm than Oracle RAC on Nehalem
- ✓ Lotus Domino on two virtualized POWER7 servers supporting 40,000 users costs **40% less** than Microsoft Exchange on Nehalem
- ✓ Message Broker on POWER7 processes messages at **one tenth** the cost of Microsoft BizTalk on Nehalem
- ✓ Running 45 heavy online banking workloads consolidated on a high end POWER7 virtualization platform **costs half** as much as running on Nehalem

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Power Systems and IBM Software

Massive parallelism for smarter planet solutions

- ✓ Massively parallel - up to 1024 threads
- ✓ Middleware that transparently leverages massively parallel threads
- ✓ Superior qualities of service
- ✓ Hardware exploitation without application redesign
- ✓ Best performance and lowest TCO

Tivoli software

Information Management

Rational software

WebSphere software

Lotus software

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Power is...

Workload-Optimizing Systems

Virtualization without Limits

Resiliency without Downtime

Dynamic Energy Optimization

Management with Automation

Integrated Value

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Power is Integrated Value

Information Management

IBM Smart Analytics System

SAP on IBM DB2 and Power Systems

IBM DB2 pureScale

Lotus. software

IBM Lotus Domino Consolidation on Power

Tivoli. software

IBM Systems Director Editions

Rational. software

IBM Rational Developer for Power

WebSphere. software

IBM WebSphere Application Server Parallelization

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Power your planet.

Smarter systems for a Smarter Planet.

© 2010 IBM Corporation

Thank you!

Questions?

ganek@us.ibm.com

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The IBM Power™ 750 Express is the highest performing 4-socket system on the planet. In addition it outperforms all other non-IBM 8 and 16-socket systems

System Name	Cores	Chips	Cores/Chip	Threads/Core	Peak*
IBM Power 750	32	4	8	4	1060
HP ProLiant DL585 G6 (2.8 GHz AMD Opteron 8439 SE)	24	4	6	1	416
HP Integrity rx6600 (1.6 GHz/24MB Dual-core Intel Itanium 2)	8	4	2	1	102
HP ProLiant DL580 G5 (2.66 GHz, Intel Xeon X7460)	24	4	6	1	291
Sun SPARC Enterprise T5440	32	4	8	8	360
Sun SPARC Enterprise M4000	16	4	4	2	152
HP ProLiant DL 785 G6 (2.8 GHz AMD Opteron 8439 SE)	48	8	6	1	800
Unisys ES7000 Model 7600R, Intel Xeon X7460, 2.66 GHz	48	8	6	1	527
Sun SPARC Enterprise M5000	32	8	4	2	296
HP Integrity rx8640 (1.6 GHz/24MB Dual-core Intel Itanium 2)	16	8	2	1	209
Unisys ES7000 Model 7600R, Intel Xeon X7460, 2.66 GHz	96	16	6	1	1049
Sun SPARC Enterprise M8000	64	16	4	2	753

* Peak = SPECint_rate2006 (Peak)

Substantiation:

- Competitive benchmark results reflect results published as of February 3, 2010. The results are the best results for four-socket single (non-clustered) systems using POWER™, Intel® x86, AMD Opteron™ x86, SPARC and Intel Itanium® processors. IBM Power 750 result submitted on February 8, 2010.
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The IBM Power 750 Express is the most energy efficient 4-socket system on the planet.

System Name	Cores	Chips	Cores/Chip	Threads/Core	Peak *	WATTs	Peak / WATT
IBM Power 750	32	4	8	4	1060	1950	0.54
HP ProLiant DL585 G6 (2.8 GHz AMD Opteron 8439 SE)	24	4	6	1	416	1548	0.26
HP Integrity rx6600 (1.6 GHz/24MB Dual-core Intel Itanium 2)	8	4	2	1	102	1600	0.06
HP ProLiant DL580 G5 (2.66 GHz, Intel Xeon X7460)	24	4	6	1	291	1412	0.20
Sun SPARC Enterprise T5440	32	4	8	8	360	2700	0.13
Sun SPARC Enterprise M4000	16	4	4	2	152	2016	0.07

* Peak = SPECint_rate2006 (Peak)

