Power Systems

IBM

IBM Power Systems: *“Linux on Power”*

A journey to *“open-innovation”*

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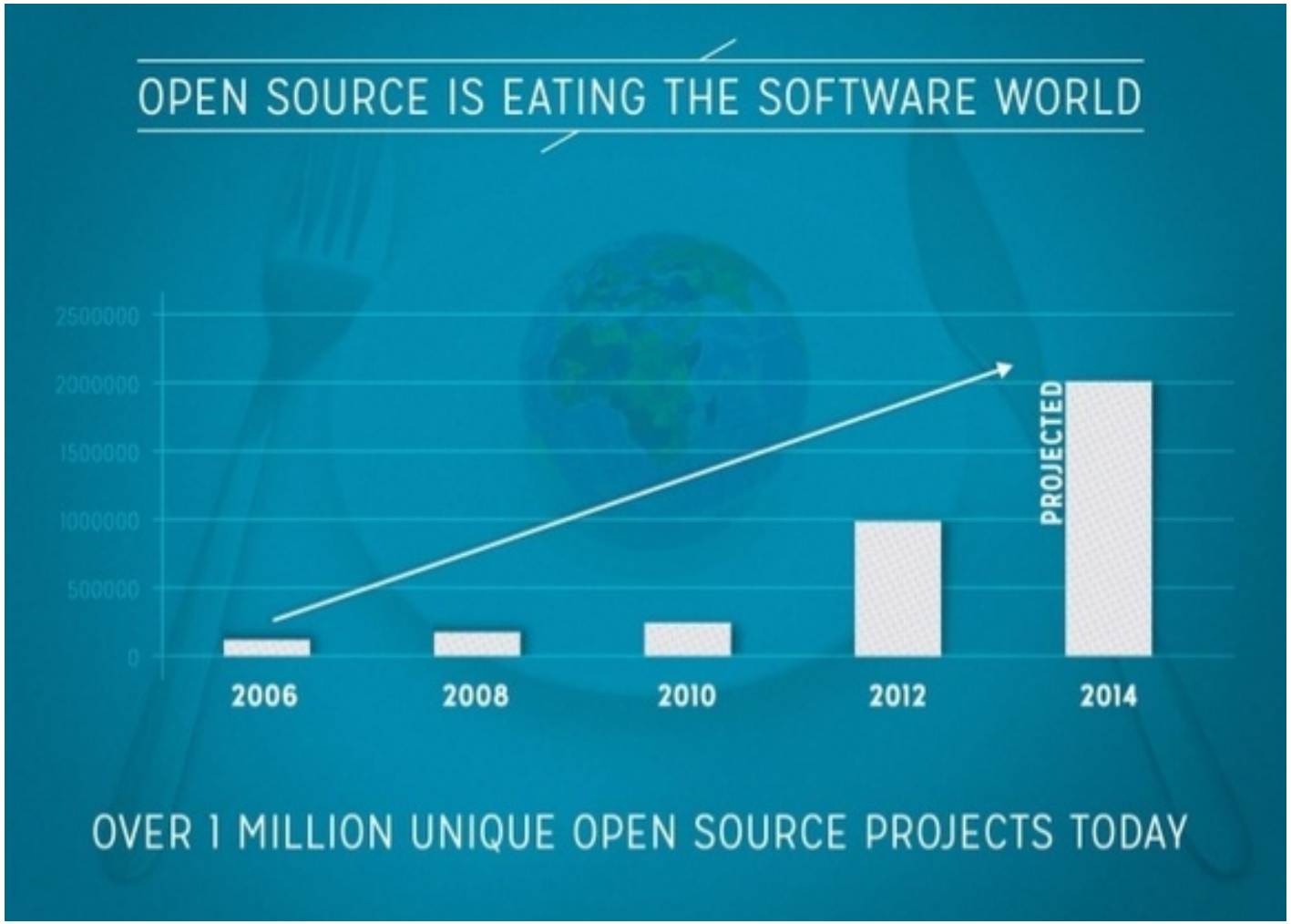
Power Systems Linux Center
IBM Montpellier

Open-Source Phenomenom

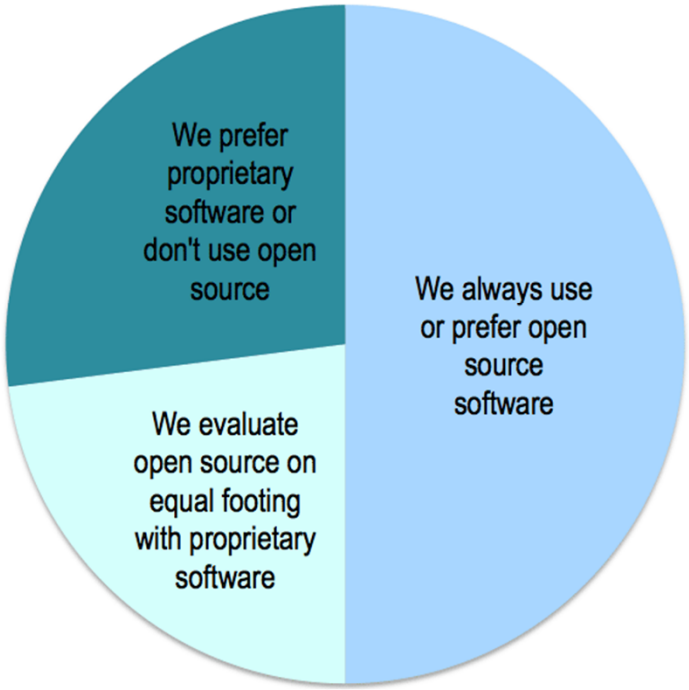
The Open-Source Explosion



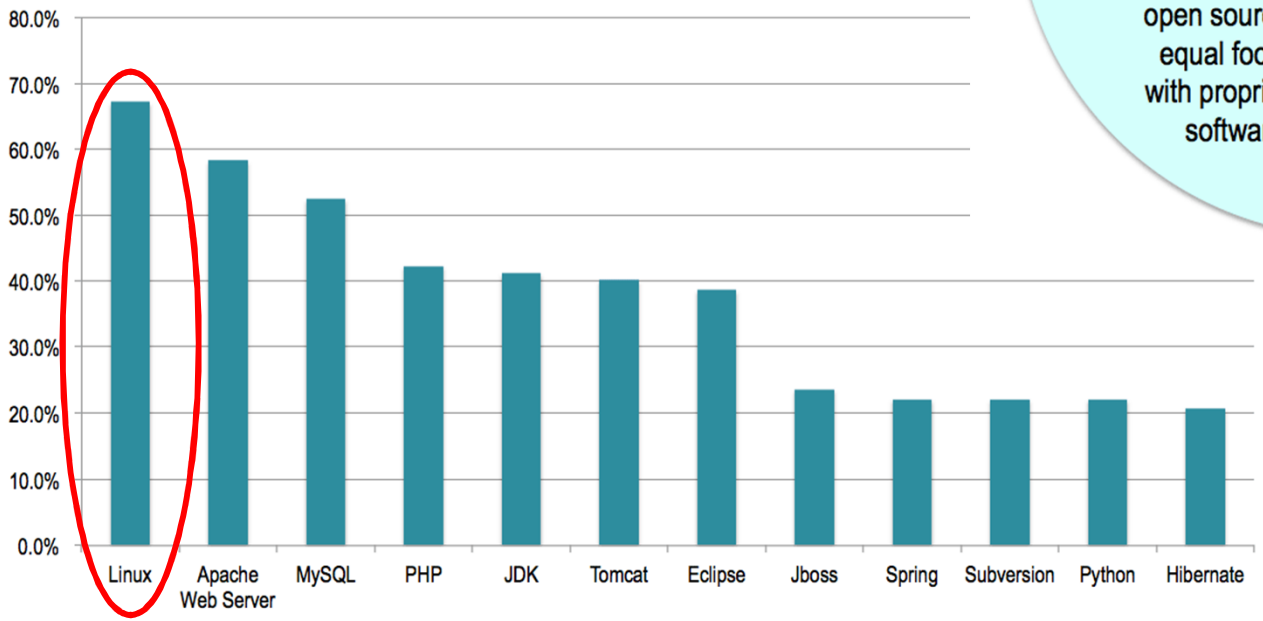
Open-Source in Enterprise

"Linux becomes strategic in the Enterprise to support Open-source project"

What is your company's stance toward open source software?

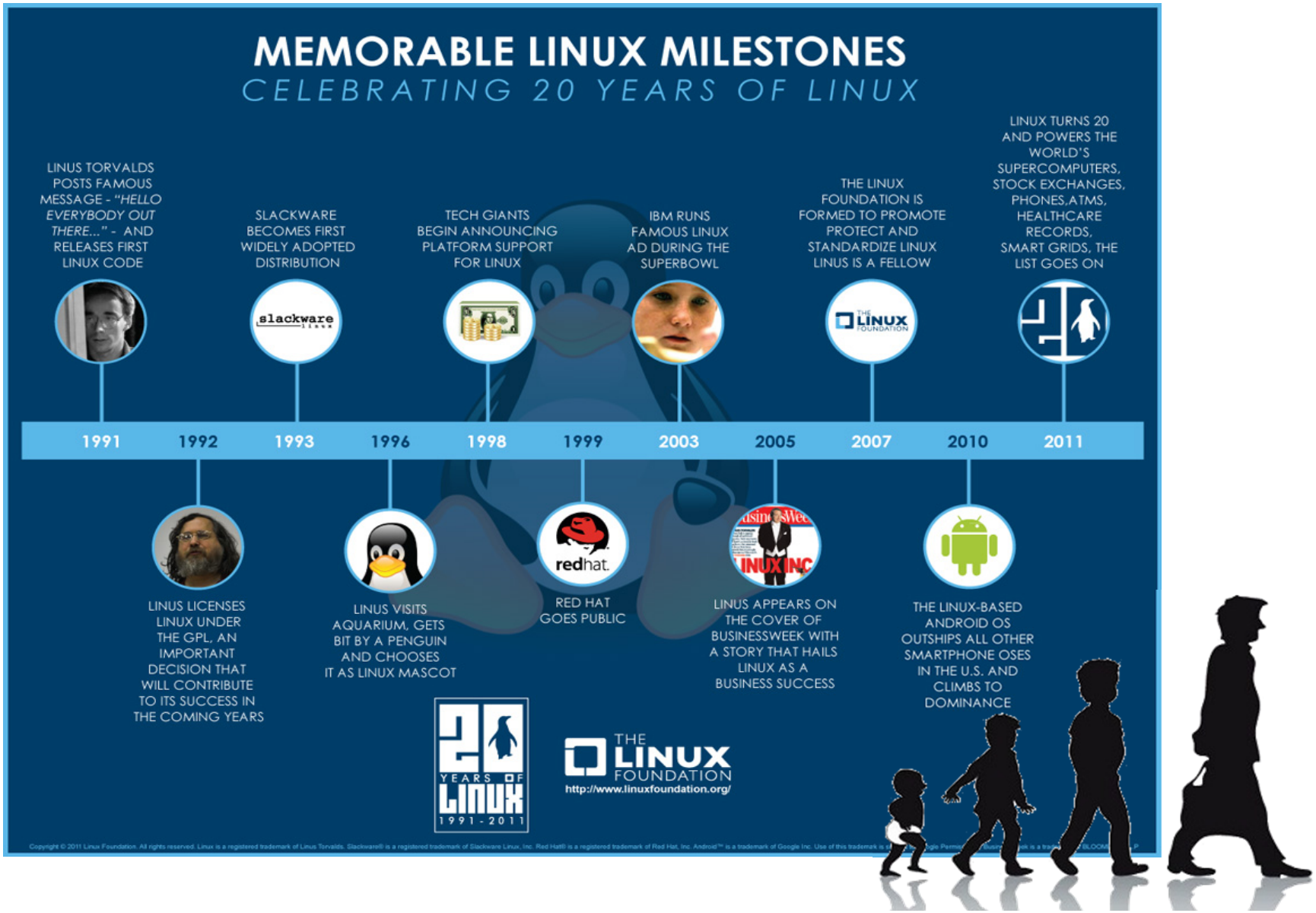


Which of the following open source projects does your company use?



http://www.openlogic.com/wazi/bid/187999/Survey-Shows-Enterprise-Open-Source-Usage-Ubiquitous

The LINUX History – a Mature Operating System



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Few Interesting Facts About Linux

Linux is the world's fastest growing Operating System

- Over 90% of world's fastest supercomputers, run on Linux
- 8 of the world's top 10 websites run on Linux (Google, YouTube, Yahoo, Facebook, Twitter)
- 80% of All Stock Exchanges in the world rely on Linux
- 95% of the servers used by Hollywood animation films run on Linux
- US Department of Defense is the "single biggest install base for Red Hat Linux" in the world

Enterprise Linux is growing with new types of workloads

- Big Data, Analytics and Cognitive Computing

IBM is focused on providing a NEW winning solution:
Linux on Power Systems

IBM is heavily invested in the success of Linux

100% of our systems (since 2001)

400+ software products

500 patents donated

600+ developers

… to support the Open Source Community

Power Systems

IBM

Customers Are Faced With Traditional Data Centers And Driving Innovation

Optimization

Reduce Cost & Minimize Risk

Innovation

Rapidly Add New Business Value

Linux on Power

Traditional Data Centers that focus on Optimization of Operational Costs

- Consolidation (solutions & infrastructure)
- Transactional Integrity
- Data Protection
- “Traditional” Analytics
- Qualities of Service

New Data that are focused on Speed and Agility

- Linux and Open Solutions
- Cloud Computing
- Fast development and deployments
- Big Data
- Cognitive Computing

Power Systems More Than Meet These Challenges With Two Approaches (AIX and Linux)

Offering the POWER advantage to emerging Linux Workloads

BigData

Mobile

Linux®

Cloud

Cloud

openstack™

Power™

Performance
Virtualization
Resiliency

Social

Power Systems

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April 2014: IBM Solutions based on Power System

Big Data & Analytics

Enhanced: IBM Solution for BLU Acceleration: Power Systems Edition

Highly scalable with Capacity on Demand for non-disruptive upgrades

NEW: IBM Solution Hadoop: Power Systems Edition

Storage-dense, optimized platform to simplify & accelerate big data analytics

NEW: : IBM Solution for Analytics: Power Systems Edition

50x faster reporting and analytics

Cognos Business Intelligence

SPSS predictive analytics

DB2 BLU for data warehouse

Mobile

NEW: Mobile Scale Out Sales Offering with Worklight & WebSphere Application Server

Efficiently develop, test, connect, run, and manage mobile and omni-channel applications

Cloud

Private Cloud: Update: Solution Edition for Cloud

Open source Linux solution for scale-out cloud servic

Hybrid Cloud: NEW: SmartCloud Entry for Power Systems

Next Generation with OpenAPIs delivers open alternative

Public Cloud: NEW: Solution Edition for Scale out Cloud

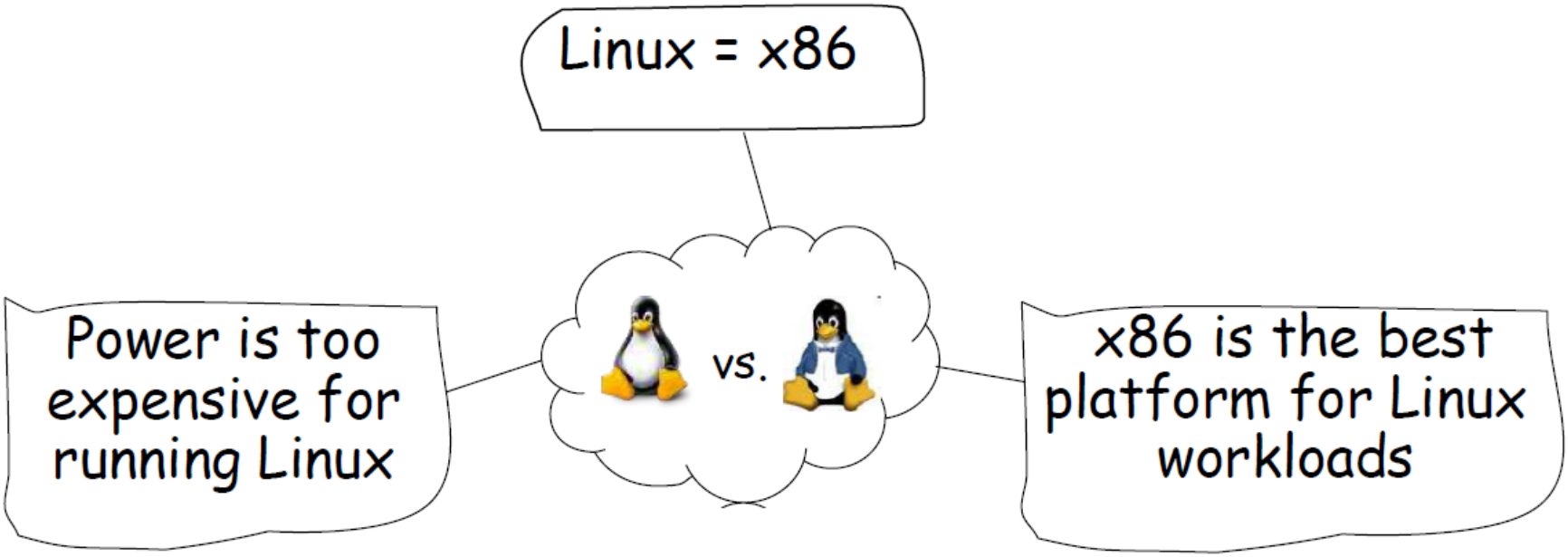
Pre-installed entry cloud system offers ability to get up and running in a day

Public Cloud: Update: Power Systems Solutions for Service Providers

Enhanced with new POWER8 scale-out configs, PowerK support, PowerVC enhancements and PAYG+

= Linux-focused solutions

The Linux myths



So why Linux on Power System ?

