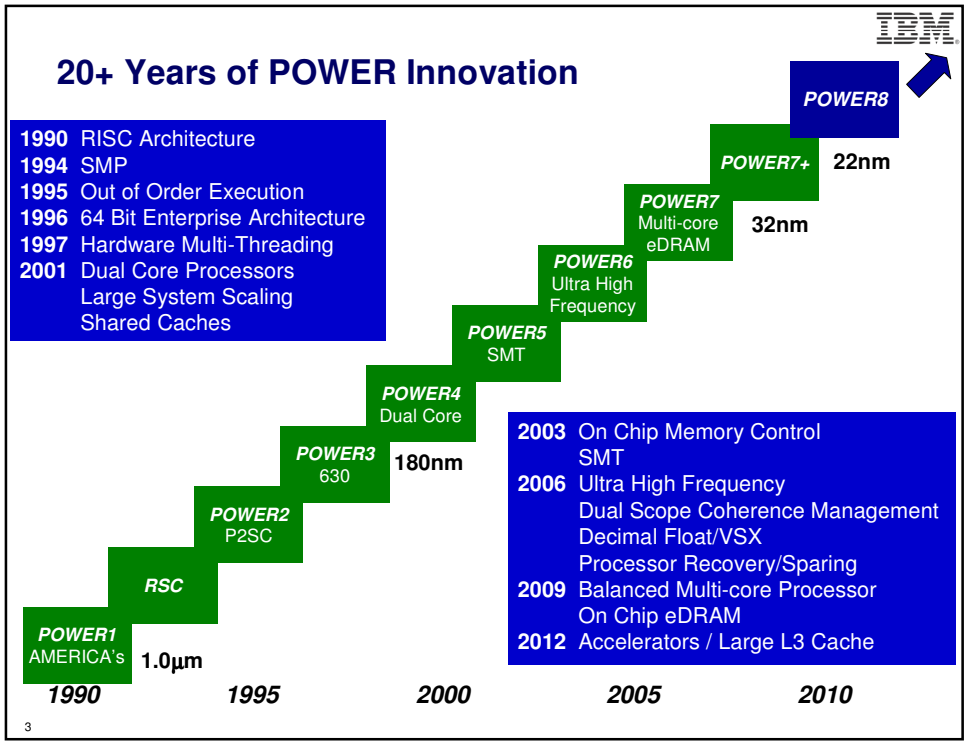
Power Systems Update

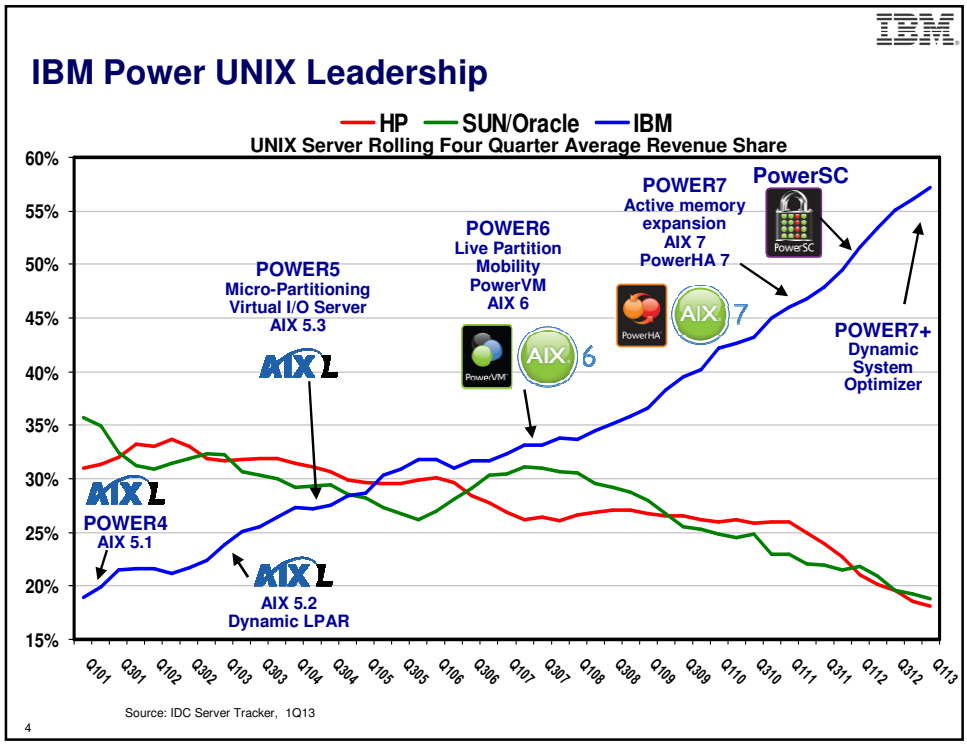
Patrick O'Rourke
pmorour@us.ibm.com
Executive Briefing Center

Agenda

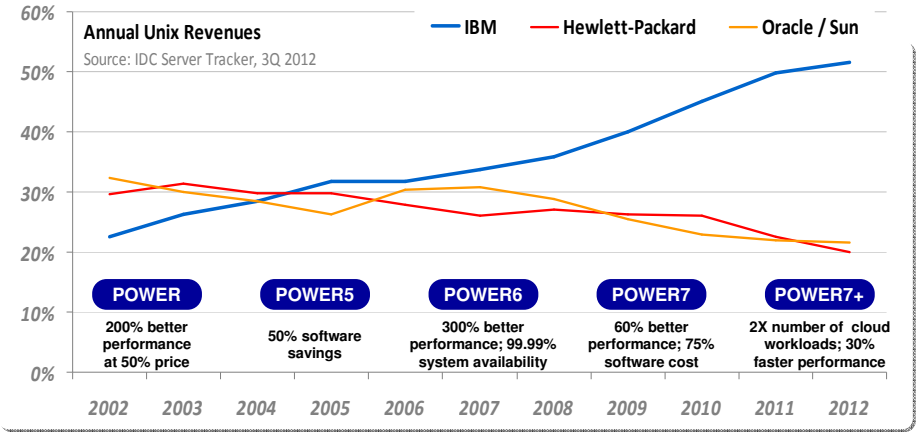
- **Recent Announcements**
  - Power 795 Enhancements
  - POWER7+
  - Enhanced Power 710 / 730
  - Enhanced Power 720 / 740
  - Enhanced Power 770 / 780
  - New Power 750 / 760
- HMC Firmware
- CoD Updates
- PowerLinux
- IBM i
- Virtualization
- Watson
- AIX
- Futures

2


20+ Years of POWER Innovation
1990 RISC Architecture
1994 SMP
1995 Out of Order Execution
1996 64 Bit Enterprise Architecture
1997 Hardware Multi-Threading
2001 Dual Core Processors
Large System Scaling
Shared Caches
POWER1 AMERICA's
RSC
POWER2 P2SC
POWER3 630
POWER4 Dual Core
POWER5 SMT
POWER6 Ultra High Frequency
POWER7 Multi-core eDRAM
POWER7+
POWER8
1.0µm
180nm
32nm
22nm
2003 On Chip Memory Control
SMT
2006 Ultra High Frequency
Dual Scope Coherence Management
Decimal Float/VSX
Processor Recovery/Sparing
2009 Balanced Multi-core Processor
On Chip eDRAM
2012 Accelerators / Large L3 Cache
1990
1995
2000
2005
2010
3


IBM Power UNIX Leadership
HP
SUN/Oracle
IBM
UNIX Server Rolling Four Quarter Average Revenue Share
60%
55%
50%
45%
40%
35%
30%
25%
20%
15%
POWER5
Micro-Partitioning
Virtual I/O Server
AIX 5.3
POWER6
Live Partition
Mobility
PowerVM
AIX 6
POWER7
Active memory
expansion
AIX 7
PowerHA 7
PowerSC
POWER7+
Dynamic
System
Optimizer
POWER4
AIX 5.1
AIX 5.2
Dynamic LPAR
Q101 Q301 Q102 Q302 Q103 Q303 Q104 Q304 Q105 Q305 Q106 Q306 Q107 Q307 Q108 Q308 Q109 Q309 Q110 Q310 Q111 Q311 Q112 Q312 Q113
Source: IDC Server Tracker, 1Q13
4

Clients invest more in IBM Power than HP & Oracle



18	3,000+	50%	50%	100+	4x	125%
Consecutive quarters UNIX share growth	Competitive displacements	Competitive displacements from HP	Competitive displacements from Oracle	Industry leading Benchmarks	more throughput vs. competitive x86	more SAP S&D users vs. competitive x86

