IBM

Smarter Planet with Power

Smarter Systems for a Smarter Planet

Power your planet.

IBM

Agenda

1

POWER7 HARDWARE
Dedicated Systems
POWER Blades offerings

Danny Vandaele

2

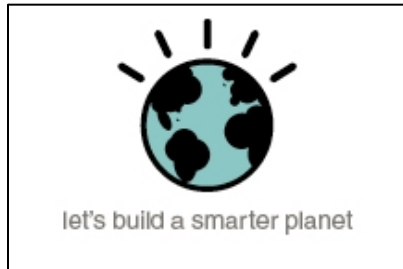**POWER AIX - Linux**
AIX Strategy
PowerVM
IBM Director

Philippe Ceyssens
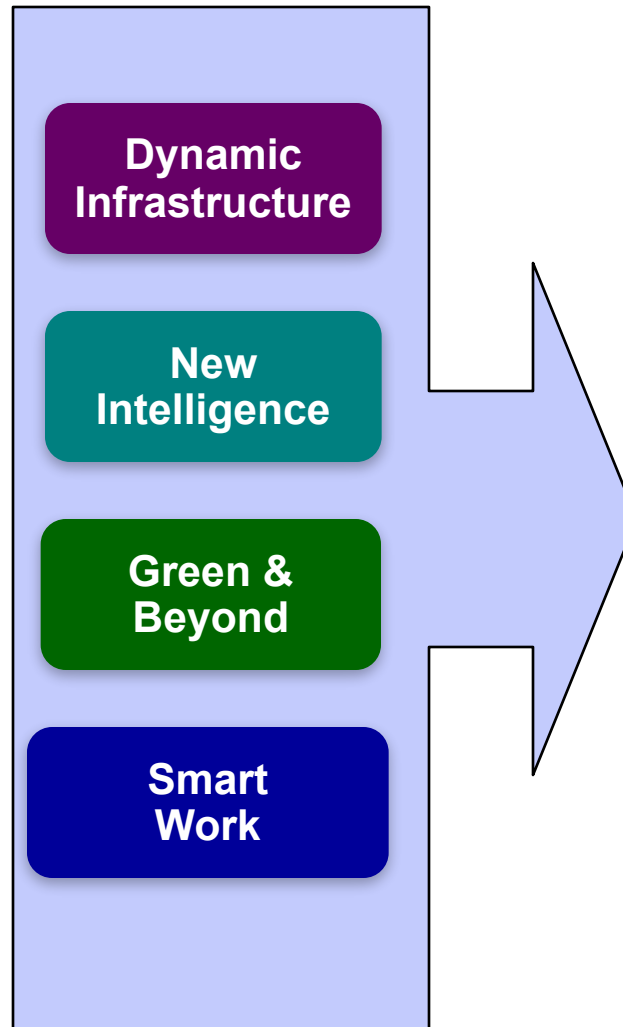
3

POWER i
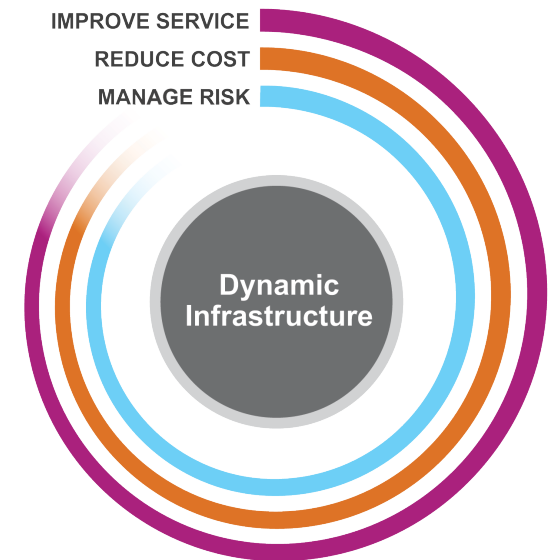IBM i7.1
PowerHA

Paul Masschelein

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Four major IBM initiatives

Dynamic Infrastructure

IBM's smarter planet vision

let's build a smarter planet

The world has become flatter and smaller. Now it must become smarter.

Dynamic Infrastructure

New Intelligence

Green & Beyond

Smart Work

IMPROVE SERVICE
REDUCE COST
MANAGE RISK

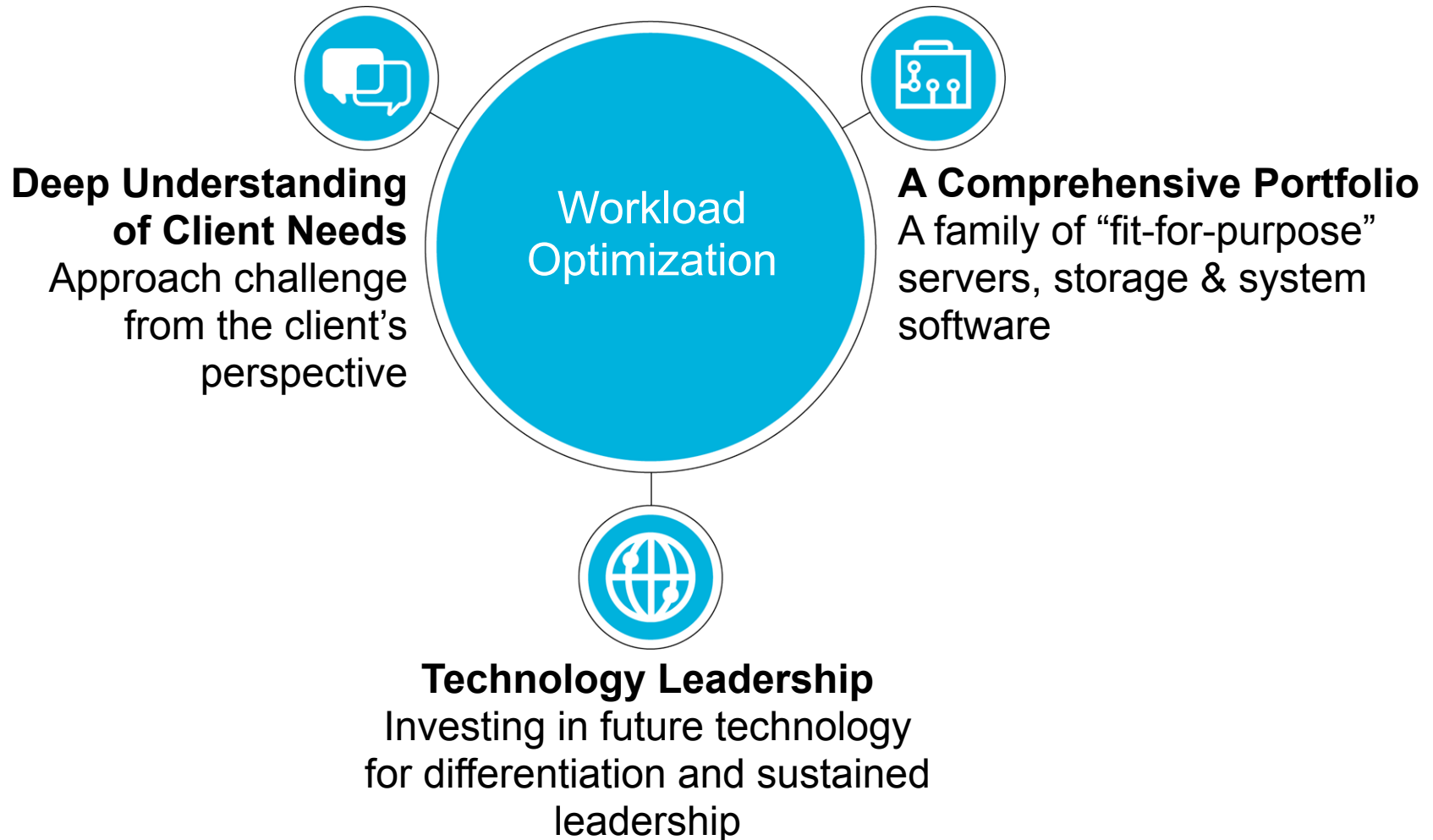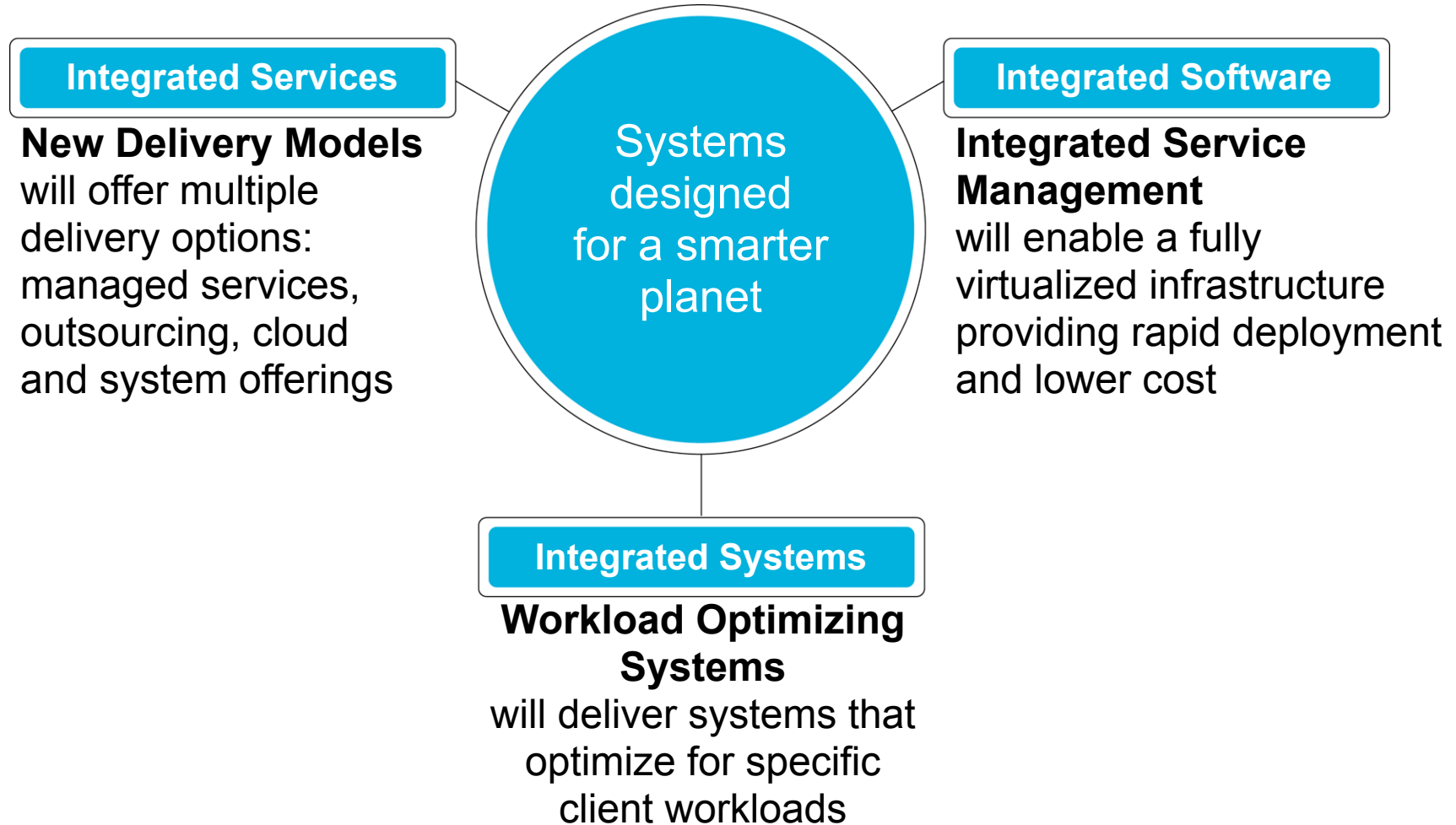**Dynamic Infrastructure**