- Substantiation:
- Competitive benchmark results reflect results published as of February 3, 2010. The results are the best results for four-socket single (non-clustered) systems using POWER, Intel x86, Opteron x86, SPARC and Itanium processors. IBM Power 750 result submitted on February 8, 2010.
- SPEC and the benchmark names SPECrate, SPECint, and SPECjbb are registered trademarks of the Standard Performance Evaluation Corporation. For the latest SPEC benchmark results, visit http://www.spec.org
- Performance/WATT is calculated by dividing the performance from the tables below by the recommended maximum power usage for site planning. This defines the requirement for the power infrastructure. Actual power used by the systems will be less than this value for all of the systems. For Power Systems™ servers, this information is available in the site planning guides available through www.ibm.com. For HP systems, this information is contained in the QuickSpecs for each system available through www.hp.com.
- For Sun systems, this information is available through the Site Planning Guides available through www.sun.com.

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The IBM Power 750 Express has more SAP performance than any 8-socket system in the industry – and is even comparable to a 128-core, 32-socket Sun M9000.

Substantiation:

All results are 2-tier, SAP EHP 4 for SAP ERP 6.0 (Unicode). IBM results valid as of 2/8/2010. Competitive results valid as of 2/3/2010.

- **IBM Power 750 Express** certification number not available at press time and can be found at **www.sap.com/benchmarks.**

  IBM Power 750 Express: 4p / 32–c / 128 – t, POWER7™, 3.55 GHz, 256 GB memory, 15,600 SD users, dialog resp.: 0.98s, line items/hour: 1,704,330, Dialog steps/hour: 5,113,000, SAPS: 85,220, DB time (dialog/ update):0.015s / 0.028s, CPU utilization: 99%, AIX® 6.1, DB2® 9.7
- **Sun SPARC Enterprise T5540:** 4p / 32-c / 256 –t, UltraSPARC T2 plus OC, 1.6 GHz, 256 GB memory, 4720 SD users, dialog resp: 0.97s, line items/hour: 516,670, dialog steps/hour: 1,550,000, SAPS: 25,830, Solaris 10, Oracle 10g , cert# 2009026-1
- **HP DL585 G6:** 4p / 24-c / 24-t, AMD Opteron 8439 SE, 2.8 GHz, 64 GB memory, 4665 SD users, dialog resp: 0.96s, line items/hour: 510,670, dialog steps/hour: 1,532,000, SAPS: 25,530, Windows Server 2008 EE, , SQL Server 2008, cert#: 2009025
- **HP DL785 G6:** 8p / 48-c / 48-t, AMD Opteron 8439 SE, 2.8 GHz, 128 GB memory, 8280 SD users, dialog resp: 0.96s, line items/hour: 907,000, dialog steps/hour: 2,721,000, SAPS: 45,350, Windows Server 2008 EE, , SQL Server 2008, cert#: 2009035
- **Sun Fire x4640: 8**p / 48-c / 48–t, Six-core AMD Opteron 8435, 2.6 GHz, 256 GB memory, 10,000 SD users, dialog resp: 0.9s, line items/hour: 1,101,330, dialog steps/hour: 3,304,000, SAPS: 55,070, Solaris 10, Oracle 10g, cert# 2009049
- **HP DL380 G6:** 2p / 8-c / 16-t, Intel Xeon® X5570, 2.93 GHz, 48 GB memory, 3171 SD users, dialog resp: 0.94s, line items/hour: 347,670, dialog steps/hour: 1,043,000, SAPS: 17,380, SUSE Linux® Enterprise Server 10, MaxDB 7.8, cert#: 2009006
- **Sun SPARC Enterprise M9000: 32**p / 128-c / 256–t, Six-core AMD Opteron 8435, 2.6 GHz, 1 TB memory, 17,430 SD users, dialog resp: 0.95s, line items/hour: 1,909,670, dialog steps/hour: 5,729,000, SAPS: 95,480, Solaris 10, Oracle 10g, cert# 2009038

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Consolidation onto POWER7 can deliver significant savings.

Ninety-two Sun SPARC Enterprise T2000 servers can be consolidated into a single IBM Power 750 Express system, saving 95% of the cores for software licensing, 97% on floorspace, and 95% on energy.