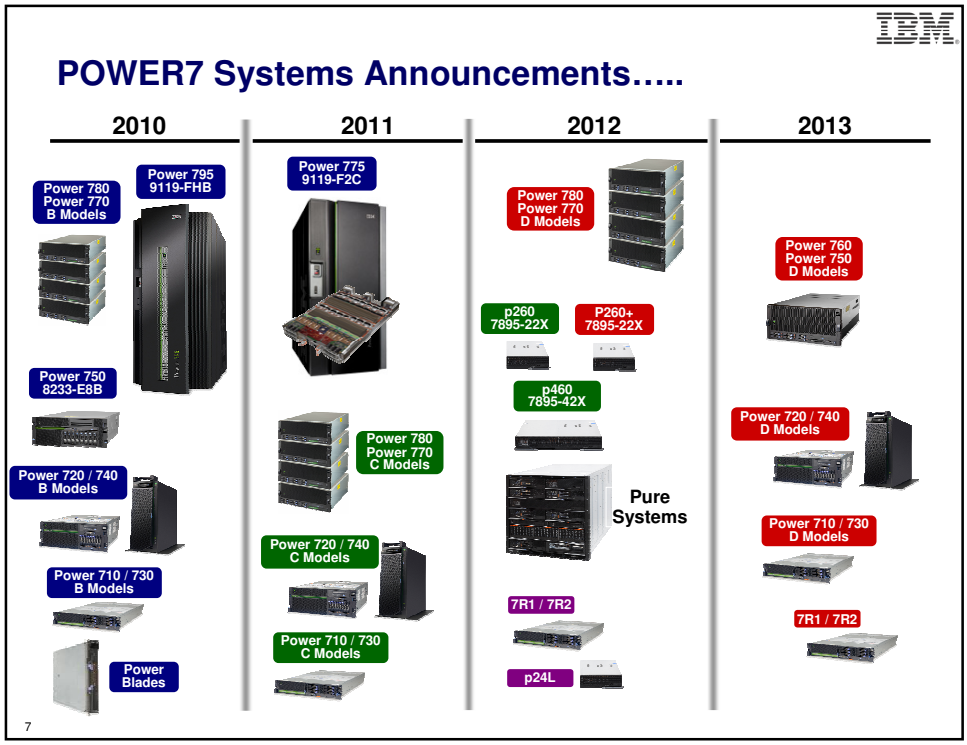
5

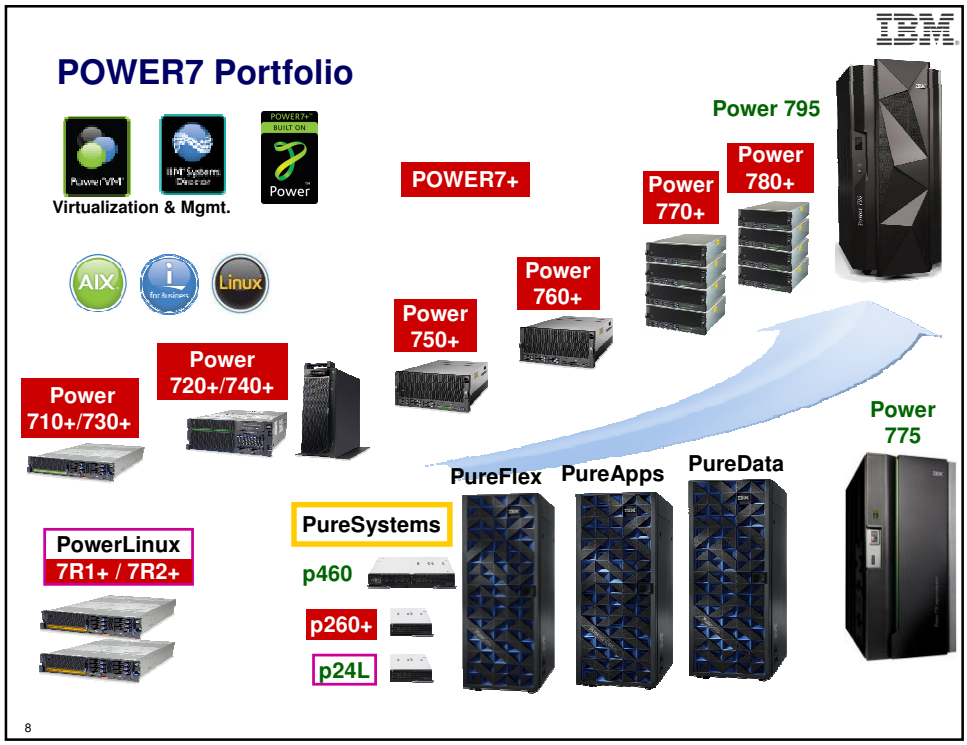
Power Hardware: The Values in our DNA

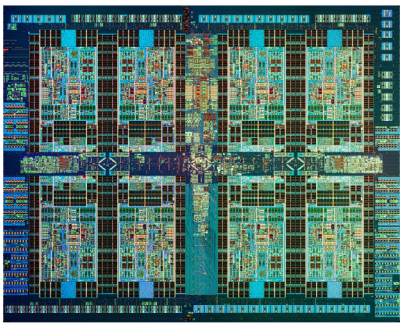
Power HW DNA is based on Core precepts.

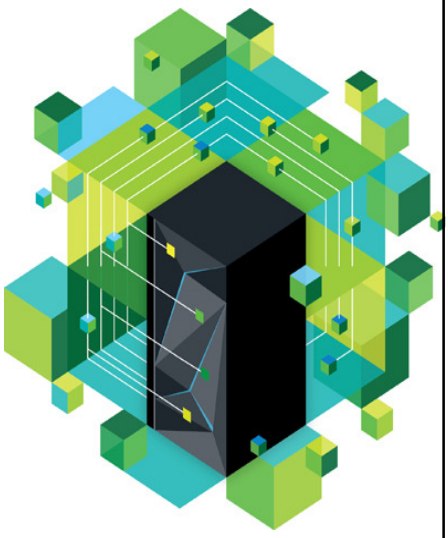
1. **Optimize the System**
   - **Design for mixed workloads**
   - **Not just a pile of components.**
   - **Not a single solution mentality.**
2. **Scalability…**
   - **Handle the biggest workloads on earth.**
3. **Un-paralleled Compatibility and Reliability**
   - **POWER4 to POWER7.**
4. **Software is critical**
   - **Minimize costs / Maximize the benefits**
5. **Integrated support: Hardware / Firmware / OS**
   - **One contact point**
6. **Capacity without disruption**
   - **Temporary or Permanent**
7. **Built in Virtualization**
   - **Not an add on / Part of the architecture**

6


POWER7 Systems Announcements.....
2010
2011
2012
2013
Power 780
Power 770
B Models
Power 795
9119-FHB
Power 750
8233-E8B
Power 720 / 740
B Models
Power 710 / 730
B Models
Power
Blades
Power 775
9119-F2C
Power 780
Power 770
C Models
Power 720 / 740
C Models
Power 710 / 730
C Models
Power 780
Power 770
D Models
p260
7895-22X
P260+
7895-22X
p460
7895-42X
Pure
Systems
7R1 / 7R2
p24L
Power 760
Power 750
D Models
Power 720 / 740
D Models
Power 710 / 730
D Models
7R1 / 7R2
7


POWER7 Portfolio
Virtualization & Mgmt.
AIX
Linux
POWER7+
Power
710+/730+
Power
720+/740+
Power
750+
Power
760+
Power
770+
Power
780+
Power 795
Power
775
PureFlex
PureApps
PureData
PureSystems
p460
p260+
p24L
PowerLinux
7R1+ / 7R2+
8

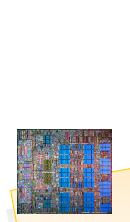




POWER7+

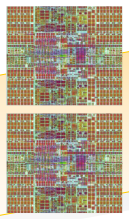
9

Power Processor Technology Roadmap



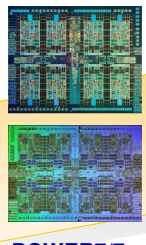
POWER5/5+
130/90 nm

- ✓Dual Core
- ✓Enhanced Scaling
- ✓SMT
- ✓Distributed Switch +
- ✓Core Parallelism +
- ✓FP Performance +
- ✓Memory Bandwidth +
- ✓Virtualization



POWER6/6+
65/65 nm

- ✓Dual Core
- ✓High Frequencies
- ✓Virtualization +
- ✓Memory Subsystem +
- ✓Altivec
- ✓Instruction Retry
- ✓Dynamic Energy Mgmt
- ✓SMT +
- ✓Protection Keys



POWER7/7+
45/32 nm

- ✓Eight Cores
- ✓On-Chip eDRAM
- ✓Power-Optimized Cores
- ✓Memory Subsystem ++
- ✓SMT++
- ✓Reliability +
- ✓VSM & VSX
- ✓Protection Keys+

2004 2007 2010 2014-2015 Future

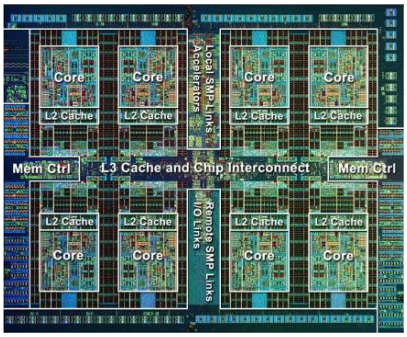
10

POWER7+ Processors & Architecture

Faster Performance
- Higher frequencies
- **10 MB L3 Cache per core**
- Random number generator
- Enhanced Single Precision Floating Point

Increased Efficiency and Flexibility
- **Active Memory Expansion accelerator**
- On-chip encryption acceleration for AIX
- **More performance per watt**
- Enhanced energy / power gating
- **20 Virtual Machines per core**

Better Availability
- Self-healing capability for L3 Cache functions
- **Processor re-initialization**

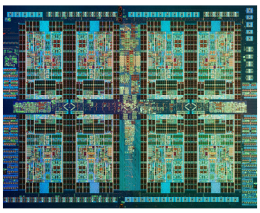


POWER7+
32 nm

11

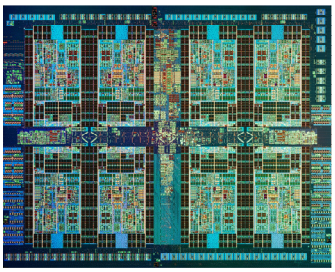
Benefits of eDRAM for POWER7+

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**

12

POWER7+ RAS Specific Features

New Power On Reset Engine (PORE)

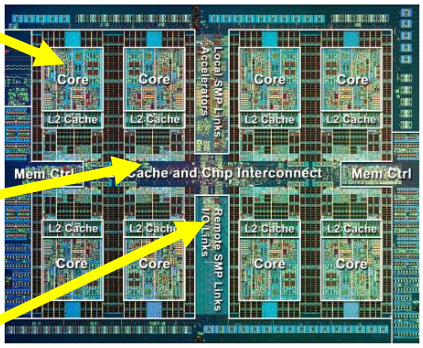
- Enables a processor to be re-initialized while system remains up and running
- Directly used to:
  - ***Allow for Concurrent Firmware Updates:*** In cases where a processor initialization register value needs to be changed

L3 Cache dynamic repair: Bit Line

- New **self-healing capability** that complements cache line delete
- Uses PORE feature to remove a substitute a failing bit-line for a spare during run-time.

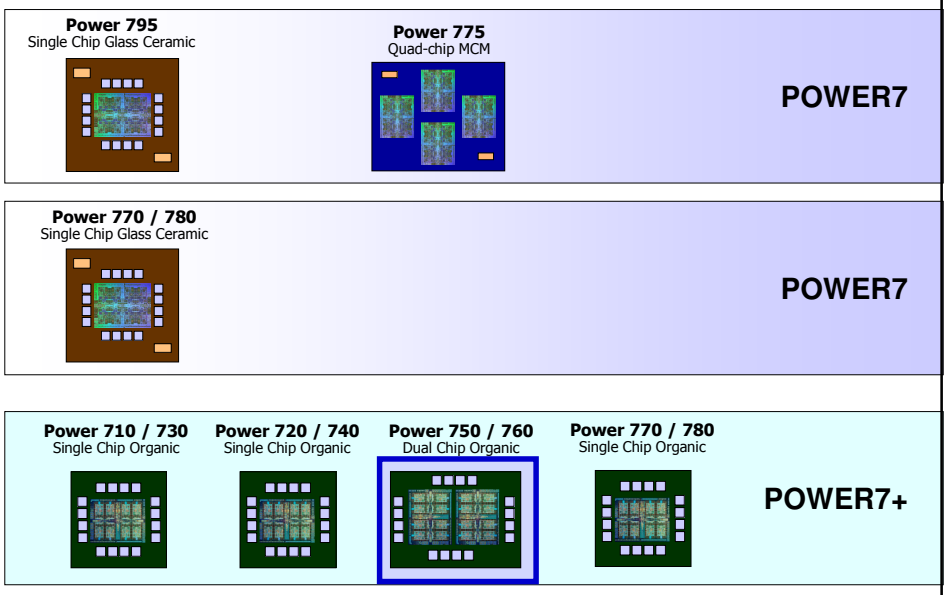
New Fabric Bus Dynamic Lane Repair

- 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.