Power your planet.

Our vision

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

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IBM Systems & Technology lay the foundation

Workload Optimization

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

Integrated Services

New Delivery Models will offer multiple delivery options: managed services, outsourcing, cloud and system offerings

Systems designed for a smarter planet

Integrated Software

Integrated Service Management will enable a fully virtualized infrastructure providing rapid deployment and lower cost

Integrated Systems

Workload Optimizing Systems will deliver systems that optimize for specific client workloads

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Transformations to "smarter" solutions require Smarter systems that:

Scale quickly and efficiently

Optimize workload performance

Flexibly flow resources

Avoid downtime

Save energy

Automate management tasks
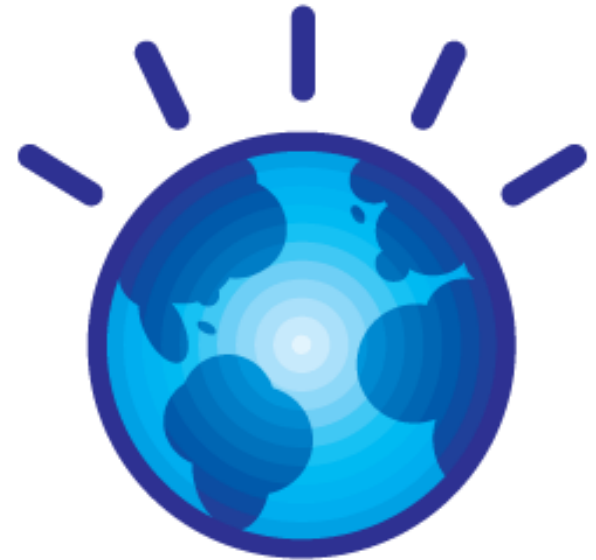
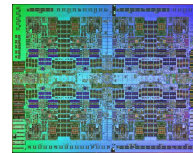Power your planet.

Power your planet.
Smarter systems for a Smarter Planet.

Power your planet.

IBM's 2009 Patent Total: 17 yrs of Leadership

- **IBM** **4,914**
- Samsung 3,611
- Microsoft 2,906
- Canon 2,206
- Matsushita 1,829
- Toshiba
- Sony 1,680
- Intel 1,537
- Seiko Epson 1,330
- HP 1,273
- SUN 562
- Apple 289
- EMC 250
- Oracle 208
- *Source: IFI Patent Intelligence*

1,696

IBM Austin: 880 Patents
#1 IBM location for 7th year

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Workload-Optimizing Systems

+

Management
Energy
Security
Availability
Operating Systems
Virtualization

IBM® Systems Software

AIX® ♦ ⓘ for Business ♦ 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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POWER7 System Highlights

- **Balance System Design**
  - Cache, Memory, and IO
- **POWER7 Processor Technology**
  - 6th Implementation of multi-core design
  - On chip L2 & L3 caches
- **POWER7 System Architecture**
  - Blades to High End offerings
  - Enhances memory implementation
  - PCIe, SAS / SATA
- **Built in Virtualization**
  - Memory Expansion
  - VM Control
- **Green Technologies**
  - Processor Nap & Sleep Mode
  - Memory Power Down support
  - Aggressive Power Save / Capping Modes
- **Availability**
  - Processor Instruction Retry
 - Alternate Process Recovery
  - Concurrent Add & Services

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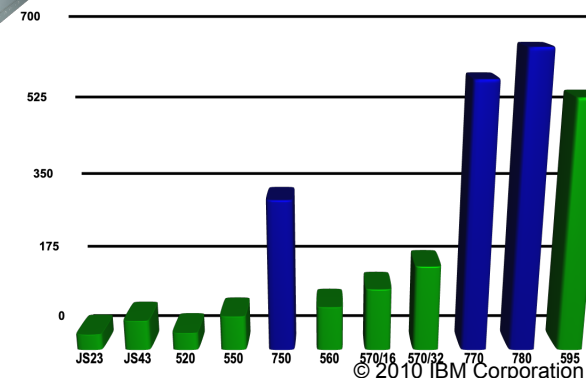
POWER7 systems optimized to the BUSINNESS needs

➢ **Have been optimized from the ground up**
   for the IBM stack, including DB2, WebSphere, Lotus Domino and Rational. As
   a result, they represent the ideal, tailor-made computing infrastructure for our
   industry framework solutions, and for the new workload demands of smarter
   planet engagements.

➢ **Deliver 71 percent better price/performance**
   than Sun SPARC Enterprise T5440 server and more than 280 percent better
   than Sun SPARC Enterprise M5000 and M4000 servers (IBM Power 750).

