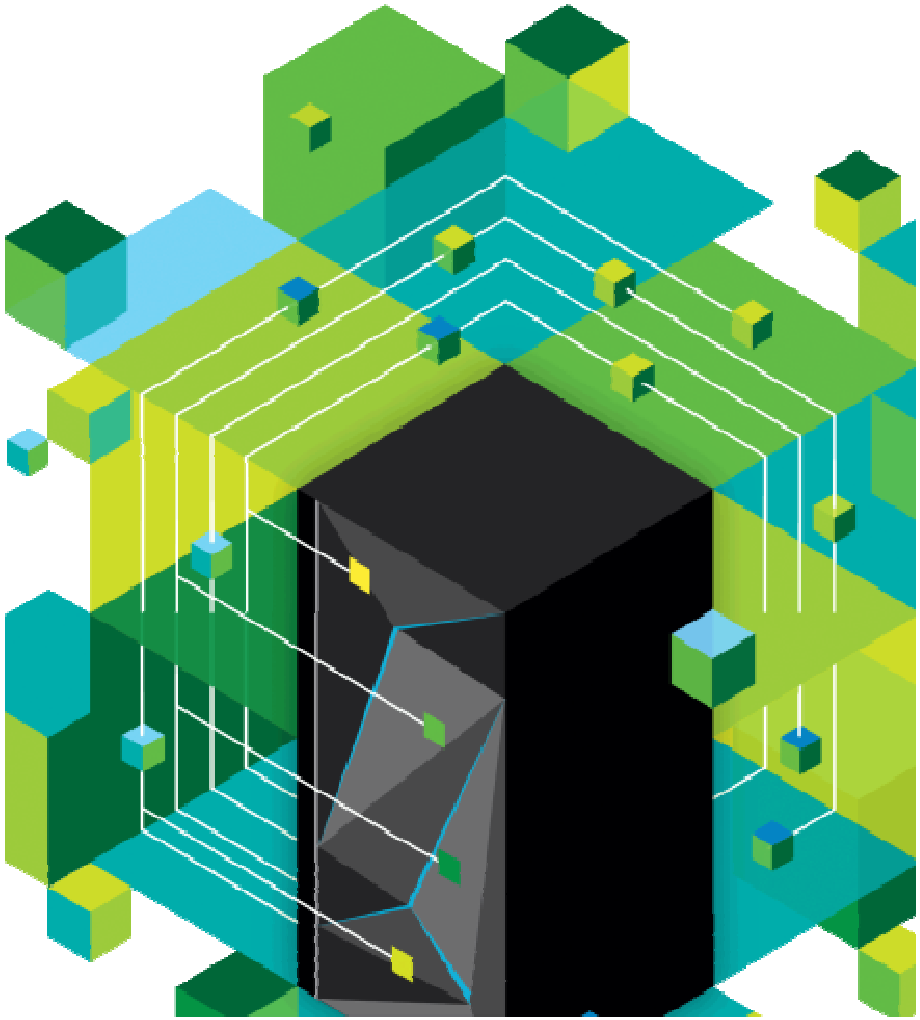
IBM Power Systems

5 February 2013 Announcement
Hardware Deep Dive



IBM Power Systems – The Ultimate Platform for Compute Intensive Workloads

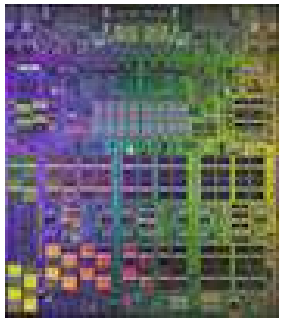
9,000+	$4.2B	100+	200M	5 of 10	88%	3,000+	20,000+	#1
Patents since 2001	Investment POWER7 & POWER7+	Industry leading benchmarks	Pages processed in 3 seconds by IBM Watson for healthcare delivering personalized medicine & cancer research	World's fastest super-computers run on POWER, including Sequoia	More SAP Users per core than x86 when running on POWER7+	Competitive displacements	ISV apps running on IBM Power Systems	UNIX server revenue share leader 6 years running

http://www-03.ibm.com/systems/power/hardware/benchmarks/

#ibmpowersystems

IBM POWER Processor Roadmap

- *3 Year Revolution*
- *18 month "+" evolution*

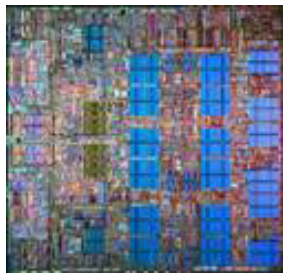


POWER4/4+

First Dual Core in Industry

- Dual Core
- Chip Multi Processing
- Distributed Switch
- Shared L2
- Dynamic LPARs (32)
- 180nm,

2001



POWER5/5+

Hardware Virtualization for Unix & Linux

- Dual Core & Quad Core Md
- Enhanced Scaling
- 2 Thread SMT
- Distributed Switch +
- Core Parallelism +
- FP Performance +
- Memory bandwidth +
- 130nm, 90nm

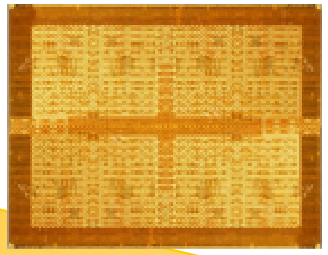
2004

POWER6/6+

Fastest Processor In Industry

- Dual Core
- High Frequencies
- Virtualization +
- Memory Subsystem +
- Altivec
- Instruction Retry
- Dyn Energy Mgmt
- 2 Thread SMT +
- Protection Keys
- 65nm

2007

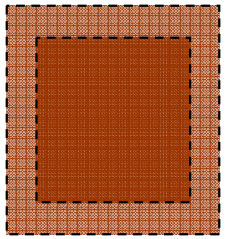


POWER7/7+

Most POWERful & Scalable Processor in Industry

- 4,6,8 Core
- 32MB On-Chip eDRAM
- Power Optimized Cores
- Mem Subsystem ++
- 4 Thread SMT++
- Reliability +
- VSM & VSX
- Protection Keys+
- 45nm, 32nm

2010



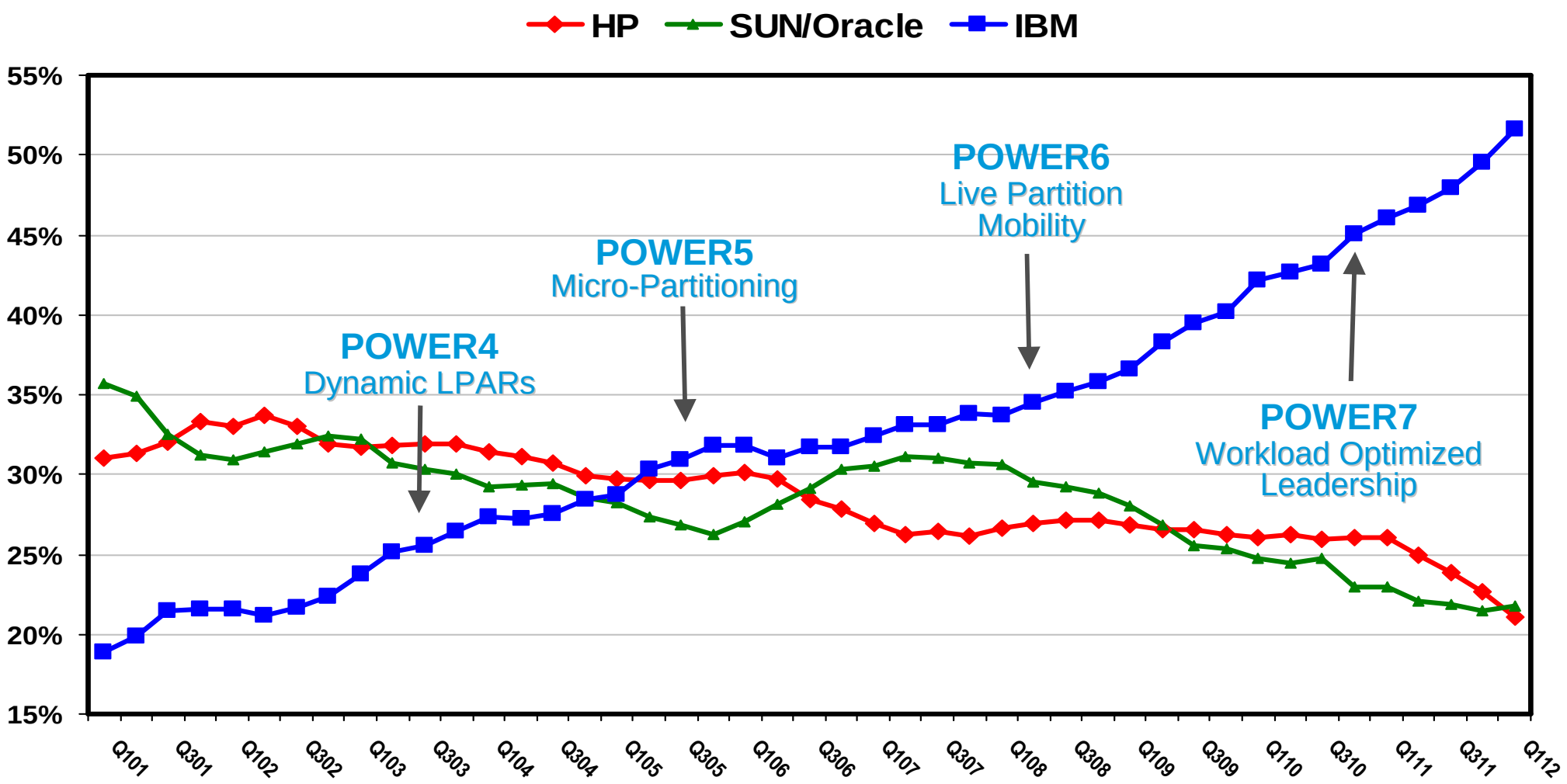
POWER8

Future

IBM is the leader in Processor and Server design

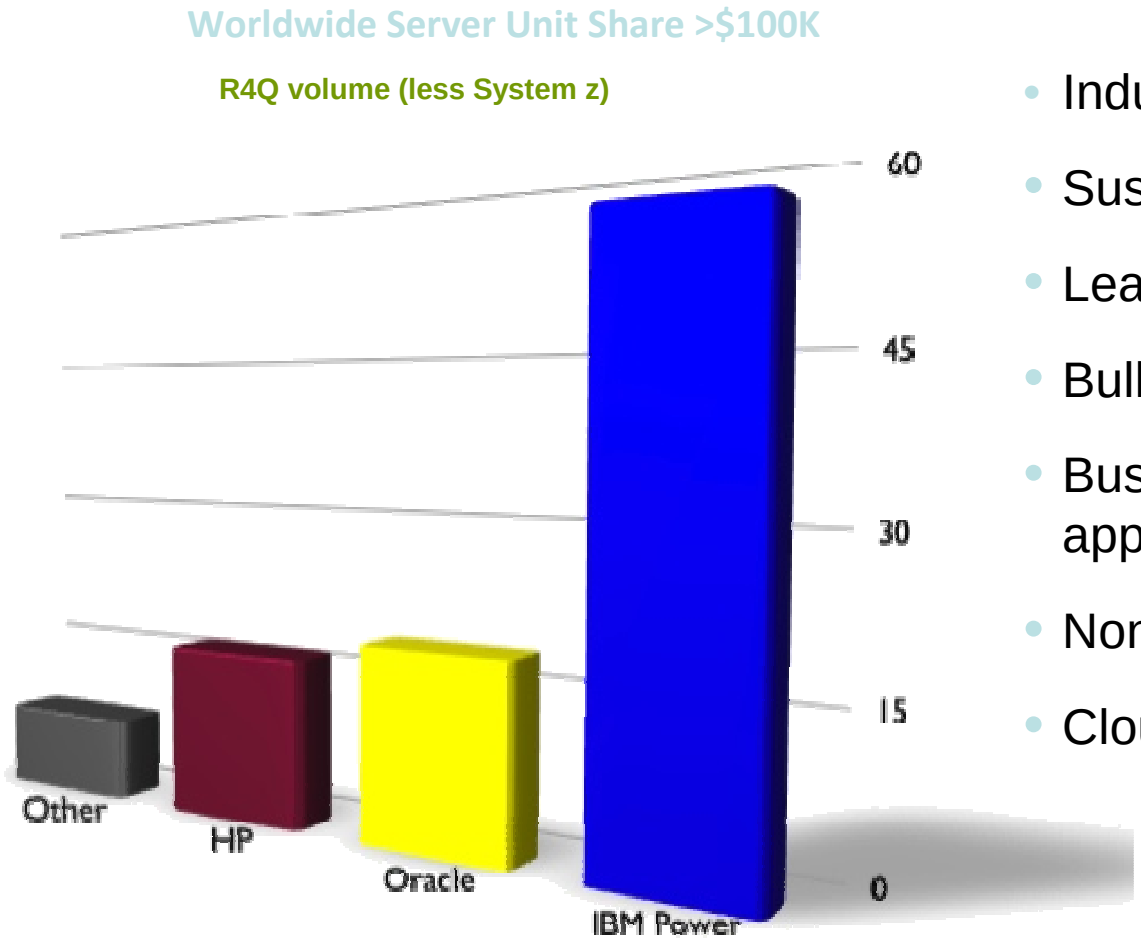
10Yr History Four Quarter Average Revenue Share

UNIX Server Rolling Four Quarter Average Revenue Share According to IDC



Source: IDC Worldwide Quarterly Server Tracker, http://www.idc.com/getdoc.jsp?containerId=IDC_P348