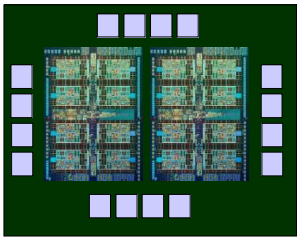
13

POWER7 / POWER7+ Module Packaging

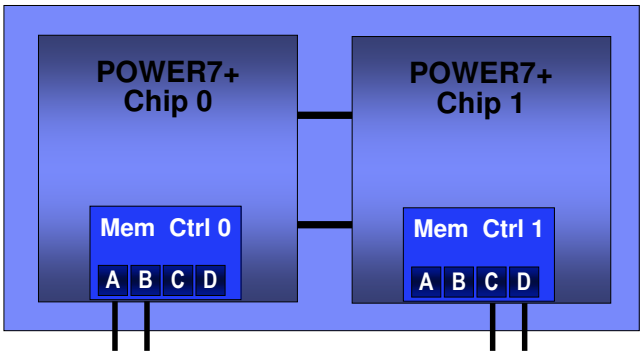


14

POWER7+ DCM

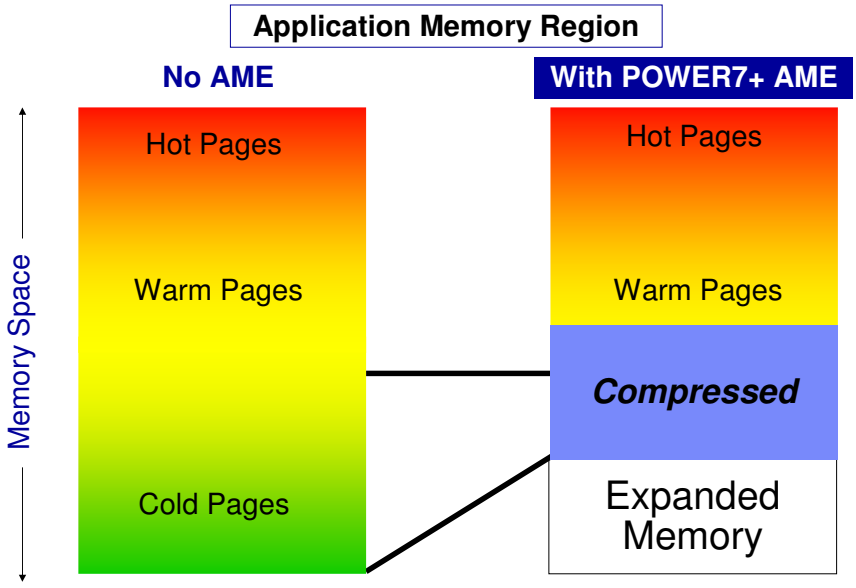


One Socket
Two POWER7+ Chips
- 4 Core chips: 8 Core DCM socket
- 6 Core chips: 12 Core DCM socket



15

Enhanced Active Memory Expansion



16

Power Mode Setup

Power Mode Setup

Current Power Server Mode: Enable Dynamic Power Saver (Favor performance) mode

- ○ Disable Power Saver mode
- ○ Enable Power Saver mode
- ○ Enable Dynamic Power Saver (Favor power) mode
- ◉ Enable Dynamic Power Saver (Favor performance) mode

Note: Enabling any of the Power Saver) modes will cause changes in the processor frequencies utilization, changes in power consumption, and performance to vary. Other effects are possible as well. Please see the EnergyScale white paper for more information on power saving modes.

Continue

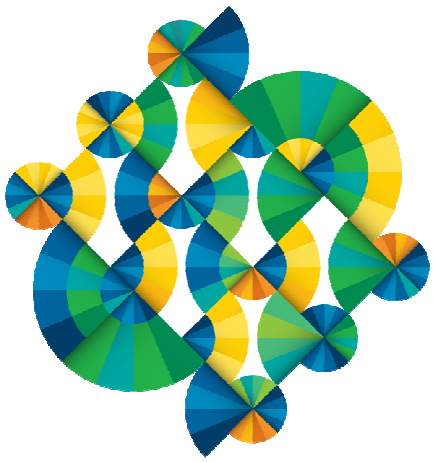
9179-MHD (780+):	
8-core @ 3.724 GHz	4.144 GHz
4-core @ 4.424 GHz	4.480 GHz
9117-MMD (770+)	
4-core @ 3.808 GHz	4.312 GHz
3-core @ 4.2228 GHz	4.396 GHz
9119-FHB (795)	
8-core @ 4.0 GHz	4.205 GHz

- Configure via ASMI menu
- Potential increase in processor frequency
- Requires firmware 740 or greater

17

POWER7+ 710 - 740

AIX for Business Linux



18

POWER7+ 710 Entry

Same price point as x86

- ✓ Single Socket 2U Form Factor
- ✓ **POWER7+:** 4, 6 or 8 core chips
  - **4 Core @ 3.6 GHz**
  - **6 Core @ 4.2 GHz**
  - **8 Core @ 4.2 GHz**
- ✓ **Up to 256 GB Memory**
- ✓ 6 PCIe Gen2 Slots
  - **Ethernet / LAN Adapter**
  - **Five general purpose slots**
- ✓ Single GX++ Slot
  - Direct Attached Storage
- ✓ Up to 6 SFF Bays
- ✓ **Supports 160 LPARs**

19

POWER7+ 730 Entry

Same price point as x86

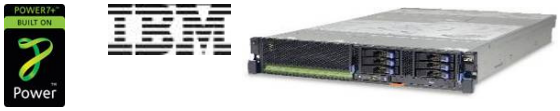
- ✓ Dual Socket 2U Form Factor
- ✓ **POWER7+:** 4, 6 or 8 core chips
  - **8 Cores @ 4.3 GHz**
  - **12 Cores @ 4.2 GHz**
  - **16 Cores @ 3.6 GHz**
  - **16 Cores @ 4.2 GHz**
- ✓ **Up to 512 GB Memory**
- ✓ 6 PCIe Gen2 Slots
  - Ethernet / LAN Adapter
  - Five general purpose slots
- ✓ Dual GX++ Slots
  - Remote IO Drawer option
  - Direct Attached Storage
- ✓ Up to 6 SFF Bays
- ✓ **Supports 320 LPARs**

20

Power 730 vs. x86 Pricing -- Head-to-Head

Same Price – Better Solution

- **Industry leading performance**
  - **Up to 23% higher SPECint_rate***
- **Significant RAS advantages**
- **Superior Virtualization capabilities**
- **Automated Security and Compliance capabilities**



	Power 730	HP ProLiant DL380p x86
Server	16-core 3.6GHz POWER7+ 64GB DDR3 memory 2x 146GB 15Krpm disks 4-port 1GB ethernet DVD RAM Redundant power 3-year warranty	16-core 2.9GHz Xeon E5-2690 64GB DDR3 memory 2x 146GB 15Krpm disks 4-port 1GB ethernet DVD RW Redundant power 3-year warranty
List price	**$11,033**	**$11,033**

21

POWER7+ 720 Entry

- ✓ Single Socket 4U Form Factor
- ✓ **POWER7+:** 4, 6 or 8 core chips
  - **4 Core @ 3.6 GHz**
  - **6 Core @ 3.6 GHz**
  - **8 Core @ 3.6 GHz**
- ✓ **Up to 512 GB Memory**
- ✓ 6 PCIe Gen2 Slots
  - **Ethernet / LAN Adapter**
  - **Five general purpose slots**
- ✓ Single GX++ Slot
  - Direct Attached Storage
- ✓ Up to 6 SFF Bays
- ✓ **Supports 160 LPARs**

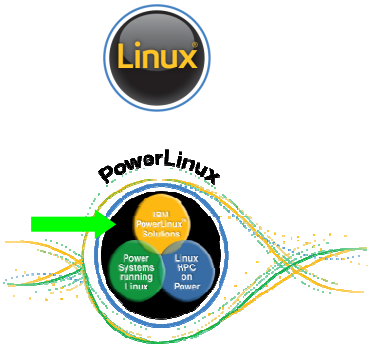
22

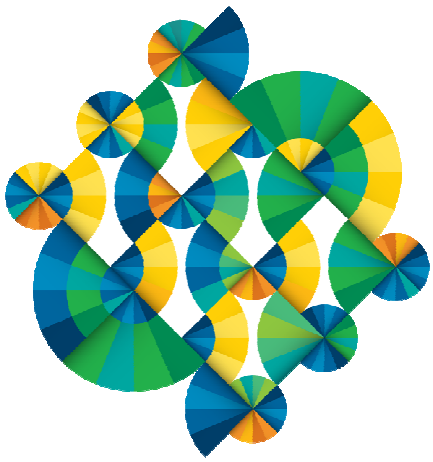
POWER7+ 740 Entry

- ✓ Dual Socket 4U Form Factor
- ✓ **POWER7+:** 6 or 8 core chips
  - **12 Cores @ 4.2 GHz**
  - **16 Cores @ 3.6 GHz**
  - **16 Cores @ 4.2 GHz**
- ✓ **Up to 1 TB Memory**
- ✓ 6 PCIe Gen2 Slots
  - Ethernet / LAN Adapter
  - Five general purpose slots
- ✓ Dual GX++ Slots
  - Remote IO Drawer option
  - Direct Attached Storage
- ✓ Up to 6 SFF Bays
- ✓ **Supports 320 LPARs**

23

POWER7+ PowerLinux





24

IBM PowerLinuxTM 7R1 / 7R2 based on POWER7+

High performance, efficient servers ideal for running multiple, industry standard Linux workloads, virtualized with PowerVM™

Robust and reliable

One or two sockets, highly efficient 2U rack

Up to eight POWER7+ cores per socket

256 GB memory per socket, 512 GB max.

Scalable and efficient

PowerVM™ exploiting integrated hypervisor

More workloads and throughput per server

- Up to 20 VMs per core and 320 total VMs

Unparalleled performance meets superior economics

Up to 41% lower virtualized solution cost

Comparable component pricing to x86 Linux

- *Server, virtualization software and Linux OS*

- **Linux only POWER7+**
- **2U rack, one or two socket**

PowerLinux 7R1

1 socket: 4-core @ 3.6 GHz

1 socket: 6 or 8-core @ 4.2 GHz

PowerLinux 7R2

2 sockets: 8-core @ 3.6 GHz

2 sockets: 8-core @ 4.2 GHz

redhat SUSE — **Operating Systems**

PowerVM — **Virtualization & Mgmt.**

25

IBM PowerLinuxTM 7R2 pricing comparison ($US)

	DELL intel	hp intel	IBM Power 7
Server list price* -3-year warranty, on-site	**$10,483**	**$11,946**	**$11,628**
Virtualization - OTC + 3yr. 9x5 SWMA	**$9,374** VMware vSphere Enterprise 5.1	**$9,374** VMware vSphere Enterprise 5.1	**$7,840** PowerVM for IBM PowerLinux
Linux OS list price - RHEL, 2 sockets, unlimited guests, 9x5, 3 yr. sub./ supp.	**$5,697** Red Hat subscription and Red Hat support	**$5,697** Red Hat subscription and Red Hat support	**$4,489** Red Hat subscription and IBM support
Total list price: Server/Virtualization/Linux	**$25,554**	**$26,568**	**$23,957**