➢ **Deliver more than 400 percent better price/performance**
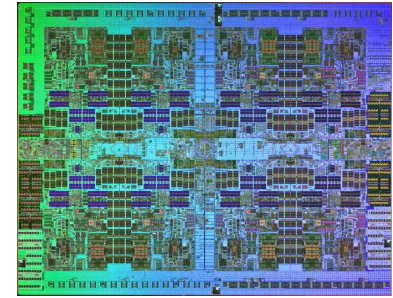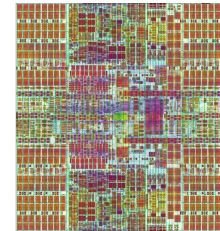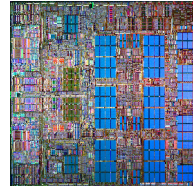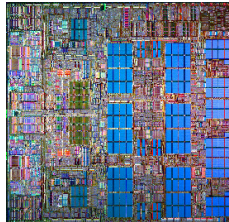   than HP Integrity rx7640 or rx6600 servers (IBM Power 750).

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Technology leadership
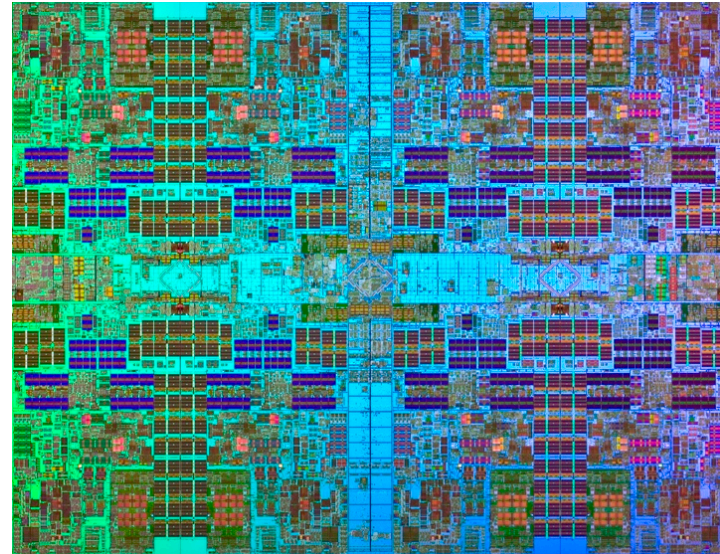

✓ 4, 6 or 8 cores per socket
✓ 3.0 to 4.14 GHz
✓ Up to 4 threads per core
✓ Integrated eDRAM L3 Cache
✓ Dynamic Energy Optimization

Power your planet.

Processor Designs

	POWER5	**POWER5+™**	**POWER6**	**POWER7**
Technology	130 nm	90 nm	60 nm	45 nm
Size	389 mm²	245 mm²	341 mm²	567 mm²
Transistors	276 M	276 M	790 M	1.2 B
Cores	2	2	2	4 / 6 / 8
Frequencies	1.65 GHz	1.9 GHz	3-5 GHz	3-4 GHz
L2 Cache	1.9 MB Shared	1.9 MB Shared	4 MB / Core	256 KB / Core
L3 Cache	36 MB	36 MB	32 MB	4 MB / Core
Memory Cntrl	1	1	2 / 1	2 / 1
LPAR	10 / Core	10 / Core	10 / Core	10 / Core

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POWER : New Intelligence
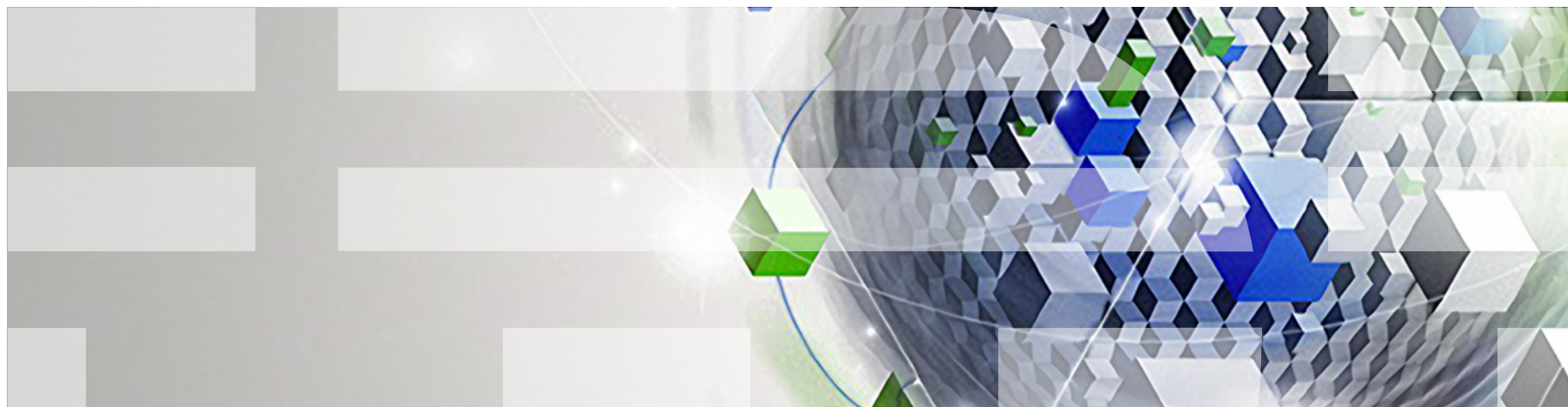
POWER7 is Workload Optimization

Power Systems offers balanced systems designs that <u>automatically optimize</u> 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
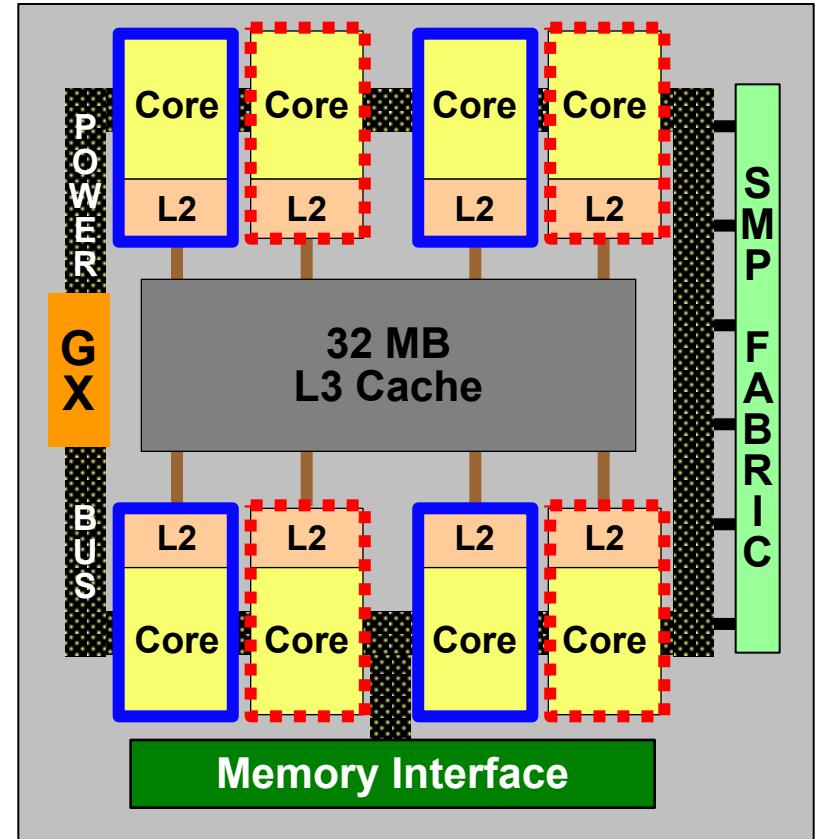#1 in Transaction <u>and</u> Throughput Computing

POWER7
BUILT ON
Power™

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POWER7 TurboCore™ Mode

Power 780 TurboCore Chip
POWER7 Chip

- **TurboCore Chips**: 4 available cores / socket

- Aggregation of L3 Caches of unused cores.

- TurboCore chips have a 2X the L3 Cache per Chip available
  - 4 TurboCore Chips   **L3 = 32 MB**

- Performance gain over POWER6.
  - Provides up to 1.5X per core to core

- Chips run at higher frequency:
  - Power reduction of unused cores.

