

Linux on Power – OMNI Group

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Agenda

1. Linux on Power Overview

2. Linux on Power Ecosystem

3. The future of Linux on Power



Linux on Power Overview



Power Systems Strategy

Power Solutions: Enable businesses with next generation applications and Big Data/Analytics solutions

- Leverage industry standard Linux
- Provide differentiated client value jointly with IBM Software and ISVs
- Facilitate integration and insights across all data sources



Open Platform for Choice: Open the Power Architecture

- Enable collaborative innovation with OpenPOWER Consortium
- Deliver Open and optimized development tools and scripting languages
- Leverage OpenStack for comprehensive resource management solutions

OpenPOWER
Foundation

IBM

Mellanox Google
TYAN NVIDIA



SmartCloud

Power Charter: Long term commitment to Power

- Drive leadership and innovation for core business and new applications
- Demonstrate the strong economics of the platform
- Ensure strong ecosystem of skills and solutions



Power Systems Strategy: Embrace Shift to Open and Linux

2Q13

- + Power Systems Linux Centers: Beijing, Austin and NYC
- + KVM support for Power (SOD)



2H13

- + OpenPOWER Foundation
- + Partnering with global innovators
- + First open platform for community: chips, systems, software, cloud infra.
- + \$1B IBM Investment in Linux on Power
- + Power Systems Linux Centers: Montpellier, Tokyo
- + PowerLinux 7R4
- + Power Integrated Facility for Linux
- + 'Power First' SWG solutions for Linux



1Q14

- + OpenPOWER: Samsung and Suzhou PowerCore
- + Power Development Cloud
- + SoftLayer Integration with Power (SOD)



SOFTLAYER
an IBM Company
SOD for 2Q Watson

2Q14

First of a New Generation



Open and Collaborative
Innovate faster

Designed for Data & Analytics
Instantaneous Insights

Cloud Innovations
Economics for Growth

Linux on Power Systems combines the unparalleled performance of Power with the capabilities and cost effectiveness of Linux

IBM Power Systems are the ultimate systems for today's compute-intensive workloads, delivering:

- Dynamic efficiency, with intelligent, workload-based resource allocation
- Business analytics—optimized for big data and compute-intensive applications
- Enhanced compliance through automated, policy-based security

Linux is a robust and uniquely extensible operating system built on open source innovation, delivering:

- Significant cost savings
- Uncompromising stability & security
- Industry-leading flexibility and performance
- Rich opportunities for innovation and enabling of new workloads

Linux on Power Systems integrates these two powerful technologies to deliver the highest levels of:

- Efficiency
- Availability
- Security
- Reliability
- Scalability
- Cost savings

Power Scale-out Servers





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



Linux Myth



myth buster

x86 is the best
platform for Linux
workloads

Linux now drives many of the leading
edge workloads....and
key ones run better on Power vs. x86

Linux support for POWER

- Built from the same source as x86
- Delivered on the same schedule as x86
- Supported at the same time as x86



▪ RHEL 7

- Public beta available for existing RHEL customers
- POWER8 (native mode) and POWER 7/7+ at GA

▪ RHEL 6

- POWER8 supported with U5 (P7-compatibility mode)
- Full support of POWER6 and POWER7 (native mode)

▪ Fedora

- Fedora 16 was first release to re-launch POWER
- Fedora 20 has POWER8 support

▪ Supported add-ons

- JBoss
- High Performance Network Add-on

▪ SLES 11

- POWER8 with SP3 (P7-compatibility mode)
- POWER7+ encryption, RNG accelerators with SP3
- Full support of POWER7 (native mode)

▪ SLES 10

- POWER7 supported with SP3 (P6-compatibility mode)
- Full support of POWER6 (native mode)

▪ openSUSE

- openSUSE 12.2 re-launched for IBM POWER
- openSUSE 13.2 includes POWER8 support

▪ Supported add-ons

- SUSE Linux Enterprise High Availability Extension

▪ Ubuntu 14.04

- POWER8 enabled (native mode)
- No official support for POWER7+ and older systems
- No support for 32-bit applications. 64-bit only.
- Supported in KVM only at this time