**** Based on US pricing for PowerLinux 7R2 announced on 2/05/2013 matching configuration table below. Source: dell.com, hp.com, vmware.com: 1/15/13***

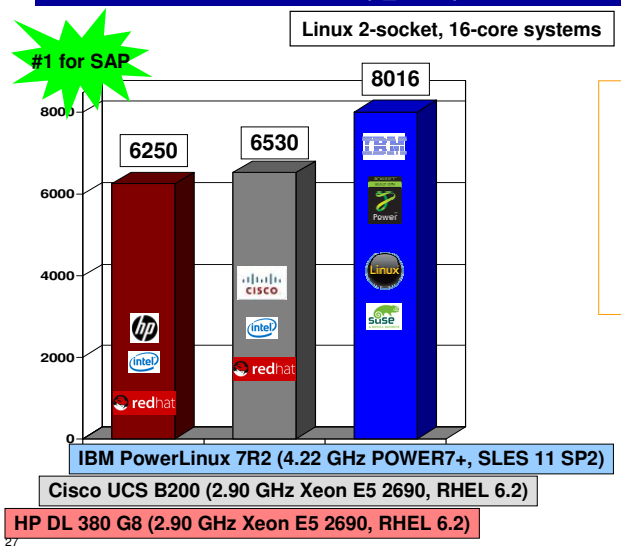
Compare prices online

Server model	Dell R720	HP Proliant DL380p G8	IBM PowerLinux 7R2
Processor / cores	Two 2.9 GHz , E5-2690, Sandy Bridge, 8-core processors		Two 4.2 GHz POWER7+, 8-core
Configuration	32 GB memory, 2 x 147GB HDD, 10 Gb two port		Same memory, HDD, NIC

26

IBM PowerLinux 7R2 SAP SD 2-Tier Performance

22% - 28% > than best published Linux 16-core Sandy Bridge EP results
SAP SD 2-Tier benchmark (6_EHP5) with 16-core, 4.22 GHz PowerLinux 7R2



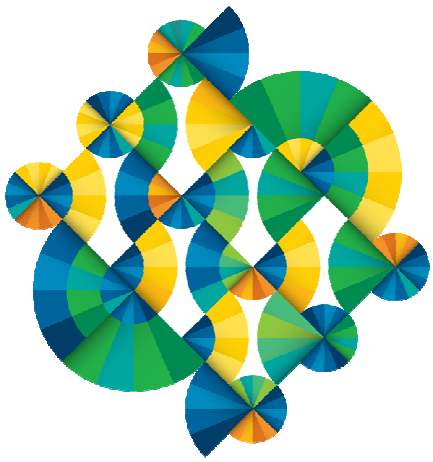
POWER7+
IBM PowerLinux
7R2

SAP source: http://www.sap.com/benchmark/
As of 02/05/13.
SAP Publication number for HP results: 2012032

27

POWER7+
750 - 760

AIX for Business Linux



28

Merging Power 770 & Power 740 = Power 750/760

Power 770

Power 740

Quad Sockets
IO Subsystem

Memory Architecture
RAS

Enterprise System features
Express System pricing

Power 760

Power 750

29

Power 750

ENERGY STAR

3 Yr Maintenance
24 x 7

AIX i for Business Linux

- ✓ Quad Socket 5U Server
- ✓ POWER7+ 4 core chips
  - 8 Core sockets @ 3.5 & 4.0 GHz
  - Four Sockets / Up to 32 Cores
- ✓ Up to 1 TB of memory
- ✓ 6 PCIe Gen2 slots
- ✓ 6 SFF DASD Bays
- ✓ Ethernet ports: Dual 10 Gbt & Dual 1 Gbt
- ✓ Dual GX++ Slots
- ✓ Enhanced POWER7+ RAS
- ✓ 3 Year 24 x 7 Maintenance coverage
- ✓ Supports 640 LPARs

30

Power 760

- ✓ Quad Socket 5U Server
- ✓ POWER7+ 6 core chips
  - 12 Core sockets @ 3.1 & 3.4 GHz
  - Four Sockets / Up to 48 Cores
- ✓ Up to 2 TB of memory
- ✓ 6 PCIe Gen2 slots
- ✓ 6 SFF DASD Bays
- ✓ Ethernet ports: Dual 10 Gbt & Dual 1 Gbt
- ✓ Capacity on Demand for Processors
  - Permanent activations
- ✓ Dual GX++ Slots
- ✓ Enhanced POWER7+ RAS
- ✓ 3 Year 24 x 7 Maintenance coverage
- ✓ Supports 960 LPARs

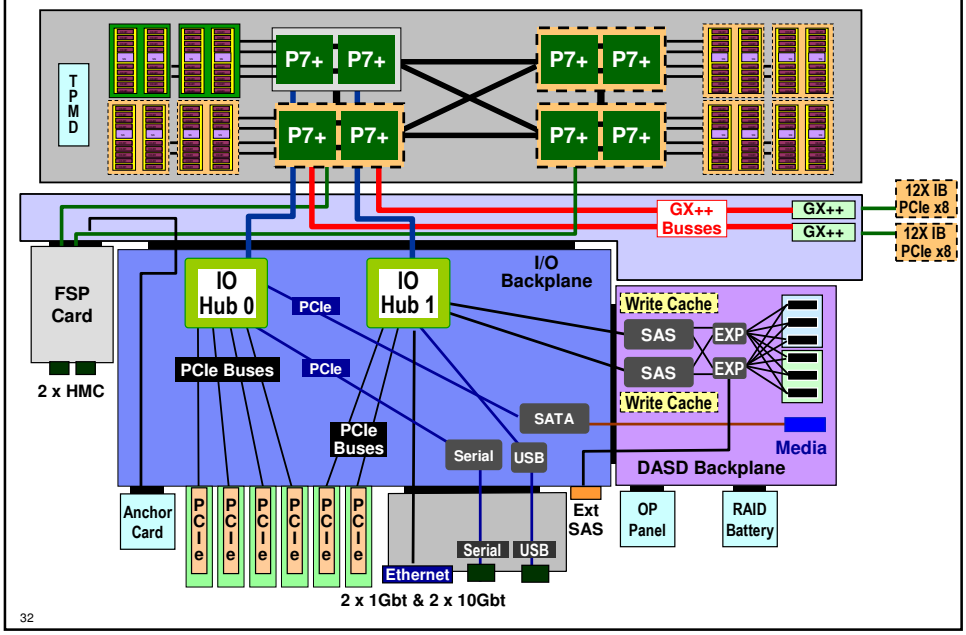
ENERGY STAR

3 Yr Maintenance 24 x 7

AIX i for Business Linux

31

POWER7+ 750 / 760



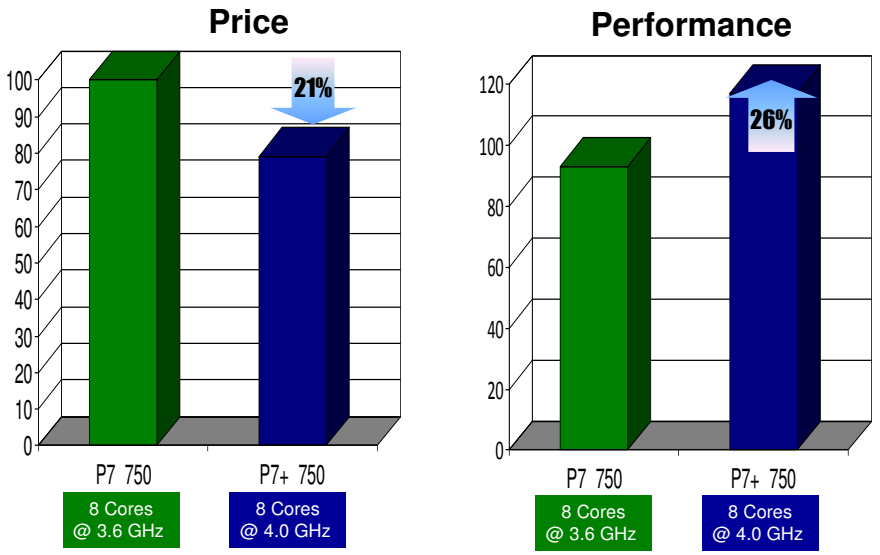
32

POWER7+ 750 / 760 Systems


	Power 750 (P7)	Power 750 (P7+)	Power 760 *(P7+)*
Sockets	4	4	4
Cores	32	32	***48***
Frequencies	3.2 – 3.6 GHz	**3.5 – 4.0 GHz**	***3.1 – 3.4 GHz***
Maximum Memory	512 GB	**1 TB**	***2 TB***
GX slots	1 GX++ & 1 shared GX	**2 GX++**	2 GX++
PCI slots	2 PCIx & 3 PCIe Gen1	**6 PCIe Gen2**	6 PCIe Gen2
Internal IO bandwidth	10 GB/sec	**40 GB/sec**	40 GB/sec
MultiFunction Ethernet ports *	Four 1Gb or two 10Gb	**Two 10Gb CNA + Two 10 / 1 Gbt**	Two 10Gb CNA + Two 10 / 1 Gbt
SFF SAS bays	6 / 8	6	6
Integrated split backplane	No	**Yes**	Yes
Max LPARs	320	**640**	**960**
Height	4U	**5U**	5U
Installation	Customer Set-Up	Customer Set-Up	***IBM installed***
CoD	N / A	N / A	***Processor on Demand***
Software Tier	Small	Small	***Medium***
HMC	Optional	Optional	***Required***

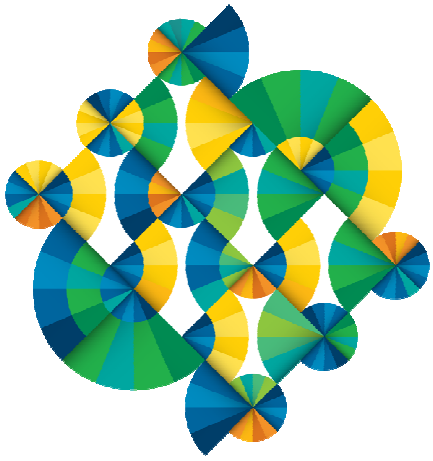
33

POWER7 750 vs POWER7+ 750



34

Power 770+ / 780+



35

Power 770+

Power 770+: 4S / 4U

- ✓ POWER7+
- ✓ Frequencies:
  - **4C SCM @ 3.8 GHz** **Max Config: 64 Cores**
  - **3C SCM @ 4.2 GHz** **Max Config: 48 Cores**
- ✓ Up to 64 Cores
- ✓ Up to 4 TB of memory
- ✓ 6 PCIe Gen2 slots / CEC
- ✓ Ethernet ports: Dual 10 Gbt & Dual 1 Gbt
- ✓ Capacity on Demand
- ✓ **Enhanced RAS**
  - **Self-healing capability for L3 Cache functions**
  - **Core re-initialization (Running system)**
  - **Dynamic Processor Fabric Bus repair**