Calculation Summary: the Power 750 has 30.93 better SPECjbb2005 performance than the Sun T2000. Assuming a 3x virtualization factor for greater consolidation - then 92 Sun Fire T2000 servers could be consolidated onto one Power 750 Express server (30.93 * 3 = 92.8 servers rounded to 92 T2000 servers)

HW System Name	JVM Instances	Cores	Processor chips	HW Threading	bops	bops/JVM
IBM Power 750 Express	32	32	4	Yes	2,478,929	77,467
Sun File T2000	4	8	1	Yes	74,365	18,591

System Name	SPECjbb2005	Max Watts	Rack space	Cores	Systems	Total Perf	Total Cores	Total Watts	Total Rack Space
IBM Power 750 Express	2,478,929	1950	4	32	1	1,380,000	32	1950	4
Sun File T2000	74,365	450	2	8	92	1,368,150	736	41,400	184
Savings with Power 750 Express							95.6%	95.2%	97.8%

Substantiation

1. SPEC and the benchmark names SPECrate, SPECint, and SPECjbb are registered trademarks of the Standard Performance Evaluation Corporation. Competitive benchmark results stated reflect results published on www.spec.org as of February 08, 2010. The comparison presented below is based on a consolidation of a legacy 8-core Sun SPARC Enterprise T2000 UltraSPARC T1 servers into a 32 core IBM Power 750. For the latest SPEC benchmark results, visit http://www.spec.org.
2. SPECjbb2005 results are:
POWER7: IBM Power 750 Express with 4 chips, and 32 cores and four threads per core with a result of 2,300,000 bops and 71,875 bops/jvm submitted to SPEC on February 8, 2010.
SPARC: Sun Microsystems Sun SPARC Enterprise T2000 with 1 chip, 8 cores and 4 threads per core with a result of 74,356 bops and 18,591 bops/jvm

***The virtualized system count and energy savings were derived from several factors:**
- A **performance ratio factor** of 30.93X was applied to the virtualization scenario. The performance factor is the SPECjbb2005 result of the Power 750 Express divided by the result of the competitive Sun SPARC Enterprise T2000 server.
- A **virtualization factor** of 3X was applied to the virtualization scenario using utilization assumptions derived from an Alinean white paper on server consolidation. The tool assumes 19% utilization of existing servers and 60% utilization of new servers. Source - www.ibm.com/services/us/cio/optimize/opt_wp_ibm_systemp.pdf.

Space calculation: The Sun T2000 is 2U in height and 21 can fit into a 42U rack. The 750 is 4U in height.
Power consumption figures of 1950W for the IBM Power 750 and 450W for the Sun T2000 were based on the maximum rates published by IBM and Sun Microsystems, respectively. This information for the Power 750 is in "Model 8233-E8B server specifications" available at http://www-01.ibm.com/common/ssi/index.wss - search for Power 750. Sun T2000 Maximum AC power consumption of 450 WATTs was sourced from Sun SPAC Enterprise T2000 Servers site planning guide at http://docs.sun.com/app/docs/doc/819-2545-11 as of 2/9/2010.

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345 million kilowatt-hours are used yearly by the 91,920* Sun SPARC Enterprise T2000 servers shipped since 2005 above what would be used yearly if consolidated into 1,000 IBM Power 750 Express servers at the rate of 92 to 1.
That's enough electricity to supply 34,500 homes for a year.**

Substantiation

- Maximum power for 1 IBM Power 750 Express server = 1950 watts
- Maximum power for 92 Sun Fire T2000 servers = 92 x 450 = 41,400 watts
- Excess power per consolidation instance (92 Sun T2000's into one Power 750) = 39,450 watts
- Number of consolidations required = 1,000 (91,320 / 92)
- Total excess kilowatt-hours per year =

  39,450 watts x 24 hrs/day x 365 days/yr x 1,000 = 345 million kilowatt-hours per year

* Source: 3Q09 IDC Server Tracker

** Source: Wikipedia estimate of average annual household energy use of 10,000 kilowatt-hours

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The IBM Power 750 Express has 28% more performance than a 64-core HP Integrity Superdome and requires only 83% as much power to run – at a fraction of the price.