▪ Supported add-ons

- JuJu Charms
- MaaS (Metal as a Service)
- Landscape

▪ Debian

- Community enablement in process

POWER8 Processor Is **Purpose Built** Which Results in Superior Performance

	Sandy Bridge EP	Ivy Bridge EP E5-26xx v2	Ivy Bridge EX E7-88xx v2	POWER 7+ Systems	POWER8
Clock rates	1.8–3.6GHz	1.7-3.7GHz	1.9-3.4 GHz	3.1–4.4 GHz	3.0–3.9 GHz
SMT options	1,2*	1, 2*	1, 2*	1, 2, 4	1, 2, 4, 8
Max Threads / sock	16	24	30	32	96
Max L1 Data Cache	0	32KB*	32KB*	32KB	64KB
Max L2 Cache	256 KB	256 KB	256 KB	256 KB	512 KB
Max L3 Cache	20 MB	30 MB	37.5 MB	80 MB	96 MB
Max L4 Cache	0	0	0	0	128 MB
Memory Bandwidth	31.4-51.2 GB/s	42.6-59.7 GB/s	68-85** GB/s	100 – 180 GB/sec	230 - 410 GB/sec

* Intel calls this Hyper-Threading Technology (No HT and with HT)

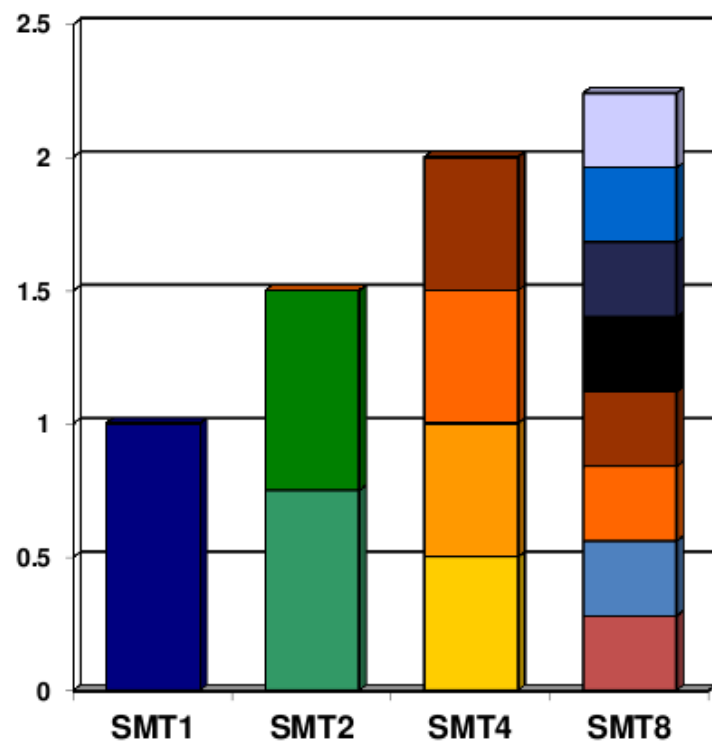
*32KB running in “Non-RAS mode” Only 16KB in RAS mode

**85GB running in “Non-RAS mode” = dual-device error NOT supported

Simultaneous Multi-Threading Can Be a Major Performance Enhancement

SMT allows separate instruction streams, or threads, to run concurrently on the same physical processor, or core