36

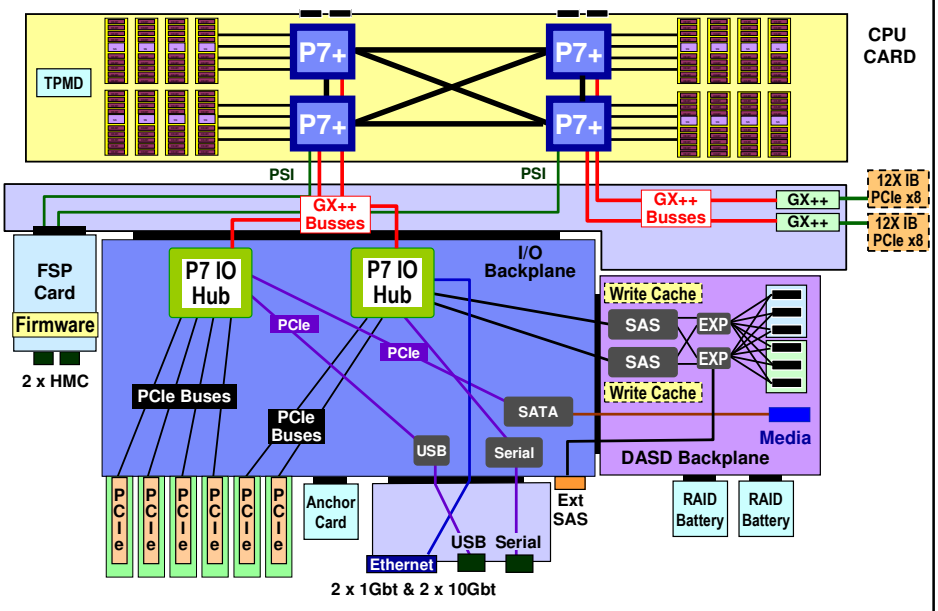
Power 780+

Power 780+: 4S / 4U

- ✓ POWER7+
- ✓ Frequencies:
  - **8C SCM @ 3.7 GHz** **Max Cores: 128 Cores**
  - **4C SCM @ 4.4 GHz** **Max Cores: 64 Cores**
- ✓ Up to 128 Cores
- ✓ Up to 4 TB of memory
- ✓ 6 PCIe Gen2 slots / CEC
- ✓ Ethernet ports: Dual 10 Gbt & Dual 1 Gbt
- ✓ **Enhanced Capacity on Demand options**
- ✓ **Enhanced RAS**
  - **Self-healing capability for L3 Cache functions**
  - **Core re-initialization (Running system)**
  - **Dynamic Processor Fabric Bus repair**

37

Power 770+ / 780+ Quad Socket Planar…..



38

POWER6 595 vs POWER7+ 780

Power 595
64 cores
5.0 GHz
rPerf 553

Power 780+
64 cores
4.4 GHz
rPerf 817

48% More Performance*

66% Less Energy

80% Less Maintenance*

82% Less Space*

* Power 780 running SMT4
* Over 3 year period

39

Power 780+ Enhanced CoD Options

Elastic CoD Elastic no-charge processor days
- **15 Elastic CoD Elastic processor days** for every processor core initially shipped with the system.

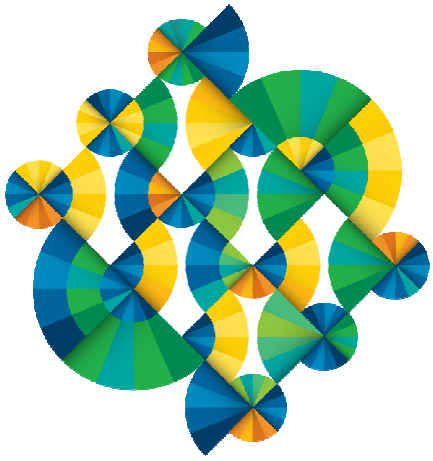
Elastic CoD Elastic no-charge memory GB-days
- **240 GB memory days** will be included for every processor core initially shipped with the system.

90-days Elastic CoD temporary processor and memory enablement
- Allows temporarily activate all inactive processor and memory CoD resources for a maximum of 90 days before you must order an other temporary

Power Systems Pools offering
- Allows for the aggregation of Elastic and Elastic CoD compute resources, including processors and memory, across a number of Power 780+ and 795 servers

40

Power 795



41

Power 795

Model FHB

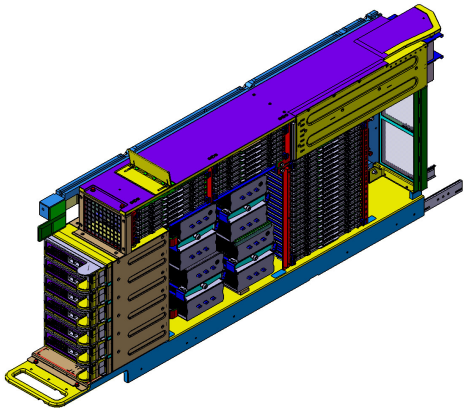
- ✓ Up to 256 Cores
- ✓ Up to **16TB** of memory
- ✓ **Enhanced Firmware**
- ✓ **PCIe Gen2 Support**
  - **Dual port 10 Gbt CNA Ethernet**
  - **Dual port 16 Gbt Fiber Channel**
- ✓ Up to 8 CECs per system
- ✓ Up to 640 IO Slots
- ✓ Up to 1000 LPARs
- ✓ **ROCE Support**
- ✓ **Enhanced CoD Options**
- ✓ Enterprise RAS
  - Dual Clocks / Service Processors
  - Redundant TPMD
  - Active Memory Mirroring

42

PCIe Gen2 GX++ Adapters

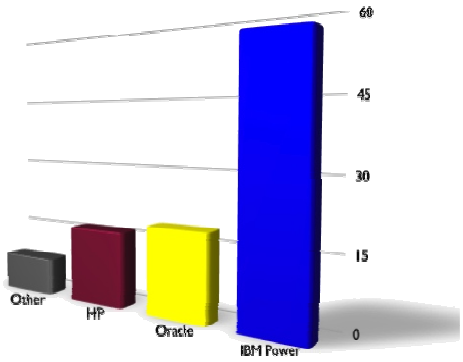
2 x 10Gb ports:
- Ethernet
- Fibre Channel CNA support

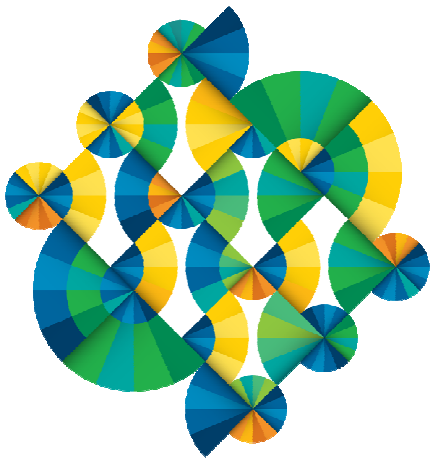
2 x 16 Gbt Fiber Channel ports



- PCIe Gen2 enabled
- GX++ Hot pluggable

43





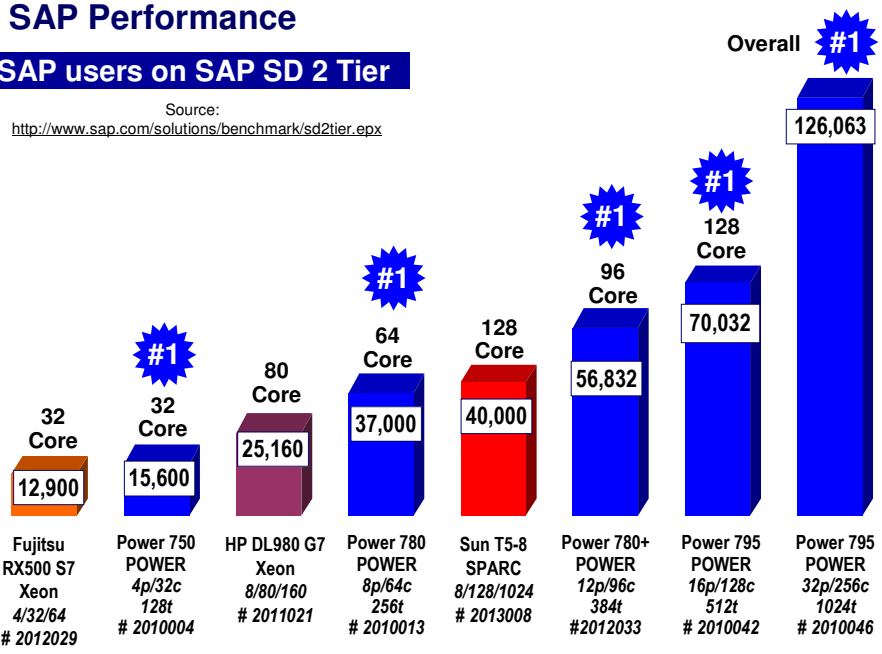
Performance

44

SAP Performance

SAP users on SAP SD 2 Tier

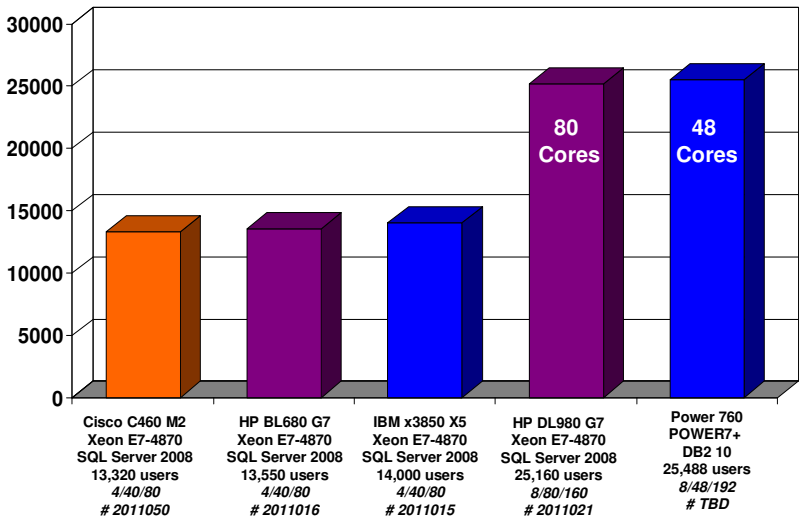
Source:
http://www.sap.com/solutions/benchmark/sd2tier.epx