Substantiation:

Notes:

1. SPEC and the benchmark names SPECrate, SPECint, and SPECjbb are registered trademarks of the Standard Performance Evaluation Corporation. HP Integrity Superdome benchmark results stated reflect results published on www.spec.org as of February 08, 2010. For the latest SPEC benchmark results, visit http://www.spec.org.
2. SPECint_rate2006 Peak results are:

POWER7: IBM Power 750 Express with 4 chips, and 32 cores and four threads per core with a result of 1060 submitted to SPEC on February 8, 2010.

Itanium: Hewlett-Packard Integrity Superdome with 32 chips, 64 cores, and one thread per core with a result of 824.

3. The HP Integrity Superdome is a rack cabinet. The 750 is 4U in height.

Power consumption is derived from the recommended maximum power for site planning. Actual power used by the systems will be less than this value for all of the systems.

This information for the Power 750 Express is available at http://www-01.ibm.com/common/ssi/index.wss - search for Power 750. The maximum power requirement for the Power 750 is 1,950 Watts.

The information for the Integrity Superdome is in "QuickSpecs HP Integrity rx6600 Server" available at http://h18000.www1.hp.com/products/quickspecs/11717_div/11717_div.HTML, which shows the maximum power requirement for the Integrity Superdome of 12,196 VA. Using the Power Factor of 0.95 shown at http://www.spectra.com/pdfs/superdome.pdf, the maximum input power is 11,586 Watts.

Price comparison based on IBM analysis:

HP Superdome price estimated at $2,117,000 for the configuration described in the SPECint_rate2006 benchmark

IBM Power 750 Express U.S. list price = $275,420

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The IBM Power 780 delivers leadership performance and consolidation capability vs. HP and Sun high-end servers. For example, eight HP Integrity Superdome 64-core systems utilized at 30% can be consolidated into a single IBM Power 780 server utilized at 80%, thus saving 87% of the cores for software licensing, reducing floorspace from 80 square feet to 7.6 square feet, and reducing energy costs by 92%.

Substantiation:

SPECint_rate2006 Results										
System Name	Cores	Chips	Cores / Chip	Threads / Core	Peak	Published		Wattage	Performance per watt	Performance per core
IBM Power 780	64	8	8	4	2530	February 2010		6,400	395.31	39.53
HP Integrity Superdome	64	32	2	1	824	October 2006		12,196	67.56	12.88
HP Integrity Superdome	128	64	2	1	1648	September 2006		24,392	67.56	12.88
Sun SPARC Enterprise M9000	256	64	4	4	2586	October 2009		44,800	57.72	10.10

Performance per watt is calculated by dividing the performance in the table above by the recommended maximum power for site planning. Actual power used by the systems will be less than this value for all of the systems. The maximum power requirement for the Power 780 is 6,400 Watts and is available at http://www-01.ibm.com/common/ssi/index.wss - search for Power 780.

Power consumption figures of 6400 W for the IBM Power 780, 12,196 W / 24,392 W for the HP Superdome and 44,800 W for the Sun SPARC Enterprise M9000 were based on the maximum rates published by IBM, HP and Sun Microsystems, respectively. The information for the HP Integrity Superdome is in "QuickSpecs HP Integrity Superdome Servers 16- processor, 32-processor, and 64- processor Systems" available at www.hp.com. The information for the Sun SPARC Enterprise M9000 is in the "Sun SPARC Enterprise M9000 Servers Site Planning Guide" available at www.sun.com

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The virtualized system count and energy savings were derived from several factors:

A performance ratio factor was applied to the virtualization scenario based on SPECint_rate2006. The performance factor is simply the SPECint_rate2006 result per core of the Power 780 divided by the per core result of the HP or Sun system.

Power 780 (64-core, 8 chips, 8 cores per chip, 3.8 GHz) SPECint_rate2006 2,530 peak as of 2/8/2010. HP Superdome (64-core, 32 chips, 2 cores per chip) 1.6 GHz, SPECint_rate2006 824 peak published October 2006. Data valid as of 2/3/2010.

Sun SPARC Enterprise M9000 (256-core, 64 chips, 4 cores per chip) 2.88 GHz, SPECint_rate2006 2,586 peak published October 2009. Data valid as of 2/3/2010. SPEC® results available at: www.spec.org.