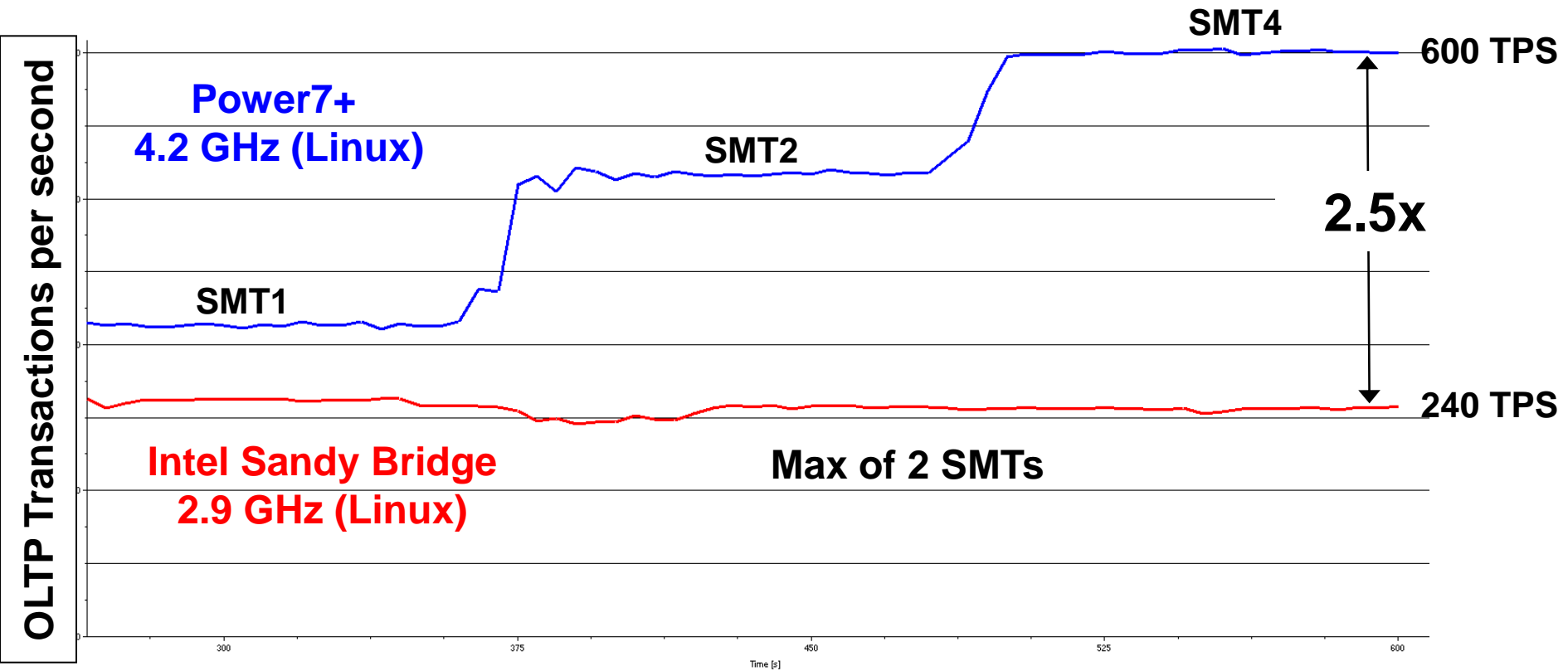
- **SMT1:** Largest unit of execution work
- **SMT2 / SMT4:** Smaller units of work, but provides greater amount of execution work per cycle
- **SMT8:** Smallest unit of work, but provides the maximum amount of execution work per cycle
- Can dynamical shift between modes as required: SMT1 / SMT2 / SMT4 / SMT8



SMT = Simultaneous Multi-Threading

SMT Has A Major Effect On Performance – Power vs. Intel x86

- Run the same WebSphere application on Intel Sandy Bridge and Power7+ in SMT 1, 2, and 4 modes and compare the throughputs





Midsize Insurer Lausanne, Switzerland

Consolidate and modernize
POWER and x86 workloads



- *New, high value user services*
- *Superior flexibility and ability to dynamically respond to user and workload requirements*
- *Fully virtualized environment with PowerVM on POWER7*
- **WebSphere on Power Linux LPARs for new Java apps**
- *Cobol/RPG apps on i LPARs*
- *Smooth evolution of IBM i*
- *Lower TCO via consolidated HW and SW investments*

Oil and Gas Producer Birmingham, Alabama

Consolidate and simplify IT for
costs savings, faster turnaround



- *Consolidated 20 Sun servers and 15 x86 servers to 2 Power Systems running PowerVM*
- *Saving \$500,000 per year on Oracle licensing costs for SAP environment running on AIX*
- *More savings by consolidating 15 x86 servers running Open Source web apps, networking to PowerLinux and PowerVM*
- *Reduced runtime for batch jobs from 24 hours to 2 hours*
- *Increased utilization by 2.5 - 3x*