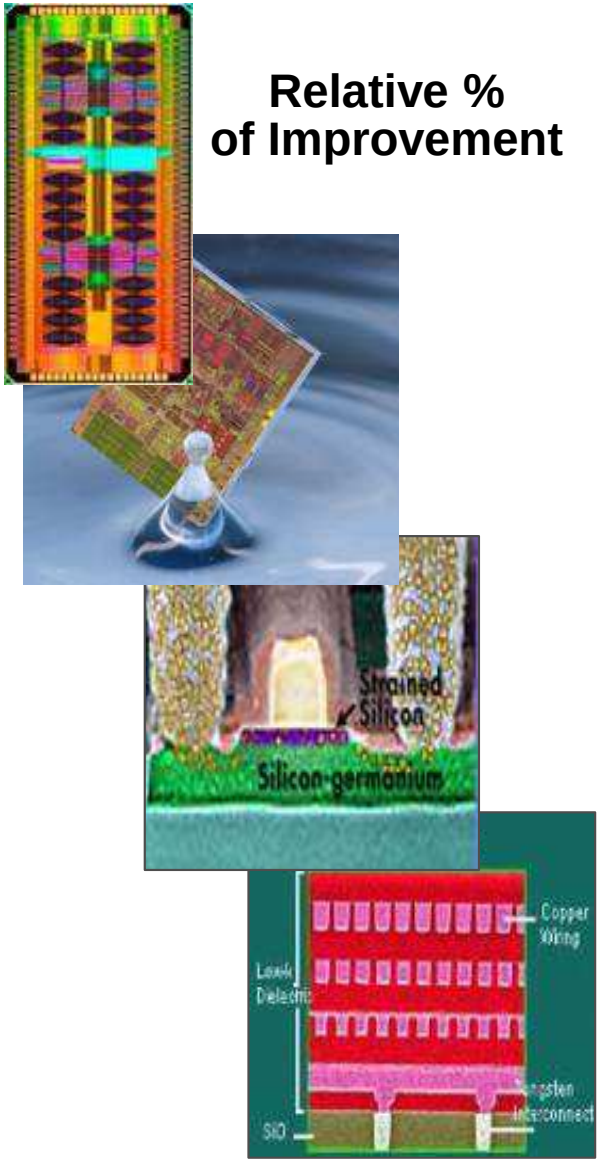
IBM Power Systems ships over 3X the volume of high value systems vs. HP, Oracle or other vendors

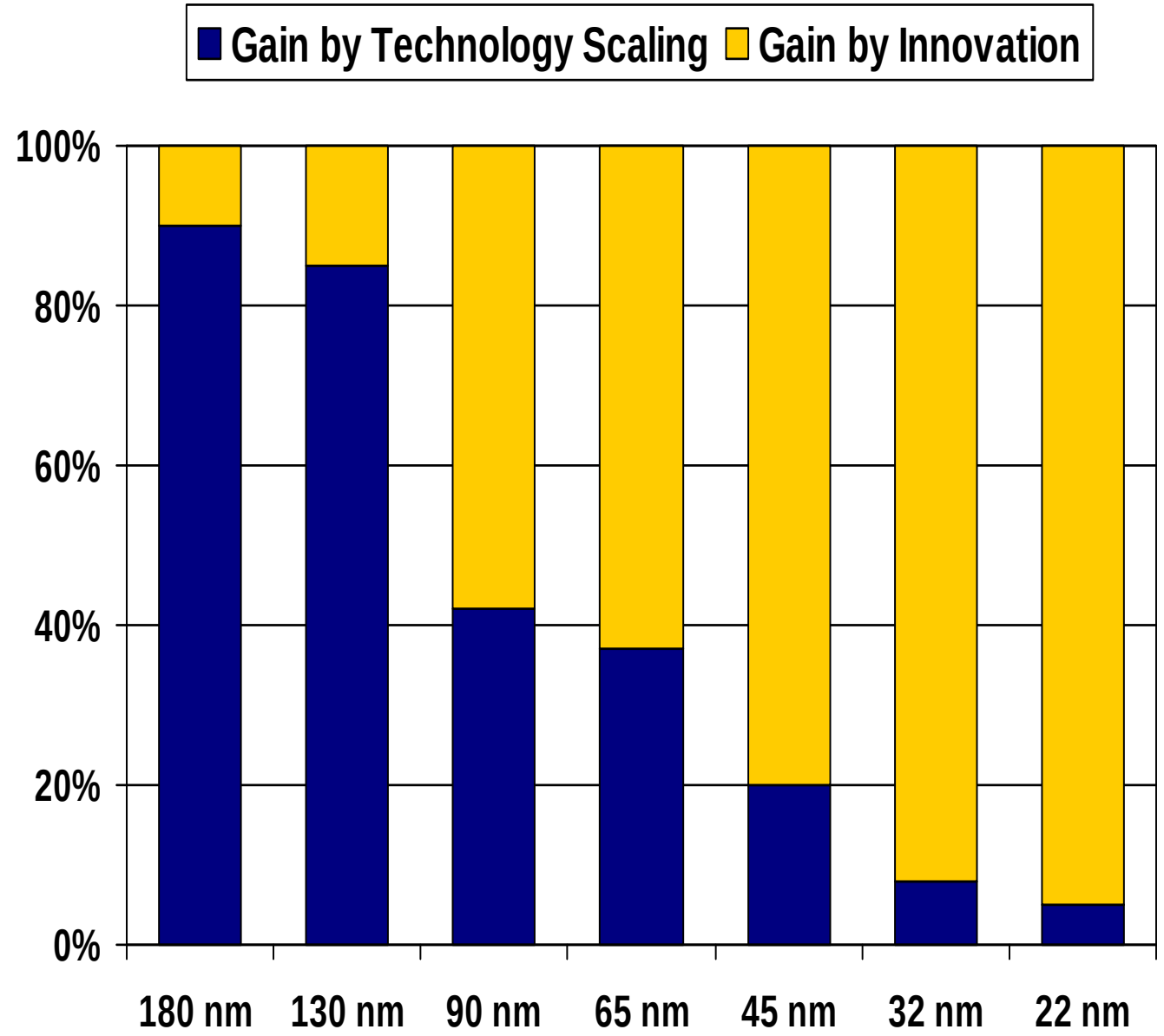


Source: IDC Server Tracker Q212 Release, August 2012

- Industry's most popular enterprise servers
- Sustained performance leadership
- Leadership virtualization efficiency
- Bullet proof security
- Business resiliency for mission critical applications
- Non-disruptive growth with CoD
- Cloud enabled for greater flexibility

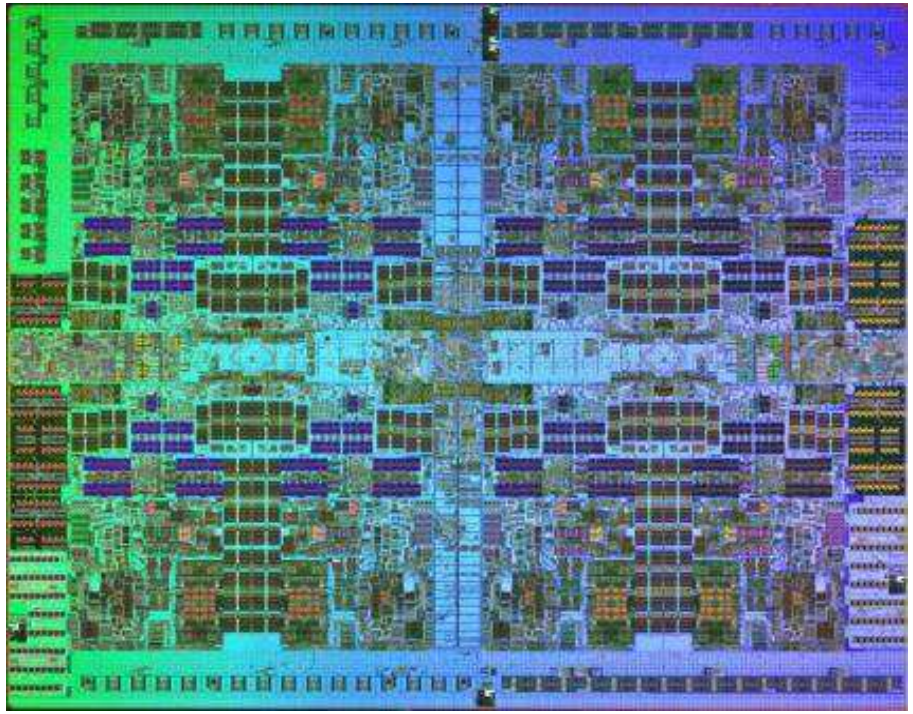
Innovation Drives Performance



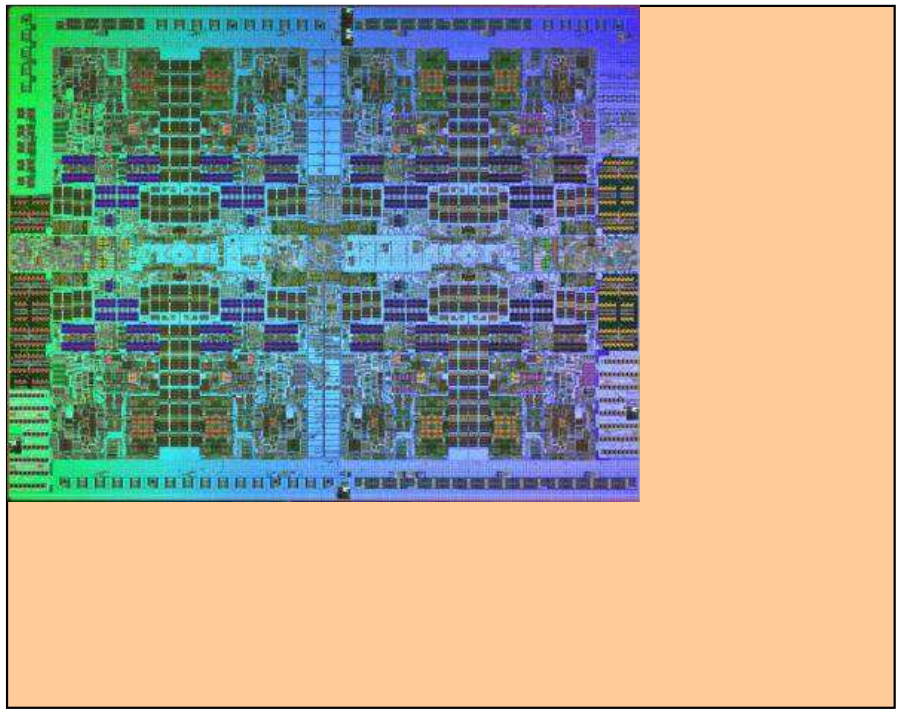


IBM plans for future 22 nm technology are subject to change.