Power Architecture is Purpose Built

x86	Power
Design point is for multiple markets - Smart Phones, Ultra Books, Desktop, Servers	**Design point is "purposeful"** for new and existing Enterprise workloads (Analytics, Big Data, OLTP, ERP, SAP, etc.)
Design Goal: Increase the number of cores supported per server	**Design Goal:** Increase the performance per core while reducing the cost per workload
Optimizations: Limited to processor only	**Optimizations:** Integrate processor micro-architecture with hypervisor, OS, IBM middleware and IBM storage

⇒ Higher Performance per Core = less software licenses needed to accomplish the same amount of work

⇒ **Less software licenses = lower cost per workload**

POWER8 – Continued Leadership
(what you expected)

More Cores

Industry Best Practice

12 processor cores per socket (50% more than before) that deliver better per core performance

What this means
Enjoy better scale up performance, and more throughput per scale out server node.

More Threads

Industry Leading

SMT8 – 8 dynamic threads per core, supporting SMT1, 2, 4, & 8 modes dynamically across VMs

What this means
You choose – Deploy VM's in the optimal SMT mode based on application needs.

More Cache

Industry Leading

At 100MB, 3X the on-chip cache as POWER7 – plus 128MB of new off-chip cache as well

What this means
Memory-intensive applications (like database) will perform better as memory latency is reduced

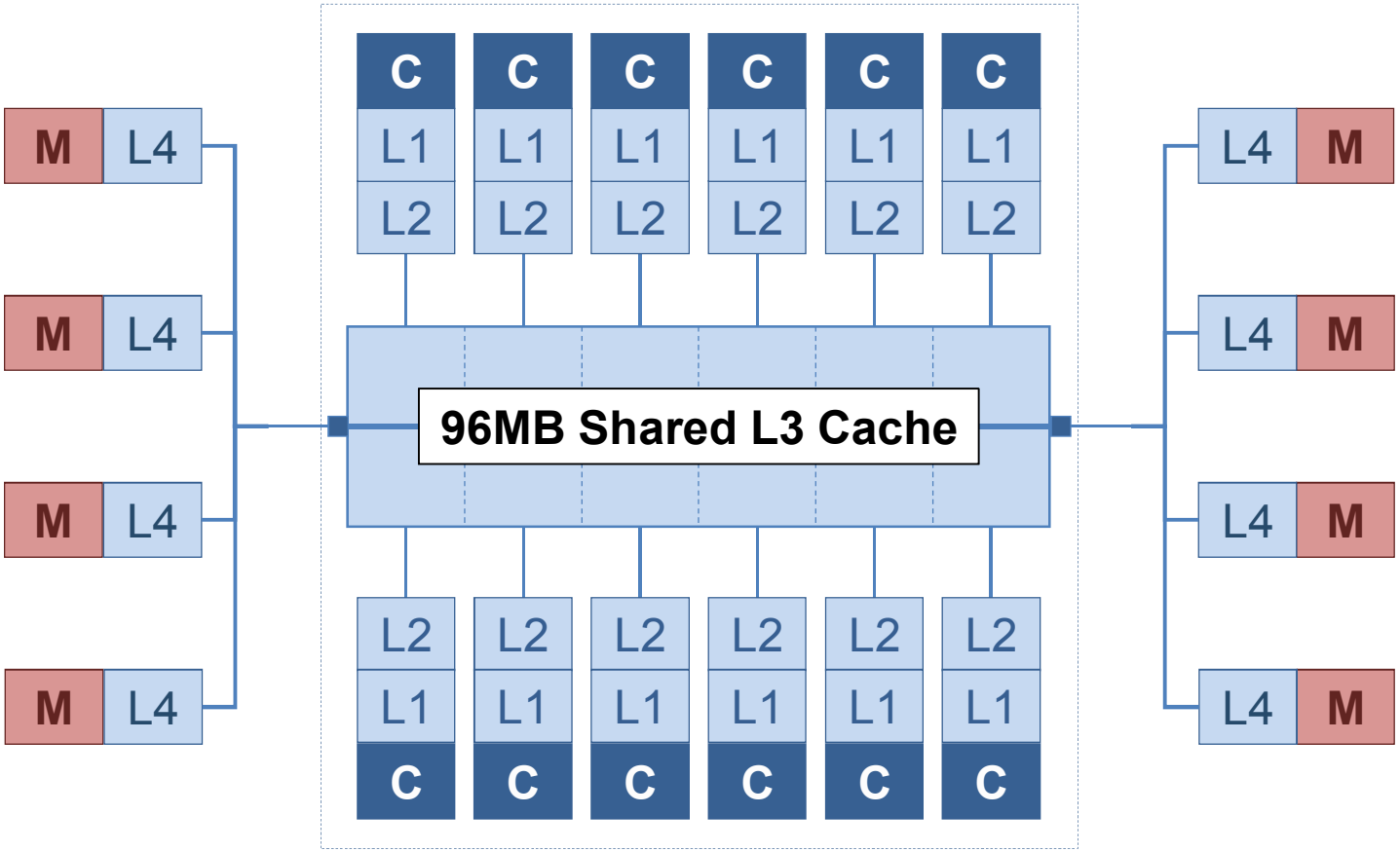
More Bandwidth

Industry Leading

2.3X our prior gen to memory, and 2.4X our prior gen to I/O.

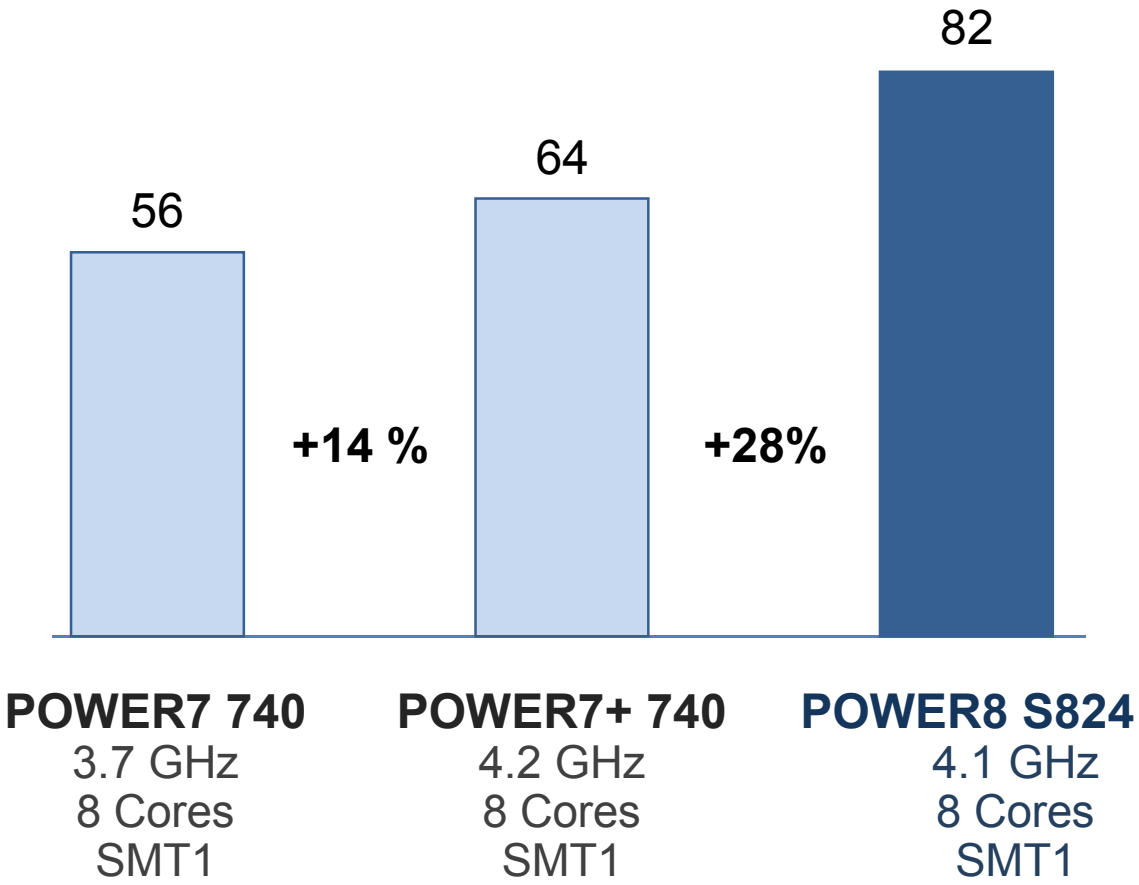
What this means
Data-hungry applications (like big data & analytics) will respond twice as fast and scale more efficiently.

POWER8 Cache: Close, Big, and Smart



12 cores per socket
8 HW threads per core (192 per socket)
96 MB Shared cache on die per socket
+ 128 MB Shared L4 Cache on DIMM