Regional Department Store Pennsylvania

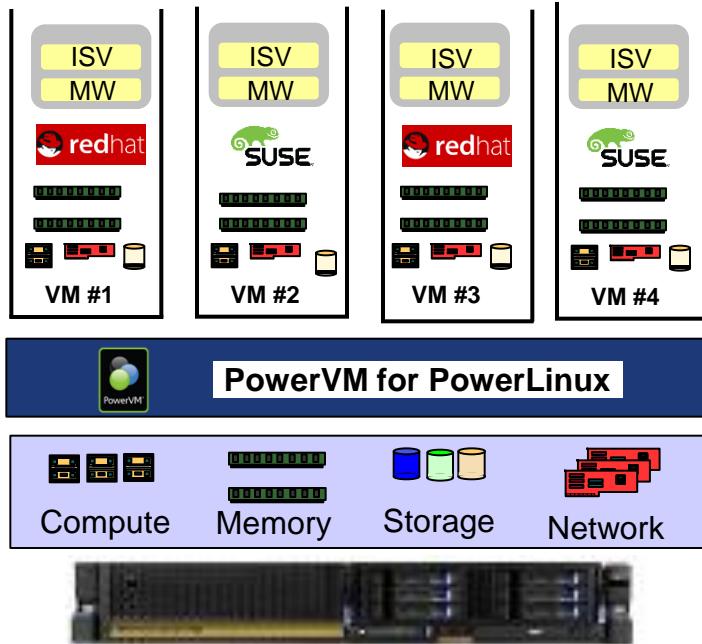
Headroom for peak online
shopping days with ½ the servers



- *2.5x more orders/min., headroom to support busiest shopping days*
- *Replace HP, VMware with 50% fewer PowerLinux 7R2s, PowerVM*
- *Big software savings, ½ # cores*
- *POWER7+ Java performance + PowerVM virtualization efficiency*
- *Smooth migration of WebSphere, Java workload to Linux on Power*
- *Integrated PowerLinux servers w/ existing storage, network infrastr.*
- *Stellar hands-on assistance by IBM Lab Services during PoC*

PowerLinux enables flexible, more efficient delivery for public or private cloud

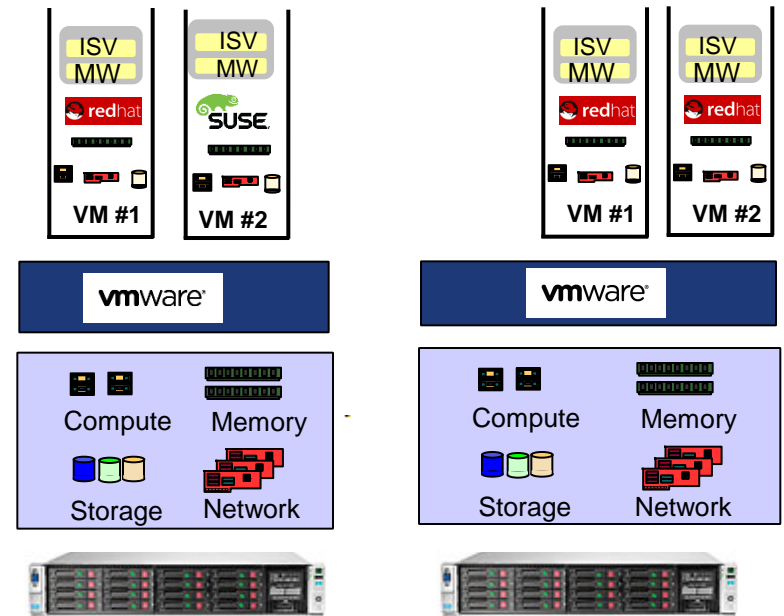
PowerLinux and PowerVM Benefits



47-53% average sustained utilization

- Move resources to the workload
 - Memory - dynamically add or remove
 - Compute, Storage - shared pools
 - Linear scalability, high demand workloads
 - Changes transparent to running workloads
- HW hypervisor
- 0 security vulnerabilities, I/O driver isolation

x86 Linux with VMware comparison



30-35% average sustained utilization

- Less flexible resource allocation
 - Memory - add but not remove
 - Compute – add and remove (no OS support)
 - Smaller workloads, less throughput per VM
 - Move workloads to the resources
- SW hypervisor
- 113 security vulnerabilities, sw patch maint.