POWER7+

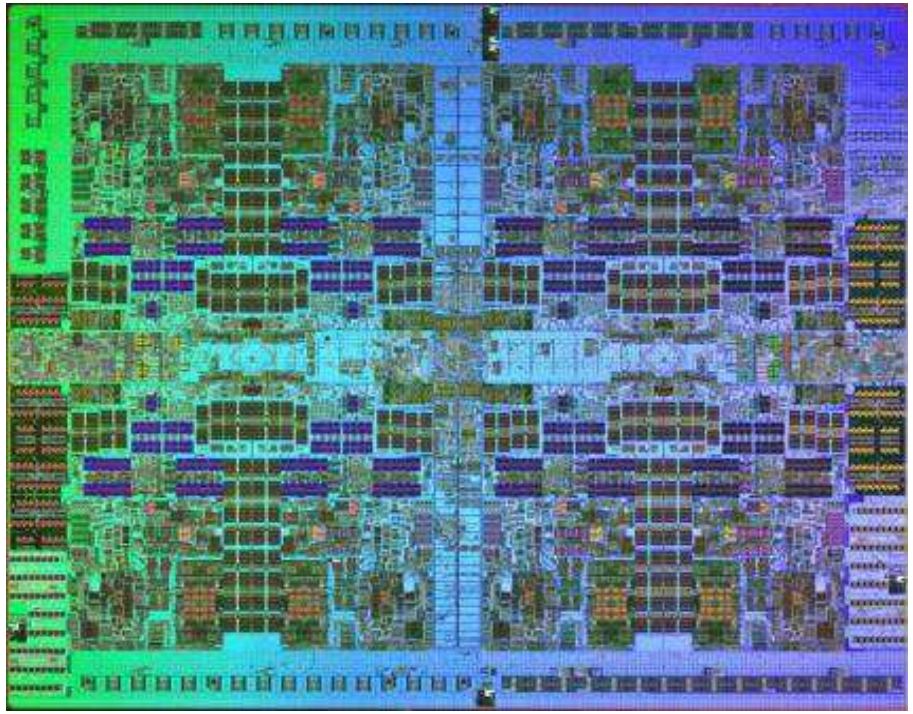


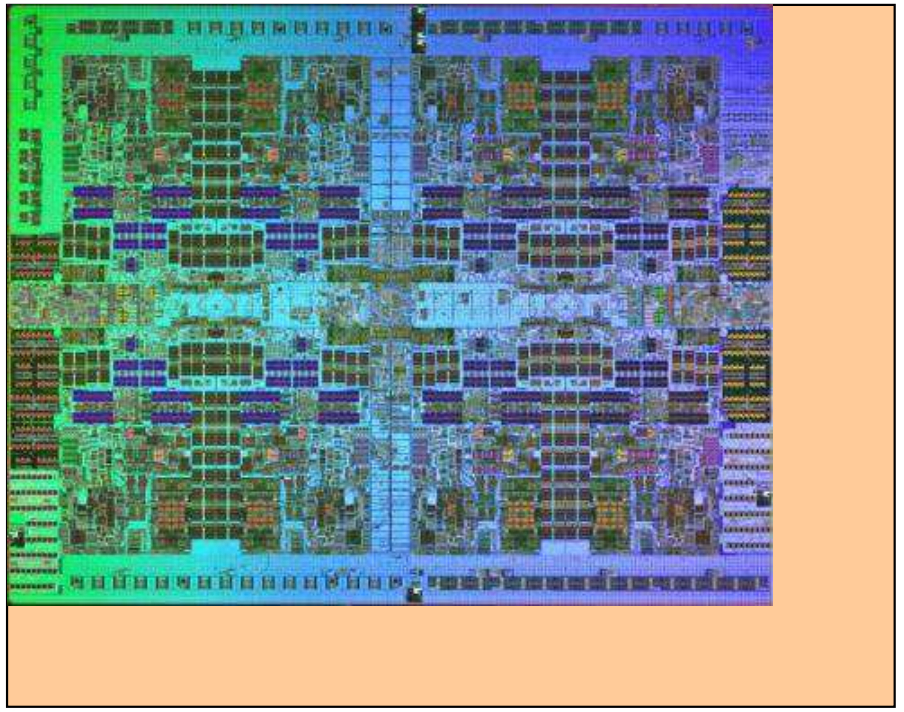
POWER7
45 nm



POWER7
32 nm

POWER7+



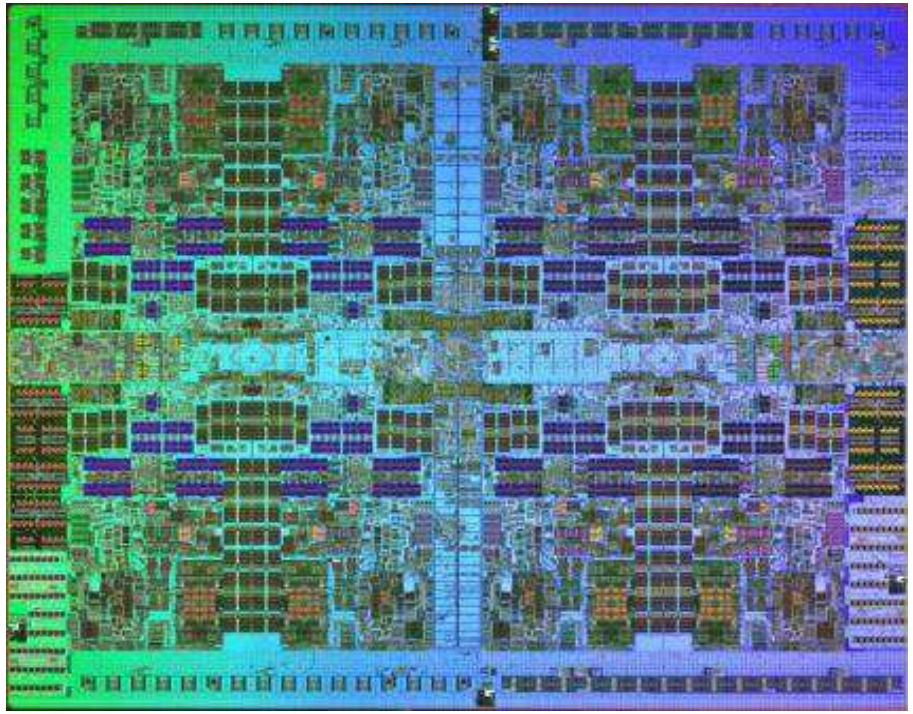


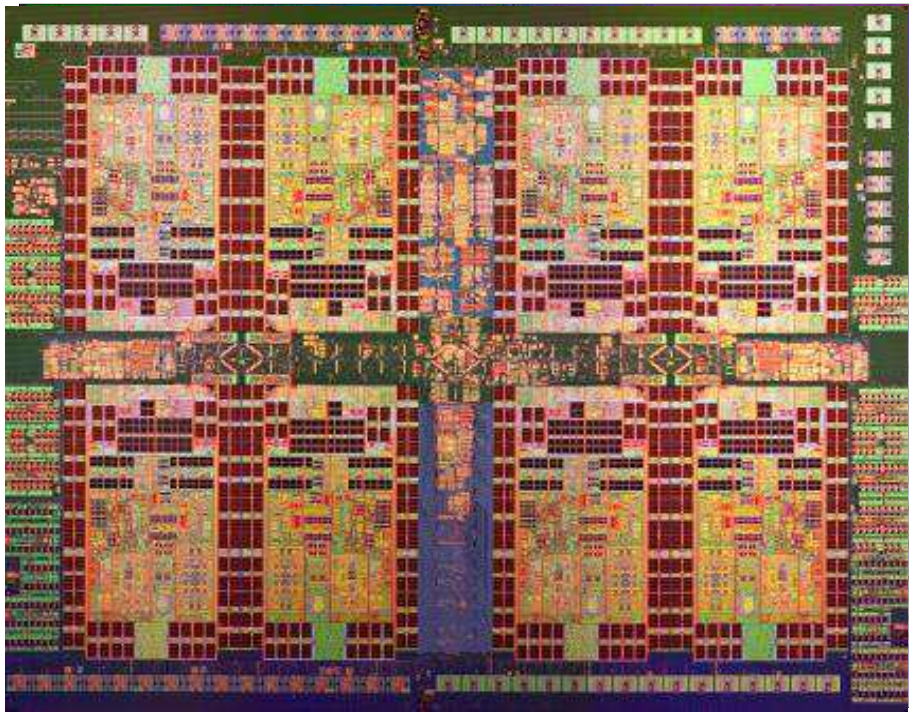
POWER7
45 nm

POWER7
32 nm

Add additional Cache

POWER7+





POWER7
45 nm

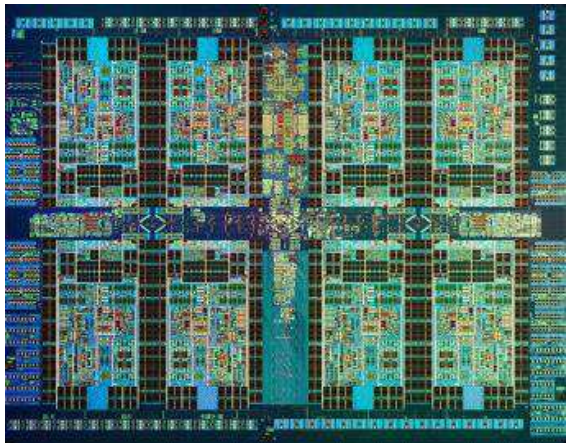
POWER7
32 nm

Add additional Cache

Add on Chip Accelerators

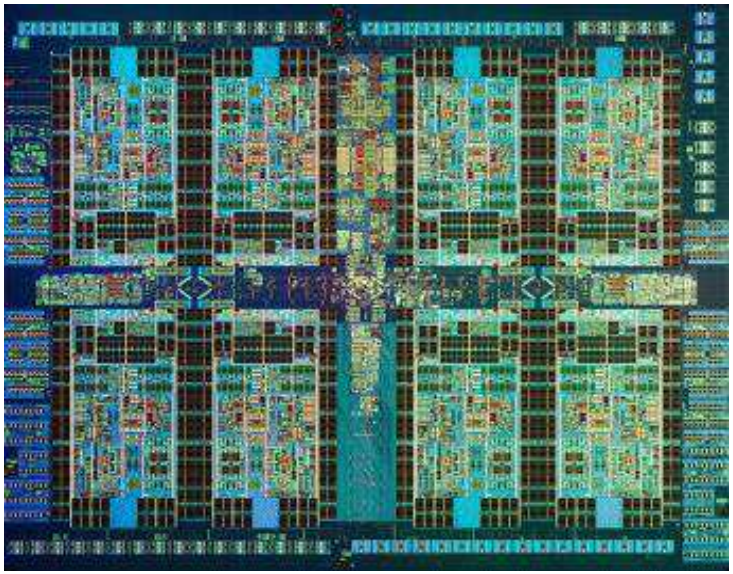
Benefits of eDRAM for POWER7+

With eDRAM



2.1B Transistors
567 mm²

Without eDRAM



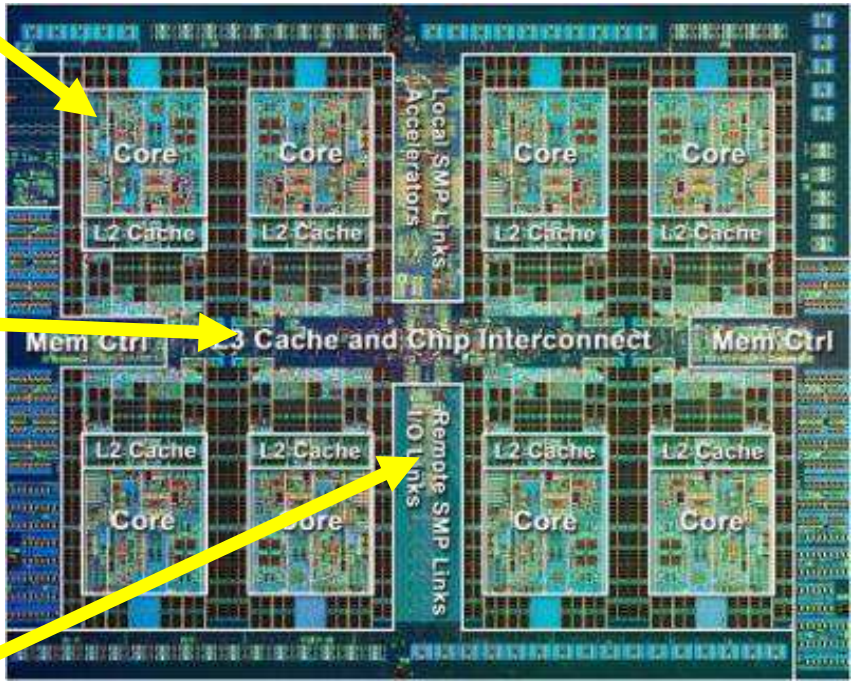
5.4B Transistors
950 mm²

IBM's eDRAM Benefits:

- **Greater density: 1/3 the space of 6T SRAM implementation**
- **Less power requirements: 1/5 the standby power**
- **Fewer soft errors: Soft Error Rate 250x lower than SRAM**
- **Better Performance**

POWER7+ RAS Specific Features

- New Power On Reset Engine (PORE)
  - Enables a processor core to be re-initialized while system remains up and running
  - Directly used to:
    - *Allow for Concurrent Firmware Updates:* In cases where a processor initialization register value needs to be changed
- L3 Cache dynamic column repair
  - New self-healing capability that complements cache line delete
  - Uses PORE feature to substitute a failing bit-line for a spare during run-time.
- New Fabric Bus Dynamic Lane Repair
  - POWER7+ has spare bit lanes that can dynamically be repaired (using PORE)
    - For Busses that connect CEC drawers
    - Avoids any repair action or outage related to a single bit failure.



POWER7+ Processors & Architecture

Faster Performance

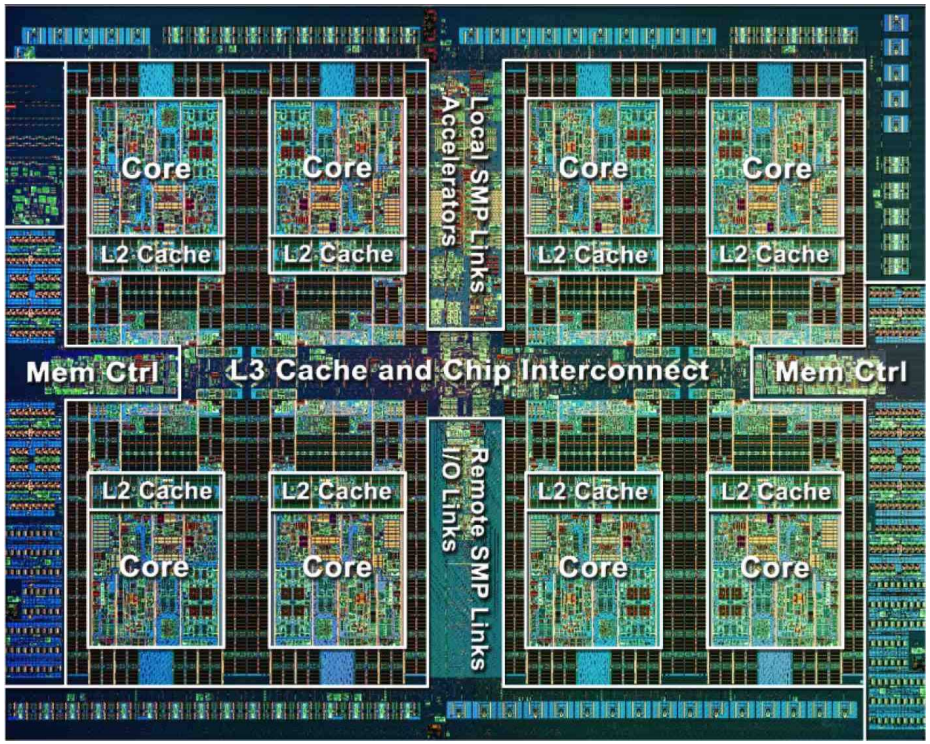
- Faster frequencies… up to 4.4 GHz POWER7+ processors
- 10 MB L3 Cache
- Random number generator
- Enhanced Single Precision Floating Point performance
- Enhanced GX system bus

Increased Efficiency and Flexibility

- Active Memory Expansion accelerator
- On-chip encryption acceleration for AIX
- Delivering 5x more performance per watt
- Enhanced energy / power gating
- 20 Virtual Machines per core

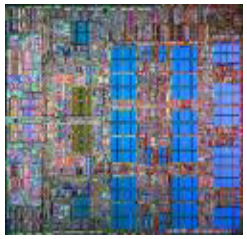
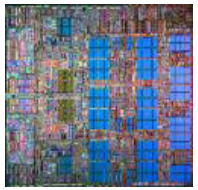
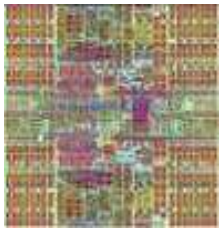
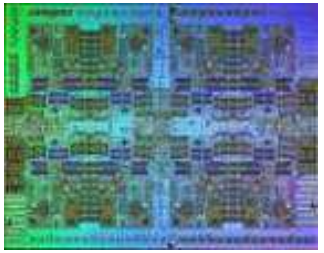
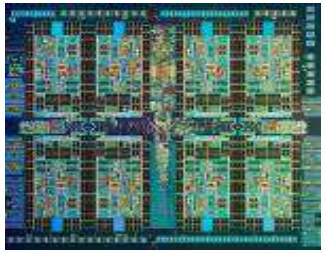
Better Availability