Single Thread Performance* is Increasing



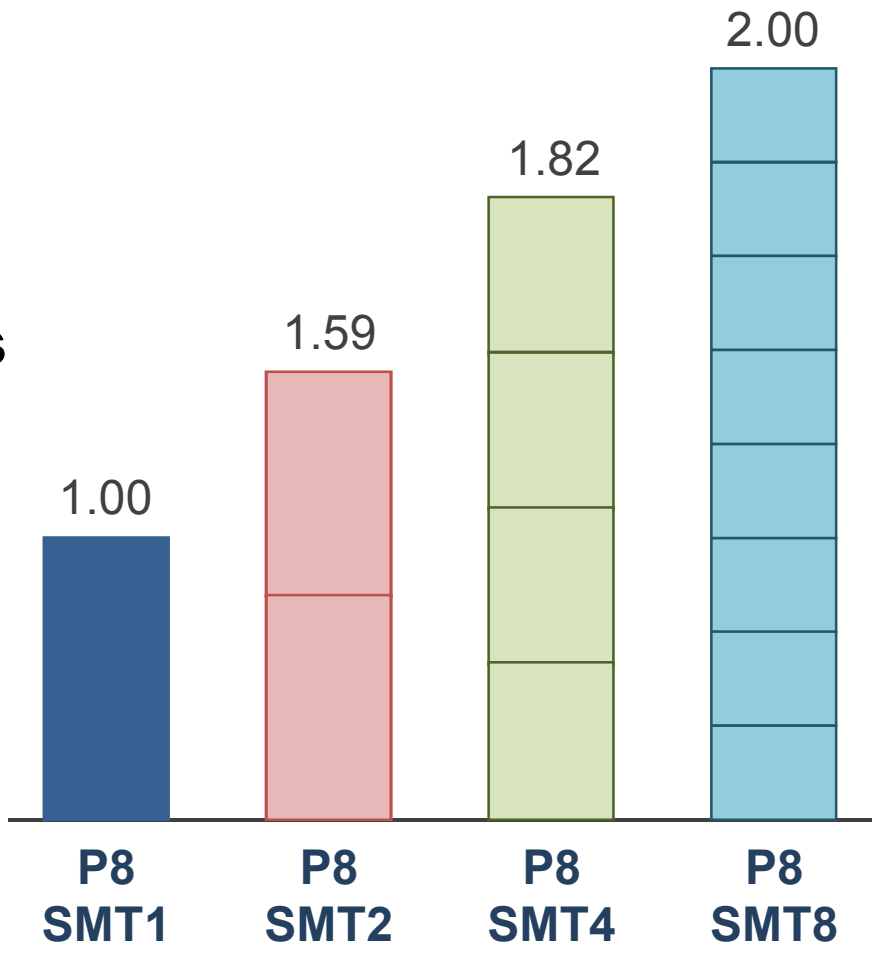
**Performance measured in rperfs*

Threading to Match Workload Needs

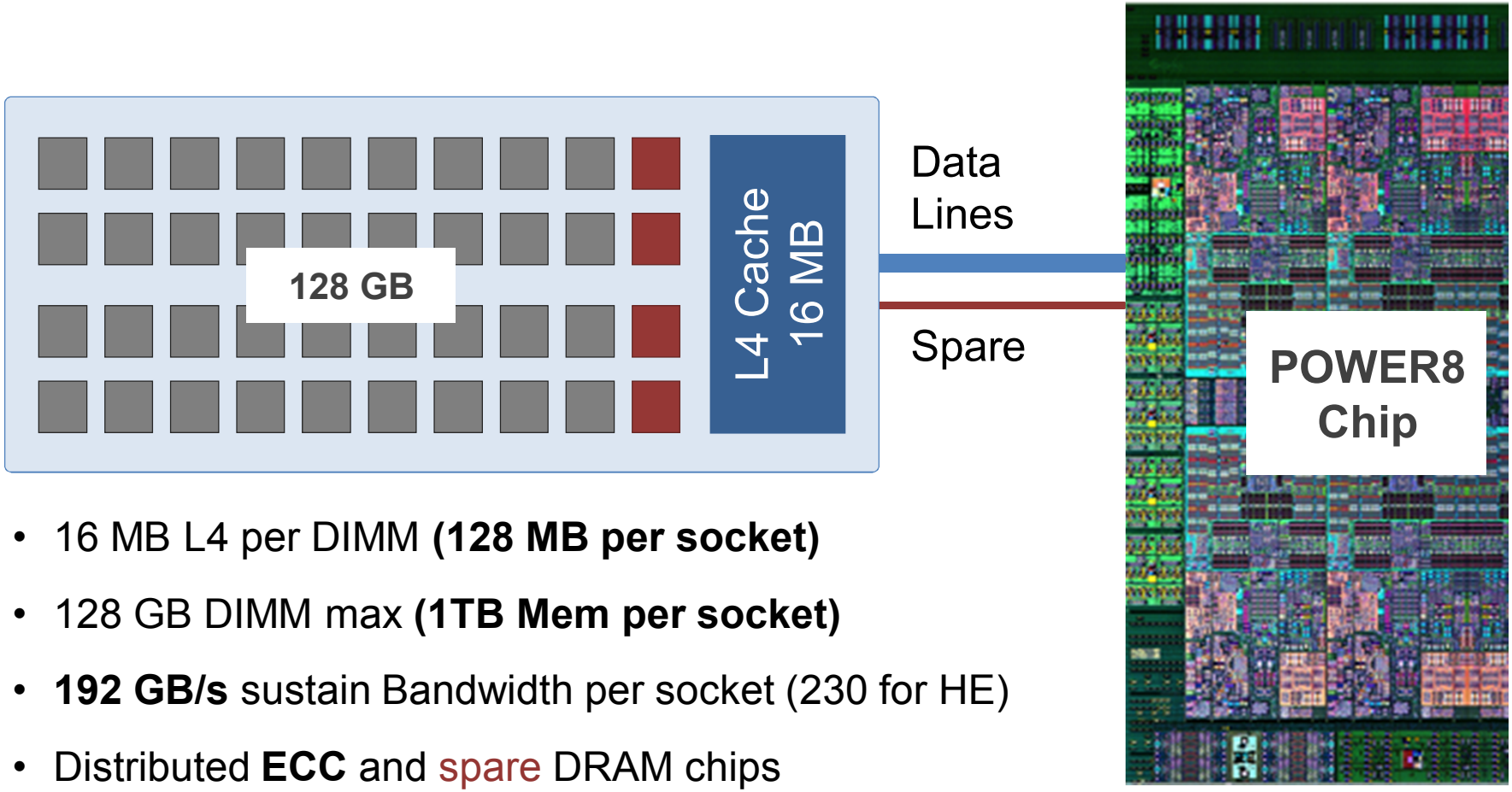
Set at **LPAR** level

Dynamically shift between modes as needed

Hardware enforced **fairness**

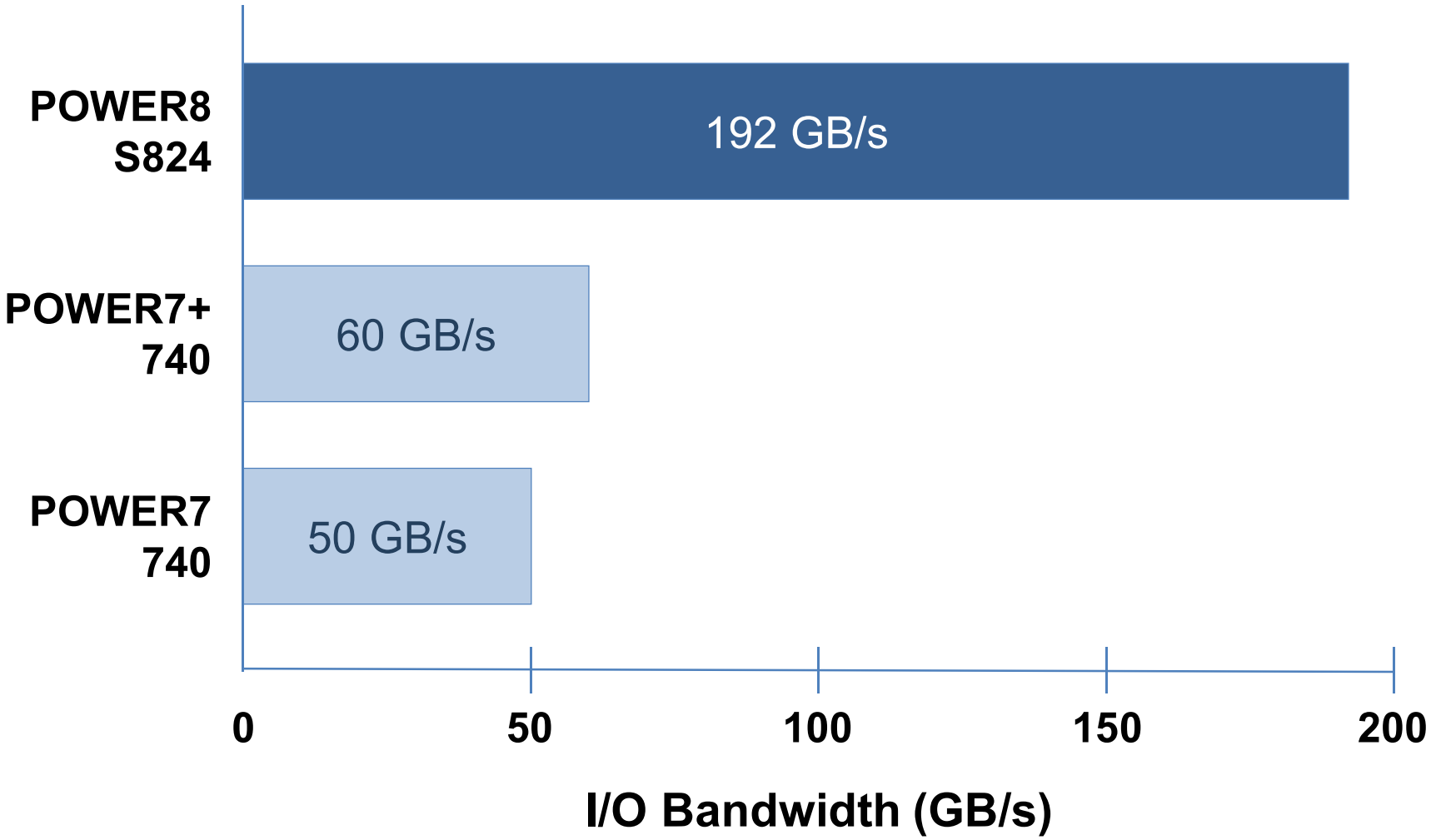


POWER8 Memory - Extends Memory RAS to Scale Out

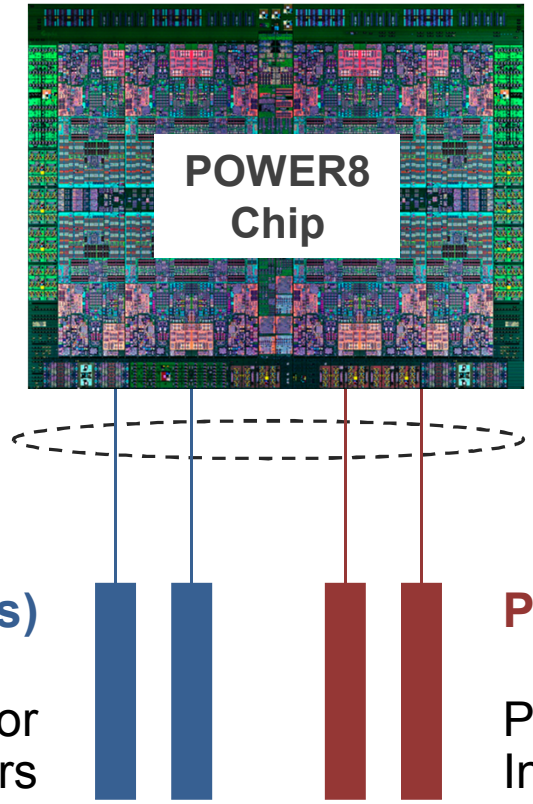


- 16 MB L4 per DIMM **(128 MB per socket)**
- 128 GB DIMM max **(1TB Mem per socket)**
- **192 GB/s** sustain Bandwidth per socket (230 for HE)
- Distributed **ECC** and spare DRAM chips
- Spare bus lines
- Buffer allows for **future DDR4 memory**

Max Peak I/O Bandwidth (2-Socket)



POWER8 I/O Architecture for Scale Out



PCIe Gen3 on Chip
48 PCIe Gen3 Lanes
96 GB/s Peak Bandwidth

PCIe Gen3 x16 (32 GB/s)

PCIe adapters or
External* I/O drawers

PCIe Gen3 x8 (16 GB/s)

PCIe adapters or
Internal Gen3 switches

* External I/O drawers have not yet been announced.

Cache, Bandwidth and Threading per socket

Chip Family	Cache per Core (MB)	Memory Bandwidth per Socket	Peak I/O Bandwidth per Socket	Threads per Core
Intel EN E5-v2 (8+ core)	2.81	38.4 GB/s *	48 GB/s	1, 2
Intel EP E5-v2 (8+ core)	2.81	59.7 GB/s *	80 GB/s	1, 2
Intel EP E5-v3 (8+ core)	2.81	68.3 GB/s *	80 GB/s	1, 2
Intel E7-v2 (8+ core)	2.81	85 GB/s **	64 GB/s	1, 2
POWER8 (8+ core)	8.6***	192 GB/s 230 GB/s	96 GB/s	1, 2, 4, 8

* NO RAS features
** Results must be divided by 2 when RAS is enable
*** Internal Cache (L1,L2,L3). 19.2 MB if we add L4 cache

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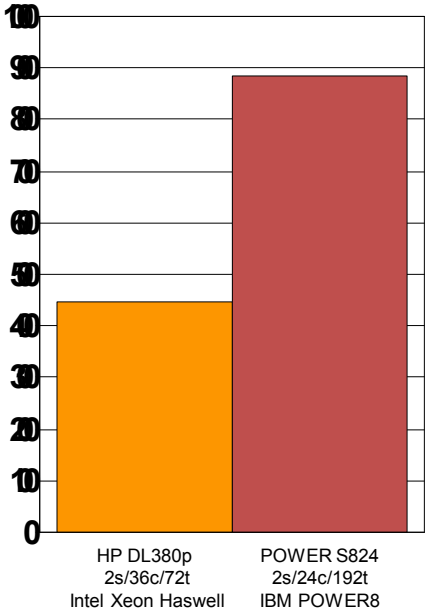
Updated with Haswell

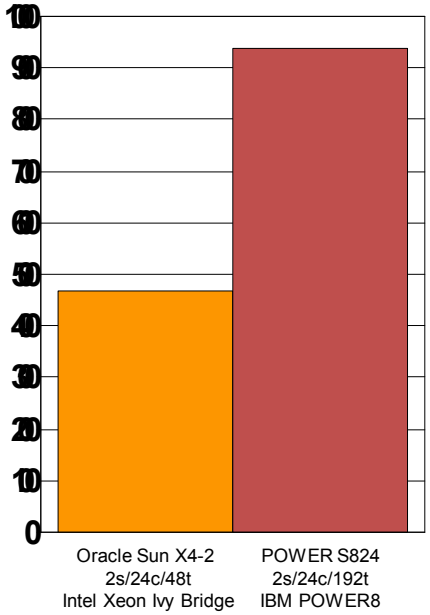
Up to TWICE the performance per core across key workloads

compared to the top 5 Intel vendors

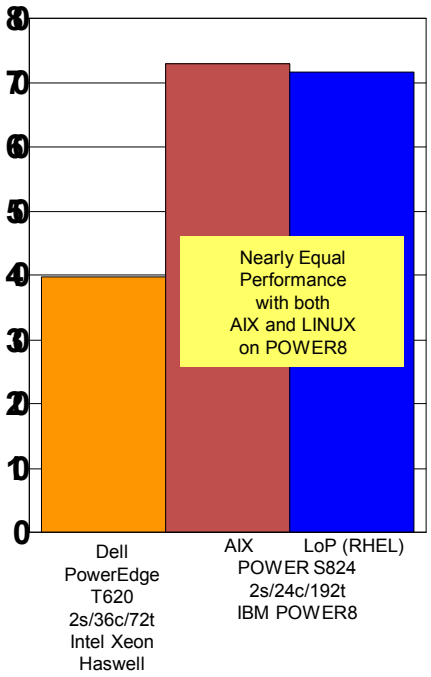
ERP – SAP 2-Tier (Users)
2.0x Performance



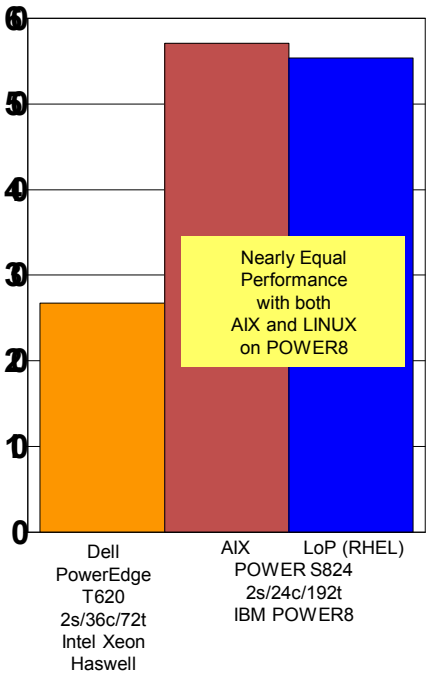
Java - SPECjEnterprise2010 (EjOPS)
2.0x Performance



SPECint_rate2006
1.8x Performance



SPECfp_rate2006
2.1x Performance



1) Results are based on best published results on Xeon E5-2697 v2 and E5-2699 v3 from the top 5 Intel system vendors (HP, Oracle, IBM, Dell, Fujitsu).
2) SAP results are based on the two-tier SAP SD standard application benchmark running SAP enhancement package 5 for the SAP ERP 6.0 application. Results valid as of September 8, 2014. Source: http://www.sap.com/benchmark
3) SPECjEnterprise2010 results are valid as of 9//8/2014. For more information go to http://www.specbench.org/jEnterprise2010/results/
4) SPECcpu2006 results are submitted as of 9/8/2014. For more information go to http://www.specbench.org/cpu2006/results/

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POWER8 vs. Intel x86 Benchmark Results

Benchmark	x86	Results	POWER8	Results	Ratio
Oracle eBS 12.1.3 Payroll	Cisco UCS C240 M3 E5-2697 v2 24 Core Ivy Bridge	1,017,639	IBM S824 12 Core	1,090,909	2.1 X
SAP SD 2-Tier ERP 6	Fujitsu RX300 S8 E5-2697 v2 24 Core Ivy Bridge	10,240	IBM S824 24 Core	21,212	2.1 X
Siebel CRM Release 8.1.1.4	Cisco UCS B200 M3 E5-2690 16 Core Sandy Bridge	10,000	IBM S824 6 Core	50,000	13.3 X

IBM Power System S824 on the two-tier SAP SD standard application benchmark running SAP enhancement package 5 for the SAP ERP 6.0 application; 4 processors / 24 cores / 192 threads, POWER8; 3.52GHz, 512 GB memory, 21,212 SD benchmark users, running AIX® 7.1 and DB2® 10.5, dialog response: 0.98 seconds, line items/hour: 2,317,330, dialog steps/hour: 6.952,000 SAPS: 115,870 database response time (dialog/update): 0.011 sec / 0.019sec, CPU utilization: 99%, Certification #2014016: * Results valid as of 3/24/14. Source: http://www.sap.com/benchmark.
Fujitsu RX300 S8 on the two-tier SAP SD standard application benchmark running SAP enhancement package 5 for the SAP ERP 6.0 application; 2 processors / 24 cores / 48 threads. Intel Xeon E5-2697 processor 2.70 GHz, 256 GB memory, 10.240 SD benchmark users, running Windows Server 2012 SE and SQL Server 2012, Certification #: 2013024

All results use Oracle eBS 12.1.3 Payroll Batch Extra Large Kit and are current as of 3/24/2014.
For more information go to http://www.oracle.com/us/solutions/benchmark/apps-benchmark/results-166922.html

All results use Siebel 8.1.1.4 PSPP Kit and are current as of 3/24/2014. For more information go to http://www.oracle.com/us/solutions/benchmark/white-papers/siebel-167484.html

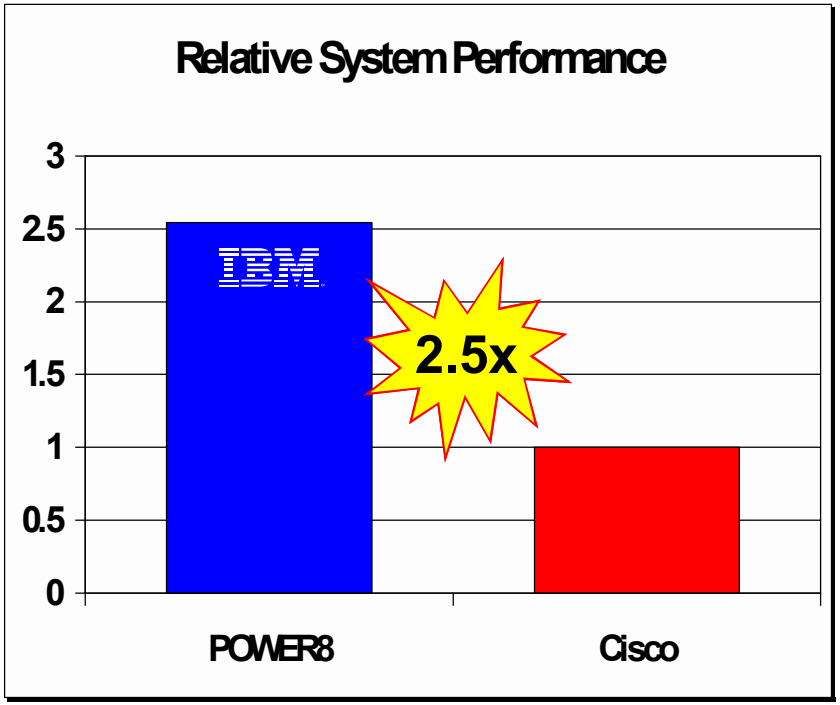
Power Systems

IBM

POWER8 delivers **2.5x performance** on Big Data / Hadoop

Terasort benchmark on a POWER8 doubles the system capacity of the best x86 published result

- **POWER8 S822L will deliver over 2.5x the performance of the best published x86 system**
  … and continues to offer far superior RAS
- **POWER8 exploits additional cores, more threads, larger caches, memory bandwidth**
- **Terasort is a popular benchmark to measure the performance of a Hadoop solution**
  - Sorts a large dataset (10 TB) in parallel
  - Exercises the Map-reduced framework and Hadoop Distributed File System (HDFS)



IBM Analytics Stack: IBM Power System S822L; 24 cores / 192 threads, POWER8; 3.0GHz, 512 GB memory, RHEL 6.5, InfoSphere BigInsights 3.0

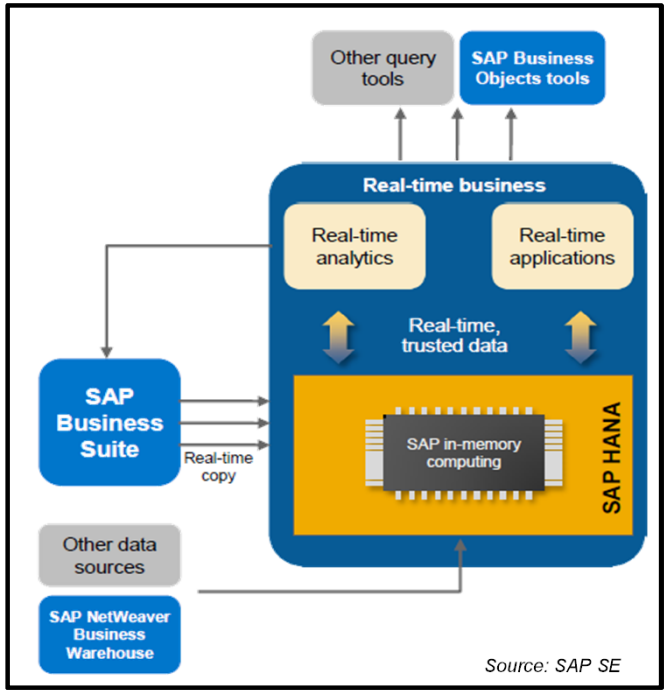
http://www.cisco.com/en/US/solutions/collateral/ns340/ns517/ns224/ns944/le_tera.pdf

Power Systems

IBM

HANA on Power: The next, new Linux workload...