- With "Reboot", System can be reconfigured to 8 core mode **"Max Core mode"**
  - 8 MaxCore chips   **L3 = 32 MB**

Core	Core	Core	Core
L2	L2	L2	L2

32 MB L3 Cache

G X

POWER BUS

SMP FABRIC

L2	L2	L2	L2
Core	Core	Core	Core

Memory Interface

TurboCores

Unused Core

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Intelligent Threads

- Historically, applications have used homogeneous systems

- In reality, different pieces of code have different needs of performance
  - Applications which do not run in parallel
  - Insufficiently parallelized or legacy applications (e.g. serial transactions within a parallel OLTP system)
  - Parallel applications with load imbalance (e.g. dispatcher thread, shared memory bottlenecks)
  - Serial code segments of parallel applications (e.g. startup, checkpoints, garbage collection)

- POWER7 processor offers multiple modes to optimize workloads
  - Power System Software stack optimizes these modes for different workloads
  - In many cases the optimization is automated; in other cases admin can set manually

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eDRAM technology

EDRAM Cell
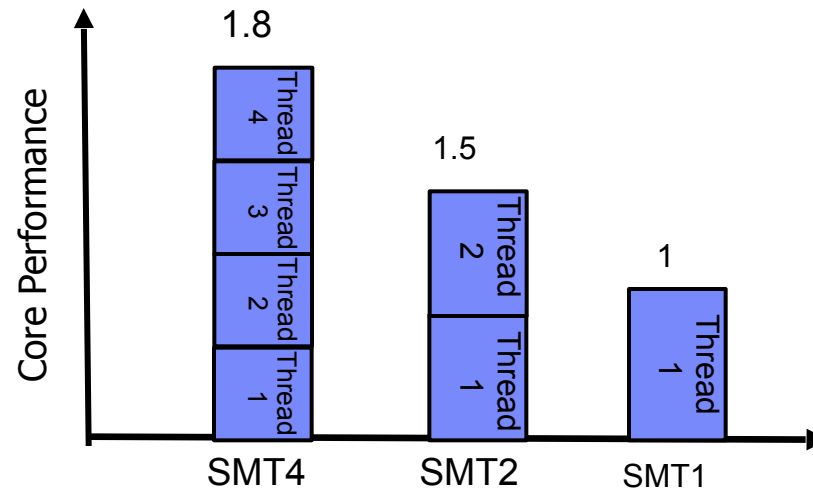
IBM's eDRAM technology benefits: Greater density, Less power requirements, Fewer soft errors, and Better performance

Enables POWER7 to provide 32MB of _internal_ L3 Cache

eDRAM is nearly as fast as conventional SRAM but requires far less space

- 1/3 the space of conventional 6T SRAM implementation
- 1/5 the standby power
- Soft Error Rate 250x lower than SRAM (Better availability)
- 1.5 Billion reduction in transistors

 IBM is effectively doubling microprocessor performance beyond what classical scaling alone can achieve," said Dr. Subramanian Iyer, DE (Distinguished Engineer)

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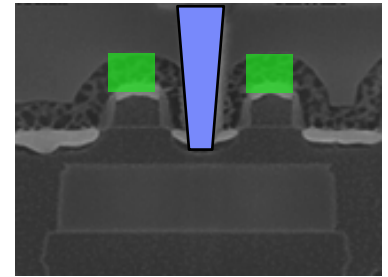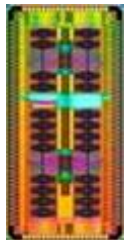
Level 3 Cache Virtualized on POWER7

POWER6

POWER7

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Active Memory Expansion

True memory	True memory	True memory

Expanded memory	Expanded memory	Expanded memory

True memory	True memory	True memory

Expanded memory	Expanded memory	Expanded memory

Effectively up to 100% more memory
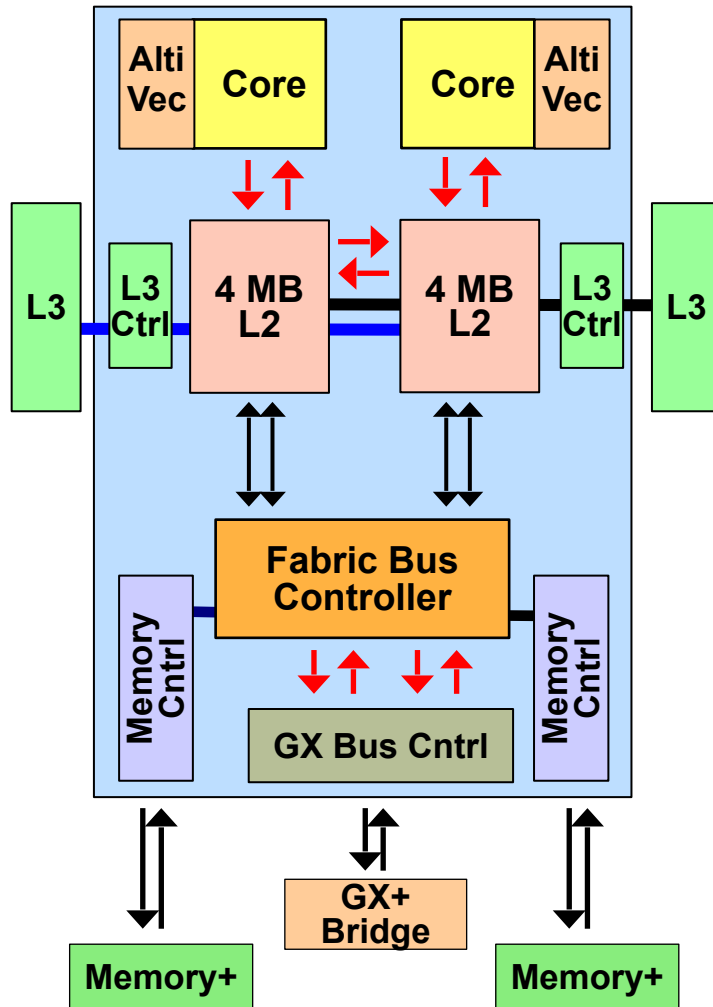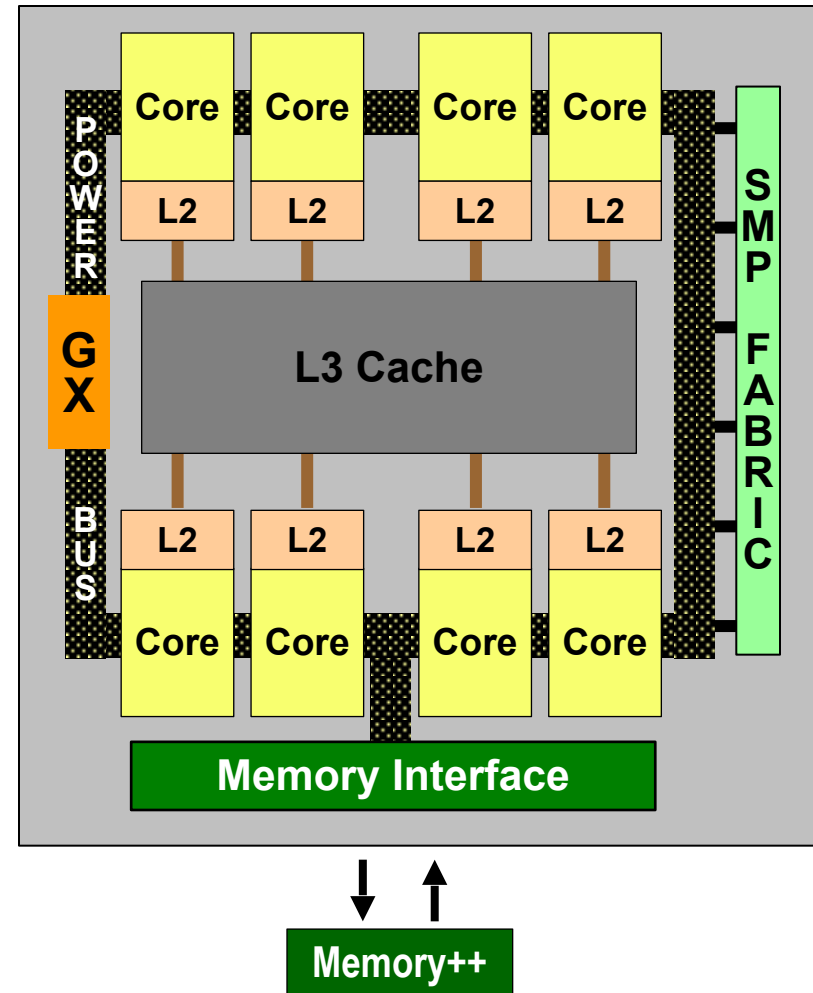
- POWER7 advantage
- Expand memory beyond physical limits
- More effective server consolidation
  - Run more application workload / users per partition
  - Run more partitions and more workload per server

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EnergyScale™

- EnergyScale is IBM Trademark. It consists of a built-in Thermal Power Management Device (TPMD) card and Power Executive software.