- Self-healing capability for L3 Cache functions
- Dynamic processor fabric bus repair
- Processor re-initialization



POWER7+
32 nm

Processor Designs

	POWER5	POWER5+	POWER6	POWER7	POWER7+
Technology	130nm	90nm	65nm	45nm	32nm
Size	389 mm^2	245 mm^2	341 mm^2	567 mm^2	567 mm^2
Transistors	276 M	276 M	790 M	1.2 B	2.1 B
Cores	2	2	2	8	8
Frequencies	1.65 GHz	1.9 GHz	4 - 5 GHz	3 – 4 GHz	3.6 – 4.4+ GHz
L2 Cache	1.9MB Shared	1.9MB Shared	4MB / Core	256 KB per Core	256 KB per Core
L3 Cache	36MB	36MB	32MB	4MB / Core	10MB / Core
Memory Cntrl	1	1	2 / 1	2 / 1	2 / 1
Architecture	Out of Order	Out of Order	In of Order	Out of Order	Out of Order
LPAR	10 / Core	10 / Core	10 / Core	10 / Core	20 / Core

Transition from POWER6

Cores:

- 8 Intelligent Cores / chip (socket)
- 4 and 6 Intelligent Cores available on some models
- 12 execution units per core
- Out of order execution
- 4 Way SMT per core
- 32 threads per chip
- L1 – 32 KB I Cache / 32 KB D Cache per core
- L2 – 256 KB per core

Chip:

- 32MB Intelligent L3 Cache on chip

Memory:

- Dual DDR3 Controllers
- 100 GB/s sustained Memory bandwidth / chip

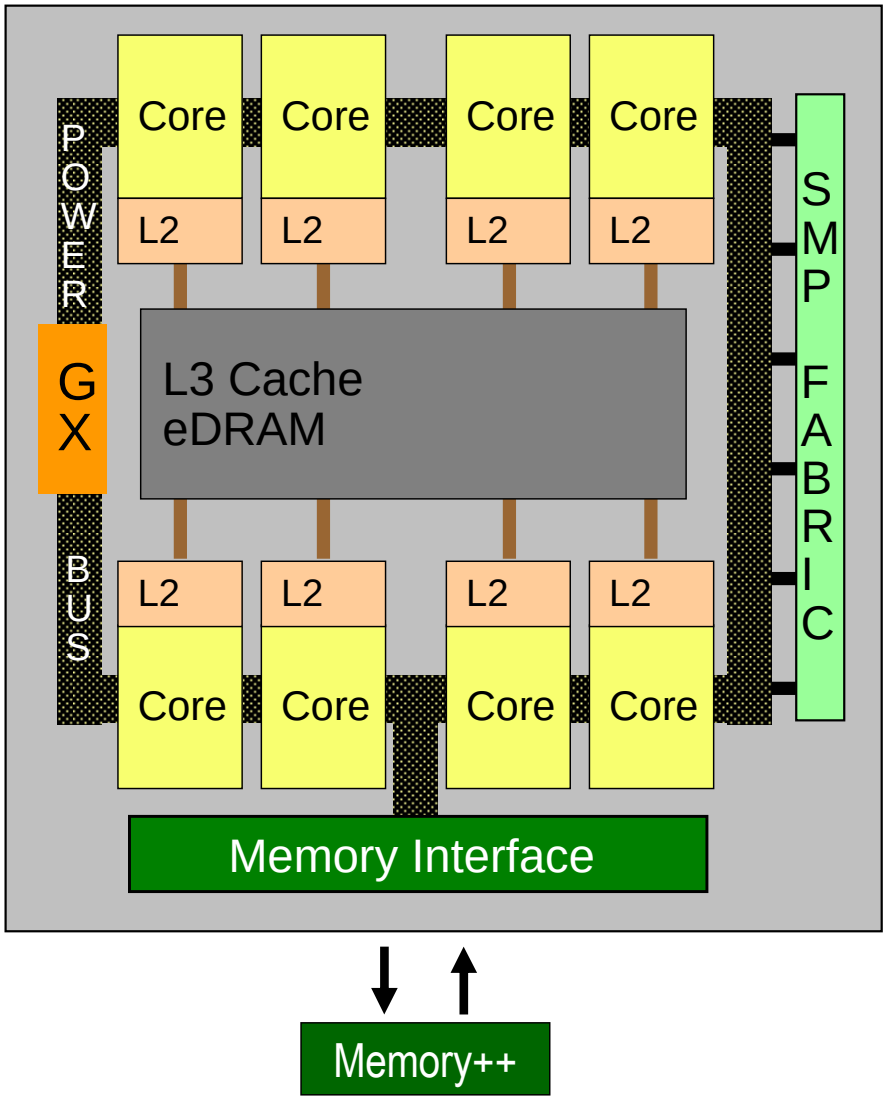
Scalability:

- Up to 32 Sockets
- 360 GB/s peak SMP bandwidth / chip
- 590 GB/s peak I/O bandwidth / chip
- Up to 20,000 coherent operations in flight

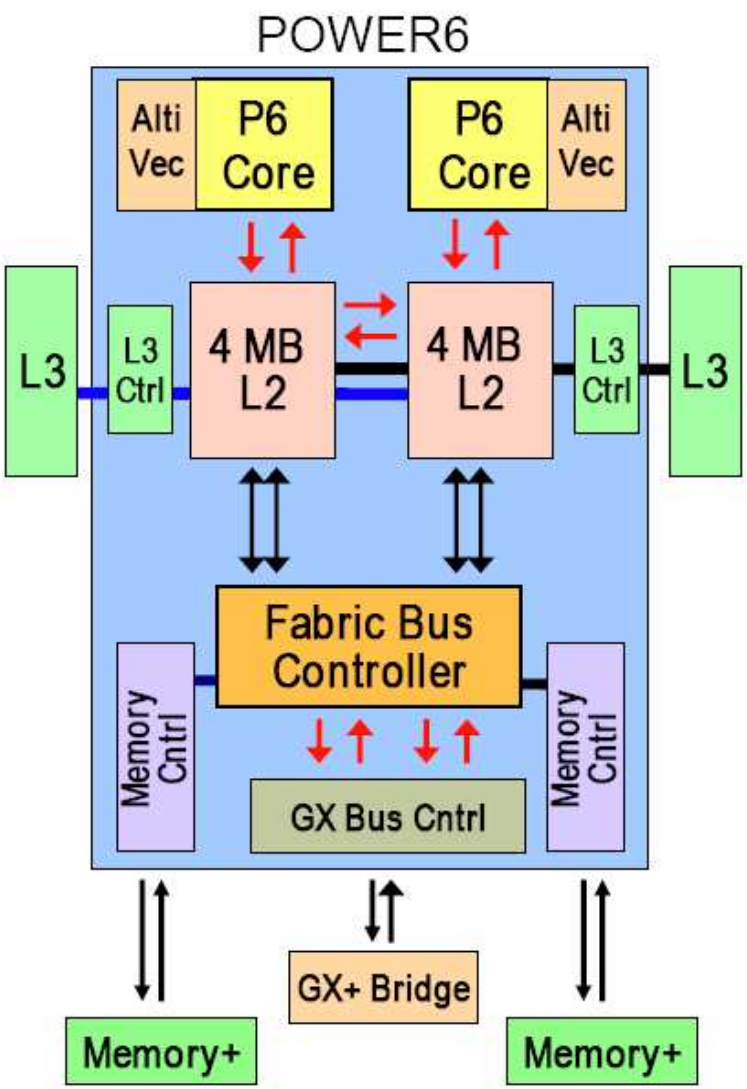
Energy:

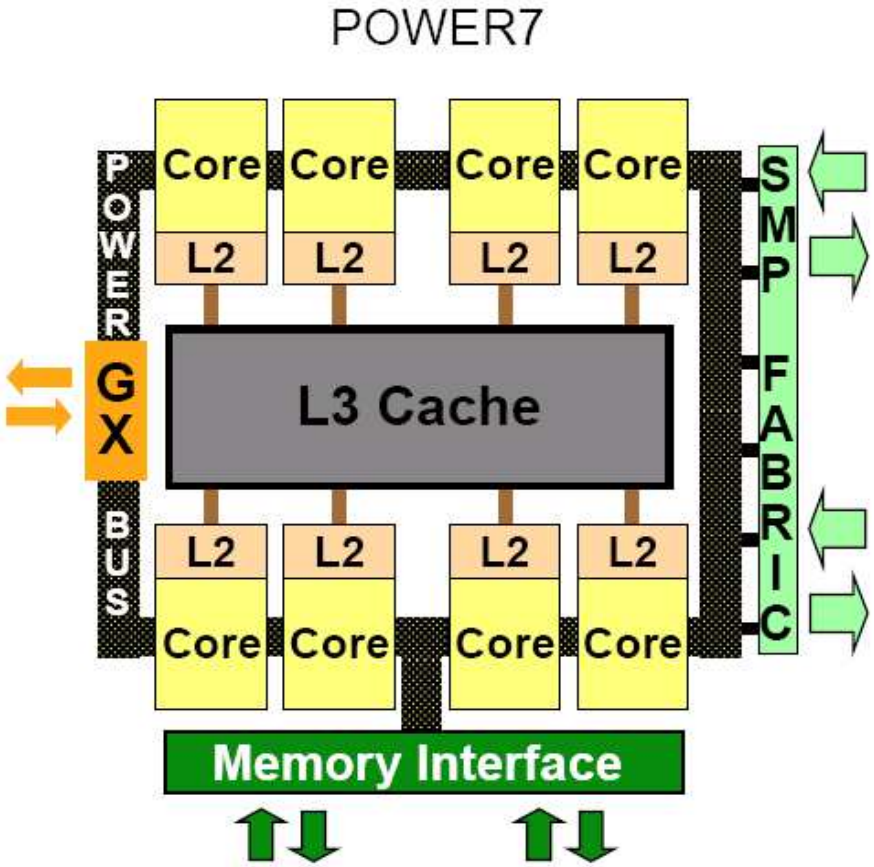
- Aggressive processor Nap & Sleep modes
- 10% “Over clock” when thermals are good

POWER7



POWER6 - POWER7 Compare



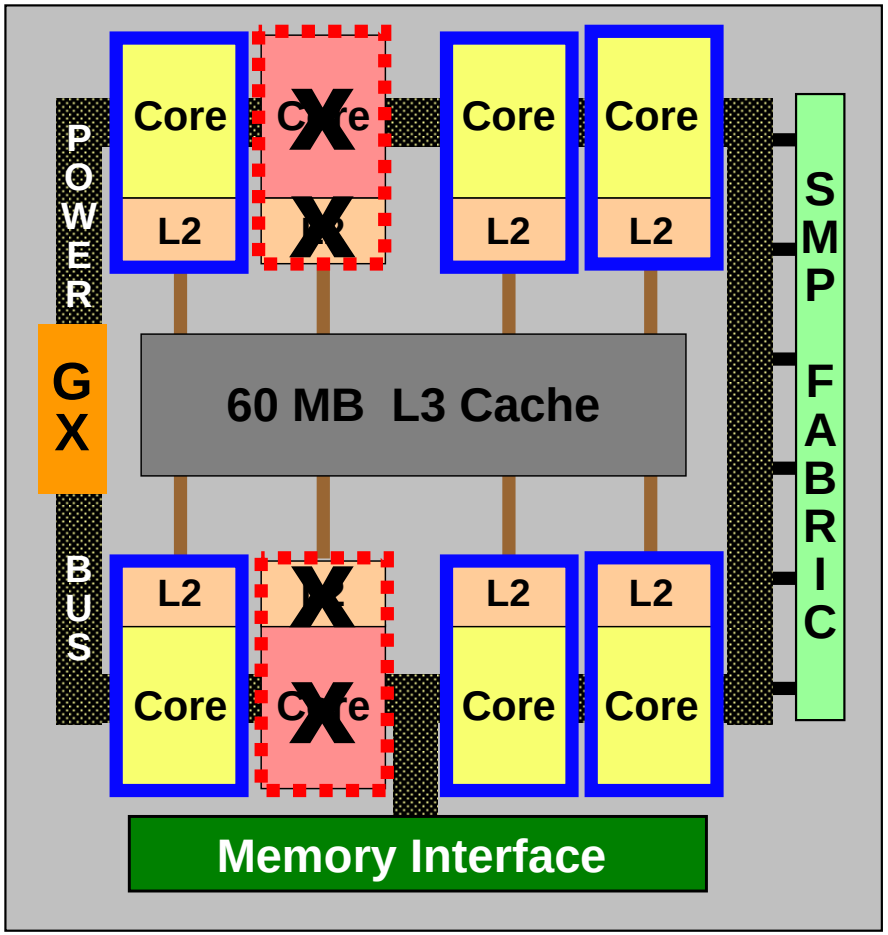


- Up to 8 cores / die
- 3rd Generation Multithreading – SMT4
- Integrated on-chip L3 Cache – lower latency
- 4th Generation SMP Fabric Bus
- Energy Optimized Design