45

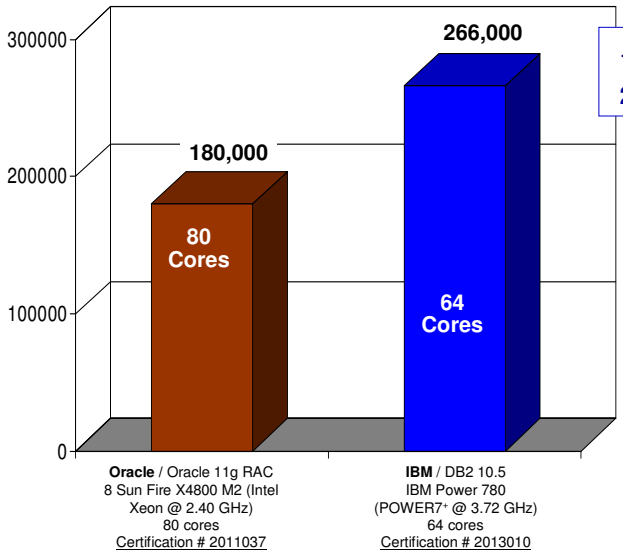
Power 760 SAP Performance

Power Systems result surpasses leading x86 80 core result



46

IBM leadership: Three-tier SAP® Sales and Distribution (SD)



1.47x More Users
20% Fewer Cores

Oracle / Oracle 11g RAC
8 Sun Fire X4800 M2 (Intel Xeon @ 2.40 GHz)
80 cores
Certification # 2011037

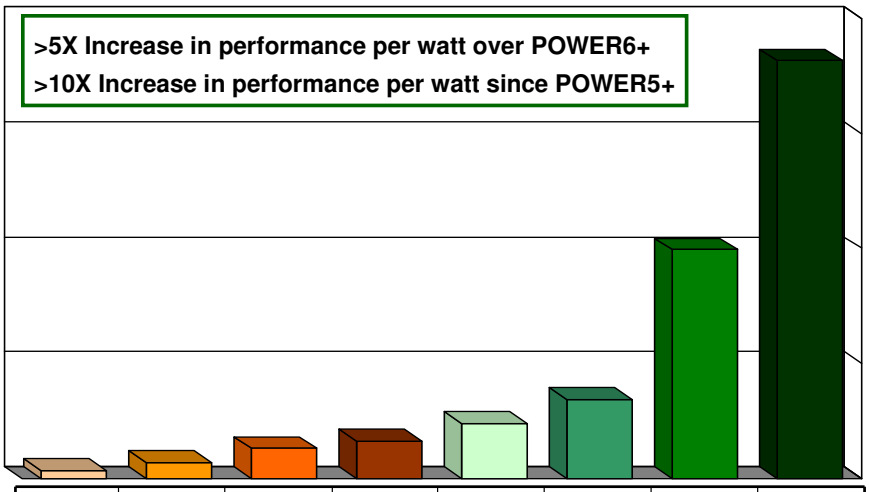
IBM / DB2 10.5
IBM Power 780
(POWER7+ @ 3.72 GHz)
64 cores
Certification # 2013010

Source: SAP Standard Application Benchmarks: http://www.sap.com/benchmark and SAP SD Parallel Standard Application Benchmark: http://www.sap.com/solutions/benchmark/sd1_results.htm

47

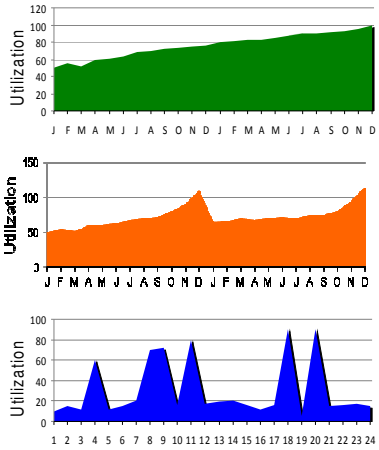
POWER7+ Deliver more *Performance per Watt*

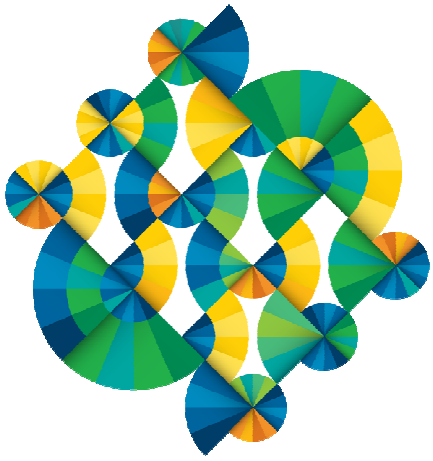
>5X Increase in performance per watt over POWER6+
>10X Increase in performance per watt since POWER5+



POWER4 p670 1.1 GHz KWatts: 6.7	POWER4+ p670 1.5 GHz KWatts: 6.7	POWER5 p5-570 1.65 GHz KWatts: 5.2	POWER5+ p570 1.9 GHz KWatts: 5.2	POWER6 Power 570 4.7 GHz KWatts: 5.6	POWER6+ Power 570 4.2 GHz KWatts: 5.6	POWER7 Power 780 3.8 GHz KWatts: 6.9	POWER7+ Power 780 3.7 GHz KWatts: 7.7

48





CoD Update

49

Capacity on Demand

Capacity Upgrade on Demand — **Power 760 / 770 / 780 / 795**

- Upgrade system with processors and/or memory
- No special contracts, no required monitoring (no ability to turn off the capacity)
- Purchase agreement

Elastic Capacity on Demand — **Power 770 / 780 / 795**

- Temporary use of requested number of processors or amount of memory
- Client selects the capacity and activates the resource (registered system)
- Capacity can be turned on and off by the client
- Information captured by IBM (or reported to IBM)
- Rental agreement

Utility Capacity on Demand — **Power 770 / 780 / 795**

- Processor resources only / **Measured by processor minutes**
- Capacity can be turned on and off by the client
- Prepaid or post pay
- Requires AIX V5.3 and APV

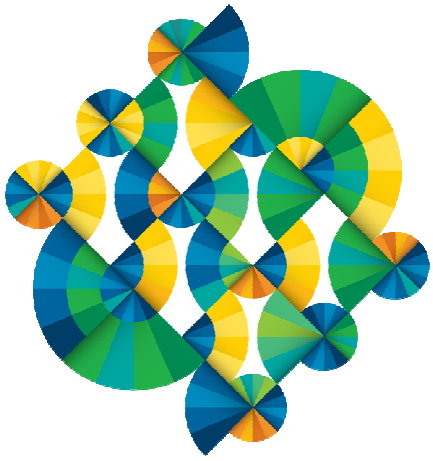
Trial Capacity on Demand — **Power 770 / 780 / 795**

- Allow clients to test the effects of additional processors and/or memory
- Partial or total activation of processors and memory
- Resources available for fixed time
- No formal commitment required

Dynamic Processor Sparing — **Power 760 / 770 / 780 / 795**

- Automated replacement of de-allocated processors
- Unassigned or inactive processors

50



HMC Firmware

51

New CR7 HMC….

Technology update:
7042-CR7 system is replacing 7042-CR6

Feature	CR6	CR7
Processor	Westmere-EP	**Intel Xeon E5 (Sandy Bridge)**
Memory	4 GB	**4 GB**
DASD	500 GB	**500 GB**
RAID 1	Optional in 4Q2012	**Default in 4Q2012**
Multitech Internal Modem	Defaulted	**Optional**
USB Ports	2 front/4 back/1 Internal	**2 front / 4 back 1Internal**
Integrated Network	2 on Main Bus + 2 on expansion slot	**4 x 1 GbE**
I/O Slots	1 PCI Express 2.0 slot	**1 PCI Express 3.0 slot**

52

HMC v7.760

HMC 760 firmware:
- Supports: 7310-C04, 7315-CR2, 7310-CR2 and later
- Last planned FW level for: 7310-C04, 7315-CR2, 7310-CR2
- No support to mange P7 for 7310-C04, 7315-CR2, 7310-CR2
- Provides support for .05 processor (LPAR) on POWER7+ systems

HMC 760 can manage P5 and newer systems
- **Power Blades support (New)**
- No Power 775

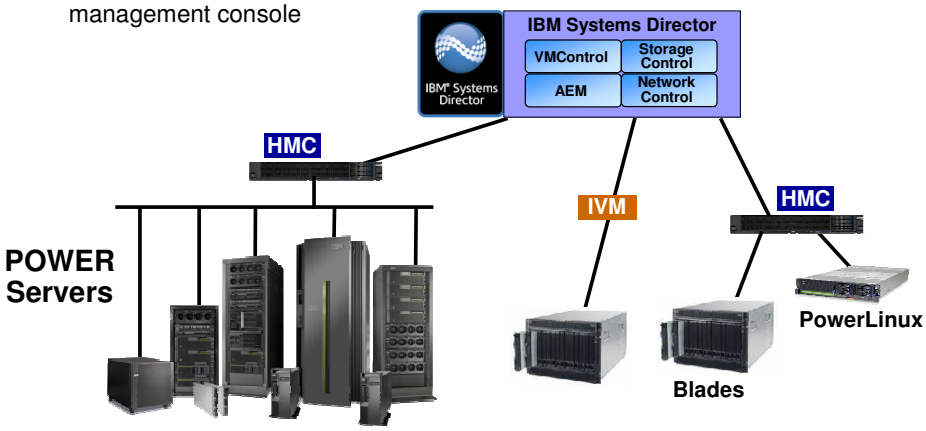
760 Firmware system support: POWER7+
- Power 795, 780, and 770

SW Requirements for .05 processor support
- AIX 7.1 TL2, AIX 6.1 TL8
- IBM i 7.1 TR4, IBM i 6.1.1-H
- Linux (Future)
- PowerVM v2.2.2
- FW 760
- HMC 760

53

HMC v7.760 Blade Support

HMC V7R760:
- HMC management of IBM BladeCenter Power Blade servers
- Support for dual VIOS
- Live partition mobility between blades and rack servers
- Management of both blades and rack servers from a single management console



54

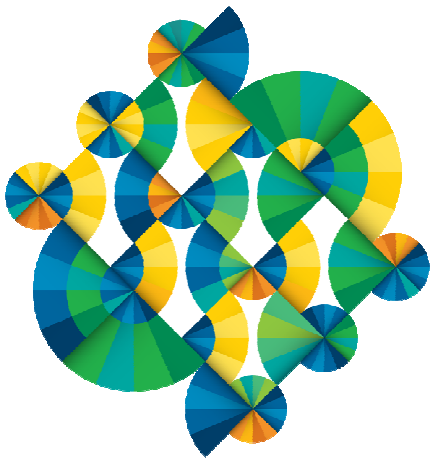
HMC V7 R7.7.0 (1H 2013) Highlights

- **Server Management**
  - **POWER7+ 710 / 720 / 730 / 740 / 750 / 760**
- **Virtualization Management**
  - **Mobility**
    - **Performance improvement for Live Partition Migration**
  - **Usability**
    - **GUI for VIOS install**
- **Console Management**
  - **Browser currency**
  - **Security currency**
  - **Update of expired user password for Kerberos authenticated users**
  - **Remove support for 7315-C04, 7315-CR2, 7310-CR2**