- IBM Systems Director is also required to manage Energy-Scale functions.

- EnergyScale is used to dynamically optimizes the processor performance versus processor power and system workload.

- IBM Systems Director is also required to manage AEM functions and supports the following functions:
    - Power Trending
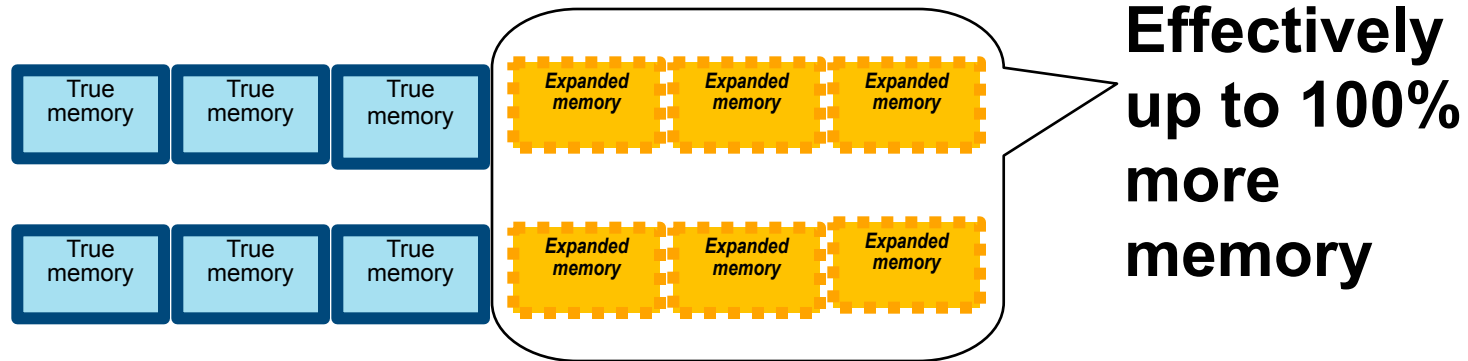   - Thermal Reporting
    - Static Energy Saver Mode
    - Dynamic Energy Saver Mode
    - Energy Capping
    - Soft Energy Capping
    - Processor Nap
    - Energy Optimized Fan Control
    - Altitude Input
    - Processor Folding

Power your planet.
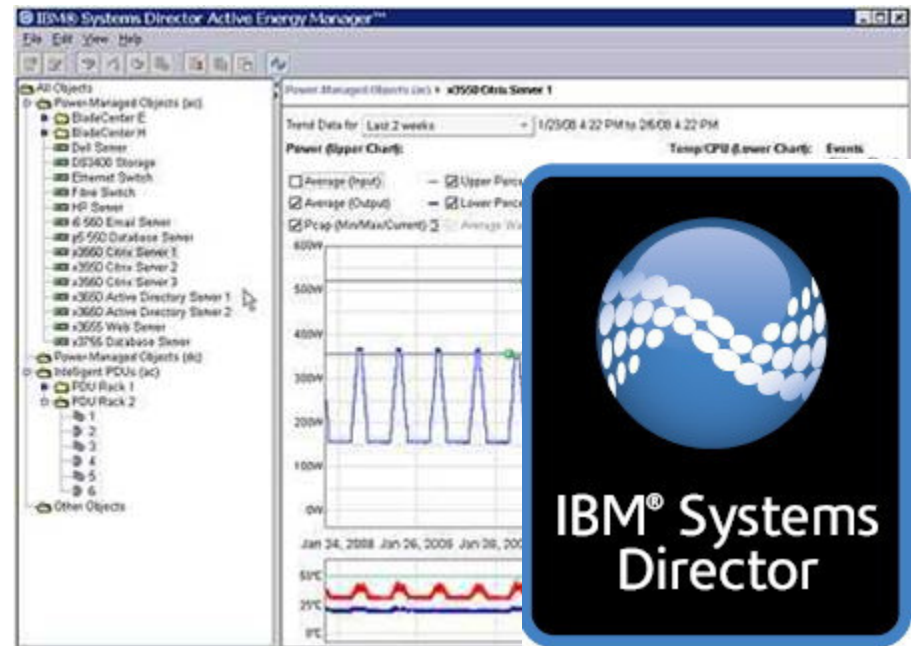
Processor Technology Roadmap

POWER8

POWER7
45 nm

POWER6™
65 nm

POWER5™
130 nm

POWER4™
180 nm

• Dual Core • Chip Multi Processing • Distributed Switch • Shared L2 • Dynamic LPARs (32)	• Dual Core • Enhanced Scaling • SMT • Distributed Switch + • Core Parallelism + • FP Performance + • Memory bandwidth + • Virtualization	• Dual Core • High Frequencies • Virtualization + • Memory Subsystem + • Altivec • Instruction Retry • Dyn Energy Mgmt • SMT + • Protection Keys	• Multi Core • On-Chip eDRAM • Power Optimized Cores • Mem Subsystem ++ • SMT++ • Reliability + • VSM & VSX (AltiVec) • Protection Keys+	• Concept Phase

2001   **2004**   **2007**   **2010**

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Hardware Announcement Insights

POWER7 technology Benefits

4 x   Energy Efficiency   TCO (total cost of ownership)

2 X   Performance   Productivity
(workload optimization)

1 X   Price = POWER6   TCA (total cost of acquisition)

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Power Systems Portfolio (April 2010)

Major Features:

- Modular systems with linear scalability
- PowerVM™ Virtualization
- Physical and Virtual Management
- Roadmap to Continuous Availability
- Binary Compatibility
- Energy / Thermal Management

595

Power 780

Power 770

Power 750

520

PowerHA | **PowerVM** | **IBM Systems Director**

575

Operating Systems

AIX | i for Business | Linux

Power 755

BladeCenter
PS700 / PS701 / PS702

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BladeCenter – Answer to the Server Challenge
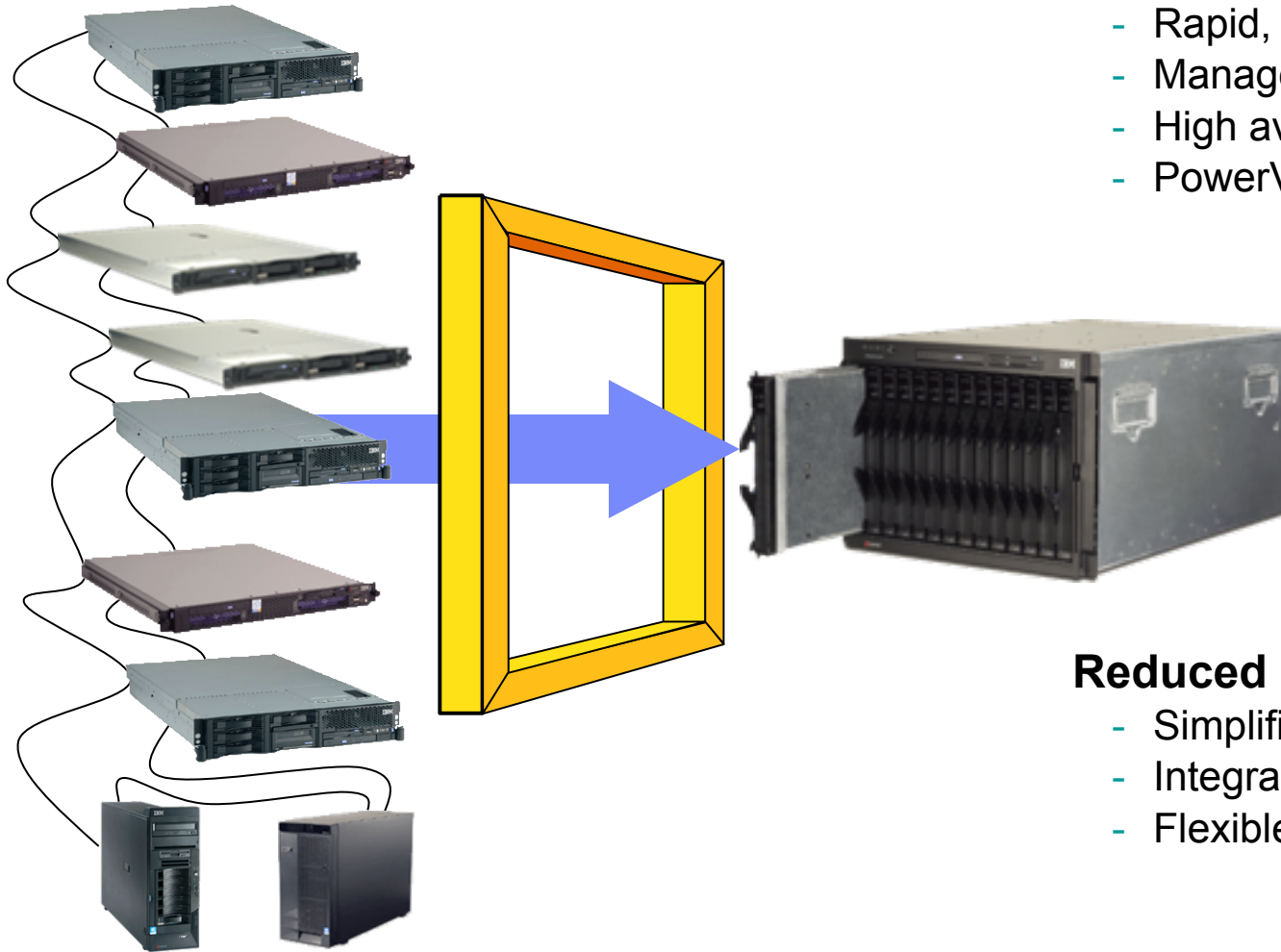
Improved Manageability
- Rapid, managed deployments
- Managed infrastructure
- High availability
- PowerVM, VMware, Hyper-V,…