Why Power

- How customers use Linux on Power Systems today
- How and why they use Power vs. x86 for Linux

Web, Collaboration and Infrastructure

Workload advantages

- ✓ Four threads/core
- ✓ 72% more throughput, 40% lower cost / workload
- ✓ 50% better performance and 30% lower TCA

Analytics & Research

Workload advantages

HPC applications for Life Sciences

- ✓ Four threads/core
- ✓ 90 GB/sec memory b/w
- ✓ Large memory, parallel, small jobs on same node
- ✓ Dynamic Energy Optimization

Memorial Sloan-Kettering Cancer Center
The Best Cancer Care. Anywhere.

WATSON

hadoop

Big Data

IBM InfoSphere BigInsights

NARUS

中国电信 CHINA TELECOM

Business Applications

Workload advantages

- 80% faster to setup VMs
- 65% less datacenter space
- 40% better performance
- 47-53% avg. utilization
- Dynamically add/remove resources

Database

Workload advantages

- Dense, low cost racks or blades w/ 8 cores / socket
- Four threads/core
- Linear scalability, higher throughput
- Zero security vulnerabilities vs. 113

PowerKVM v2.1

*Open Virtualization Choice for Linux-only Scale-out Servers***NEW**

- ✓ *Optimize **Linux Workload Consolidation and scale out** of workloads at a lower cost of ownership*
- ✓ *Maintain flexibility and agility by exploiting **Open Source** Community*
- ✓ ***Leverage** traditional **Linux admin skills** on Power Systems to administer virtualization*
- ✓ *Use **open source tools like OpenStack** to manage virtualization*

Announce – 4/28 GA – 6/10

- ✓ *Reduces IT Infrastructure costs*
- ✓ *Optimize Linux workload consolidation at a lower cost*
- ✓ *Simplify your virtualization management using open source tools*

- Kernel-Based Virtual Machine(KVM) Linux based virtualization For Scale Out POWER8 Linux Servers
- Processor and memory sharing and over commitment enables higher VM and workload consolidation
- Dynamic addition & removal of virtual devices
- Live VM Migration enables higher availability and allows workload balancing
- Exploits P8 Features like Micro-Threading providing greater scheduling granularity vs x86 virtualization
- Exploits performance, scalability and security built into Linux
- Managed by PowerVC and open source tools which provides flexible familiar Linux admin tools
- Supports Redhat, SUSE, Ubuntu Linux Guests



150+ SWG Products available for Linux on Power today and growing
SWG 70 PVU pricing on licensed software products for **ALL** Power cores **running Linux**

Big Data and Analytics:

- **Big Data:** InfoSphere BigInsights, InfoSphere Streams, Data Explorer
- **Analytics:** Cognos BI, Cognos TM1, AlgoOne, SPSS
- **Data services:** DB2[®], Informix, InfoSphere[™]
- **Enterprise Content Management:** IBM Web Content Manager, WebSphere Portal

Cloud Delivery

- **SoftLayer: Watson** in 2Q, additional services in 2H
- **SmartCloud Entry, OpenStack support, BlueMix, Cloud Foundry**
- **Cloud:** SmartCloud Monitoring, Provisioning, Orchestration, Storage Productivity Center, ...

Open Engagement (connect to Systems of Record)

- **Mobile:** IBM Worklight, WAS Liberty Profile, IBM Mobile Portal Accelerator
- **Social:** WebSphere Portal, IBM Web Content Manager, Connections
- **Business application middleware:** WebSphere Application Server, WAS Liberty Profile, WebSphere Process Server, WebSphere Commerce, ...
- **Infrastructure services:** WebSphere MQSeries[®], WebSphere Message Broker, WebSphere Ent. Service Bus, DB2 Connect[™], IBM JVM, Eclipse SDK

Support:

- **Development and test:** WAS Liberty Profile, Rational[®] ClearCase/Quality Manager/Team Concert, IBM XL C/C++, XL Fortran, ESSL
- **High Availability, Security:** Tivoli[®] System Automation, IBM Security Identity Manager

April 2014: Introducing offerings to deliver simplified consumability

- Power Systems Solutions Optimized for POWER

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 services



Hybrid Cloud: NEW: SmartCloud Entry for Power Systems

Next Generation with OpenAPIs delivers open cloud stacks


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, PowerKVM support, PowerVC enhancements and PAYG+



 = Linux-focused solutions

Linux Myth

Power is too expensive for running Linux

myth buster



Power provides platforms with comparable TCA to x86

IBM Power 822L pricing comparison (\$US) – vs. Ivy Bridge

Comparable TCA

**Linux on Intel
Ivy Bridge +**

VMware

Vs.