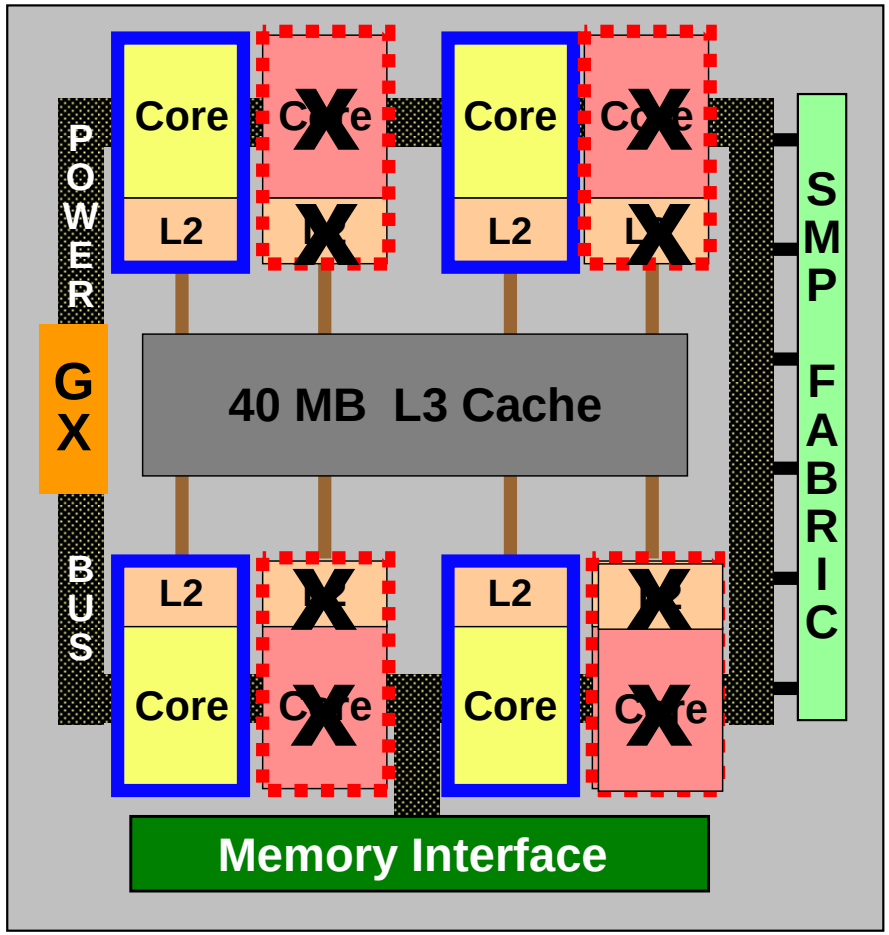
15

POWER7 Core / Cache options

POWER7+ 6 Core Chip



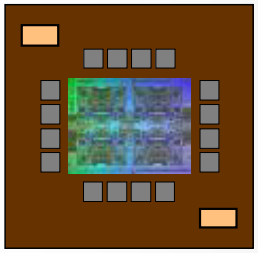
POWER7+ 4 Core Chip



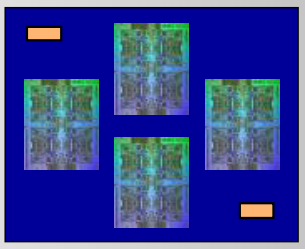
Conceptual diagrams above show one of several options to result in 6-core or 4-core chips

POWER7 / POWER7+ Module Packaging

Power 795
Single Chip Glass Ceramic

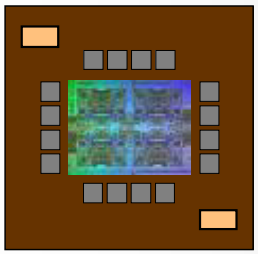


Power 775
Quad-chip MCM



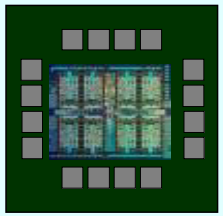
POWER7

Power 770 / 780
Single Chip Glass Ceramic

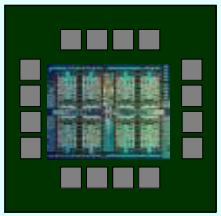


POWER7

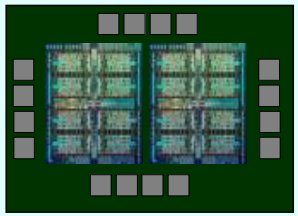
Power 710 / 730
Single Chip Organic



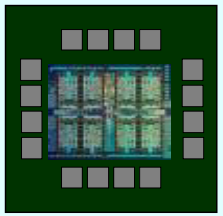
Power 720 / 740
Single Chip Organic



Power 750 / 760
Dual Chip Organic



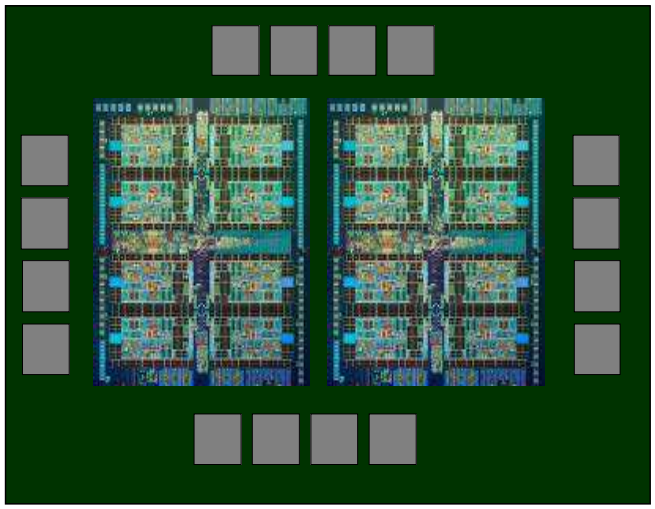
Power 770 / 780
Single Chip Organic



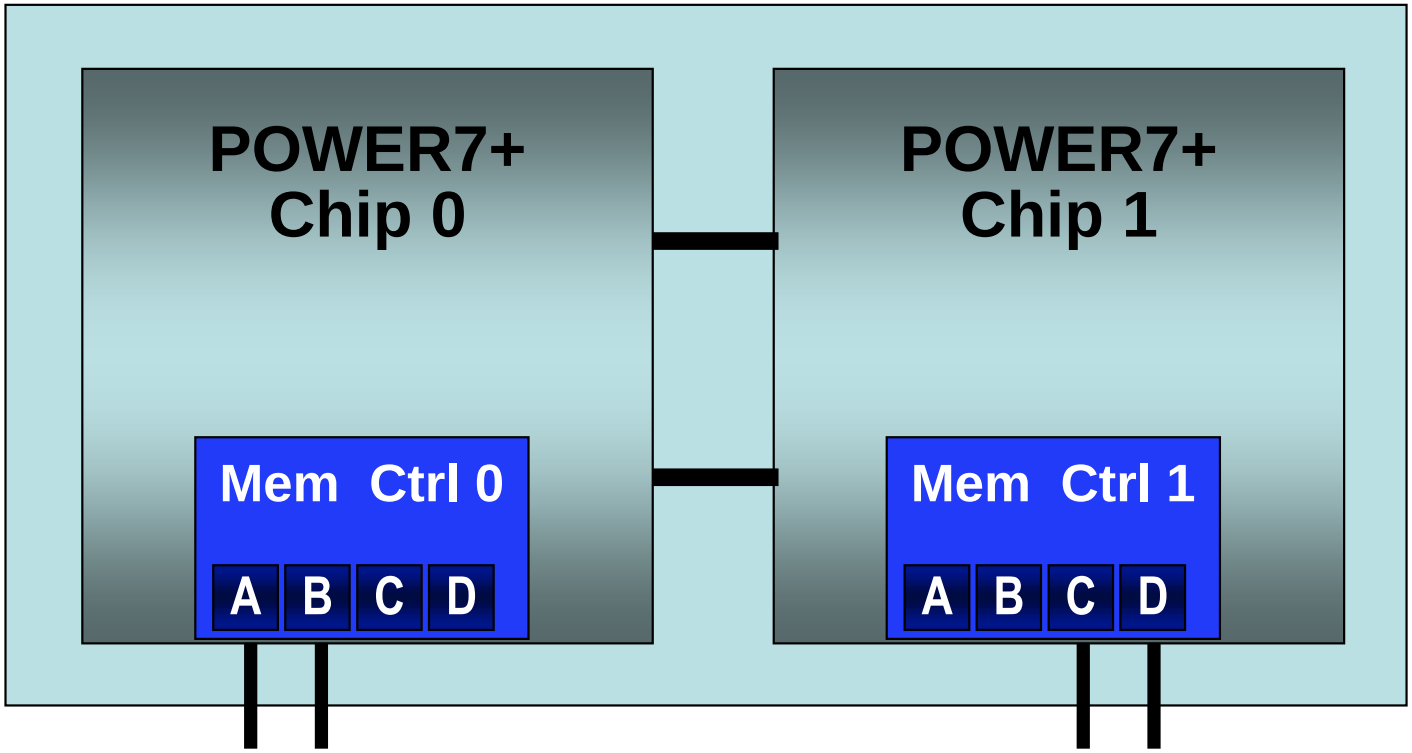
POWER7+

POWER7+ DCM

One Socket
Two POWER7+ Chips
- **4 Core option**
- **6 Core option**



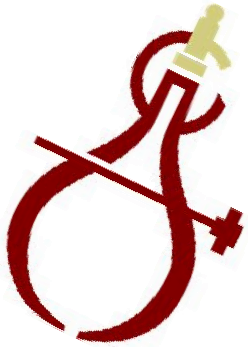
Results in
- **8 Core DCM**
- **12-Core DCM**



Processor Frequencies

- The single decimal GHz values used in announcement letters and brochures (for example 3.6) are simplified descriptions of the actual GHz provided by IBM
- The actual frequencies are 3 digit numbers:

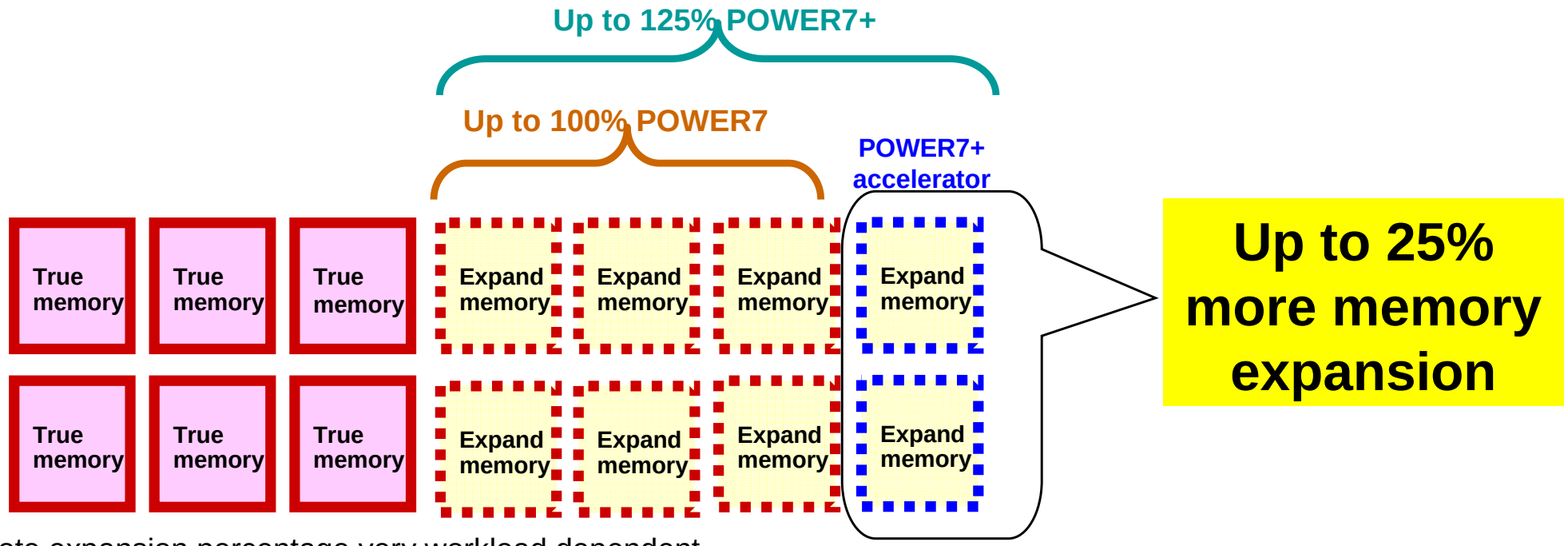
Announcement Letter Values	Actual Values
POWER7+ 4-core @ 3.6 GHz 6-core @ 4.2 GHz 8-core @ 4.2 GHz	 4 Core @ 3.612 GHz 6 Core @ 4.284 GHz 8 Core @ 4.228 GHz
POWER7+ 8-core @ 4.3 GHz 12-core @ 4.2 GHz 16-core @ 3.6 GHz 16-core @ 4.2 GHz	 8 Core @ 4.312 GHz 12 Core @ 4.284 GHz 16 Core @ 3.612 GHz 16 Core @ 4.228 GHz