Reduced Costs
- Acquisition
- Installation
- Foot Print Consolidation
- Power and cooling
- Life-cycle

Reduced Complexity
- Simplified installation
- Integrated infrastructure
- Flexible architecture

Maintain topology

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Blade Center Architecture supporting POWER

IBM BladeCenter H

High performance

IBM BladeCenter S

Distributed, small office,

Easy to configure

- **A common set of blades**

- **A common set of industry-standard switches and I/O fabrics**

- **A common management infrastructure**

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IBM BladeCenter PS700 / PS701 / PS702 Express

✓ POWER7 technology
✓ 4, 8 or 16 cores per blade
✓ Single or Double Wide
✓ 3.0GHz
✓ Up to 256GB of Memory

- Up to 2X more cores & up to 2X more memory than POWER6 blades
- Up to 200+% CPW performance increase
- Elegantly simple blade scalability and efficiency
- **Flexibility and choice**
  - **Supports AIX, i and Linux**
  - **Can consolidate all three on a single platform**
  - **Supports multiple BladeCenter chassis**
  - **Can be used in same chassis as POWER6 or x86 blades**

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Processor Offerings for POWER7 Blade

POWER7 Blade architecture			
Cores / Socket	4	6	8
PS700	Yes	-	-
PS701 / PS702	-	-	Yes

1 Socket Blade

1 Socket Blade **2 Socket Blade**

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IBM i performance on POWER7 blades

Performance and Energy Efficiency
- **More performance <u>per core</u>**
- **More performance <u>per blade</u>**

# Cores	CPW	SW tier
16	76,300	p10

PS702

JS43

# Cores	CPW	SW tier
8	24,050	p10

+217%

+75%

# Cores	CPW	SW tier
8	42,100	p10

PS701

JS23

# Cores	CPW	SW tier
4	14,400	p10

+192%

+46%

JS22

# Cores	CPW	SW tier
4	13,800	p10

+53%

# Cores	CPW	SW tier
4	21,100	p05

PS700

+197%

JS12

# Cores	CPW	SW tier
2	7,100	p05

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NEW Generation of Power Rack Systems
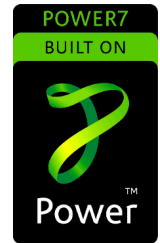
IBM Power 750 Express

- An Energy Star-qualified server with up to 32 POWER7 cores
- Over 3X the SAP performance or all other 4-socket servers
- 4X to 7X the energy efficiency of Sun SPARC and HP Integrity

IBM Power 755 for HPC

- HPC cluster node with 32 POWER7 cores
- Energy Star—qualified for exceptional energy efficiency, and optimized for the most challenging analytic workloads

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IBM Power 755
(8236-E8C)

- *4-socket, 4U server*
- *8-core POWER7 processors*
- *32-core 3.3GHz configuration*
- *Up to 256GB of memory*
- *Up to 64 clustered nodes*
- *Energy Star-qualified*
- *GA: 2/19*

IBM Power 750 Express
(8233-E8B)

- *1- to 4-socket server*
- *6-core and 8-core POWER7 processor modules*
  - *6-core 3.3 GHz*
  - *8-core 3.0, 3.3 GHz and 8-core 3.55 GHz(32-core)*
- *Up to 512 GB of Memory*
- *ENERGY STAR-qualified*
- *Light Path Diagnostics*
- *GA: 2/19*

Source: SPECint_rate2006. For the latest SPEC benchmark results, visit http://www.spec.org. See Power 750 power and efficiency claims page in backup for full substantiation detail

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33

What is ENERGY STAR?

- ENERGY STAR is a program developed by the U.S. Environmental Protection Agency (EPA) to reduce energy consumption

- Voluntary labeling program designed to identify and promote energy efficient products

- Computer servers that earn EPA's ENERGY STAR include:
  - Efficient power supplies that have smaller conversion losses and generate less waste heat,
  - Capabilities to measure real time power use
  - Advanced power management features
  - Power and Performance Data Sheet

- Power 750 Express and Power 755 are the *first* RISC or Itanium ENERGY STAR-qualified server

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750 CPW & rPerf Details

6-core 3.3 GHz #8335	CPW	rPerf
6-core	37200	70.07
12-core	69200	134.54
18-core	94900	193.40
24-core	135300	252.26
8-core 3.0 GHz #8334		
8-core	44600	81.24
16-core	82600	155.99
24-core	122500	224.23
32-core	158300	292.47
8-core 3.3 GHz #8332		
8-core	47800	86.99
16-core	88700	167.01
24-core	129700	140.08
32-core	168800	313.15
8-core 3.55 GHz #8336		
32-core	181000	331.06

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550/750 Functional Differences

Power 550 Express		Power 750 Express
Up to 8 POWER6 cores (4 sockets)		Up to 32 POWER7 cores (4 sockets)
Up to 256 GB Memory 32 DIMM DDR2 slots		Up to 512 GB Memory 32 DIMM DDR3 slots
6 3.5 in or 8 SFF SAS disk/SSD	**SSF only**	8 SFF SAS disk/SSD
175MB Write cache RAID card	**same**	175MB Write cache RAID card
Split backplane w/ PCI SAS adapter	**same**	Split backplane with PCI SAS adapter*
3 PCIe & 2 PCI-X slots	**same**	3 PCIe & 2 PCI-X slots
Commercial focus		Commercial & HPC focus
1 GX+ & 1 GX++ slot	**same**	1 GX+ & 1 GX++ slot
RIO/HSL or 12X	**12X only**	12X
IVE: Dual Gb or Quad Gb, or 10 Gb	**similar**	IVE: Quad Gb or Dual 10 Gb
TPMD		Enhanced TPMD
Guiding Light		Light Path

* #5901 PCIe SAS adapter available new, #5912 PCI-X SAS adapter supported, but not available new

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The highest performing 4-socket system on the planet