NEW



- Accelerated Analytics
  - Deliver faster insight and manage 'big data'
  - No anticipation of data aggregation and query pre-compilation
- New Applications and Business Processes
  - Transform "offline" transactions to real-time interaction
  - Improve quality and agility of business
- Logical and physical Simplification
  - Ideally, one consistent data model for OLTP and OLAP
  - No data transformation (ETL)

- June 2014 – IBM & SAP joint statement from SAPPHIRE:
  - "SAP and IBM have a long-standing successful technology partnership, and we are excited about extending that partnership with the Test and Evaluation Program for SAP HANA running on Linux on IBM Power Systems"
    Source: http://www.marketwatch.com/story/sap-fosters-open-ecosystem-for-driving-customer-innovation-2014-06-04
  - "SAP and IBM continue to collaborate closely with the intent to enable SAP Hana to run on the IBM Power technology, including Power7+ and the newly introduced Power8 system on Linux."
    Source: http://www.itjungle.com/tfh/tfh060914-story03.html
- Watch for more details...

Power Systems

Open innovation to put data to work

Power8 server family available in 2014

New Logo & New System Naming

Power Systems

S824(L)

ScaleOut Power8 2sockets 4U (LINUX)

Power Systems

IBM

Power Scale-out Servers

NEW
Announce
October 6th

Power Systems S812L

1-socket, 2U
POWER8 processor
Linux only
CAPI support (2)

Power Systems S822L

2-socket, 2U
POWER8 processor
Up to 24 cores
1 TB memory
9 PCI Gen3 slot
Linux only
CAPI support (4)
PowerVM & PowerKVM

Power Systems S822

2-socket, 2U
Up to 20 cores
1 TB memory
9 PCIe Gen 3
AIX & Linux
CAPI support (4)
PowerVM

Power Systems S814

1-socket, 4U
Up to 8 cores
512 GB memory
7 PCIe Gen 3
AIX, IBM i, Linux
CAPI support (2)
PowerVM

Power Systems S824L

2-socket, 4U
Up to 24 cores
Linux
NVIDIA GPU
CAPI support(2)

Power Systems S824

2-socket, 4U
Up to 24 cores
1 TB memory
11 PCIe Gen 3
AIX, IBM i, Linux
CAPI support (4)
PowerVM

1 & 2 Sockets

openstack CLOUD SOFTWARE

AIX

for Business

Linux

PowerSC PowerVC

PowerHA PowerVP

PowerKVM

ubuntu Supported by Canonical

SUSE

redhat

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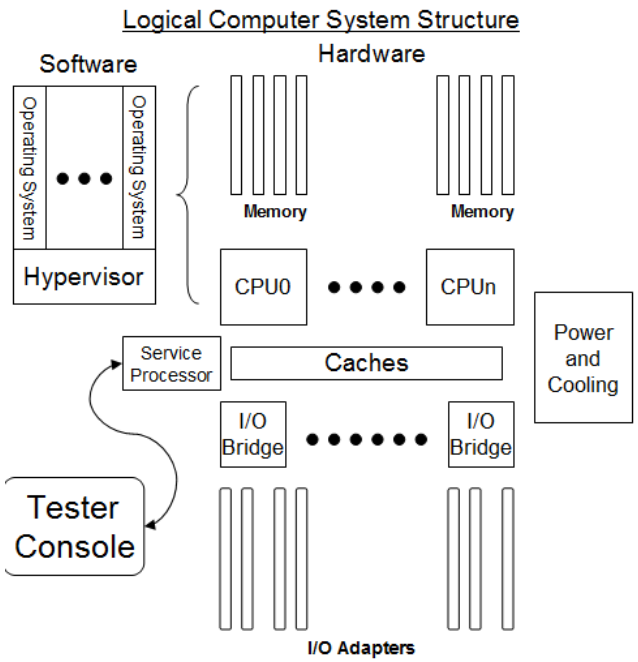
Processor RAS Test Point Comparison – Power Has Significantly More Than Intel



Test Area	x86 (Ivy Bridge) (Test Points)	POWER 7 (Test Points)	POWER8
Processors and Caches	50+	5000+	6500+
Memory	20+	100+	120+
I/O Bridges	15+	250+	400+
I/O Adapters and Devices	70-100 per adapter and device	70-100 per adapter and device	70-100 per adapter and device
Power and Cooling	10-20	10-20	10-20
Hypervisor and Virtualization	20-30 per hypervisor	100+ for PowerVM	100-120 for PowerVM/ PowerKVM
Service Processor	30+	50+	70+

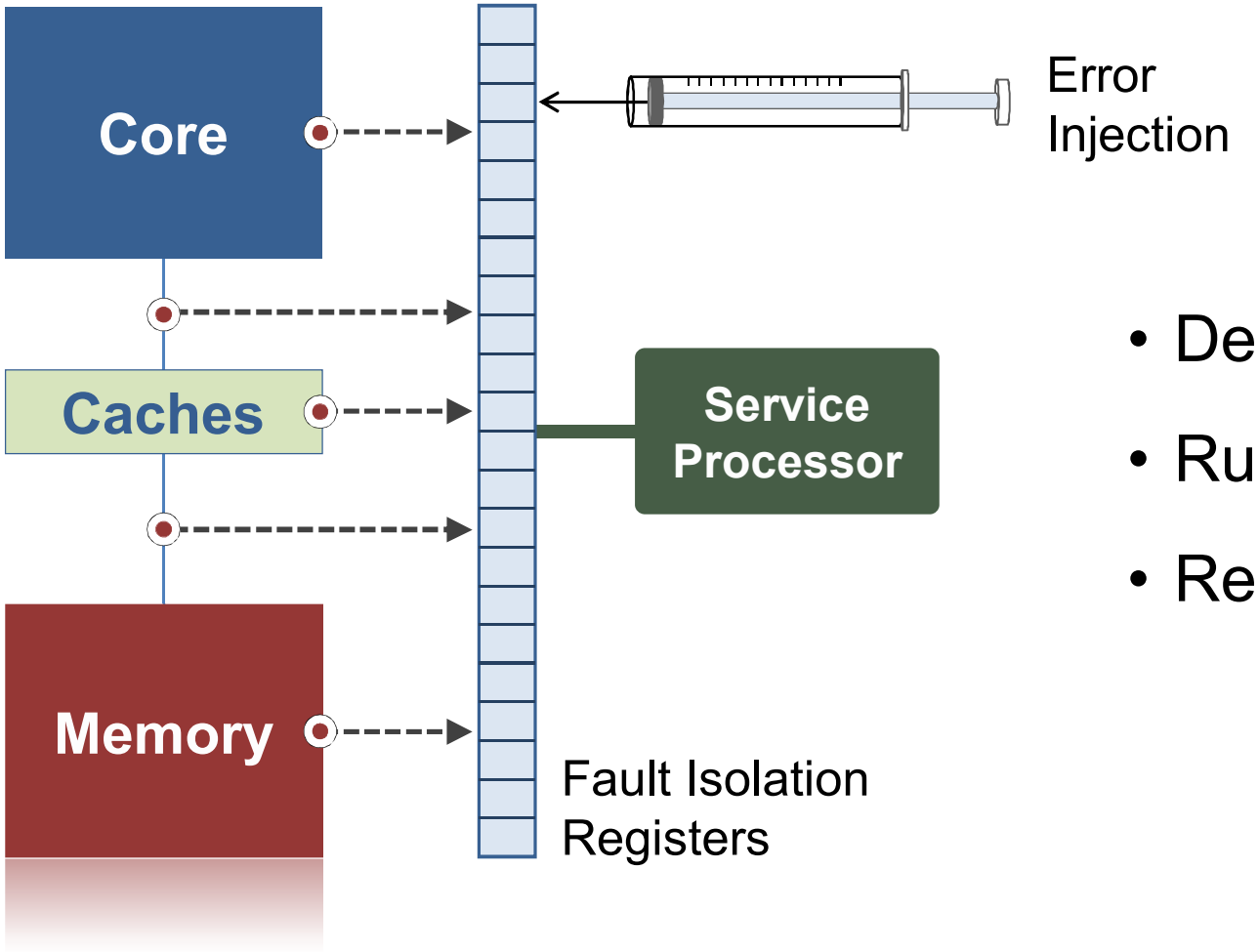
Test Point:
Represents individual failing latches in the hardware and fault isolation summary bits

Additional Differentiators:

Power Systems Test has more sophisticated RAS tools allowing deeper coverage.

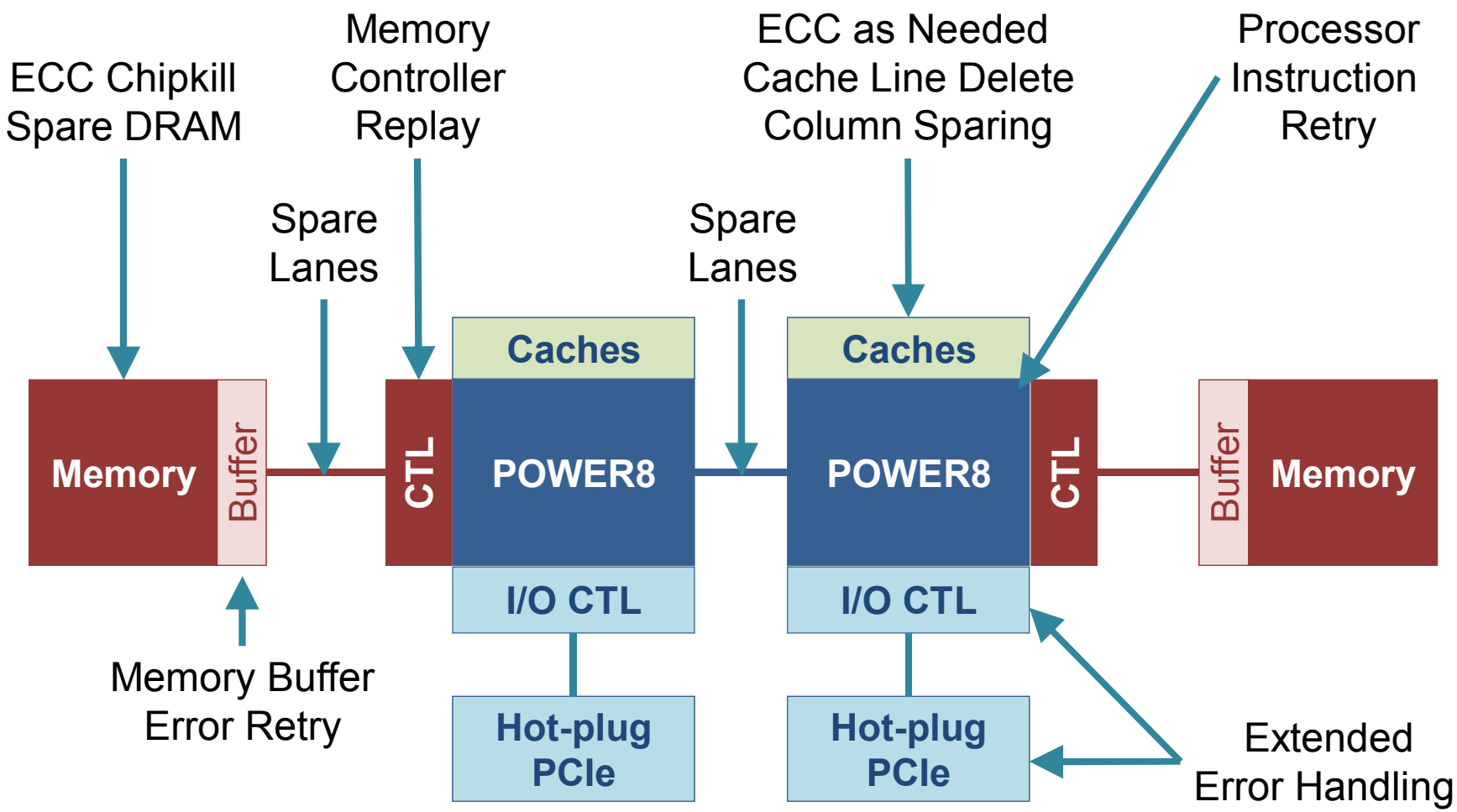
Power System Test 'Must-Fix Criteria' for RAS defects are more rigorous than for x86 servers.

First Failure Data Capture



- Design-time
- Run-time
- Repair-time

Resolve Errors Transparently in Hardware



Power System *"Classical"* vs. Linux-Only server
What Is The Difference?

- Linux on Power is Linux running on any Power System
- Power8 Linux-Only servers have the same HW, but cannot run AIX or IBMi
  - With a lower cost to the customer for this "bundling"

Examples:

POWER8

S822L

20 cores @ 3.5 GHz
24 cores @ 3.0 Ghz

Firmware enabled to only run Linux

KVM → Linux, redhat, SUSE, ubuntu

PowerVM → Linux, redhat, SUSE

S822

20 cores @ 3.5 GHz

Can run AIX, System i and Linux

PowerVM → Linux, redhat, SUSE

Power Systems

Pricing comparison ($US) – *vs. Ivy Bridge*

IBM

Comparable TCA

Linux on Intel Ivy Bridge + VMware Vs. Linux on Power7+ with PowerVM

Dell PowerEdge R720	HP ProLiant DL380 G8	IBM Power 822L
$28,366	**$29,829**	**$29,264**

	Dell PowerEdge R720	HP ProLiant DL380 G8	IBM Power 822L
Server list price* -3-year warranty, on-site	**$12,605**	**$14,068**	**$14,895**
Virtualization - OTC + 3yr. 9x5 SWMA	**$10,064** VMware vSphere Enterprise 5.1	**$ 10,064** VMware vSphere Enterprise 5.1	**$9,880** 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: (Total cost of acquisition)	**$28,366**	**$29,829**	**$29,264**

Server model	Dell R720	HP Proliant DL380p G8	IBM Power 822L
Processor / cores	**Two 2.7 GHz , E5-2697, Ivy Bridge, 12-core processors**		**Two 3.4 GHz POWER8, 10-core**
Configuration	64 GB memory, 2 x 300GB 15k HDD, 10 Gb two port		Same memory, HDD, NIC

**** Based on US pricing for Power S822L announcing on April 28, 2014 matching configuration table above. Source: hp.com, dell.com, vmware.com***

Power Systems

Pricing comparison ($US) – *vs. Ivy Bridge*

IBM

Comparable TCA

Linux on Intel Ivy Bridge + KVM

Vs.