More to come

FYI: POWER7 Servers which currently are not planned to be provided 7.6 or later Firmware levels. (Fixes continued to be provided.)
- Power 710/720/730/740 "B" or "C" models
- Power 750 "B" model
- Power 755 "C" model
- Power 770/780 "B" models
- Power Blades

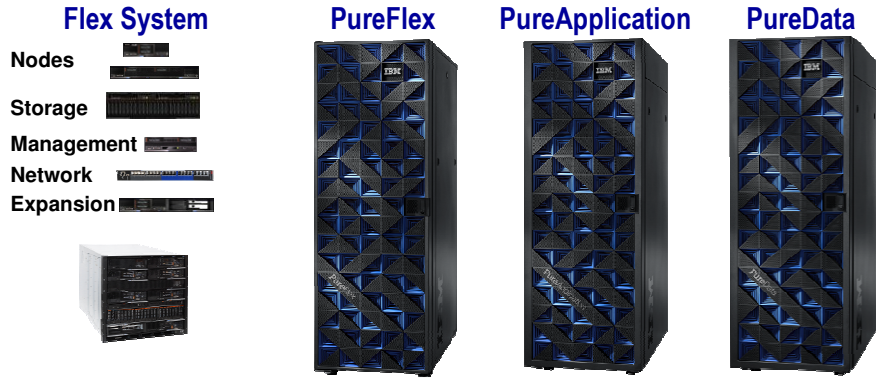
55



PureSystems

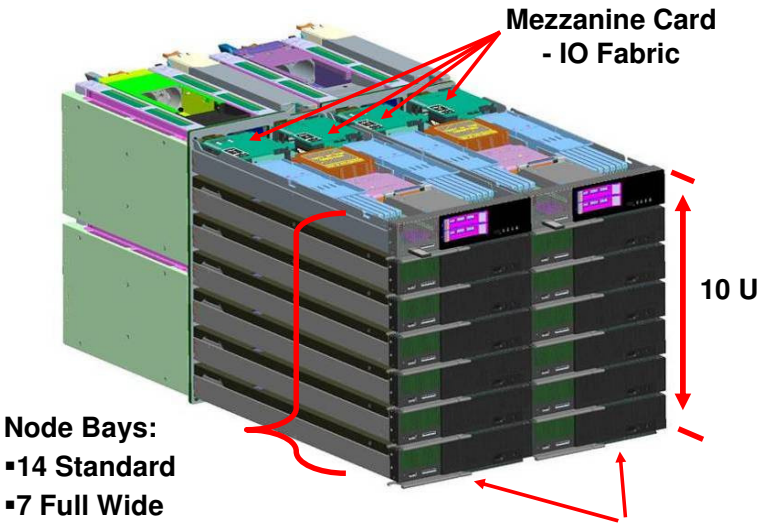
56

PureSystems Family



57

Flex System Enterprise Chassis Overview: Front View



58

Flex System Power Offerings…

- Half-wide compute node
- 2-socket Power7®
- 64-bit POWER7+ processor
- 8 to 16 core : 2 Socket x 4/8 core
- 16 DIMMs DDR3, 1066 MHz, 512 GB Max

p260

p460

- Full wide compute node
- 4-socket POWER7
- 64-bit POWER7 processor 16/32 core : 4 Socket x 4/8 core
- 32 DIMMs DDR3, 1066 MHz, 1TB Max

Storwize V7000

Rack & I/O

- Rack
- Rear-door heat exchanger
- 1 / 10Gb Ethernet
- 8Gbt Fiber Channel card

Chassis

Systems Management Appliance

- Flex System Manager
- Ease of deployment tools
- Virtualization Automation tools
- Workload Migration tools

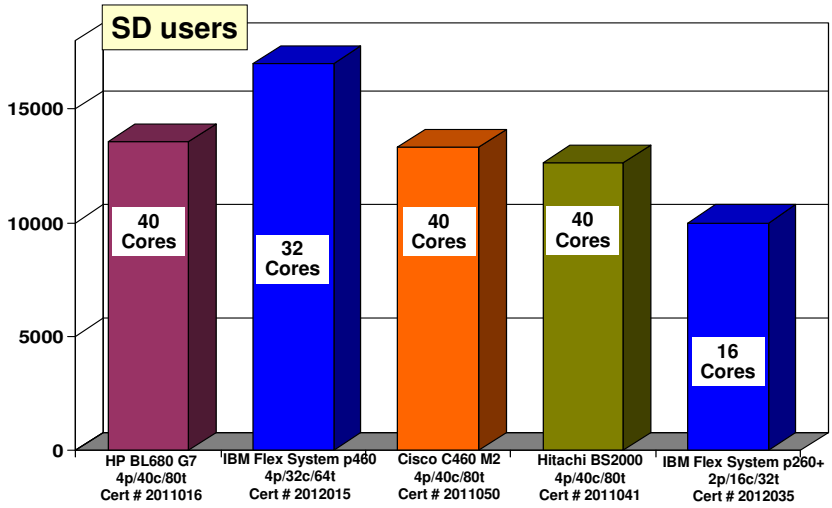
High Speed Switches

- Fiber Channel
- 1 & 10 Gbt Ethernet / FCoE
- InfiniBand

59

p460 *26% more users than competition*

SAP Sales and Distribution Standard Application 2-Tier Benchmark
Four Socket Systems



60

PureFlex System Integrated System Solution

Rack

Chassis

Flex Compute Nodes

Flex System Manager

V7000 Storage

Operating Systems

Virtualization

IBM 42U Slim Rack (7953-94X)
IBM Flex System Enterprise Chassis (7893-92X)
IBM Flex System Compute Node: p260, p460, x220, x240, & x440
IBM Flex System Manager (7955-01M)
IBM Storwize V7000 Disk System (2076-124)

61

Positioning with Power …

Capability

Size and Complexity of Data Center

Power Express

- Traditional and highly customizable portfolio of systems designed for a wide array of client needs.
- Lowest entry price
- Smallest configuration

Flex Systems

- Clients leading the wave toward integrated compute, networking and storage with integrated mgmt and integrated solution building blocks
- Rapid deployment of virtualized compute, network, & storage
- Consolidated x86 & Power applications

Power Enterprise

- Most resilient and scalable systems with flexibility to consolidate the most demanding workloads and customize to deliver the highest quality SLAs
- Industry-best performance, scalability, availability
- Greatest resource sharing and highest utilization with seamless growth from Capacity on Demand
- Memory and I/O infrastructure to optimize most demanding workloads

62

IBM PureData System Offerings..

PureData *System for Transactions*

E-commerce like apps…

Database cluster services optimized for transactional throughput and scalability

---

PureData *System for Analytics*

Next generation Netezza appliance

Customer Analysis like apps…

Data warehouse services optimized for high-speed, peta-scale analytics and simplicity

---

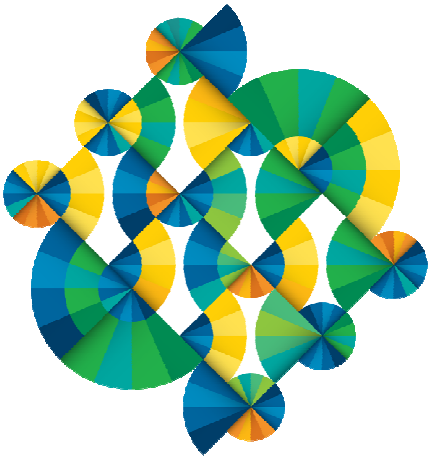
PureData *System for Operational Analytics*

Power Systems

Real-time Fraud Detection like apps…

Operational data warehouse services optimized to balance high performance analytics and real-time operational throughput

63



Virtualization

64

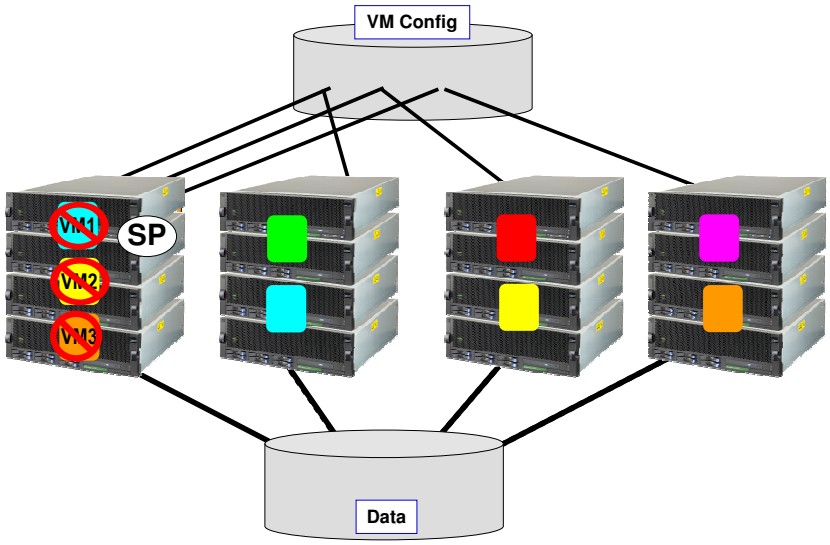
PowerVM 2.2.2 – New release

PowerVM 2.2.2 – Industrial strength virtualization
- IBM i, AIX and Linux workloads

New Features…
- Live partition mobility performance improvements doubles concurrency and i**mproves single VM mobility by up to 3X** which accelerates mobility and business agility
- **New VIOS performance advisor** proactively recommends changes to optimize performance to provide better service
- Enhanced flexibility allows up to **20 VMs per core**
- Improvements in scaling, RAS for shared storage pools which enable more effective storage management and utilization
- Improved Shared Storage Pool support

65

Remote Server Restart ….



66

PowerVM Editions: Features

PowerVM Editions	Express	Standard	Enterprise
Concurrent VMs	2 per server	20 per Core** (up to 1000)	20 per Core** (up to 1000)
Virtual I/O Server	✓	✓ ✓	✓ ✓
NPIV	✓	✓	✓
Suspend/Resume		✓	✓
Shared Processor Pools		✓	✓
Thin Provisioning		✓	✓
Live Partition Mobility			✓
Active Memory Sharing			✓
Shared Storage Pools Enhancements		✓	✓
VIOS Performance Advisor	✓	✓	✓
Linked Clones		✓	✓
Live Partition Mobility Performance Improvements			✓

** Requires eFW7.6

Q4 2012 Features

67

PowerVM Remote VM Restart Automation with VMControl

What is it?