**POWER7 continues to break the rules
with more performance**

Power 750

SPECint_rate

1,000
750
500
250
0

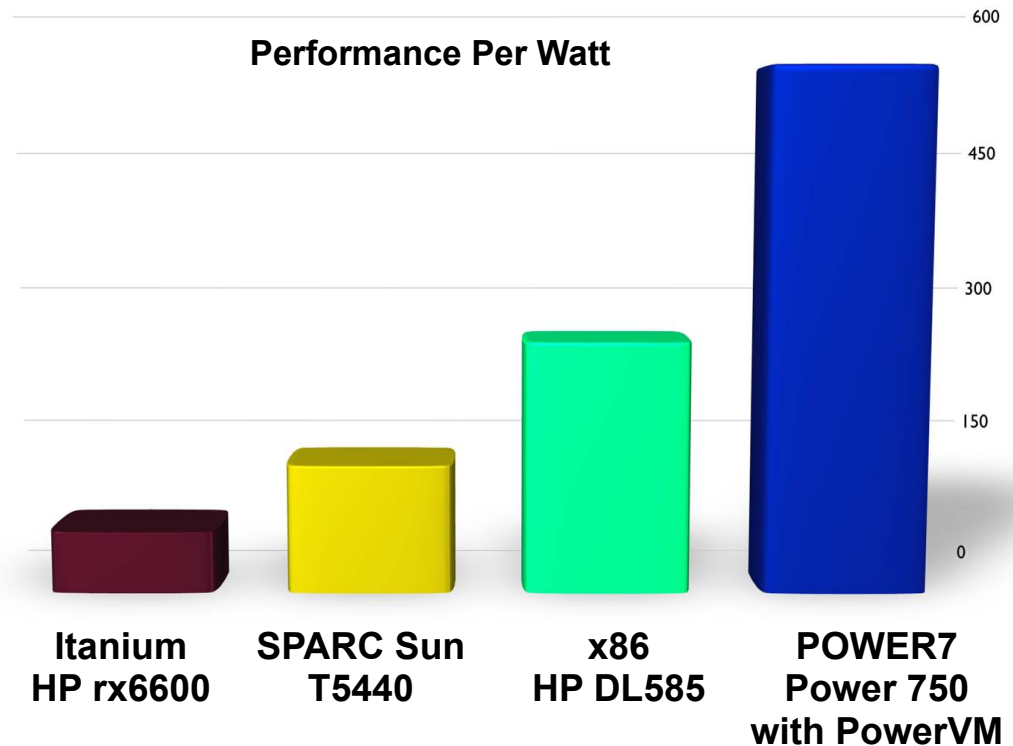| Itanium	SPARC	x86	POWER7
HP rx6600	**Sun T5440**	**HP DL585**	**Power 750**
			with PowerVM

Power your planet.
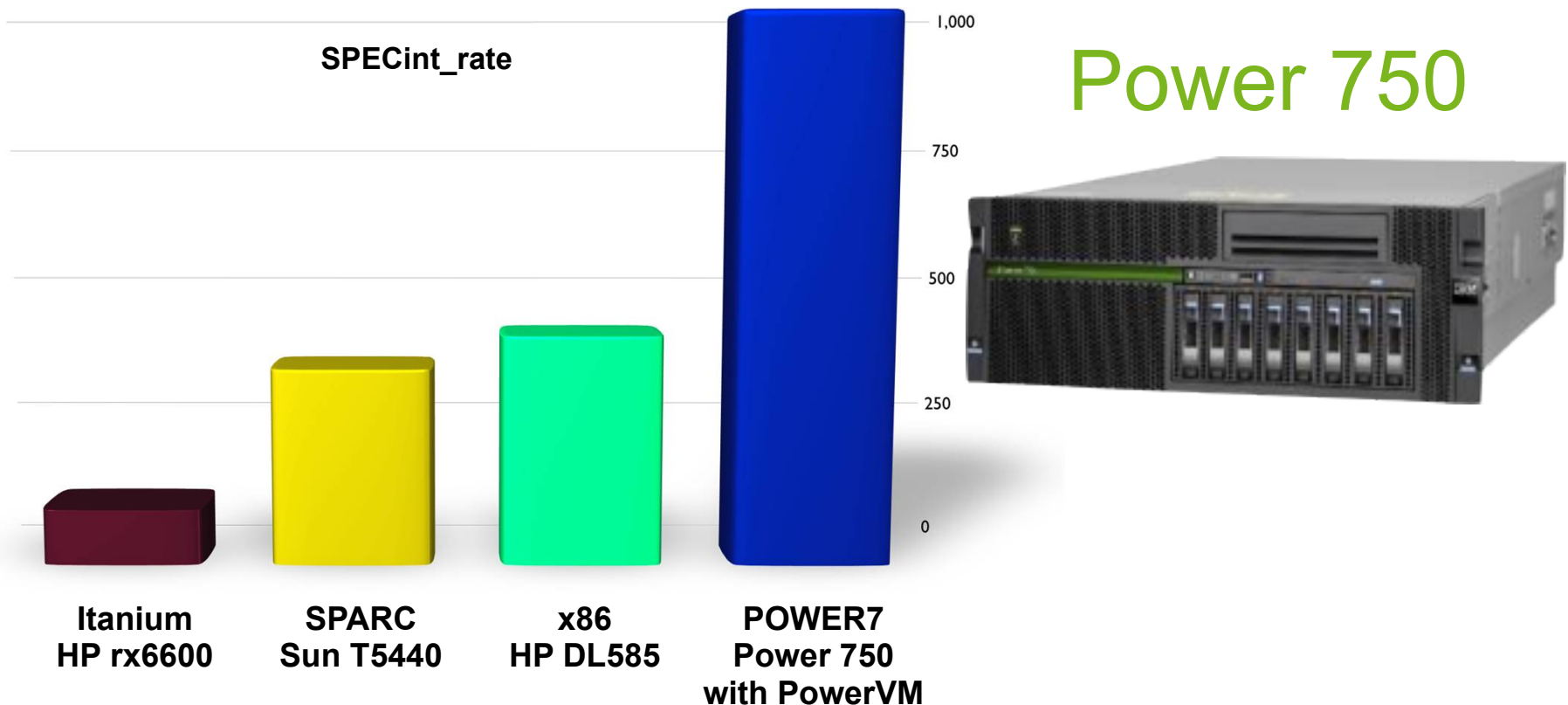
The most energy efficient 4-socket system on the planet

The first Energy Star certified RISC system

Power 750

Most energy efficient systems

Performance Per Watt

Itanium HP rx6600	SPARC Sun T5440	x86 HP DL585	POWER7 Power 750 with PowerVM

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NEW Generation of Modular Power Systems

IBM Power 770

- Modular enterprise server with up to 64 POWER7 cores
- More performance per core, up to 70 percent less energy
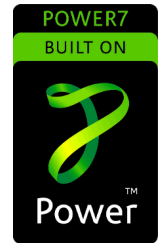
IBM Power 780

- New category of scalable high-end servers, featuring an advanced modular design with up to 64 POWER7 cores
- New TurboCore™ workload optimizing mode that maximizes per core database performance

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

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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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Processor Offerings for Modular Systems

	POWER7 TurboCore / CoD Processor Offerings			
Cores / Socket	4 TurboCore	6	8	8 MaxCore
Power 770	-	Yes	Yes	-
Power 780	Yes	-	-	Yes

Configuration Options				
Enclosures	1	2	3	4
4 Core Chips	8 Cores	16 Cores	24 Cores	32 Cores
6 Core Chips	12 Cores	24 Cores	36 Cores	48 Cores
8 Core Chips	16 Cores	32 Cores	48 Cores	64 Cores

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770 and 780 CPW & rPerf Details

770

12-core 3.5 GHz #4980	CPW	rPerf
12-core	73100	140.75
24-core	131050	261.19
36-core	*	377.28
48-core	248550**	493.37
16-core 3.1 GHz #4981		
16-core	88800	165.30
32-core	155850	306.74
48-core	229800**	443.06
64-core	292700**	579.39

780

8-core 3.86 GHz #4982	CPW	rPerf
16-core	105200	195.45
32-core	177400	362.70
48-core	265200**	523.89
64-core	343050**	685.09

TurboCore 4.14GHz values not shown. Note that on a "per server" basis, since using only ½ the cores, CPW and rPerf will be lower.

* not measured, use WLE or use add a 12-core + a 24-core partitions together to estimate
** used two 24-core partitions or two 32-core partitions

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Power 770 & 780 vs. Power 570 Differences

Power 570	Power 770 & Power 780
Up to 8 sockets, Up to 32 Cores	Up to 8 Sockets, Up to 64 cores
Up to 768 GB Memory	Up to 2 TB Memory (Initially 1TB until Nov 2010)
DDR2 DIMMS	DDR3 DIMMS
Six 3.5" SAS Bays / Enclosure	Six SFF SAS Bays / Enclosure
4 PCIe & 2 PCI-X slots per Enclosure	6 PCIe slots per Enclosure
No integrated cache or RAID-5/6 support	175MB integrated cache & RAID-5/6 support
Single integrated DASD/SSD/Media Controller per enclosure	Three integrated DASD/SSD/Media Controllers per enclosure
Optional Split Backplane	Standard Split backplane Optional Tri-Split Backplane
No Power & Management Thermal	Power & Thermal management TPMD support
Clock Cold Failover No Concurrent Maintenance of FSP/Clock Concurrent Drawer Maint restrictions Concurrent Drawer Add cable restrictions	Clock Hot Failover Planned Concurrent Maintenance No Restrictions (4Q / 2010) No Restrictions
One service processor per enclosure	One service processor in 1st & 2nd enclosure, passthru 3rd & 4th
No option to attach disk drawer to system unit (no SAS port)	Option to attach #5886 disk drawer to SAS port