POWER7+ Active Memory Expansion

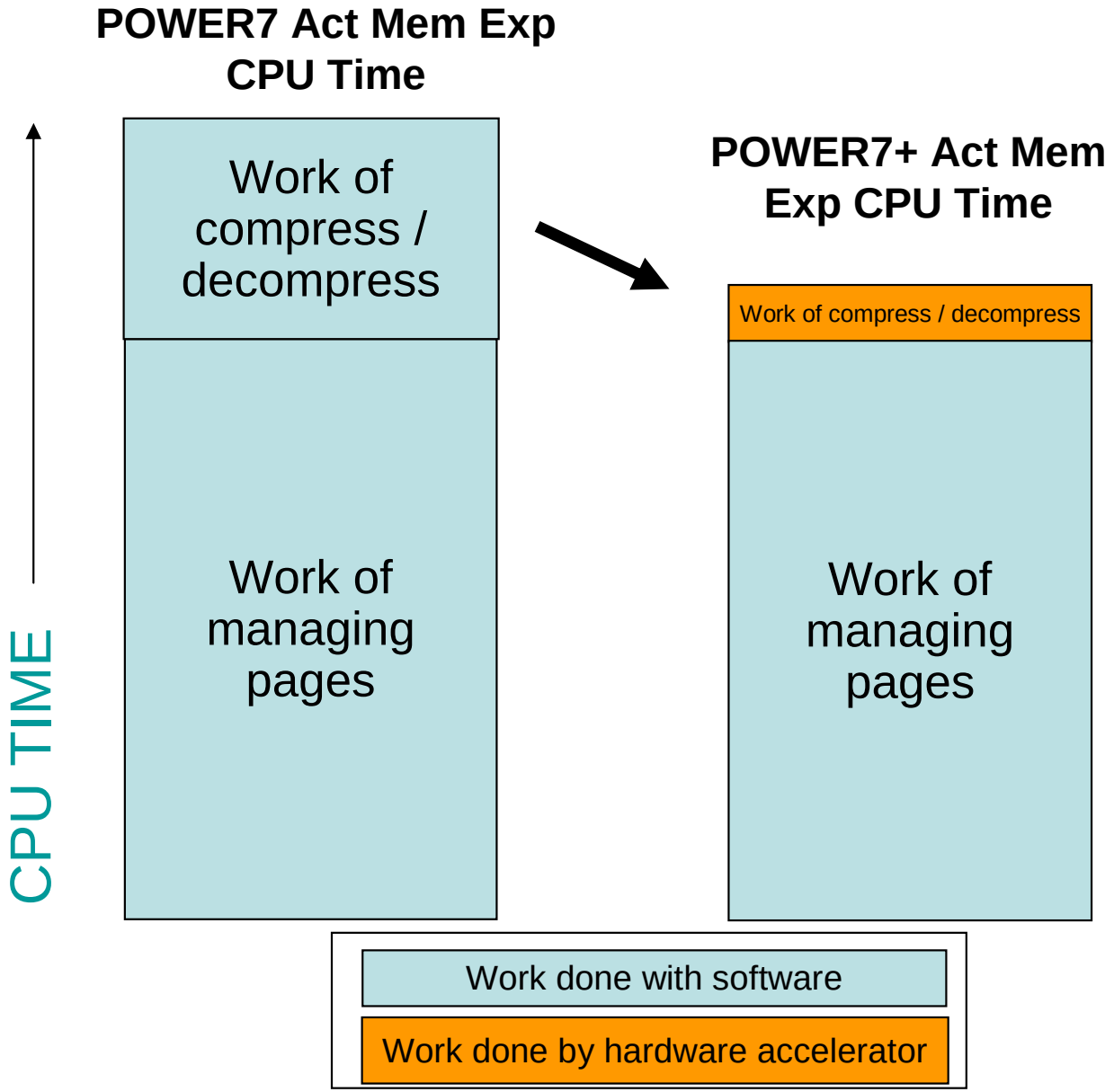
- POWER7+ AME Hardware Accelerator
  - Enhanced Power Systems value for AIX
  - On-chip enhancement

- Compared to POWER7, more efficient memory expansion (less processor overhead for the same compression/decompression – or even more equivalent memory for the same processor overhead)



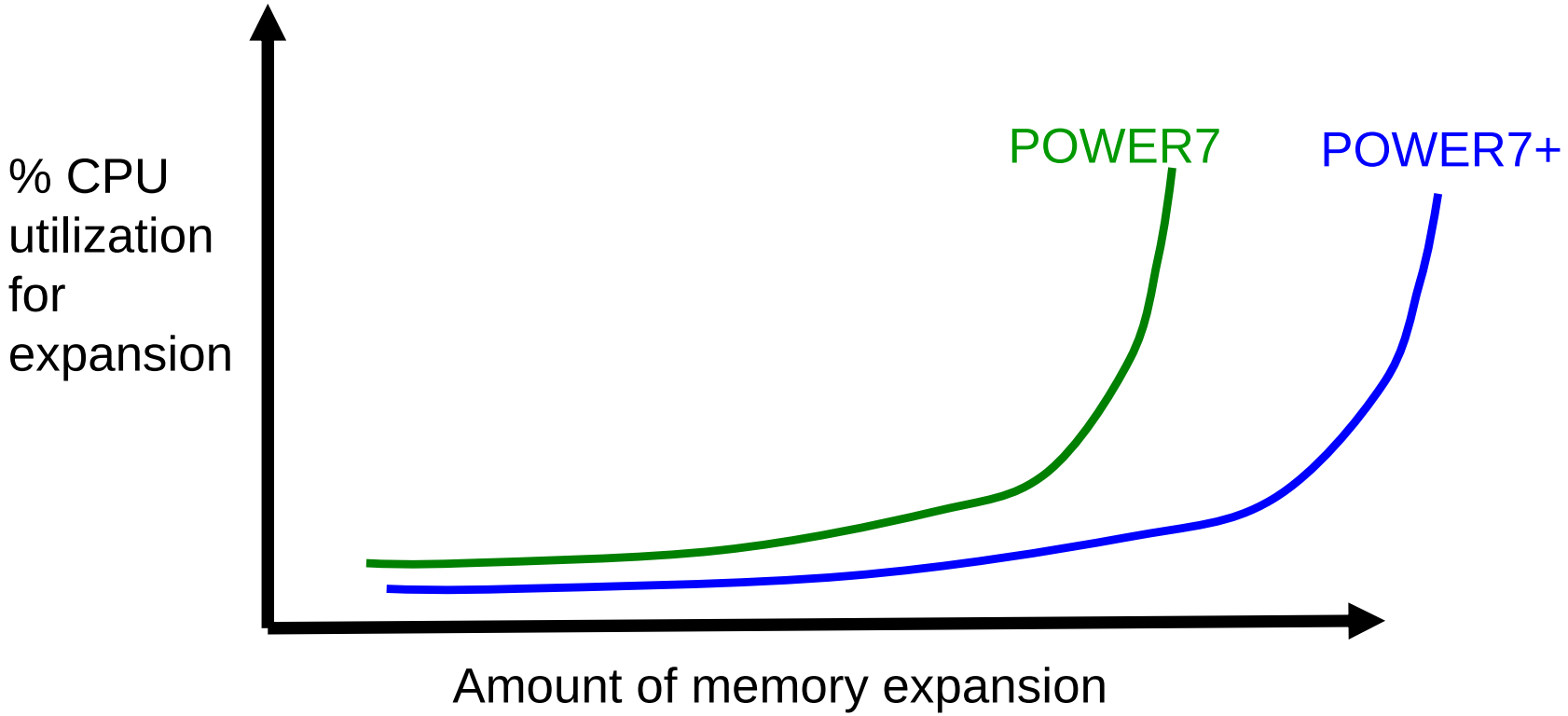
Note expansion percentage very workload dependent

Benefit of POWER7+ HW Accelerator



- ***Less CPU for the same amount of memory expansion***
  - ***Can then run more partitions or work per partition***
  - ***If fewer cores needed, may result in lower software licensing***
- ***OR more memory expansion for the same amount of processor***
  - ***Better able to relieve memory shortages and improve performance***
  - ***May be able to do more work***

Active Memory Expansion - CPU & Performance

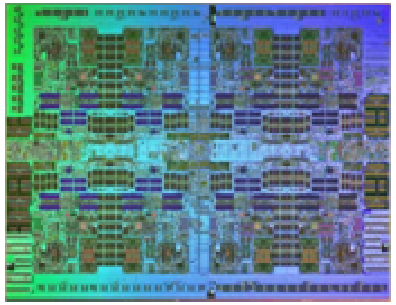


- POWER7+ uses on-chip hardware accelerator to do some of the compression / decompression work. There is a knee-of-cure relationship for CPU resource required for memory expansion
  - Even with POWER7+ hardware accelerator there is some resource required.
  - The more memory expansion done, the more CPU resource required
- Knee varies depending on how compressible memory contents are

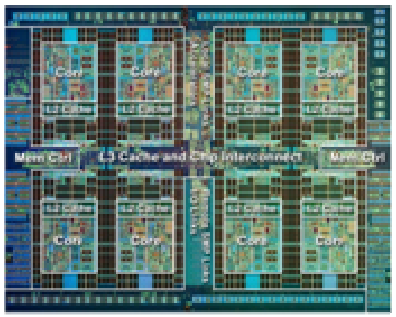
Chip Comparison

POWER7 vs Intel Poulson

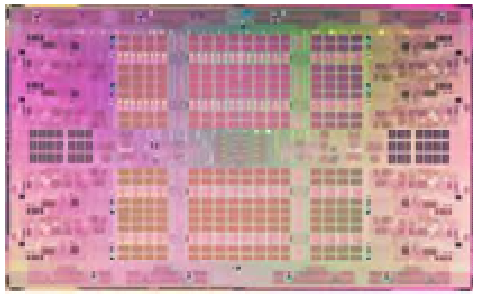
POWER7



POWER7+



Intel Poulson



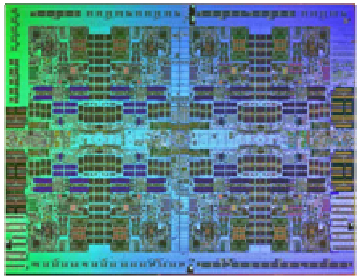
Cores	**8**	**8**	**8**
Threads per Core	**4**	**4**	**2**
Frequency	**4.0 Ghz**	**4.5 GHz**	**2.53 GHz**
Chip Size	**567mm2**	**567mm2**	**544 mm2**
Technology	**45nm SOI 11 LM EDRAM**	**32nm SOI 13 LM Edram**	**32nm 9 LM**
Max Socket support	**32**	**32**	**32**
Power	**250 Watts**	**250 Watts**	**170 Watts**
Spec_int Rate/Chip	**340**	**390**	**180**
Memory BW (70% utilization)	**96GB/s (16 DDR3 channels)**	**96GB/s (16 DDR3 channels)**	**45 GB/s (4 DDR3 channels)**
L3	**32MB**	**80MB**	**32MB**
Extras	**Advanced Prefetch HPC Features Energy management Turbo Mode/Core**	**Need to add**	**QPI busses to IO interfaces**

Chip Comparison

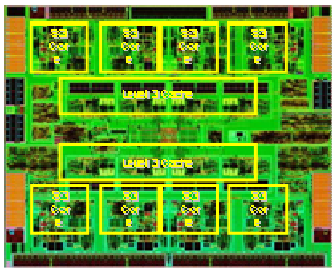
Chip Comparison

POWER7 vs Oracle T4

POWER7



Oracle T4

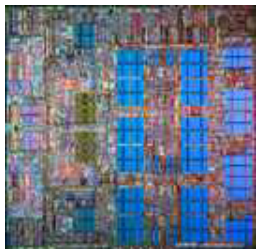


Oracle T5

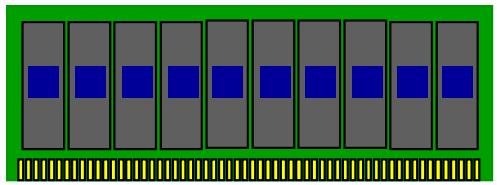
Cores	**8**	**8**	**16**
Frequency	**4.0 Ghz**	**3.0 Ghz**	**3.6 GHz**
Chip Size	**567mm2**	**403mm2**	**450 mm2 (est)**
Technology	**45nm SOI 11 LM EDRAM**	**40nm TSMC 12LM**	**28nm TSMC xxLM**
Max Socket support	**32**	**4**	**8**
Power	**250 Watts**	**240 Watts**	**240 Watts (est)**
Spec_int Rate/Chip	**340**	**170 (est)**	**300 (est)**
Memory BW (70% utilization)	**96GB/s (16 DDR3 channels)**	**24GB/s (4 DDR3 channels)**	
L3	**32MB**	**4MB**	**12MB**
Extras	**Advanced Prefetch HPC Features Energy management Turbo Mode/Core**	**16 lanes PCI 2X10 Gb Enet Encryption/Decryption**	**32 PCI lanes (est) 2X10 Gb Enet**