- VM Remote Restart automates VM restarts in the case of server failure
- Improves availability of systems by recovering faster from server HW failure
- Works with AIX, IBM i or Linux VMs
  - Requires VMControl Enterprise Edition
  - VMControl automates failover via system pools
- Requires PowerVM Enterprise Edition

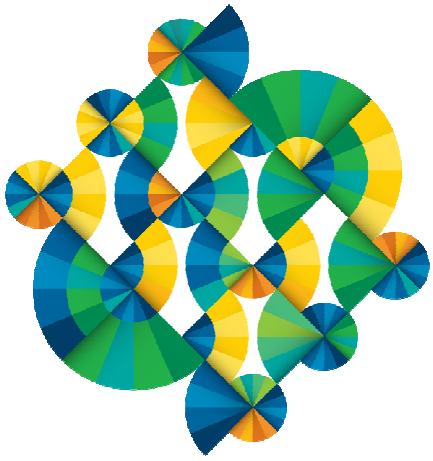
68

IBM

Solutions…

Cognos

SPSS



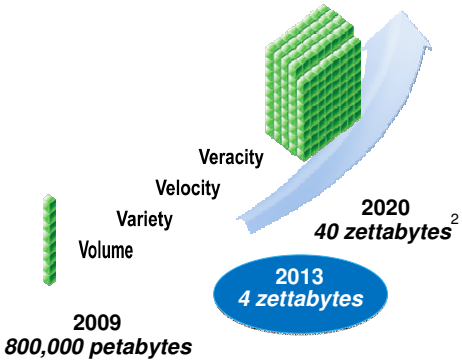
69

IBM

An Explosion in Information & Data

50x

as much Data and Content Over Coming Decade



Lack of Insight…
1 in 3 managers frequently make critical decisions without the information they need

Inefficient Access…
1 in 2 don't have access to the information across their organization needed to do their job

Inability to Predict…
3 in 4 business leaders say more predictive information would drive better decisions

Uncertainty of Trust…
1 in 3 business leaders don't trust the information they use to make decisions

1-- Source: IBM Institute for Business Value http://www.ibm.com/services/us/gbs/thoughtleadership/
2-- Source: IDC Predictions 2013 http://event.lvl3.on24.com/event/54/34/13/rt/1/documents/slidepdf/wc20130108.pdf

70

Power: The Future of Analytics

Industry's best platform for compute intensive analytics workloads

Custom Designed Business Analytics Solutions

BI and Predictive Analytics of real-time and historical data

sas SAP Cognos SPSS

Big Data Analytics Solution

Analyze and manage massive amounts of structured and unstructured data

Watson Solutions and Initiatives

Expert Integrated Operational Analytics Solution

Real-time continuous analysis of operational data streams

PureData

71

IBM Cognos Business Intelligence

Inform	Engage	Align
• *Reports* • *Dashboards* • *Real-Time Monitoring* • *Mobile*	• *Ad Hoc Query* • *Trending and Drill Down* • *Statistical Analysis*	• *Scorecards* • *Collaboration*

COGNOS BI

Unified workspace

All time horizons

Progressive Interaction

Cognos Collaboration

Cognos Real-time Monitoring

Cognos TM1

Cognos Statistics

Cognos Mobile

For more information: http://www.ibm.com/software/data/cognos/?S_CMP=ba_hp

72

The power of IBM SPSS Predictive Analytics

Having the knowledge to **Predict** … and the power to **Act**

- **IBM SPSS Statistics** puts the power of advanced statistical analysis in your hands.
- With **IBM SPSS Modeler**, you can quickly discover patterns and trends in your data more easily, using a unique visual interface supported by advanced analytics.
- Get an accurate view of people's attitudes, preferences, and opinions with **IBM SPSS Data Collection.**
- Use **IBM SPSS Deployment** products to drive high-impact decisions by making analytics a vital part of your business.

SPSS AN IBM® COMPANY

For more information:
http://www.ibm.com/software/analytics/spss/

73

AIX Solution Edition For Cognos and SPSS

Leveraging IBM business and predictive analytics software Optimization on IBM Power Systems

Cognos SPSS

POWER7 BUILT ON Power

- AIX Standard or Enterprise Edition
- PowerVM Standard or Enterprise Edition
- **Cognos POWER7+** with 1-button ordering
- **SPSS POWER7+**
- Power 710, 720, 730, 740

Hardware incentives:
- ½ processor activations at no-charge
- 50% discount on AIX licenses more information: http://www.ibm.com/systems/power/hardware/solutioneditions/aix/index.html

Delivering Faster Insights

40% better performance with Cognos BI V10.1.1 on POWER7/AIX 7.1, over Windows 2008 on x86[1]

Predicting Outcomes Faster

22% better performance with SPSS Collaboration and Deployment Services V4.2 on POWER7/AIX 7.1, over Windows 2008 on x86[2]

[1] https://review.boulder.ibm.com/webapp/iwm/web/signup.do?source=stg-web&S_PKG=us-en-po-wp cognosbi&test=Y

[2] Based on IBM Internal tests. See speaker notes.

74

IBM PureApplication System with Power Technology

POWER based model for increased performance and density

Featuring:

Quad (4 socket) full width
POWER7+ compute nodes

512 GB memory per compute node (16 GB / core)

2 x V7000 Controller and Expansion
- 48 TB disk total (formatted)

2 x BNT TOR 64 ports, 10Gb Ethernet

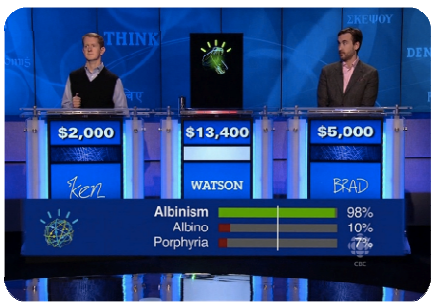
2 PureAS FRM with HW Additions
- Mgmt laptop

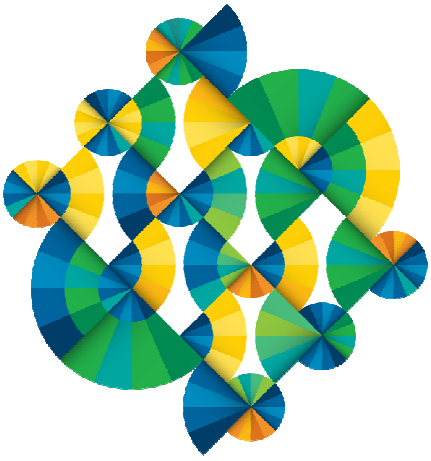
Centralized Mgmt and Tivoli Monitoring

Pre-loaded & pre-configured with:
- AIX
- IBM WebSphere Application Server Hypervisor Edition
- IBM DB2 Enterprise Edition
- Patterns: IBM Transactional Database, Data Mart, and Application for Java

Fully assembled, integrated rack in four configurations:
- 96, 192, 384, 608 cores
- Upgrades available from models above and can be completed without powering down

75

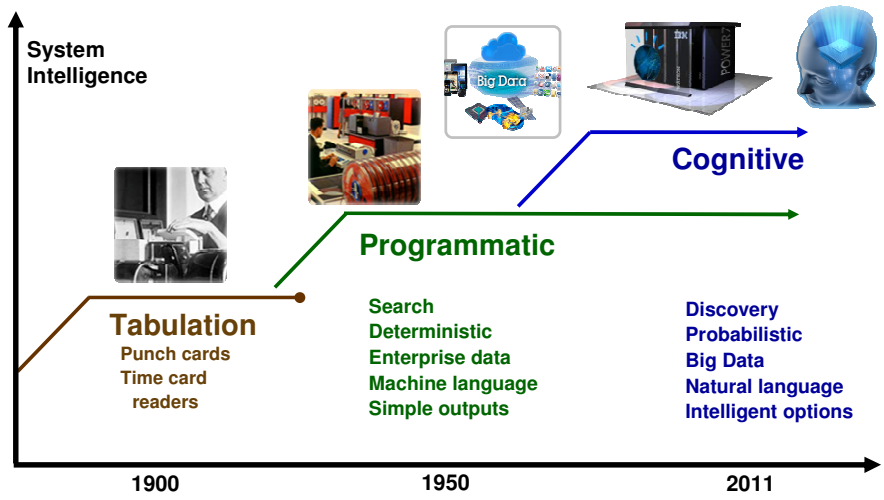




Watson

76

Watson is ushering in a new era of computing . . .



. . .Enabling new opportunities and outcomes

77

Watson-based Applications

Watson based apllications

- **Lung Cancer Treatment Analysis**
  - Watson considers what treatment is most likely to succeed
  - Being adopted by the Maine Center for Cancer Medicine & WestMed in New York's Westchester County
- **Health Insurance Decisions and Claims Management.**
  - Watson considers what treatment should be authorized for payment
  - Used by Wellpoint in Indiana, Kentucky, Ohio and Wisconsin
- **Oncology Research & Insights Advisory**
  - Compares electronic medical record (EMR) against text books, journal articles, best practices, and guidelines.
  - Presents the oncologist with…..
    - Case Information
    - Test Options
    - Treatment Options
  - Identifies missing information that the oncologist should gather from the patient or via tests.

What the applications do…

- Reduces the effort for doctors and nurses / Can review 1000's of pages of information
- Take advantage of the Speed, Huge database and Language skills of Watson
- Watson can quickly compare a patient's medical records to what it has learned
- Make several recommendations in decreasing order of confidence.
- Watson does not make the "Decisions" on treatment or authorization

78

Capabilities of Cognitive Systems

Cognitive Systems Era

	Watson 1.0	Watson 2.0	Watson 3.0
Memory	✓	✓	✓
Learning	✓	✓	✓
Judgment	✓	✓	✓
Perception	✓	✓	✓
Multi-Modal		✓	✓
Reasoning		✓	✓

79

IBM Austin Watson Lab

Activities:
- trations
- One Briefings
- Concepts

80

Executive Briefing Center in Austin

Subject Content

- IBM Power Servers: POWER8, SRIOV,
- PureFlex / PureApplications / PureData
- AIX, Linux, IBM i / Tivoli Offerings
- Virtualization / Systems Management /
- Storage, TMS, SAN etc.
- Lab Tours (Flex Systems / POWER8 / Watson / Green)
- Watson
- Demos

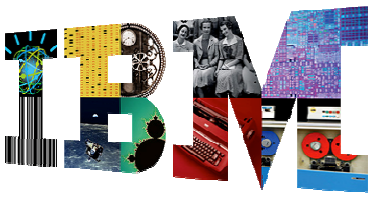
In Bound Briefings / Out Bound Sessions / Road Shows

Contact Information:

Web: http://www-03.ibm.com/systems/services/briefingcenter/abc/index.html
e-mail mirandac@us.ibm.com / Phone: 512.286.7410

81

Questions



82

UK Tour: Ask the Experts 2013

10:00 - 11:15	Power Systems Update - Pat O'Rourke:
11:15 - 12:30	Performance Best Practices with POWER7 - Nigel Griffiths
12:30 - 13:30	Lunch
13:30 - 14:30	Tricks of the Power Masters - Gareth Coates
14:30 - 15:15	Cost Comparison between IBM Power and Intel - David Spurway
15:15 - 15:30	Coffee
15:30 - 16:45	Power Systems Trends and Directions - Pat O'Rourke
16:45	Close

83

Special notices

84

Special notices (cont.)

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

Revised December 2, 2010

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.

==========

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

Revised April 2, 2007