A virtualization factor of 3.157X was applied to the virtualization scenario using utilization assumptions derived from an Alinean white paper on server consolidation. The tool assumes 19% utilization of existing servers and 60% utilization of new servers. Source - www.ibm.com/services/us/cio/optimize/opt_wp_ibm_systemp.pdf.

Air conditioning power requirement estimated at 50% of system power requirement.

Energy cost of $.1031 per kWh is based on 2009 YTD US Average Retail price to commercial customers per US DOE at http://www.eia.doe.gov/cneaf/electricity/epm/table5_6_b.html as of 1/27/2010.

The reduction in floor space, power, cooling and software costs depends on the specific customer, environment, application requirements, and the consolidation potential. Actual numbers of virtualized systems supported will depend on workload levels for each replaced system.

System data for HP from the HP Superdome Datasheet and HP Integrity Superdome Server — specifications both available at www.hp.com. System data for Sun from the Sun SPARC Enterprise M9000 Tech Specs available at www.sun.com. Data is current as of January 27, 2010.

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The modular enterprise class POWER systems have continued to deliver significant improvements year over year. With the Power 770 server, clients can consolidate four POWER5™ processor-based Power 570 systems onto one Power 770. In fact, it only takes two nodes and moving to the Power 770 still has an effective capacity increase of 50%.

Substantiation:

System Name	Cores	Nodes	rPerf	Utilization	Effective Performance	WATTs	Maintenance
IBM Power 770	24	2	261.19	60%	156.7	3200	
IBM System p® 570 (x4)	64	16	309.8	30%	92.9	20,800	
Advantage / Savings		87% Less Space			> 50% Capacity	84% Less Energy	

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POWER7 systems deliver up to three or four times the energy efficiency of POWER6™ based systems.

Substantiation:

- SPEC and the benchmark names SPECrate, SPECint, and SPECjbb are registered trademarks of the Standard Performance Evaluation Corporation. Benchmark results stated reflect results published on www.spec.org as of February 8, 2010. The comparison used in the claim is based on a consolidation of the best high-end POWER6 result (Power 595) to the Power 780, the best mid-range POWER6 result (Power 570) to the Power 770, and the best four-socket and above POWER6 Express results with the Power 750 Express. For the latest SPEC benchmark results, visit http://www.spec.org.

- Performance/WATT is calculated by dividing the performance from the tables below by the recommended maximum power usage for site planning. This defines the requirement for the power infrastructure. Actual power used by the systems will be less than this value for all of the systems. This information is available in the site planning guides available through www.ibm.com.

	SPECint_rate2006 results as of January 7, 2010						
System Name	**Cores**	**Chips**	**Cores/ chip**	**Threads / Core**	**Peak**	**WATTs**	**Peak / WATT**
IBM Power 780	**64**	**8**	**8**	**4**	**2530**	**6400**	**0.39**
IBM Power 595	**64**	**32**	**2**	**2**	**2160**	**28300**	**0.07**
IBM Power 770	**64**	**8**	**8**	**4**	**2013**	**6400**	**0.31**
IBM Power 570	**16**	**8**	**2**	**2**	**542**	**5600**	**0.09**
IBM Power 750 Express	**32**	**4**	**8**	**4**	**1060**	**1950**	**0.54**
IBM Power 560 Express	**16**	**8**	**2**	**2**	**363**	**2400**	**0.15**
IBM Power 550 Express	**8**	**4**	**2**	**2**	**263**	**1400**	**0.18**

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POWER7 systems deliver up to three or four times the performance with less energy than POWER6 based systems.

Substantiation:

rPerf (Relative Performance) is an IBM estimate of commercial processing performance relative to other IBM UNIX® systems.
The comparison used in the claim is based on these comparisons:

- 4-node Power 570 (POWER6+™) to a 1-node Power 780 (POWER7)
- 4-node Power 570 (POWER6+) to a 3-node Power 780 (POWER7)
- 4-node Power 570 (POWER6+) to a 3-node Power 770 (POWER7)
- 2-node Power 560 Express (POWER6+) to Power 750 Express (POWER7)

Performance/WATT is calculated by dividing the performance (rPerf) from the tables below by the recommended maximum power usage for site planning. This defines the requirement for the power infrastructure. Actual power used by the systems will be less than this value for all of the systems. This information is available in the site planning guides available through www.ibm.com.