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IBM Power Systems Comparisons

	Power 750	Power 770	Power 780	Power 595
Nodes	One	Up to four	Up to four	Up to eight
Cores (single system image)	6, 12, 18, 24 or 8, 16, 24, 32	4 – 64	4 – 64	8 – 64 Upgradeable to 256
Frequency	3.0, 3.3, 3.55 GHz	3.1, 3.5 GHz	3.8, 4.1 GHz	4.2, 5.0 GHz
SMP buses	4 byte	8 byte	8 byte	8 byte
System memory	Up to 512 GB	Up to 2 TB*	Up to 2 TB*	Up to 4 TB
Memory per core	16 or 21 GB	32 or 42 GB	32 or 64 GB	64 GB
Memory Bandwidth (peak)	273 GB/s	1088 GB/s	1088 GB/s	1376 GB/s
Memory Bandwidth per core (peak)	8.5 GB/s	17 or 22 GB/s	17 or 34 GB/s	21.5 GB/s
Memory controllers	1 per processor	2 per processor	2 per processor	2 per processor
I/O Bandwidth (peak)	30 GB/s	236 GB/s	236 GB/s	640 GB/s
I/O Bandwidth per core (peak)	0.9GB/s	3.6 or 4.9 GB/s	3.6 or 7.3 GB/s	10 GB/s
rPerf per core	Up to 11	Up to 11	Up to 13	Up to 10.8
Maximum LPARs	Up to 320*	Up to 640*	Up to 640*	Up to 254
RAS	Standard	P7 Enhanced Memory Dynamic FSP & clocks	P7 Enhanced Memory Dynamic FSP & clocks	P6 Enhanced Memory Dynamic FSP & clocks
Warranty	9 x 5	9 x 5	24 x 7	24 x 7
PowerCare	No	No	Yes	Yes

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* Planned availability in 4Q 2010   © 2010 IBM Corporation

POWER7 Performance and IBM i

POWER7 technology delivers more performance <u>per core</u>

POWER7 technology delivers more performance <u>per system</u>

POWER6 550

# Cores	CPW
8	37,950

Power 550 5.0 GHz

POWER7 750

# Cores	CPW*	%
8	47,800	26%
32	168,800	345%

Power 750 3.3 GHz

32	181,000	377%

Power 750 3.55 GHz

POWER6 570

# Cores	CPW
16	77,600

Power 570 5.0 GHz

POWER7 770

# Cores	CPW*	%
16	88,800	14%
64	292,700	277%

Power 770 3.1 GHz

POWER6 570

# Cores	CPW
16	77,600

Power 570 5.0 GHz

POWER7 780

| # Cores	CPW*	%
16	105,200	35%
64	343,050	342%

Power 780 3.86 GHz

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IBM

POWER : Work Smarter
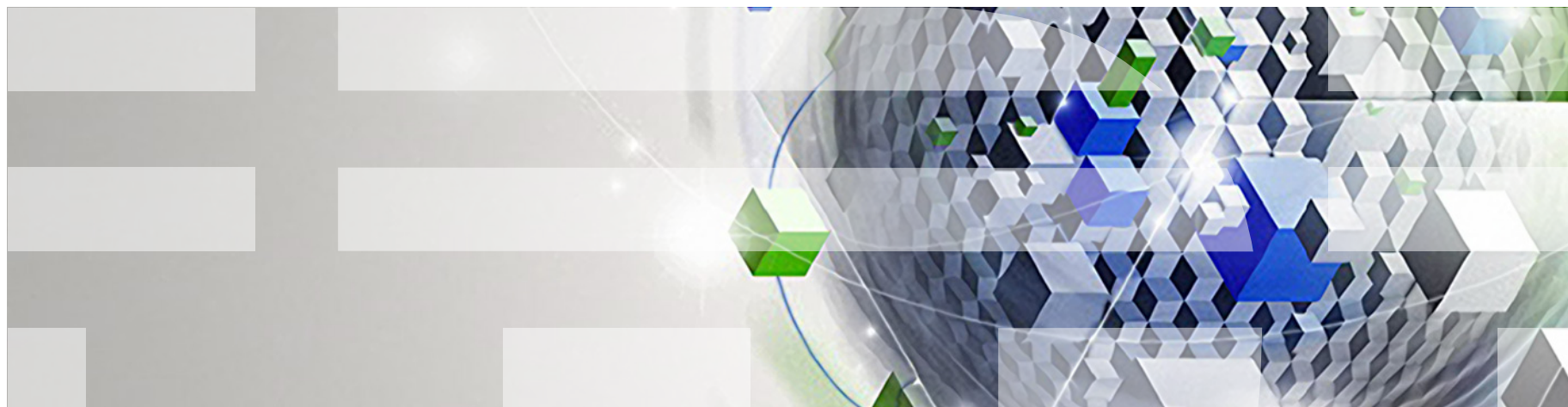
IBM Smart Analytics System

✓ **Complete, ready-to-deploy and modular system that combines**
  - ➢ broad analytic capabilities
  - ➢ powerful warehouse foundation
  - ➢ scalable and fully-integrated IBM hardware
  - ➢ set-up services and single point of support

✓ **Deliver results in days instead of months**
  - ➢ six pre-set configurations to choose from (T-shirt sizes)
  - ➢ fast path shipping option
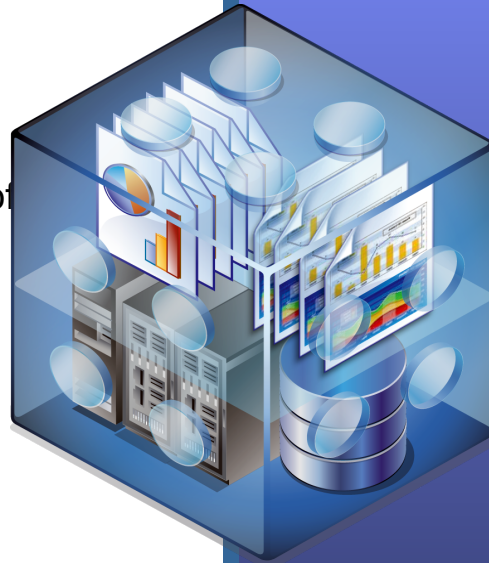
Analytics Options
☑ Business Intelligence (Cognos 8 BI)
☑ Cubing Services
☑ Text Analytics & Data Mining

Data Warehouse Software
☑ InfoSphere Warehouse
☑ Advanced Workload Management
☑ Tivoli System Automation

Hardware/OS
☑ AIX 6.1
☑ IBM Power 550
☑ IBM System Storage DS5300

*IBM **Smart Analytics System** includes **everything** required to serve as a foundation for your **Business Intelligence solutions**, out-of-the-Box !*

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Power is Optimized for Cloud
Enabling mission critical applications to move to the cloud

Management with Automation
✓ Physical & virtual server lifecycle, image and system pool management
✓ Automate workload provisioning
✓ Capture/import, create/remove standardized virtual building blocks

Workload Optimized Systems
✓ POWER7 delivers optimal performance for different workloads
✓ More performance per core while using up to 70 percent less energy

Virtualization without Limits
✓ Enables industrial strength consolidation
✓ Drive systems to over 90% utilization
✓ Live Partition Mobility with VM's of any size up to entire system

Resiliency without Downtime
✓ Increased flexibility to dynamically scale (both up & out) and change workload capacity
✓ Dynamically move workloads

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Power is Optimized for Cloud
From the processor to the hypervisor to the software

IBM Software

Private clouds built on IBM Power Systems and Tivoli Software can be up to **70-90% less expensive** (cost/image) than stand-alone x86 servers or public cloud alternatives

Reduce management costs with simplified virtual and physical management from a single console, unlike VMWare

Maximize resource flexibility for growing workloads with the ability to dynamically **add & remove VM resources,** unlike VMware

Radically reduce downtime with rock solid AIX
- ✓ **2.3 times better** than the closest UNIX competitor
- ✓ **More than 10X better** than Windows

Deliver mission critical virtualized workloads with ease. PowerVM delivers up to 32x the VM size and 8x the memory of VMware on HP Nehalem*

Dynamically optimize energy use with energy star qualified POWER7 which can save **83% on energy costs** with **28% more performance** at a fraction of the price of competitive UNIX servers

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