Linux on POWER8 + KVM

Dell PowerEdge R720	HP ProLiant DL380 G8	IBM Power 822L
$21,300	**$22,763**	**$22,382**
redhat KVM intel Ivy Bridge	redhat KVM intel Ivy Bridge	redhat KVM IBM POWER8

	Dell PowerEdge R720	HP ProLiant DL380 G8	IBM Power 822L
Server list price* -3-year warranty, on-site	**$12,605**	**$14,068**	**$14,895**
Virtualization - 2 sockets, 3 yr. 9x5 sub./supp.	**$2,998** KVM for Red Hat on x86 (RHEV)	**$ 2,998** KVM for Red Hat on x86 (RHEV)	**$2,998** KVM for Linux on Power (PowerKVM)
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
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Power Systems

IBM

SWG's 70 PVU Licensing

(Processor Value Unit)

70 PVUs
All Power cores running Linux

- Applies to SWG PVU licensed software products for **ALL** Power cores **running Linux**
- 70 PVU pricing previously only available for 1-2 socket servers
  - PowerLinux 7R1/7R2, p260/p270 and Power 710/720/730/740
  - Intel SandyBridge/IvyBridge servers
- 70 PVU pricing includes:
  - Power IFLs
  - Power 750 to Power 795
  - PowerLinux 7R4
  - Flex System p460
- Applies to Power8

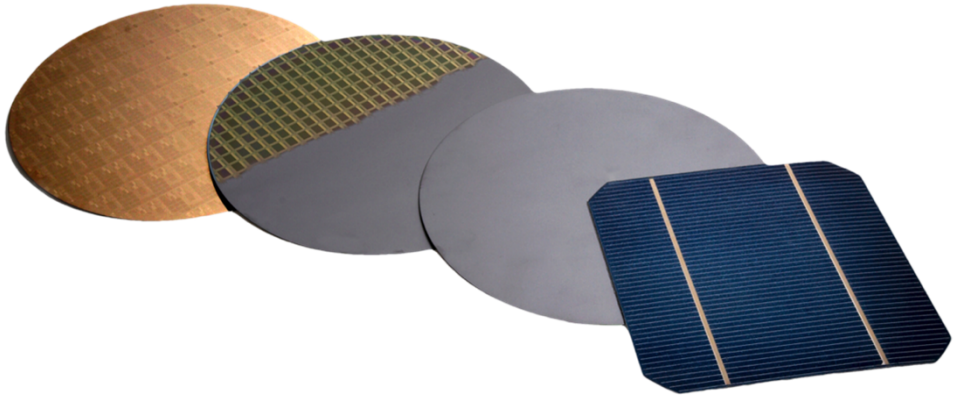
PVU Table per Core (section 1 of 2 - RISC and System z)

Processor Technologies												
	Processor Brand			Processor Type								
Processor Vendor	Processor Name	Server model numbers	Maximum number of sockets per server	Cores per socket (1)	(2)	(4)	(6)	(8)	(12)	IFL Engine	Proc. Model Number	PVUs per Core
IBM	POWER Systems cores running Linux OS	7R1, 7R2, 7R4 POWER IFL, p24L Any POWER System core running Linux	All			■	■	■	■		All	70
IBM	POWER7 [4]	770, 780, 795	> 4			■	■	■			All	120
IBM	POWER7 [4]	750, 755, 760, 775, PS704, p460, Power ESE	4			■	■	■			All	100
IBM	POWER7 [4]	PS700-703, 710-740, p260, p270	2			■	■	■			All	70
IBM	POWER6	550, 560, 570, 575, 595	All		■						All	120
IBM	POWER6	520, JS12, JS22, JS23, JS43	All		■						All	80

PVU Table link: http://www-01.ibm.com/software/lotus/passportadvantage/pvu_licensing_for_customers.html

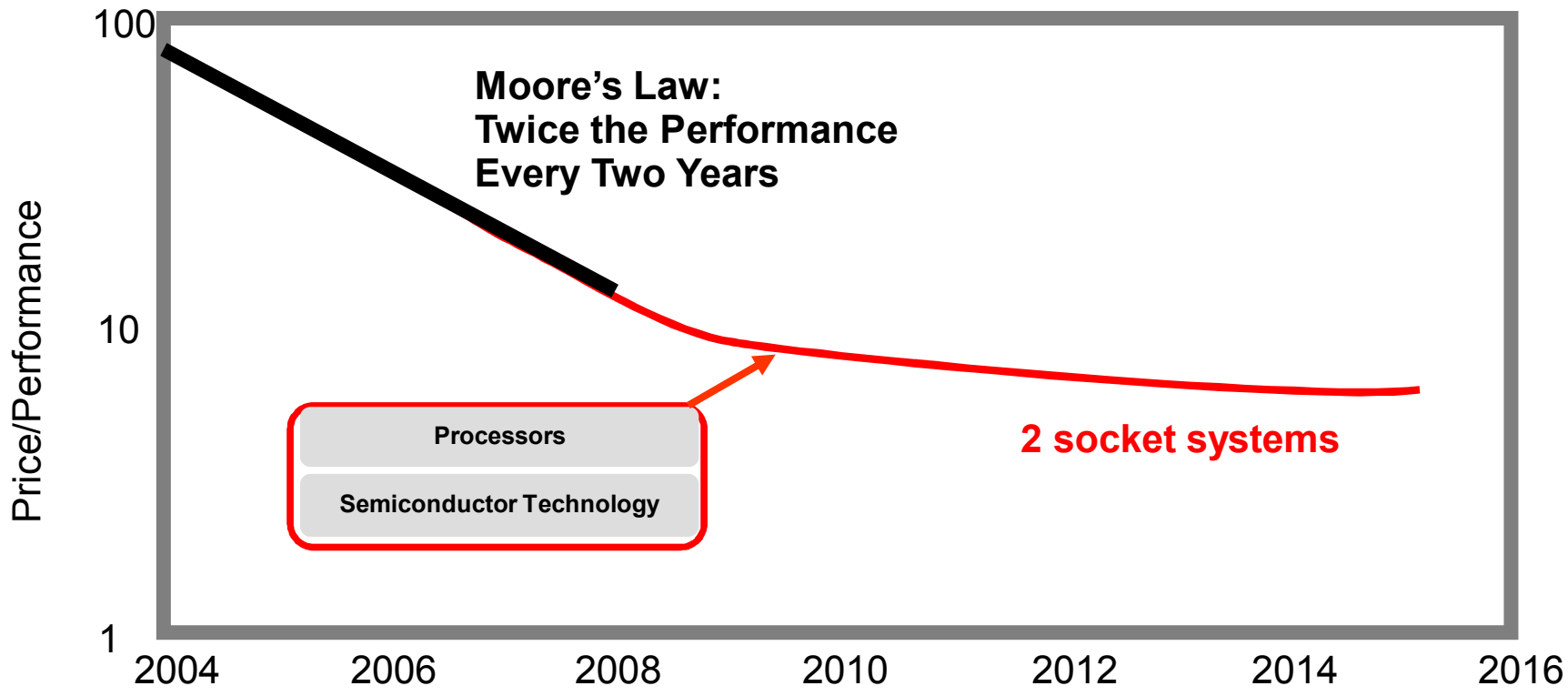
Power Systems

“Open – Innovation” Inside ;-)



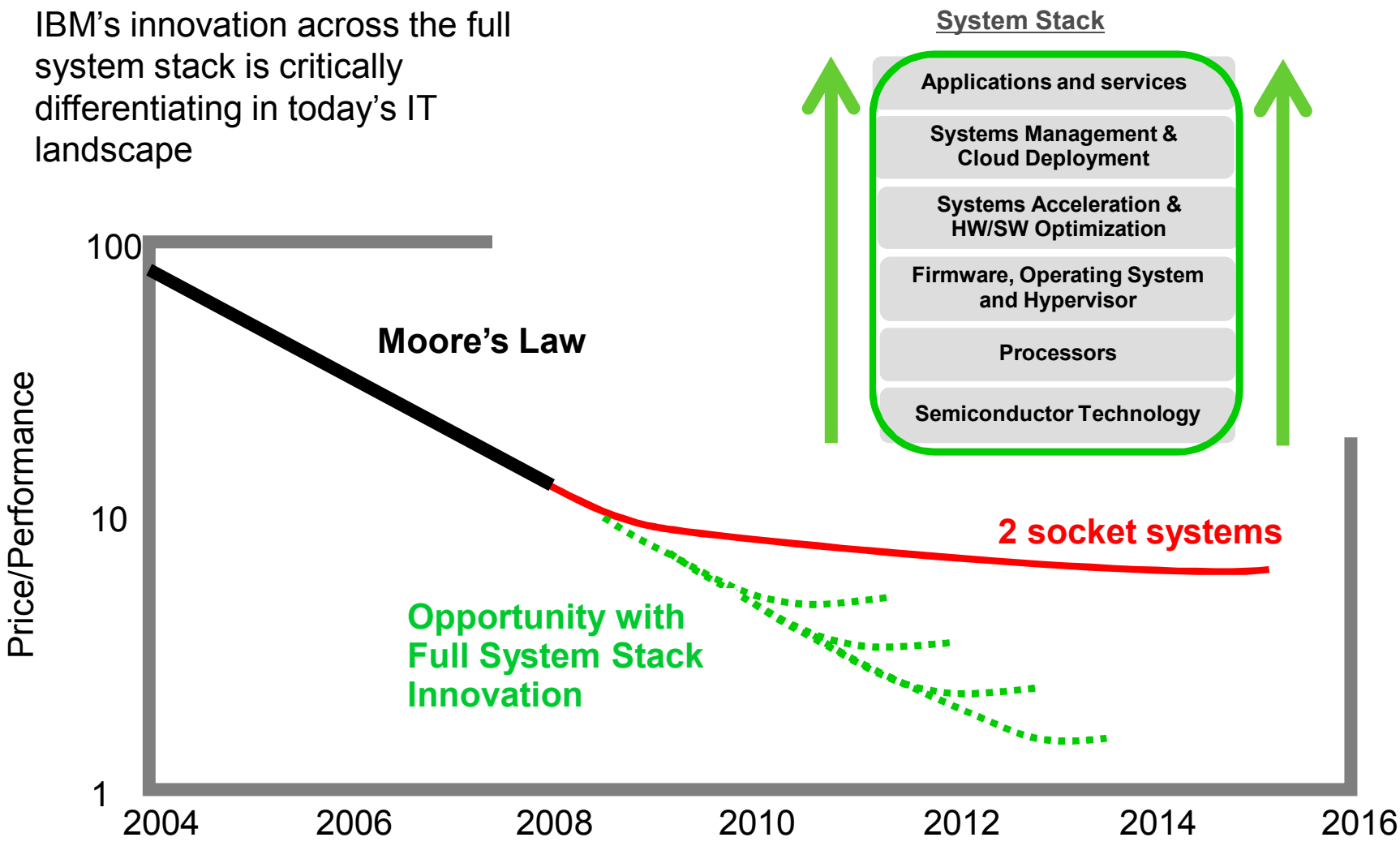
Why open is critical now

Microprocessors alone can no longer maintain the promise of Moore's Law



System level value has never been more important

IBM's innovation across the full system stack is critically differentiating in today's IT landscape



POWER8 – Innovating for Tomorrow

Industry Innovation

CAPI

Open interface allows PCIe3 devices to participate in operations at memory speed without risk.

What this means

Gain orders of magnitude application performance with PCI card technology w/o hiring specialized skills

Innovation Extended

Transactional Memory

Borrowed from the mainframe, this technology speeds up memory writes by reducing contention.

What this means

A feature that improved OLTP database performance by 45% on System z is now available on Power.

Innovation On Power

Native PCIe

Integrating PCIe Gen 3 into the processor boosts performance by eliminating logic overhead.

What this means

I/O intensive data applications will run faster due to high bandwidth, low latency communications.

Innovation On Power

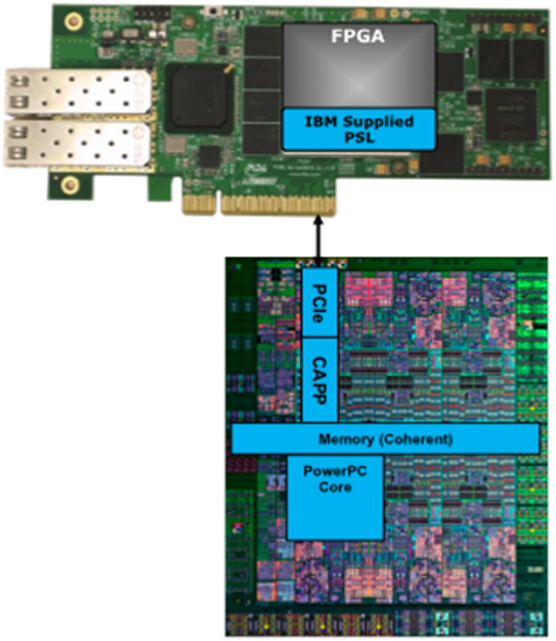
PowerKVM

KVM, the open-source virtualization solution, can be used to manage Linux-only systems.

What this means

Data centers can now standardize their clouds with a single open-source virtualization technology.

CAPI – an open invitation to innovate on POWER

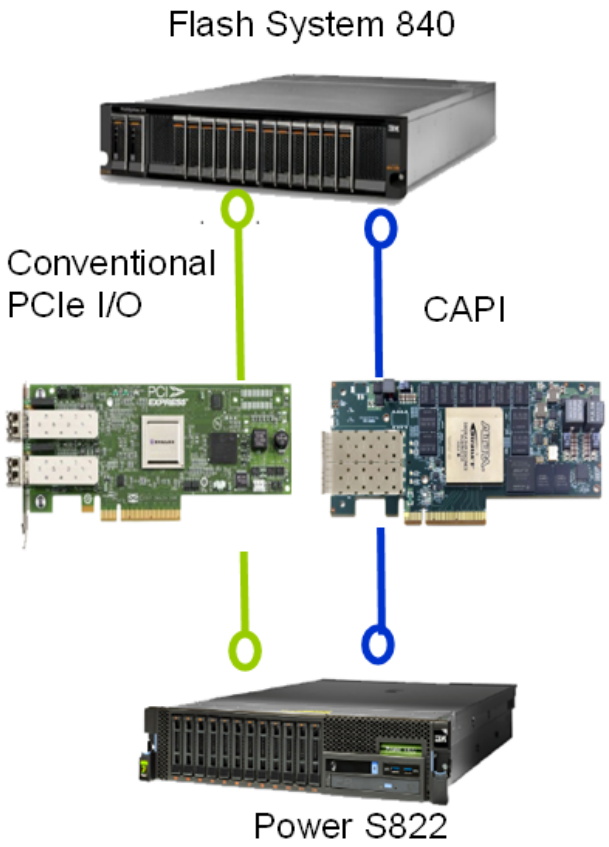


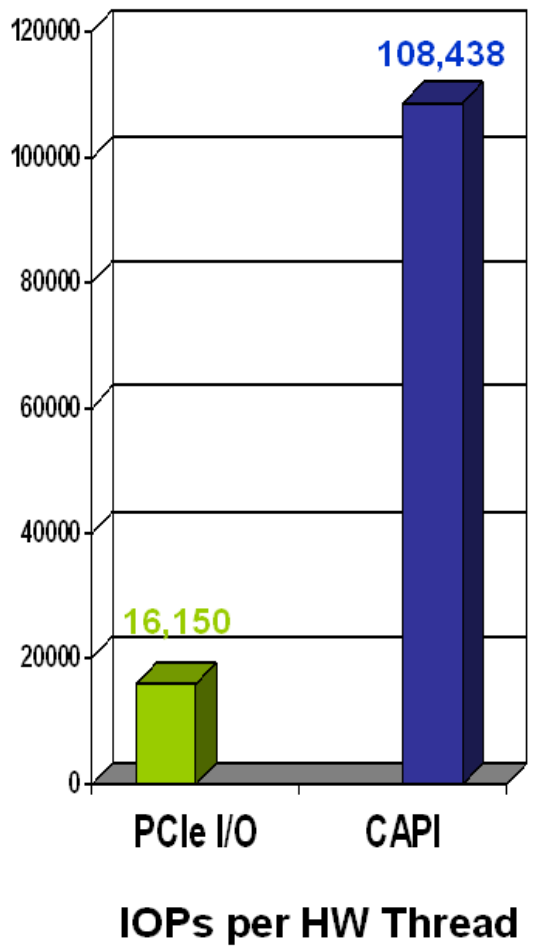
Power Processor

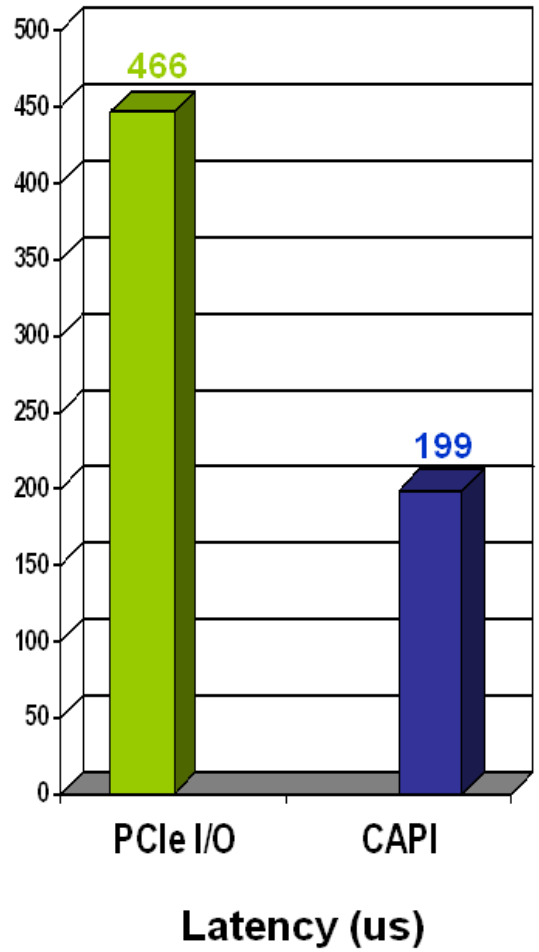
- **Coherent Attached Processor Proxy (CAPP) in processor**
  - Unit on processor that extends coherency to an attached device
- **Coherency protocol tunneled over standard PCIe**
  - Eliminates the need for special I/Os and protocol logic
- **Enables attached device to be a peer to the processor**
  - Simplifies programming model between application
  - Enables device to use same effective address as application running in processor
  - Eliminates the cumbersome I/O Device Driver requirements
- **Accelerator example :**
  - ASICS
  - GPU
  - FPGA
  - Network
  - FlashDisks
  - …