System Name	Nodes	Processor Technology	Proc. Freq.	Energy (Watts)	rPerf	Factor* (P7 over P6)
IBM Power 780	1	POWER7	3.8 GHz	1600	195	1.38
IBM Power 570	4	POWER6+	5.0 GHz	5600	141	-
IBM Power 780	3	POWER7	3.8 GHz	4800	523	3.7
IBM Power 570	4	POWER6+	5.0 GHz	5600	141	-
IBM Power 770	3	POWER7	3.1 GHz	4800	443	3.1
IBM Power 570	4	POWER6+	5.0 GHz	5600	141	-
IBM Power 750 Express	1	POWER7	3.55 GHz	1950	331	3.3
IBM Power 560 Express	2	POWER6+	3.6 Ghz	2400	100	-

* Factor = Performance increase factor of POWER7 system over POWER6 system for less energy

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Notes on benchmarks and values

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IBM benchmark results can be found in the IBM Power Systems Performance Report at http://www.ibm.com/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, AIX 5L or AIX 6 were used. All other systems used previous versions of AIX. The SPEC CPU2006, SPEC2000, 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	http://www.tpc.org
SPEC	http://www.spec.org
LINPACK	http://www.netlib.org/benchmark/performance.pdf
Pro/E	http://www.proe.com
GPC	http://www.spec.org/gpc
VolanoMark	http://www.volano.com
STREAM	http://www.cs.virginia.edu/stream/
SAP	http://www.sap.com/benchmark/
Oracle Applications	http://www.oracle.com/apps_benchmark/
PeopleSoft - To get information on PeopleSoft benchmarks, contact PeopleSoft directly	
Siebel	http://www.siebel.com/crm/performance_benchmark/index.shtm
Baan	http://www.ssaglobal.com
Fluent	http://www.fluent.com/software/fluent/index.htm
TOP500 Supercomputers	http://www.top500.org/
Ideas International	http://www.ideasinternational.com/benchmark/bench.html
Storage Performance Council	http://www.storageperformance.org/results

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Notes on HPC 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 Power Systems Performance Report at http://www.ibm.com/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.

SPEC	http://www.spec.org
LINPACK	http://www.netlib.org/benchmark/performance.pdf
Pro/E	http://www.proe.com
GPC	http://www.spec.org/gpc
STREAM	http://www.cs.virginia.edu/stream/
Fluent	http://www.fluent.com/software/fluent/index.htm
TOP500 Supercomputers	http://www.top500.org/
AMBER	http://amber.scripps.edu/
FLUENT	http://www.fluent.com/software/fluent/fl5bench/index.htm
GAMESS	http://www.msg.chem.iastate.edu/gamess
GAUSSIAN	http://www.gaussian.com
ANSYS	http://www.ansys.com/services/hardware-support-db.htm
	Click on the "Benchmarks" icon on the left hand side frame to expand. Click on "Benchmark Results in a Table" icon for benchmark results.
ABAQUS	http://www.simulia.com/support/v68/v68_performance.php
ECLIPSE	http://www.sis.slb.com/content/software/simulation/index.asp?seg=geoquest&
MM5	http://www.mmm.ucar.edu/mm5/
MSC.NASTRAN	http://www.mscsoftware.com/support/prod%5Fsupport/nastran/performance/v04_sngl.cfm
STAR-CD	www.cd-adapco.com/products/STAR-CD/performance/320/index/html
NAMD	http://www.ks.uiuc.edu/Research/namd
HMMER	**http://hmmer.janelia.org/** http://powerdev.osuosl.org/project/hmmerAltivecGen2mod

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Notes on performance estimates

rPerf for AIX

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 and other pertinent software at the time of system announcement. Actual performance will vary based on application and configuration specifics. The IBM eServer 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. Note that the rPerf methodology used for the POWER6 systems is identical to that used for the POWER5 systems. Variations in incremental system performance may be observed in commercial workloads due to changes in the underlying system architecture.

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.

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CPW for IBM i

Commercial Processing Workload (CPW) is a relative measure of performance of processors running the IBM i operating system. Performance in customer environments may vary. The value is based on maximum configurations. More performance information is available in the Performance Capabilities Reference at: www.ibm.com/systems/i/solutions/perfmgmt/resource.html

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