Memory Channel Bandwidth Evolution

POWER5

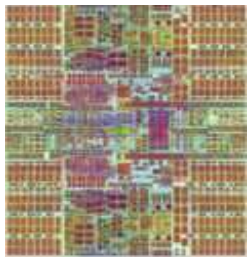


Memory Performance:
2x DIMM

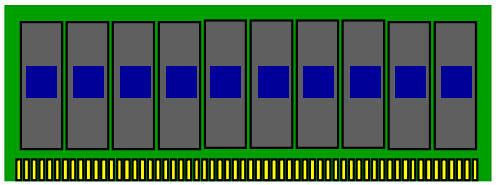


DDR2 @ 553 MHz
Effective Bandwidth:
1.1 GB/s

POWER6

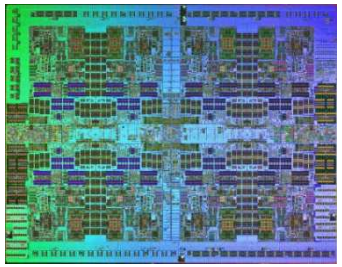


Memory Performance:
4x DIMM

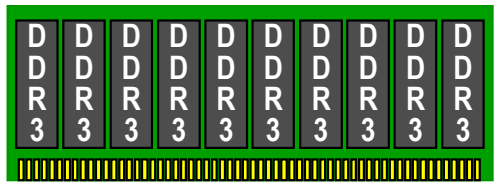


DDR2 @ 553 / 667 MHz
Effective Bandwidth:
2.6 GB/sec

POWER7



Memory Performance:
6x DIMM

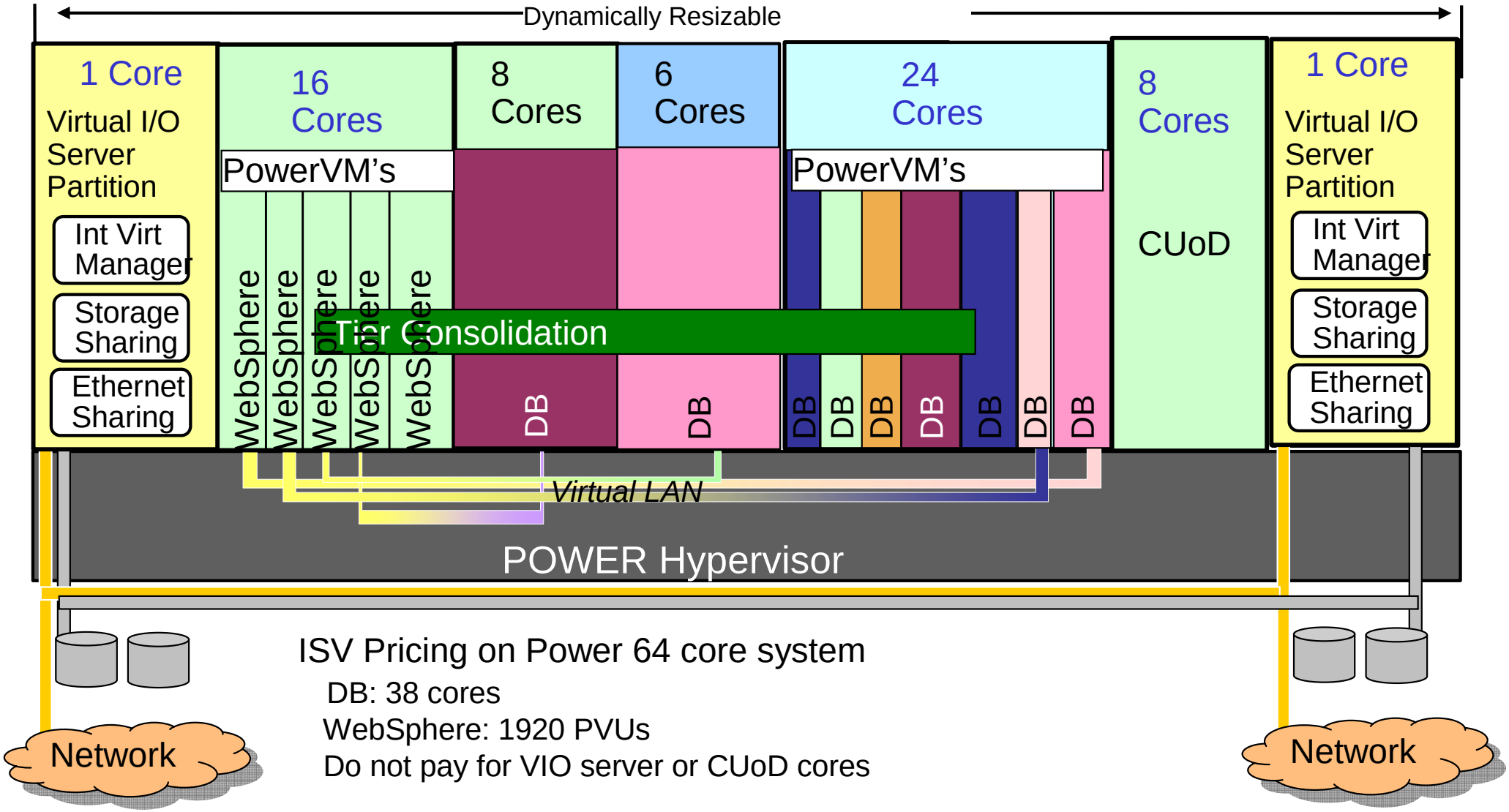


DDR3 @ 1066 MHz
Effective Bandwidth:
6.4 GB/sec

POWER7+ technology in a mid-range system provides enterprise class availability, modular flexibility and Capacity on Demand for critical business workloads

- ***What's New***
  - POWER7+ technology brings faster frequencies and larger L3 cache sizes which helps improve performance by over 20% on most workloads
  - Hardware assisted memory compression helps reduce memory requirements without penalizing performance
  - Hardware assisted AIX file system encryption improves security without penalizing performance
  - Improved RAS and energy efficiency features improve system attractiveness
  - Increased VM's per core improve virtualization efficiency
- ***Features / Business Value***
  - Industry leading performance per system and per-core, especially OLTP/database applications
  - Advanced virtualization capabilities including Micro-Partitions and the ability to move live applications from one physical system to another without user interruption which enables higher system utilization and efficiency
  - Extraordinary reliability with comprehensive redundancy and system enablement for reduced unplanned downtime and elimination of planned application downtime
  - Modular systems design, Utility CoD, and Hot-Node Add capabilities for easy "pay-as-you-grow" scenarios that respond quickly to change yet are easy on the bottom line
  - Highly stable and reliable POWER roadmap
- ***Client Benefits***
  - Easily handles virtualized consolidation of large mission critical applications and workloads
  - Enables OLTP workloads to be managed in the most demanding service level agreements
  - Supports highly secure environments for commercial applications
  - Enables flexible, non-disruptive growth for highly available workloads

Power Systems Virtualization – Tier Consolidation & Virtualization –



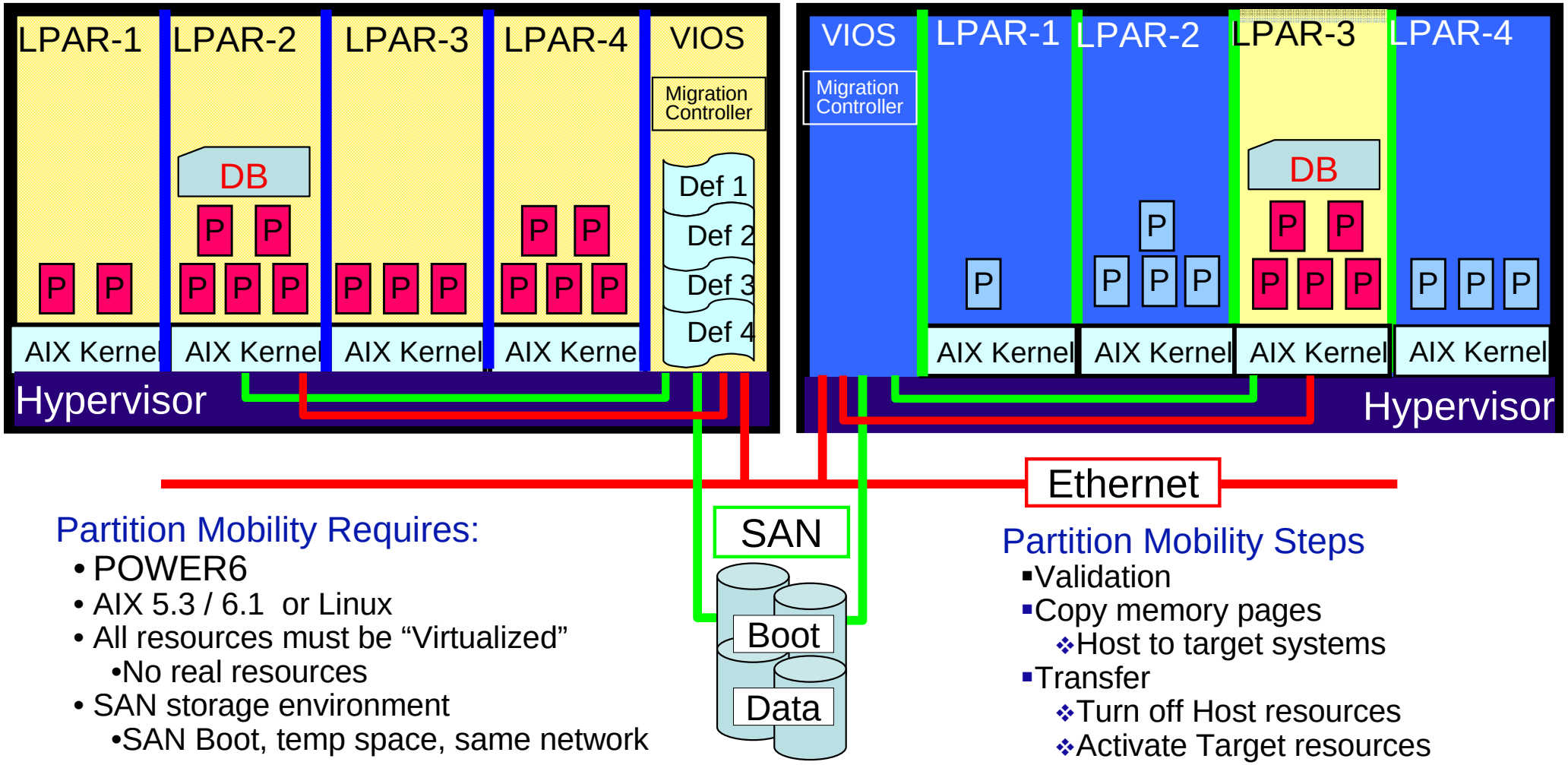
ISV Pricing on Power 64 core system

- DB: 38 cores
- WebSphere: 1920 PVUs
- Do not pay for VIO server or CUoD cores

Virtual Network WebSphere to DB works at memory speeds

Live Partition Mobility On DB Workloads

Reduce impact of planned outages, relocate workloads to enable growth, provision new technology with no disruption to service



Partition Mobility Requires:

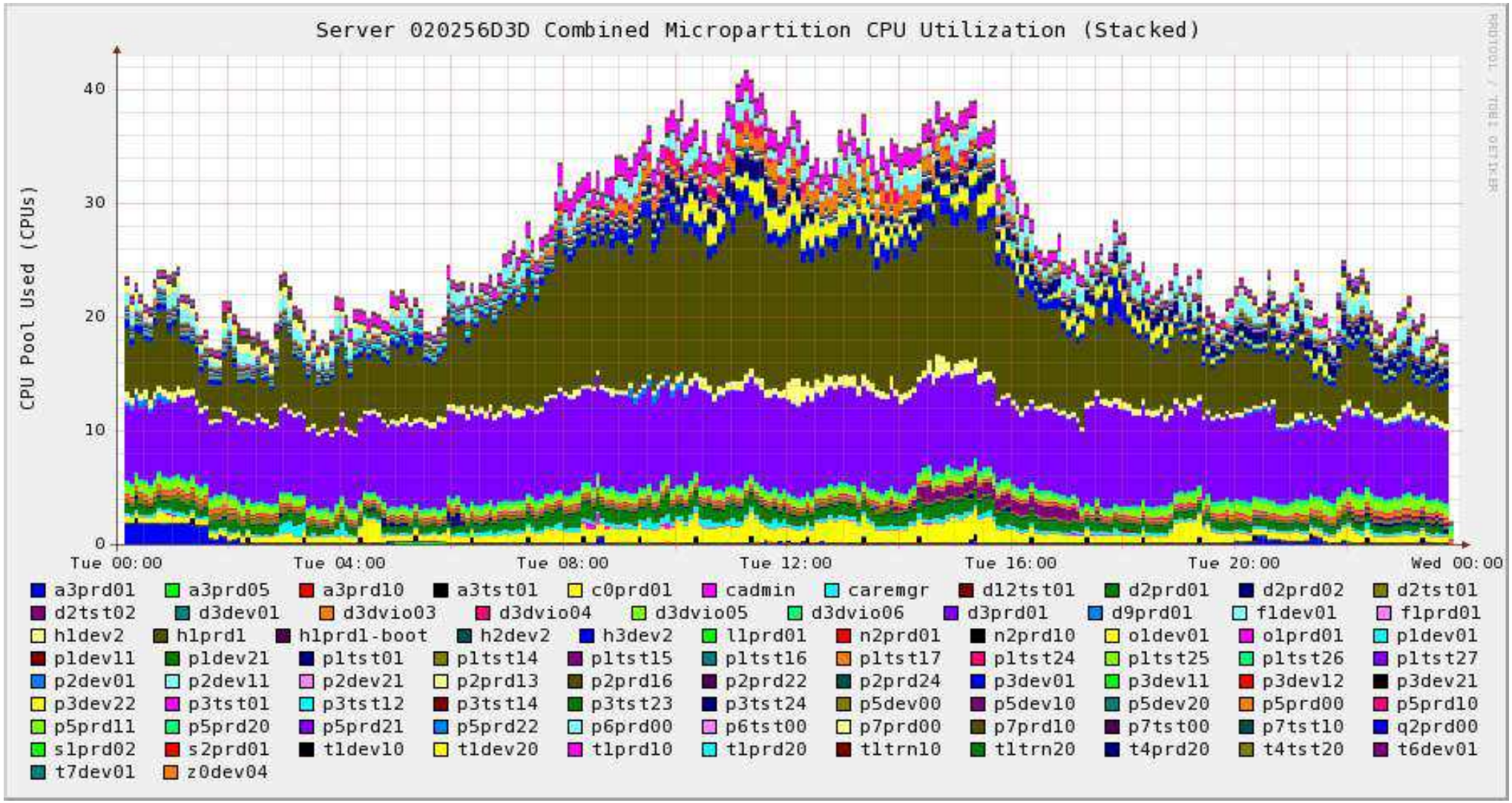
- POWER6
- AIX 5.3 / 6.1 or Linux
- All resources must be “Virtualized”
  - No real resources
- SAN storage environment
  - SAN Boot, temp space, same network

Partition Mobility Steps

- Validation
- Copy memory pages
  - Host to target systems
- Transfer
  - Turn off Host resources
  - Activate Target resources