Demonstrating the Value of CAPI Attachment

Identical hardware with 2 different paths to data



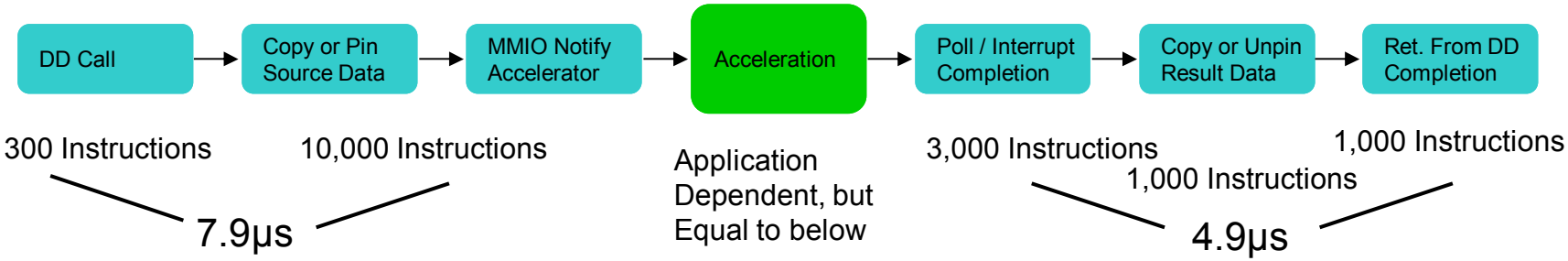




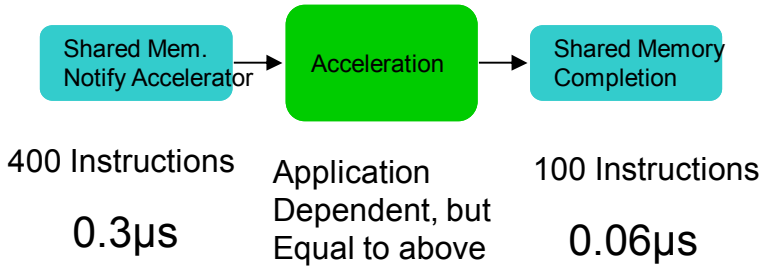
Demonstrating the Value of CAPI Attachment (2)

CAPI vs. I/O Device Driver: Data Prep

Typical I/O Model Flow: Total ~13µs for data prep

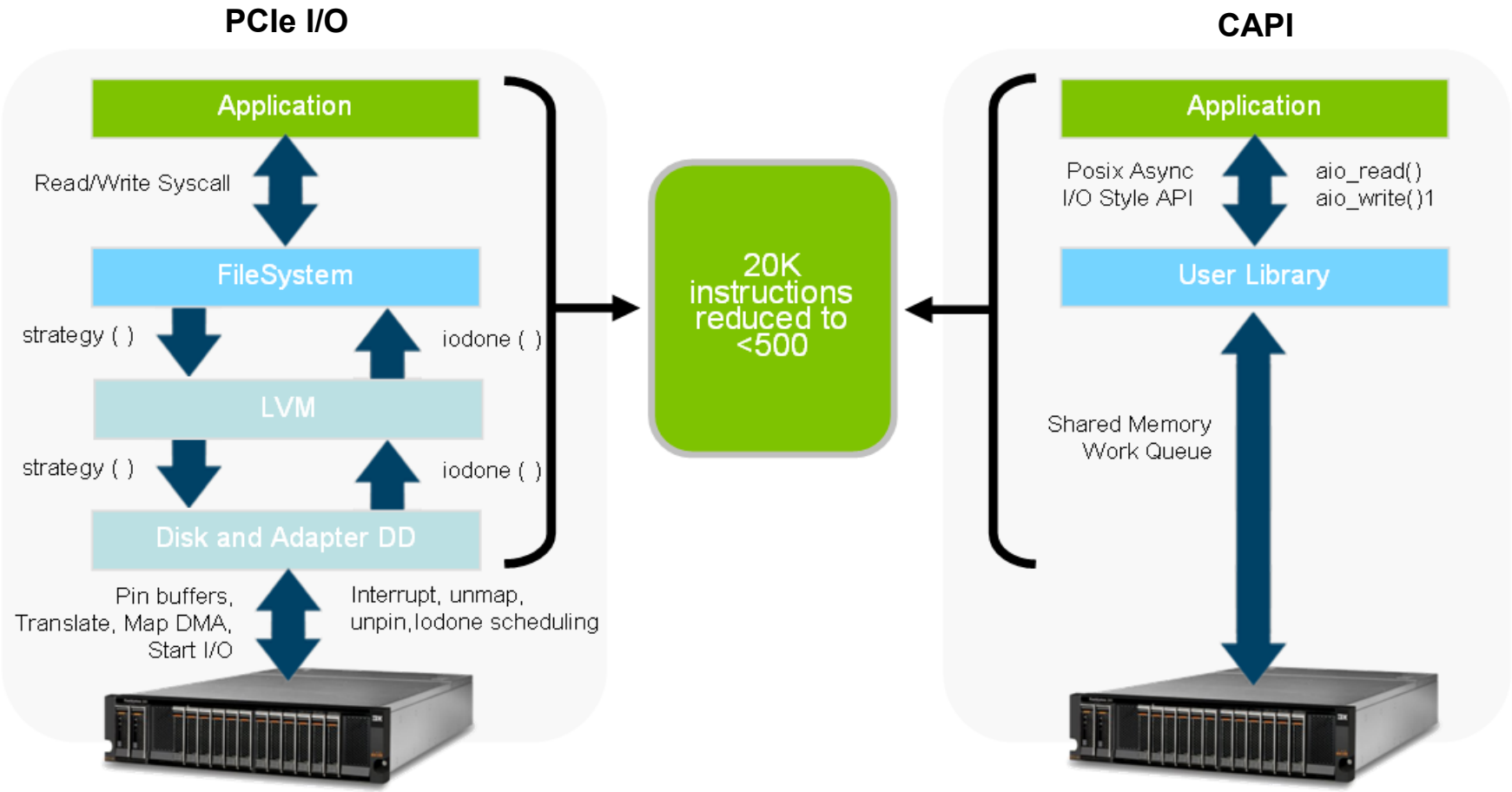


Flow with CAPI (coherent model): Total 0.36µs



Demonstrating the Value of CAPI Attachment (3)

- Attach TMS Flash to POWER8 via CAPI coherent Attach
- Issues Read/Write Commands from applications to eliminate 97% of code path length
- ► Saves ~20 cores per 1M IOPs



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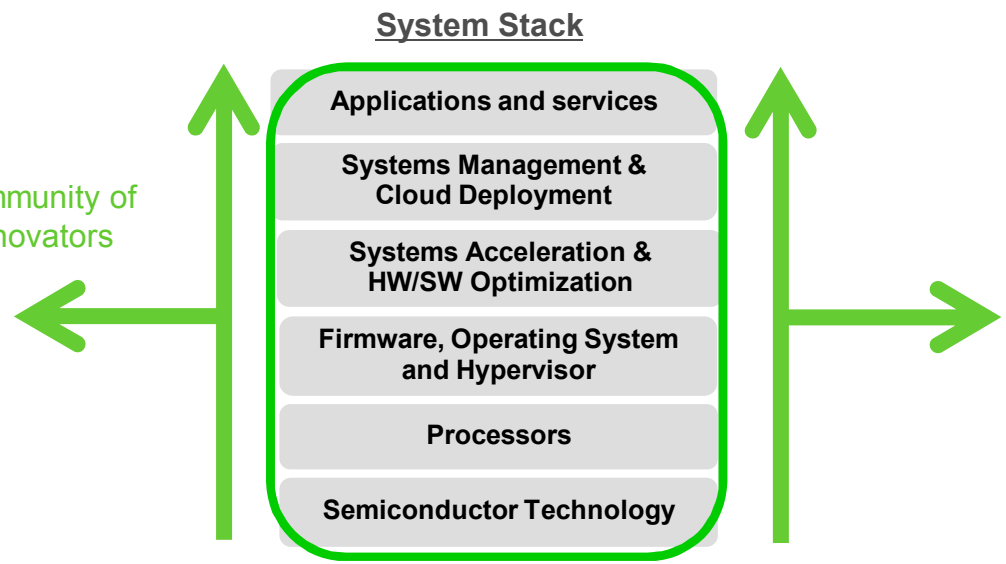
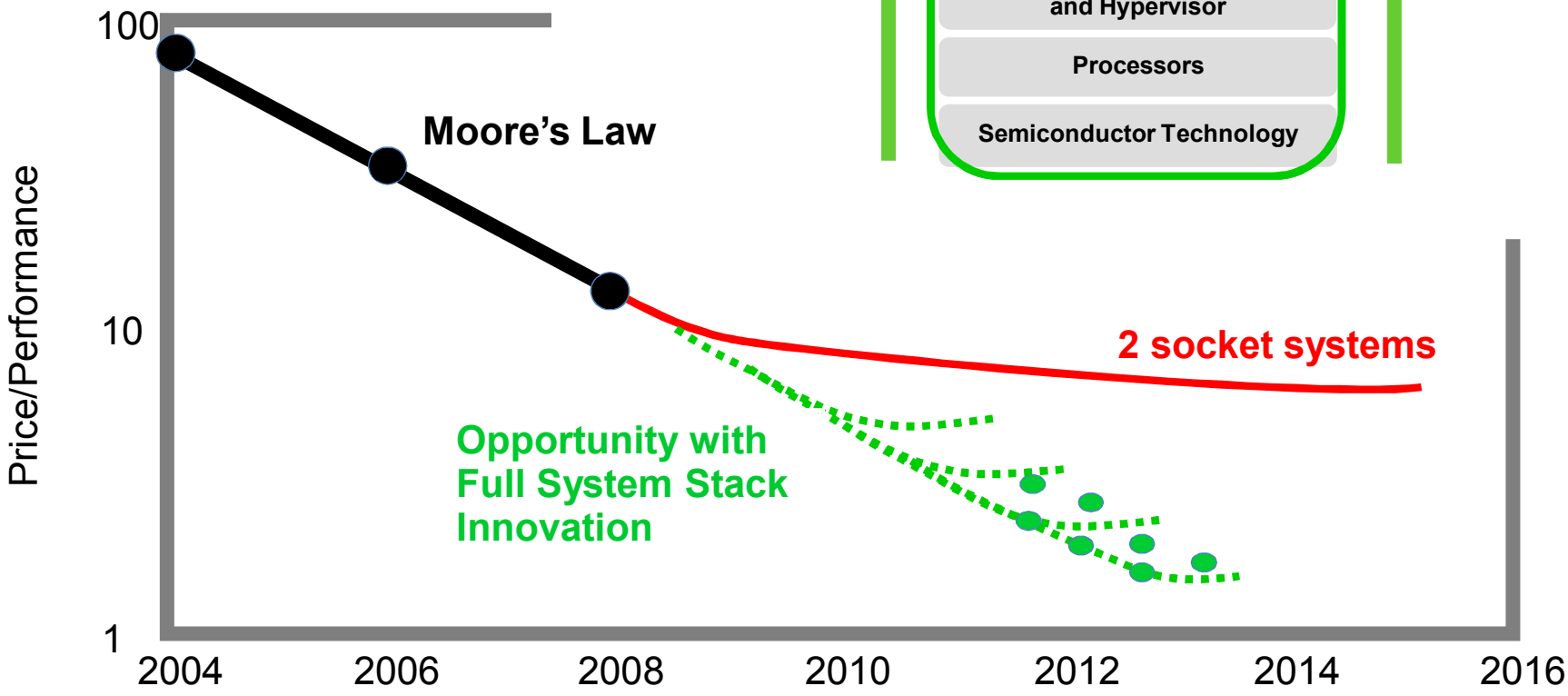
The Value of Open

More innovators….
Across the Stack ….
Building on the
POWER Architecture





An open server ecosystem

Embraces open stack of software for easy development and implementation

Creates a pipeline of ecosystem innovation

OpenPOWER™

Accelerates applications on a purpose-built infrastructure

Leverage industry innovation

POWER8

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Power Systems

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OpenPOWER™

Foundation is Growing a Community

Platinum Members

ALTERA, Google, IBM, Mellanox Technologies, Micron, NVIDIA, SAMSUNG, Suzhou PowerCore, TYAN

Member and Pipeline Diversity across the ecosystem

Technology Fab	Chip SoC Dev IP Dev	I/O Memory Networking Storage	Systems ODM OEM	Firmware Open Source	Software Linux ISV Open Source	Web 2.0 Internet Data Center Cloud High Perf Computing
IBM	**IBM** **Nvidia** **Altera** **Suzhou PowerCore** **Xilinx**	**Mellanox** **Fusion-io** **Micron** **Samsung** **SK Hynix** **Emulex**	**IBM** **Tyan** **Suzhou PowerCore** **Servergy**	**IBM** **Google**	**IBM** **Canonical** **Teamsun**	**Google** **Jülich Supercomputer Centre**

100+ inquiries and active dialogues underway

Power Systems

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OpenPOWER™ Driving industry innovation

OpenPOWER is an **Open** development Community

- Built on the premise of Open Source Software and Hardware
- Opening entire stack for innovation, from chip to software
- Removes proprietary boundaries
- Little Endian Linux simplifies software migration to POWER

OpenPOWER fosters **Collaboration** across multiple stakeholders

- Collaboration of multiple thought leaders on multiple projects in parallel
- Building an ecosystem for choice and flexibility in systems
- Delivering set of compelling, shared building blocks

OpenPOWER leverages the **Performance** of leading POWER architecture

- Built for demands of big data and analytics
- Incredible innovation and differentiation options
- Includes SOC design, Bus Specifications, Reference Designs, Firmware and Open Source Hypervisor

The goal of the OpenPOWER Foundation is to create an open ecosystem, using the POWER Architecture to share expertise, investment, and server-class intellectual property to serve the evolving needs of customers.

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OpenPOWER Proposed Ecosystem Enablement

Power Open Source Software Stack Components

Software

Cloud Software — openstack CLOUD SOFTWARE

Standard Operating Environment (System Mgmt) — Ganglia, KCAT, oVirt

Operating System / KVM — Linux

Firmware — OpenPOWER Firmware

Hardware — OpenPOWER Technology

Existing Open Source Software Communities

New OSS Community

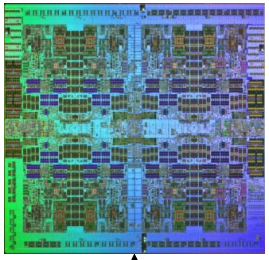
System Operating Environment Software Stack

A modern development environment is emerging based on tools and services

Multiple Options to Design with POWER Technology Within OpenPOWER

Hardware

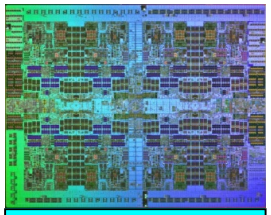
POWER8



CAPI over PCIe

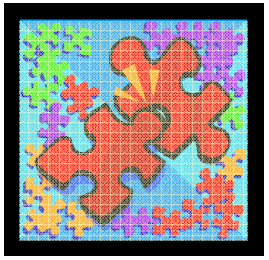
"Standard POWER Products" – 2014

Framework to Integrate System IP on Chip



Customizable

Industry IP License Model

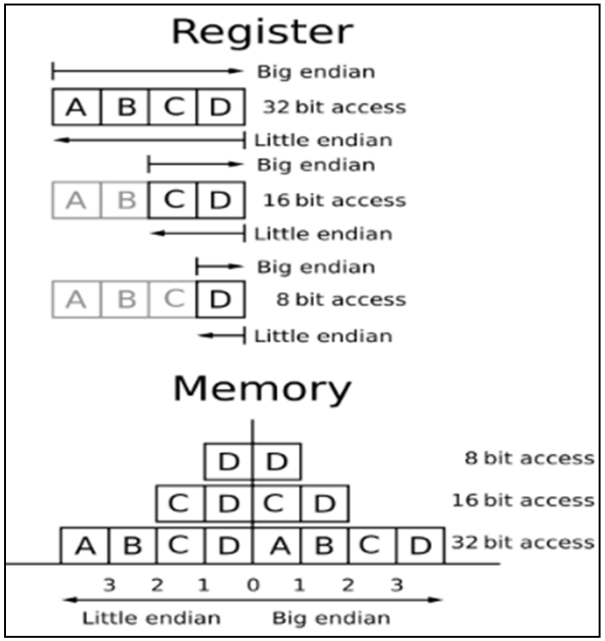


"Custom POWER SoC" – Future

© OpenPOWER Foundation 2014

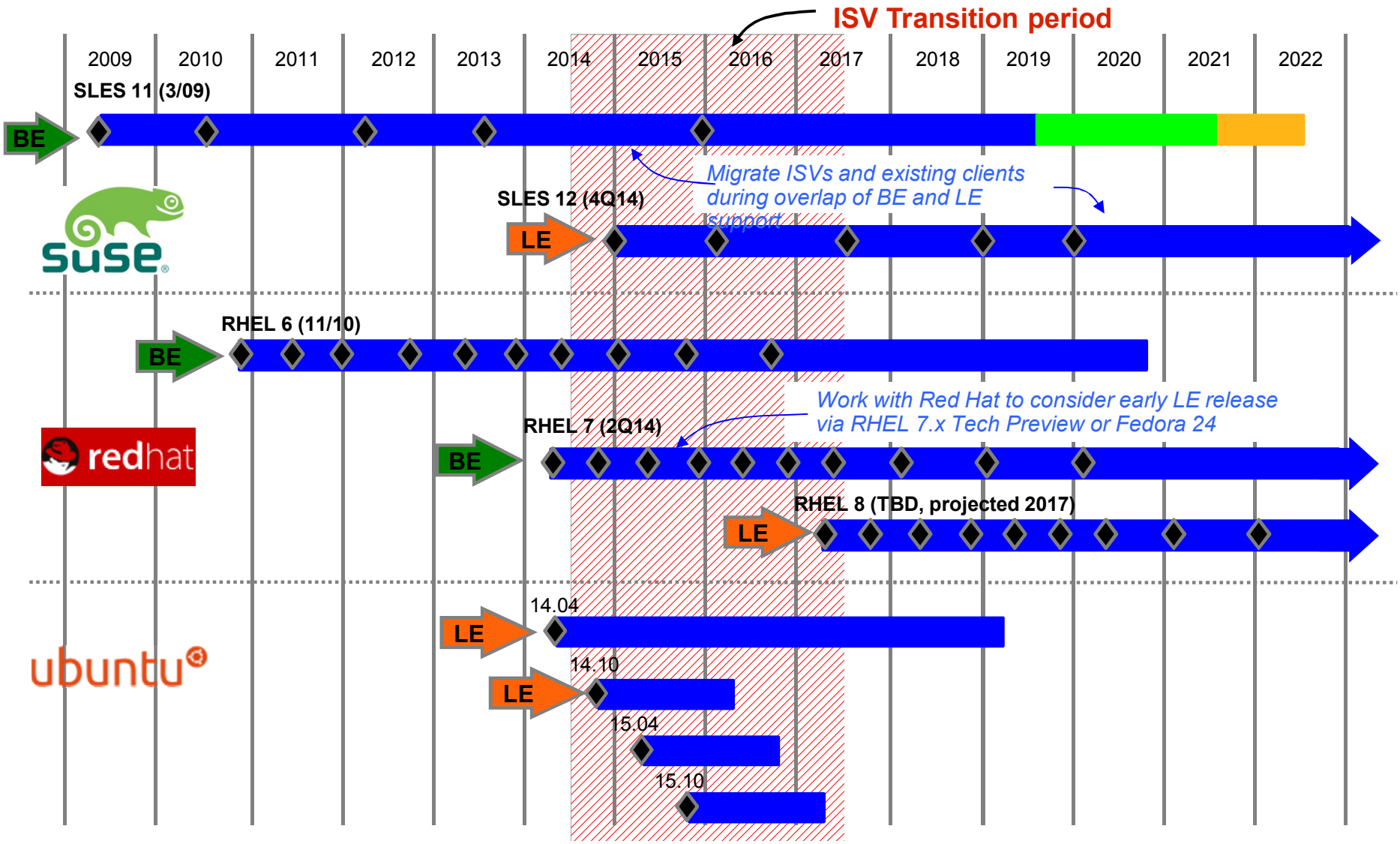
Simplify and grow Power software with little endian Linux...

- "Endian" simply describes the **way data is accessed in memory** – from the low order or LSB end ("little") or high order or MSB end ("big").
- POWER8 processors support execution in **both** big endian (BE) and little endian mode (LE). Intel processors are LE.
- **Linux on Power has chosen to exploit little endian (LE) processor mode based on OpenPOWER partner feedback.**
  - Eases the migration of applications from Linux on x86.
  - Enables simple data migration from Linux on x86.
  - Simplifies data sharing (interoperability) with Linux on x86.
  - Improves Power I/O offerings with modern I/O adapters and devices, e.g. GPUs.



- LE distributions for Linux on Power does NOT mean x86 applications magically run: **applications must still be compiled for Power**.
- **AIX and IBM i will remain BE**.

Linux operating system roadmap and LE/BE transitions



...without confusing everyone. What does LE mean to me???

If you are a customer:

- You mostly likely don't care about BE/LE.
- You will focus on Linux distributions and supported applications.
- You will need to do a little more planning when upgrading your OS and HW while we transition.

If you are an ISV:

- If you provide support on multiple hardware platforms, e.g. POWER and x86, you have already addressed endianness. Today's (BE) Linux distributions can support you today.
- If you only run on x86 systems today, you may benefit from LE distributions when they are available. (A decision tree is included in the link provided below)

If you are a business partner, VAR, distributor, seller, etc:

- Today's solutions and offerings (BE) are mature and ready.
- New solutions will be coming to the market in the coming years. Endianness details are generally irrelevant in solution selling.

More information can be found in the Linux on Power developerWorks community blog, *Removing the FUD and De-mystifying LE (little endian)*.

Power Systems

First OpenPower Achievements

1-800-SERVERGY

POWERED BY Servergy

Servergy Home Products Support Developers Partners and Alliances Newsroom Company

CTS-1000 Cleantech Server ®

A new class of Enterprise Linux Server in a blade footprint.

At under 9lbs, with the foot print of a legal pad of paper. The CTS-1000 is the next generation of high-density high-bandwidth PowerLinux enterprise blade server that operates on up to 80% less power and space. Built on Power Architecture, and offering a variety of Linux distributions and software applications, the servers literally help pay for themselves.

TYAN POWER8 Motherboard

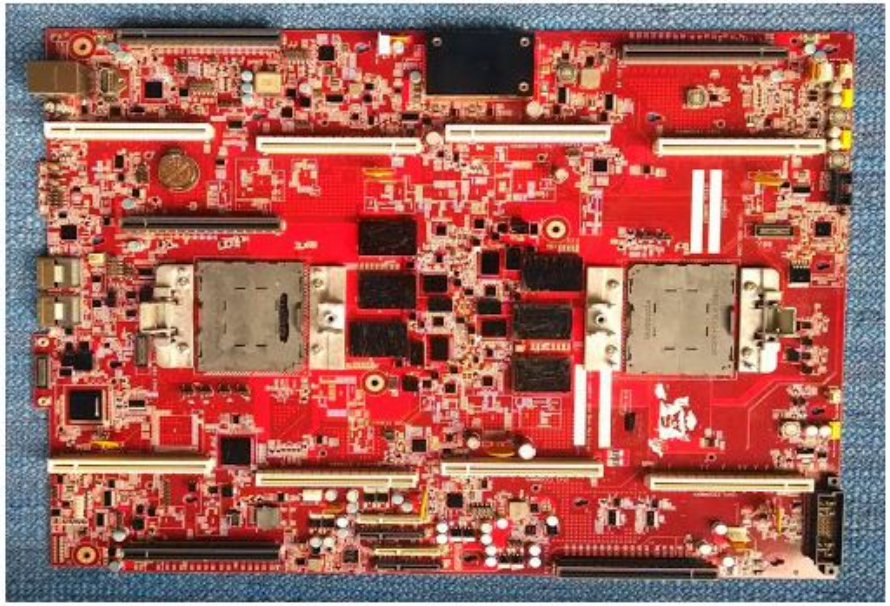
Gordon MacKean

Partagé en mode public - 28 avr. 2014

#OpenPower

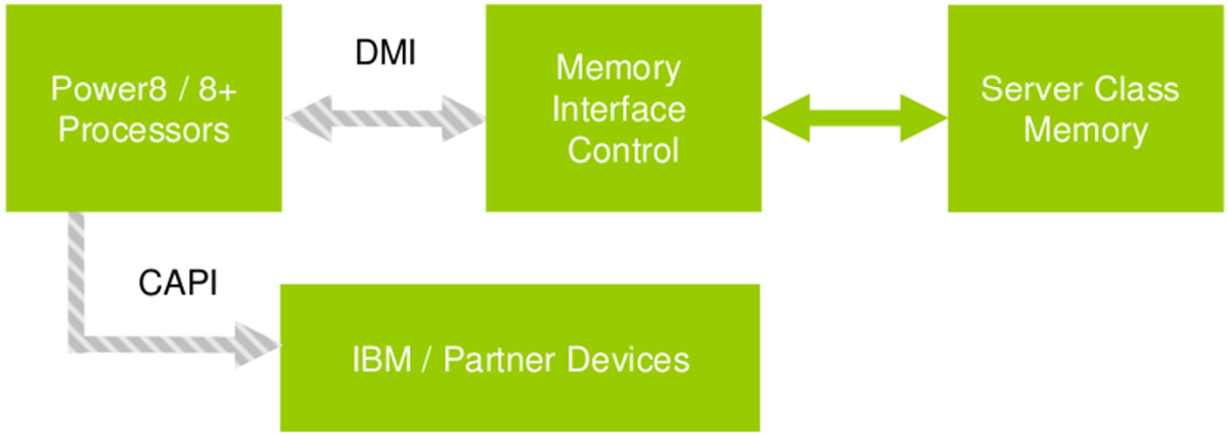
Today I'm excited to show off a Google POWER8 server motherboard in the OpenPOWER booth at the Impact 2014 conference in Las Vegas. We're always looking to deliver the highest quality of service for our users, and so we built this server to port our software stack to POWER (which turned out to be easier than expected, thanks in part to the liitle-endian support in P8). A real server platform is also critical for detailed performance measurements and continuous optimizations, and to integrate and test the ongoing advances that become available through OpenPOWER and the extended OpenPOWER community. (Google, IBM and others formed the OpenPOWER Foundation, a non-profit organization dedicated to developing an open ecosystem.

Traduire



Looking Forward: Helping Cloud Providers Optimize Services

OpenPOWER™

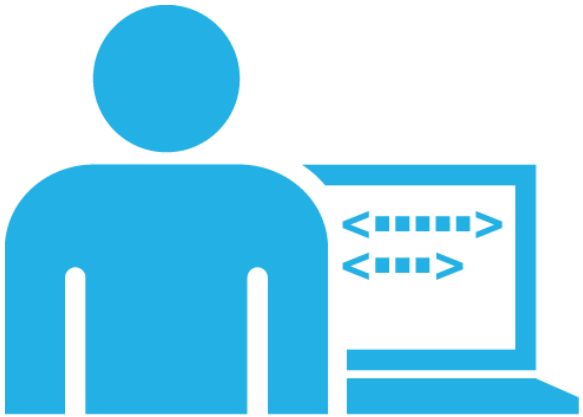


XILINX ALL PROGRAMMABLE. ALTERA NVIDIA Mellanox TECHNOLOGIES tms Texas Memory Systems, Inc. An IBM Company SAMSUNG Micron SK hynix

OpenPOWER open interfaces enable an unbeatable innovation pace

Two Paths to the CAPI Ecosystem

CAPI Developer Kit



Clients create their own, proprietary business solution.

Nallatech IBM

CAPI Market Solutions

IBM & Partners create business solutions for the CAPI Market.
Clients buy pre-packaged solutions from the CAPI Market.

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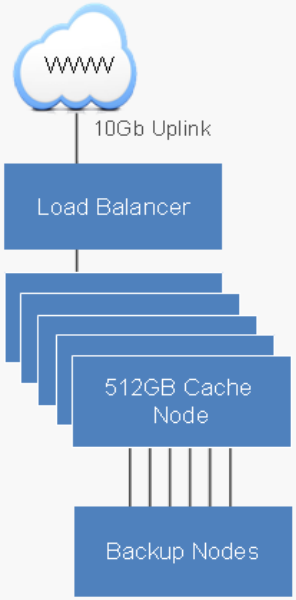
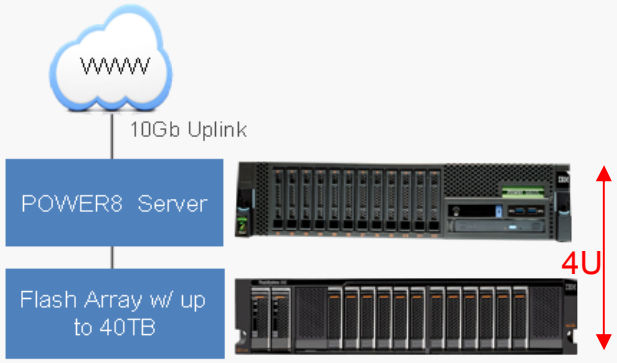
CAPI + Flash : Innovative "In-Memory" NoSQL/KVS Integrated Solution

24" Full rack with 24 x86 server **Vs** **1 S822L CAPI + 1 Flash System**

Today's NoSQL in memory (x86)



4Q14 - Differentiated NoSQL (POWER8 + CAPI Flash solution)



24:1
Reduction in infrastructure

2.4x
Price reduction

12x
Less Energy

6x
Less rack space

40TB of extended memory

Target LoB / solution architects and MSPs

- Supporting or building mobile/web/social apps
- Leveraging Key Value Store (KVS) for fast lookups
- Require high performance in-memory data access

Power + CAPI Flash Advantage

- 24:1 physical server consolidation
- 6x less rack space (2U server+2U Flash vs. 24 1U servers)
- Regain infrastructure control
- Dramatically reduce costs to deliver services

redis

CAPI Attached FPGA : Monte Carlo Simulations

- **Medicine:**
  - Monte Carlo simulations are used in leading edge cancer treatment for radiology
  - Current simulation runtimes for an individual is multiple weeks

- **Financial:**
  - Monte Carlo methods are used to price complex financial derivatives which in turn allows financial institutions determine the risk (e.g.VaR) of their investment portfolios
  - Required by regulators of risk compliance