The number of DB licenses needed does not change before and after the migration

Customer Shared Pool



POWER7+ RAS Feature Overview

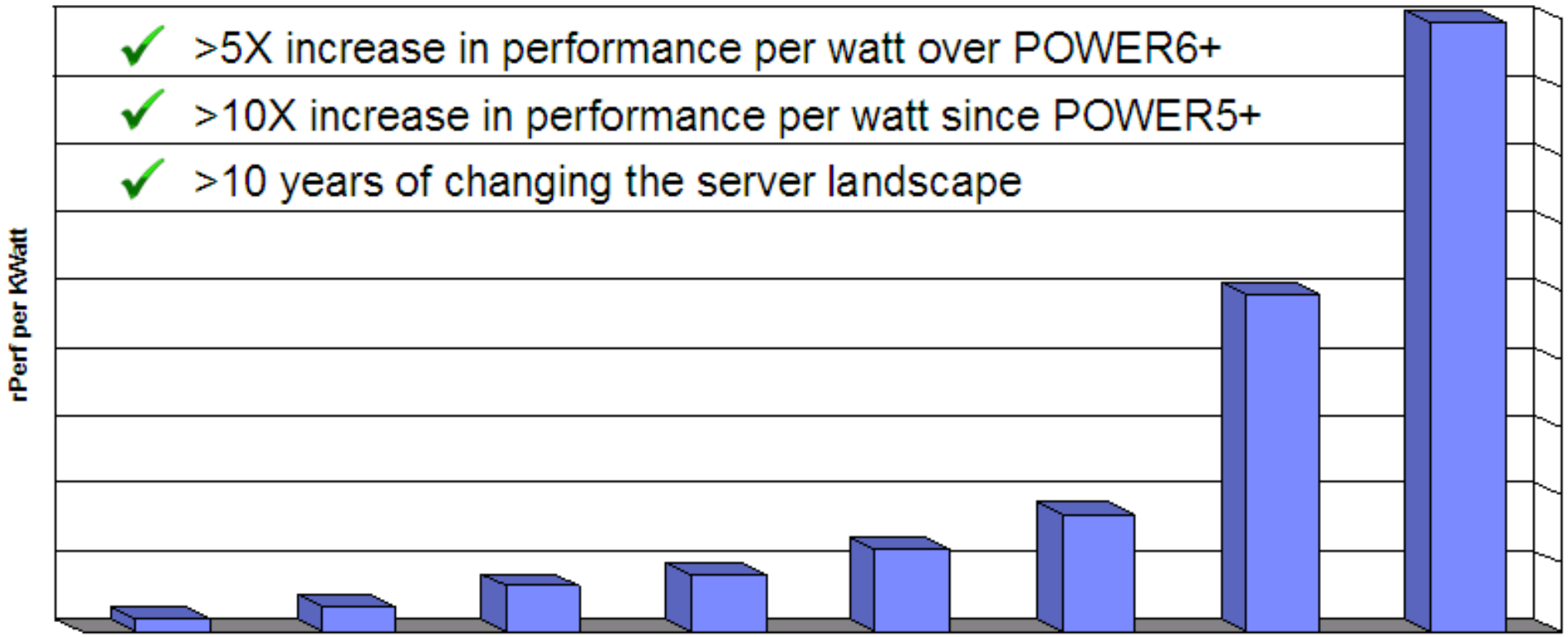
● Standard
◙ Optional
— Not Available

RAS Item	Power 750+	Power 760+	Power 770+	Power 780+	Power 795
Redundant / Hot Swap Fans & Blowers	●	●	●	●	●
Hot Swap DASD / Media / PCI Adapters	●	●	●	●	●
Concurrent Firmware Update	●	●	●	●	●
Redundant / Hot Swap Power Supplies	●	●	●	●	●
Dual disk controllers (split backplane)	●	●	●	●	●
Processor Instruction Retry	●	●	●	●	●
Alternate Processor Recovery	●	●	●	●	●
Redundant / Hot Swap Power Regulators	●	●	●	●	●
PowerVM™/Live Part. Mobility/Live App Mobility	◙	◙	◙	◙	◙
Dynamic Processor Sparing	—	◙	◙	◙	◙
Memory Sparing	—	—	◙	◙	◙
Redundant Service Processors	—	—	●*	●*	●
Redundant System Clocks	—	—	●*	●*	●
Hot GX Adapter Add and Cold Repair	—	—	●	●	●
Hot-node Add / Cold-node Repair	—	—	●*	●*	●*
Hot-node Repair / Hot-memory Add	—	—	●*	●*	●*
Dynamic Service Processor &System Clock Failover	—	—	●*	●*	●
Hot-node Repair / Hot-memory Add for all nodes**	—	—	●*	●*	●*
Enterprise Memory	—	—	●	●	●
Hot GX Adapter Repair	—	—	●	●	●
Active Memory Mirroring for Hypervisor	—	—	◙	●	●
Power Pools	—	—	—	●	●

* Requires two or more nodes

POWER7+ continues to deliver more

Performance per Watt



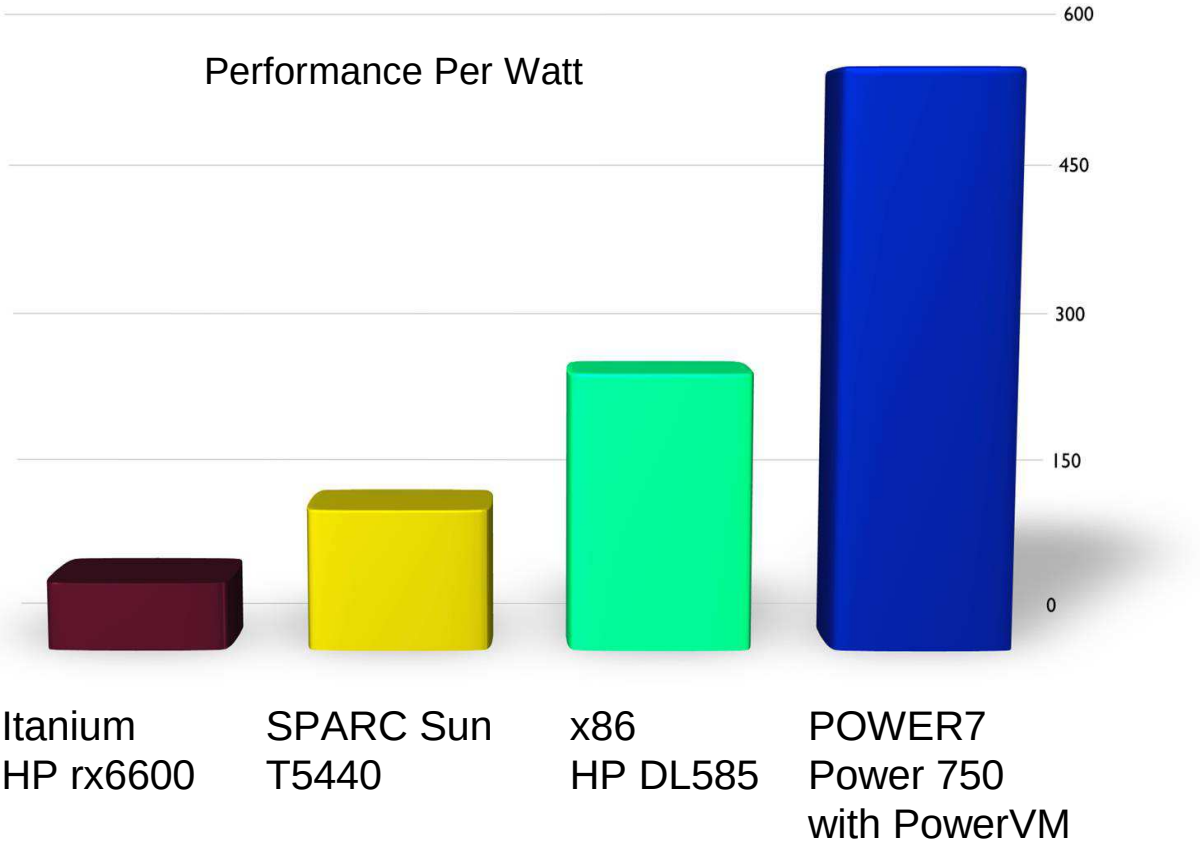
POWER4™	POWER4+™	POWER5™	POWER5+™	POWER6™	POWER6+™	POWER7™	POWER7+™
p670 1.1 GHz rPerf: 24.46 KWatts: 6.71	p670 1.5 GHz rPerf: 46.79 KWatts: 6.71	p5-570 1.65 GHz rPerf: 68.4 KWatts: 5.2	p570 1.9 GHz rPerf: 85.20 KWatts: 5.2	Power 570 4.7 GHz rPerf: 134.35 KWatts: 5.6	Power 570 4.2 GHz rPerf: 193.25 KWatts: 5.6	Power 780 3.8 GHz rPerf: 685.09 KWatts: 6.9	Power 780 3.7 GHz rPerf: 1380.19 KWatts: 7.7

The most energy efficient 4-socket system on the planet

The first Energy Star certified RISC system

Power 750

Most energy efficient systems



2012 Power Systems leadership

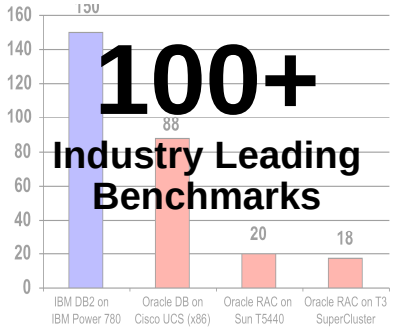
- ✓ Performance redefined
- ✓ Scalability
- ✓ Virtualization
- ✓ Availability
- ✓ Security

IBM Watson

transforming industry innovation

Top 500

Powering 5 of the world's top 10 supercomputers



100+

Industry Leading Benchmarks

9,000+

Patents since 2001

3,000+

Competitive migrations 1Q 2010-3Q 2012

Linux®

CPW

GHz (#core/socket) : CPW (# core)

POWER7+ 710 3.6 GHz (4): 28,400 (4) 4.2 GHz (6): 49,400 (6) 4.2 GHz (8): 64,500 (8)	POWER7+ 730 4.3 GHz (4): 59,700 (8) 4.2 GHz (6): 89,200 (12), 3.6 GHz (8): 104,700 (16) 4.2 GHz (8): 117,600 (16)
POWER7+ 720 3.6 GHz (4): 28,400 (4) 3.6 GHz (6), 42,400 (6), 3.6 GHz (8): 56,300 (8)	POWER7+ 740 4.2 GHz (6): 49,000 (6), 91,700 (12) 3.6 GHz (8): 56,300 (8), 106,500 (16) 4.2 GHz (8): 64,500 (8), 120,000 (16)
POWER7+ 750 3.5 GHz (8): 52,000(8), 96,000(16), 141,500(24), 185(32) 4.0 GHz (8): 59,000(8), 108,000(16), 158,000(24), 208,000(32)	
POWER7+ 760 3.1 GHz (12): 69,800(12), 129,000(24), 194,700(36), 258,000(48) 3.4 GHz (12): 75,200(12), 137,000(24), 209,000(36), 274,000(48)	

rPerf

GHz (#core/socket) : rPerf (# core)

POWER7+ 710 3.6 GHz (4): 53.9 (4) 4.2 GHz (6): 90.6 (6) 4.2 GHz (8): 115.5 (8)	POWER7+ 730 4.3 GHz (4): 120.4 (8), 4.2 GHz (6): 176.6 (12), 3.6 GHz (8): 197.7 (16) 4.2 GHz (8): 223.1 (16)
POWER7+ 720 3.6 GHz (4): 53.9 (4) 3.6 GHz (6), 79.5 (6), 3.6 GHz (8): 102.4 (8)	POWER7+ 740 4.2 GHz (6): 90.6 (6), 176.6 (12) 3.6 GHz (8): 102.4 (8), 197.7 (16) 4.2 GHz (8): 115.5 (8), 223.1 (16)
POWER7+ 750 3.5 GHz (8): 104.5 (8), 197.0 (16), 275.9 (24), 354.9 (32) 4.0 GHz (8): 117.1 (8), 220.7 (16), 309.2 (24), 397.7 (32)	
POWER7+ 760 3.1 GHz (12): 142.1 (12), 264.8 (24), 370.7 (36), 476.7 (48) 3.4 GHz (12): 151.4 (12), 282.1 (24), 395.0 (36), 507.8 (48)	

Q & A

IBM Power Systems

5 February 2013 Announcement
Hardware Deep Dive

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Revised September 26, 2006

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Revised November 28, 2012

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Fußnoten zum vorherigen Slide

Reference the PowerLinux 7R2 SAP SD 2-Tier Performance chart in the 710/730/7R2 section

(1) The SAP Sales and Distribution (SD) Standard Application Benchmark performed on December 9, 2012 by IBM in Austin, TX, USA, has been certified with the following data: Number of SAP SD benchmark users: 8,016, Average dialog response time: 0.98 seconds, Throughput: Fully processed order line 876,000 items/hour, Dialog steps/hour: 2,628,000, SAPS: 43,800, Average database request time 0.020 sec / 0.018 sec (dialog/update): CPU utilization of central server: 99% Operating system, central server: SUSE Linux Enterprise Server 11 SP2, RDBMS: DB2 10, SAP Business Suite software: SAP enhancement package 5 for SAP ERP 6.0, Configuration: Central server: IBM PowerLinux 7R2, 2 processors / 16 cores / 64 threads, IBM POWER7+, 4.22 GHz, 32 KB (I) and 32 KB (D) L1 cache, and 256 KB L2 cache per core, 10 MB L3 cache per core, 256 GB main memory. The SAP certification number was not available at press time and can be found at the following Web page: www.sap.com/benchmark

(2) The SAP Sales and Distribution (SD) Standard Application Benchmark performed on December 24, 2012 by Cisco Systems in Walldorf, Germany, was certified on January 8, 2013, with the following data: Number of SAP SD benchmark users: 6,530 Average dialog response time: 0.98 seconds, Throughput: Fully processed order line items per hour: 713,670, Dialog steps per hour: 2,141,000, SAPS: 35,680 Average database request time (dialog/update): 0.015 sec / 0.036 sec, CPU utilization of central server: 99% Operating system, central server: Red Hat Enterprise Linux 6.3 RDBMS: Sybase ASE 15.7 SAP Business Suite software: SAP enhancement package 5 for SAP ERP 6.0 Configuration: Central server: Cisco UCS B200 M3, 2 processors / 16 cores / 32 threads, Intel Xeon Processor E5-2690, 2.90 GHz, 64 KB L1 cache and 256 KB L2 cache per core, 20 MB L3 cache per processor, 256 GB main memory

Notes on benchmarks and values

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

IBM benchmark results can be found in the IBM 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, the latest versions of AIX were used. All other systems used previous versions of AIX. The SPEC CPU2006, 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 for AIX v11.1, XL C/C++ for AIX v11.1, XL FORTRAN for AIX v13.1, XL C/C++ for Linux v11.1, and XL FORTRAN for Linux v13.1.

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, Siebel, PeopleSoft	http://www.oracle.com/apps_benchmark/
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

Revised December 2, 2010

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, the latest versions of AIX were used. All other systems used previous versions of AIX. The SPEC CPU2006, 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 for AIX v11.1, XL C/C++ for AIX v11.1, XL FORTRAN for AIX v13.1, XL C/C++ for Linux v11.1, and XL FORTRAN for Linux v13.1. Linpack HPC (Highly Parallel Computing) used the current versions of the IBM Engineering and Scientific Subroutine Library (ESSL). For Power7 systems, IBM Engineering and Scientific Subroutine Library (ESSL) for AIX Version 5.1 and IBM Engineering and Scientific Subroutine Library (ESSL) for Linux Version 5.1 were used.

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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