UNDER REVIEW

=> Monte Carlo on FPGA with CAPI

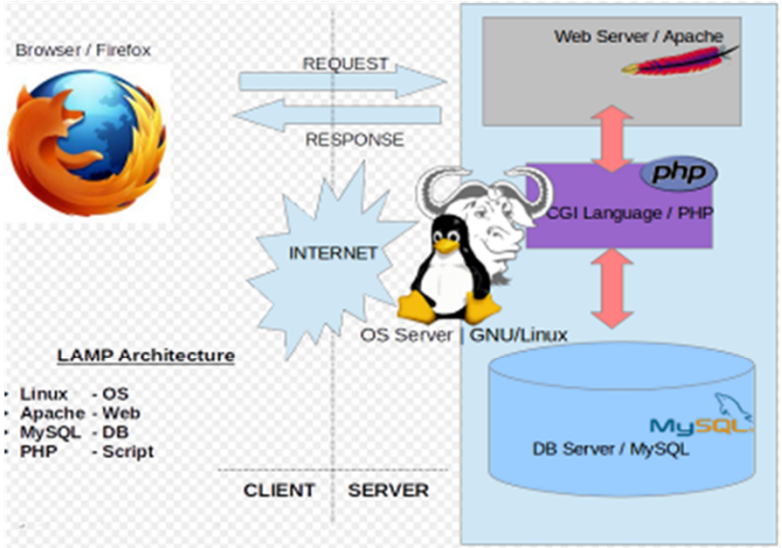
Reduced C code **40x** compared to non-CAPI FPGA

Running
1 million iterations

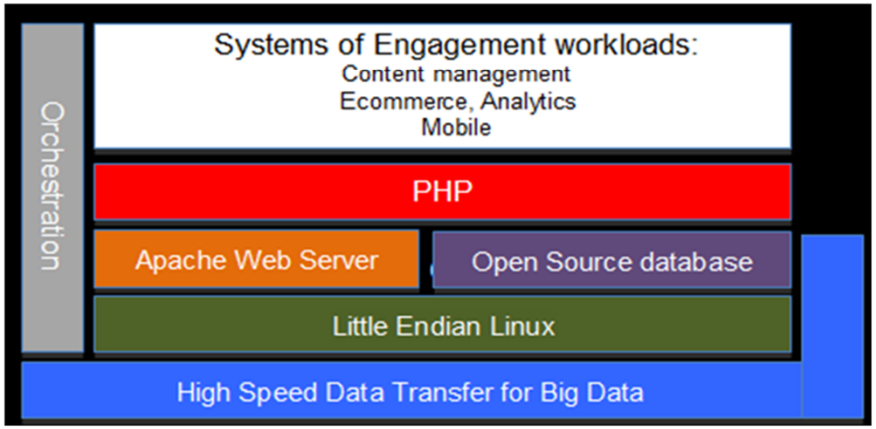
At least
250x Faster
with CAPI FPGA + POWER8

LAMP Stack evolution

- **LAMP for basic web applications**
  - Linux, Apache, MySQL, PHP s/w stack
  - Easy to use, open, community based
  - Enables dynamic, data driven websites



- **LAMP for next gen mobile, web apps**
  - Data centric, mobile/web app. services
  - Performance, scale, secure access to business systems of record are critical
  - Faster, open innovation is key to differentiated services and economics



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Introducing the "Turbo LAMP Stack" for next gen mobile and web apps

UNDER REVIEW

Faster Innovation

Performance and scalability

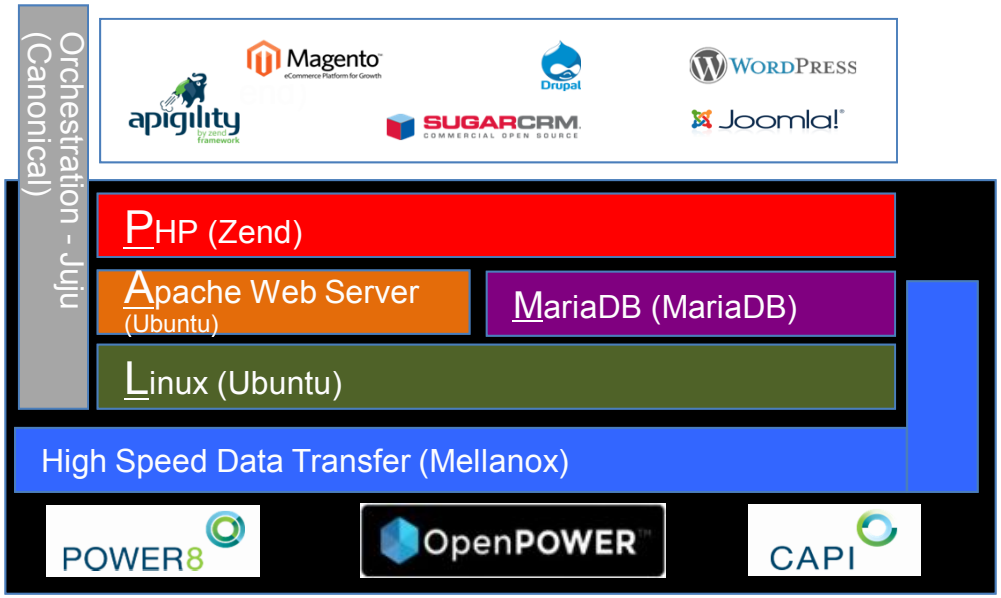
Compliance and security

ubuntu
Supported by Canonical

Faster time to value via provisioning and orchestration in minutes

Mellanox TECHNOLOGIES

High performance, internet scale and availability across multiple locations



Open Innovation Platform

Superior Cloud Economics

Designed for Big Data

zend

Continuous mobile application development for rapid innovation

MariaDB

Exploitation of multi-threading, memory bandwidth and stack integration with Zend

IBM and NVIDIA deliver new acceleration capabilities for analytics, big data, and Java

NEW

- ✓Runs pattern extraction analytic workloads faster
- ✓Provides new acceleration capability for analytics, big data, Java, and other technical computing workloads
- ✓Delivers faster results and lower energy costs by accelerating processor intensive applications

Power System S824L

- Up to 24 POWER8 cores
- Up to 1 TB of memory
- Up to 2 NVIDIA K40 GPU Accelerators
- Ubuntu Linux running bare metal

IBM POWER8 S824L

ubuntu NVIDIA POWER8

Nvidia K40 GPU (on IBM POWER8 S824L)

- **Systems**
  - Up to 2 K40 GPU in S824L
- **GPU Spec**
  - Kepler-2 architecture GPU
  - ASIC: GK110B
- **PCIe interface**
  - PCIe Gen3 x16
  - Full length / double wide PCIe form factor
  - Plugs in using existing double wide cassette
- Power
  - 235W Max power draw :75W via PCIe slot plus 160W via 8-pin Aux. cable.
- OS support
  - Ubuntu 14.10 or later

Features	Tesla K40
Number and Type of GPU	1 Kepler GK110B
Peak double precision floating point performance	1.43 Tflops
Peak single precision floating point performance	4.29 Tflops
Memory bandwidth (ECC off)	288 GB/sec
Memory size (GDDR5)	12 GB
CUDA cores	2880

http://www.nvidia.com/object/tesla-servers.html

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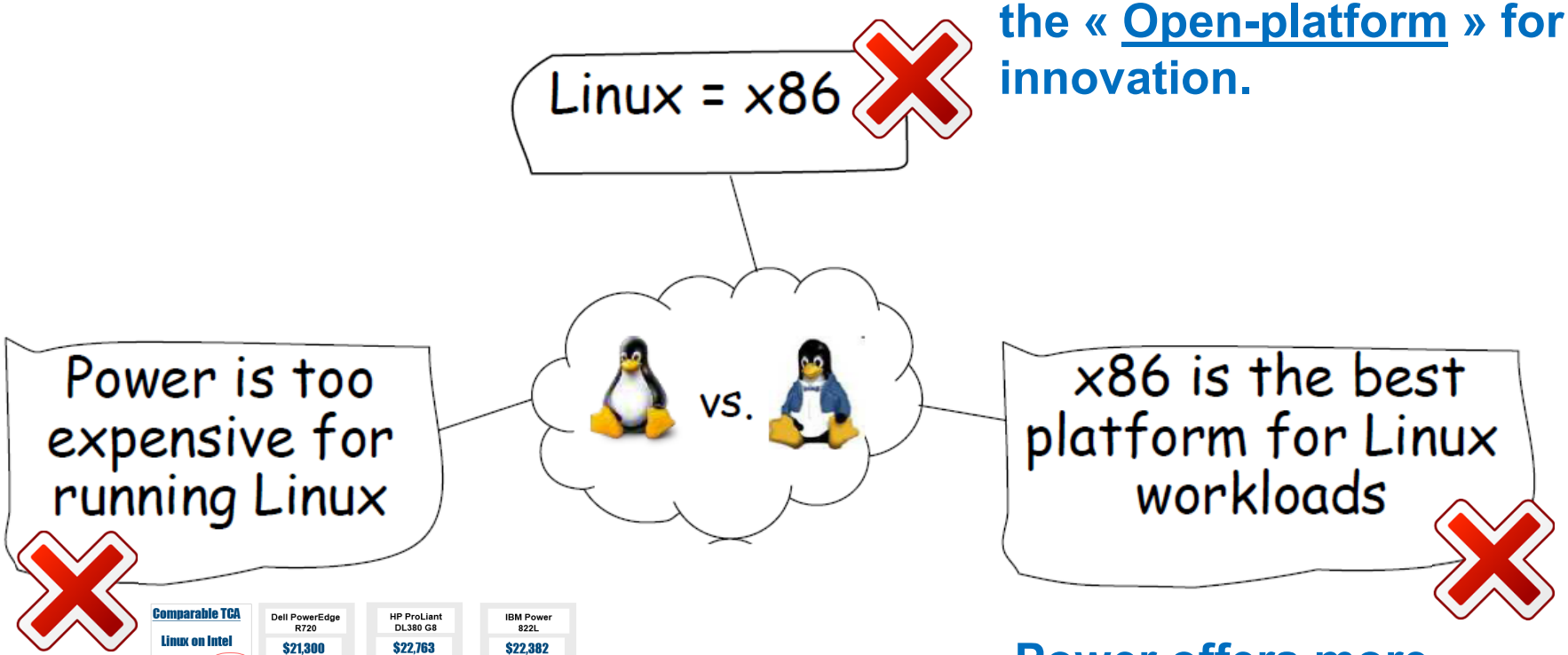
The Linux myths

Power Platform is not only a REAL alternative, it is the « Open-platform » for innovation.



Comparable TCA	Dell PowerEdge R720	HP ProLiant DL380 G8	IBM Power 822L
Linux on Intel Ivy Bridge + KVM Vs. Linux on POWER8 + KVM	$21,300	$22,763	$22,382
Server list price* -3-year warranty, on-site	$12,605	$14,068	$14,895
Virtualization - 2 sockets, 3 yr. 9x5 sub./supp.	$2,998 KVM for Red Hat on x86 (RHEV)	$ 2,998 KVM for Red Hat on x86 (RHEV)	$2,998 KVM for Linux on Power (PowerKVM)
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: (Total cost of acquisition)	$21,300	$22,763	$22,382
Server model	Dell R720	HP Proliant DL380p G8	IBM Power 822L
Processor / cores	Two 2.7 GHz , E5-2697, Ivy Bridge, 12-core processors		Two 3.4 GHz POWER8, 10-core
Configuration	64 GB memory, 2 x 300GB 15k HDD, 10 Gb two port		Same memory, HDD, NIC

** Based on US pricing for Power S822L announcing on April 26, 2014 matching configuration table above. Source: hp.com, dell.com, vmware.com*

Competitive prices…

Power offers more Performances, more Scalability, more Reliability and unique access to « workload accelerator »

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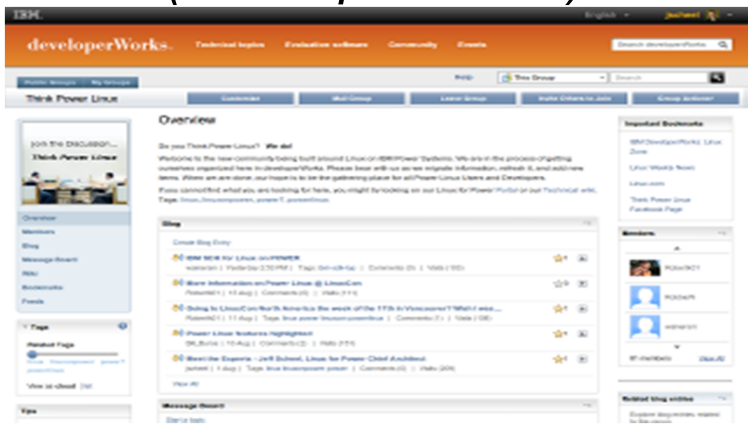
Be part of the Community and Learn more about PowerLinux

PowerLinux Home Page

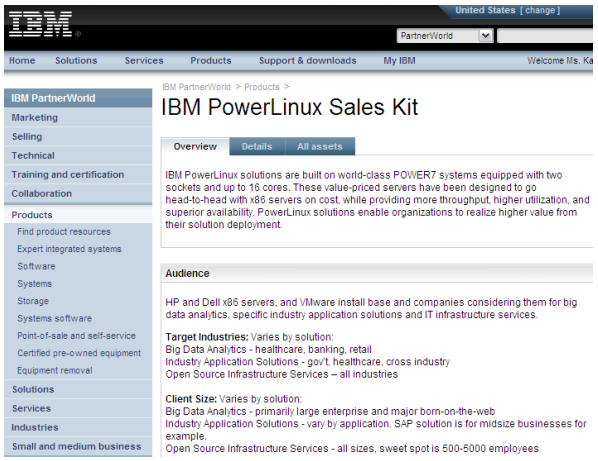
www.ibm.com/power/powerlinux

The PowerLinux community (developerWorks)

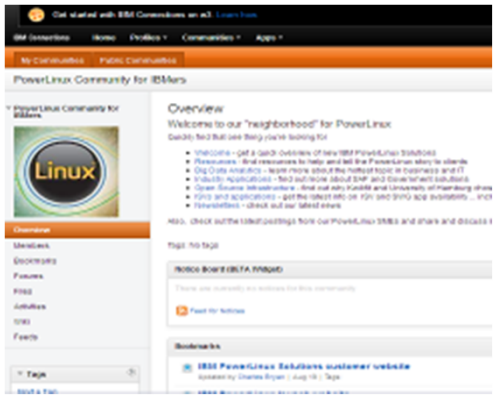


SSI for IBMers

PartnerWorld for BPs



PowerLinux Community for IBMers



Thanks for your time

Power Systems

Open innovation to put data to work

Sébastien Chabrolles :
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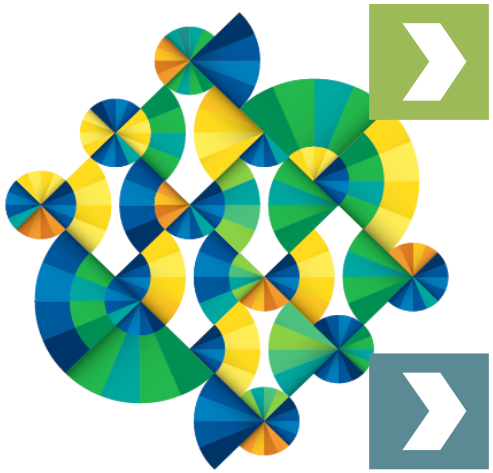
Power Systems

IBM

MOP Power Systems Linux Center Capabilities & Focus



Power Systems Linux Center for Europe

Strategic Focus on:

- Big Data
- Cloud
- Mobile
- Social Media

Providing Support for :

- Access to platforms (HW + SW + Support)
- Customer architecture design
- General Developer Resources Support
- ISV Resources Support
- Education / Training

Capabilities

Talk and Teach : Customer, BP, CSI & ISV Briefings, Demos, Videos
Design: Pre-sales Customer support, Customer Consultancy, Architecture Design Workshops
Prove : Linux on Power Benchmark & PoCs, Remote Power Linux Platform access

+ Second level of support for technical IIC, IMTs (Infrastructure, Virtualization, OS, Compilers, Certification programs, …)

Marie-Line Reynier
Power Systems Linux Center
Program Manager ((+ Business contact and Bus Dev)

Sebastien Chabrolles
Technical Leader
Linux on Power Specialist
Performance, Virtualization

Julien Limodin
Linux on Power Specialist
(Middleware knowledge,
Mobile & Java skills, Cloud)

Fabrice Moyen
Linux on Power Specialist
Performance, Virtualization

Christophe Menichetti
Power Architect
(Big Data knowledge /
Competitive knowledge)

Engage with us : PSLCmop@fr.ibm.com