**Linux on Power7+
with PowerVM**

**Dell PowerEdge
R720**

\$28,366



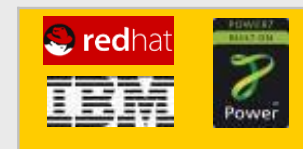
**HP ProLiant
DL380 G8**

\$29,829



**IBM Power
822L**

\$29,264









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

IBM Power 822L: Comparison (\$US) - Scale-Out Cloud & KVM

Comparable TCA

Linux on Intel Ivy Bridge + KVM
Vs.
Linux on POWER8 + KVM

<p>Dell PowerEdge R720</p> <p>\$21,300</p>  	<p>HP ProLiant DL380 G8</p> <p>\$22,763</p>  	<p>IBM Power 822L</p> <p>\$22,382</p>  
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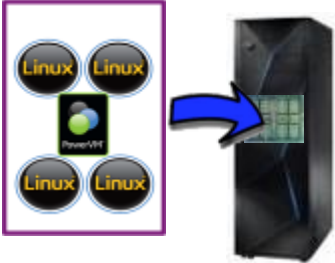
Server list price* -3-year warranty, on-site	\$12,605	\$14,068	\$14,895
Virtualization - 2 sockets, 3 yr. 9x5 sub./supp.	\$2,998 KVM for Red Hat on x86 (RHEV)	\$ 2,998 KVM for Red Hat on x86 (RHEV)	\$2,998 KVM for Linux on Power (PowerKVM)
Linux OS list price - RHEL, 2 sockets, unlimited guests, 9x5, 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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New Power Integrated Facility for Linux (IFL) *Get Enterprise Server Benefits At Fraction Of The Cost*

- Special bundle consisting of
 - ▶ 4 core activations
 - ▶ 4 PowerVM Enterprise Edition license
 - ▶ 32 GB memory activations
 - ▶ Runs only Linux (Red Hat or SUSE)
- Priced competitively vs. equivalent Linux stand-alone server
 - ▶ US List Price is \$8,591 per IFL
 - ▶ Without IFL pricing, this bundle would be worth \$49,568 on a 780 (US List price)
- Requires existing 770, 780, 795 systems with inactive cores and memory
- IBM Middleware is priced at 70 PVU
 - **Same as 2-socket x86 server**


Power IFL
on enterprise-class Power servers



Virtual stack consisting of :

- 4 x CUoD core activations
- 32 GB CUoD memory activations
- 4 x PowerVM for PowerLinux license entitlement
- Scales in increments of 4 cores

Announced on 10/8 and GA on 11/5
Power 770, 780 & 795



Linux on Power Ecosystem



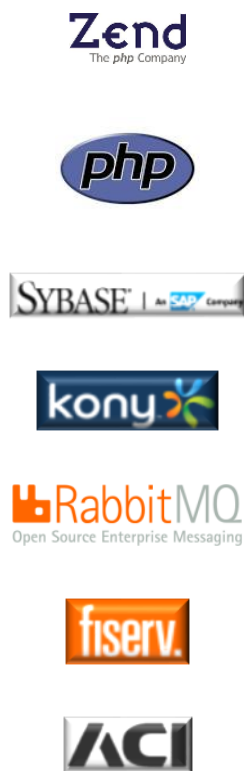
Data & Analytics



Cloud



Mobile



Focus Areas in 2014

- Leverage IBM Ecosystem - Differentiate
- Gain Platform share in Big Data, Mobile and Cloud
- Build Regional ISV Ecosystem
- Develop Open Software Linux community for Power
- Create incremental value around existing Power base



Available on All Linux Servers



Ecosystem Strategy for Linux on Power

Power Solutions:

Team with key Partners including IBM Software to deliver solutions



- Differentiated capabilities with big data/analytics, mobile and industry specific solutions
- Enable developers with built-in stack optimization, accelerators and emerging technologies

Open Platform for Choice:

Open the Power Architecture



- Provide comprehensive Linux capabilities including open source stacks
- Leverage collaborative innovation driven by OpenPOWER Consortium
- New/enhanced platform, virtualization and cloud management solutions through Open Stack and KVM



Ecosystem Role: Extend community role in delivering client value

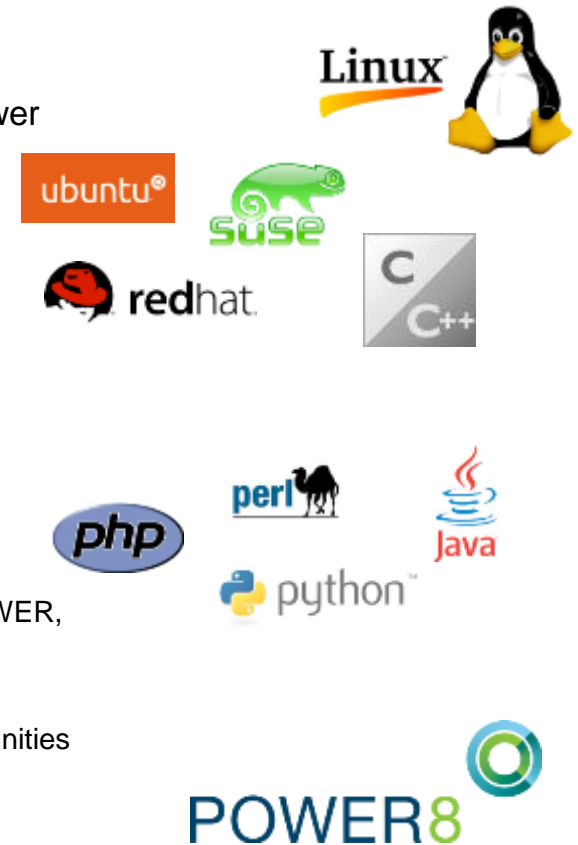
- Build a broad, connected ecosystem including MSPs, to deliver new solutions
- Engage Start-up community through the Global Entrepreneur Program
- Extend reach to the individual developer community to build a strong base of Power Linux skills in the marketplace
- Expand Academic Programs to reach the Higher Education student community, driving Power Linux content and courseware into top Universities



Porting Linux applications to Power Systems

Most applications port with a simple recompile and test

- **95% of Linux on x86 applications** written in C/C++ port to Linux on Power with **no source code change**, just a simple recompile and test¹
 - Canonical reported an average of 250 open source applications ported per day on Ubuntu. 95% of the Ubuntu 14.04 LTS compiled software ported with a simple recompile and test
- **100% of well written Linux on x86 applications** written in scripting (Java) or interpretive languages **will run as is** with no changes²
- IBM is committed to further simplifying porting and development on Linux on Power
 - Embrace open standards and partner with open communities such as OpenPOWER, OpenStack, Ubuntu, and Cloud Foundry
 - New tooling and function such as BlueMix
 - Provide easier means to build apps leveraging existing code in the open communities



1. Includes C/C++ and other compiled languages. Assumes 16 hours of dedicated time and prior experience with the application code and its dependencies (e.g. language, libraries, web application, database) and that dependencies already ported and installed. Assumes no platform or device specific dependencies.

2. Interpretive languages include PHP, Python, Perl, Ruby, Java, etc. Assumes 8 hours of dedicated time and prior experience with the application code and its dependencies (e.g. language, libraries, web application, database) and that dependencies already ported and installed. Assumes no platform or device specific dependencies.

North America Linux on Power ISV Team

- Recruiting new ISVs to Linux on Power!!!!
- Working with existing ISVs to port their applications to Power
- Enabling and educating new ISVs
- Liaison between IBM field sellers and ISVs
- Facilitating IBM briefings, porting center request, and technical assistance
- Driving solutions by introducing ISVs to business partners
- End user meetings with ISVs



Linux Resources for Power ISVs and Developers to Support the Ecosystem

Power Systems Linux Centers

Beijing New York Tokyo
 Austin Montpellier



IBM Innovation Centers

Over 40 centers world wide
 North America Europe Asia
 Africa Latin America



Linux Centers

- One-stop for ISVs, developers
- HW access, technical support, demos, toolkits, Hands-on labs, and how to guides



IBM Innovation Centers

- Technical Expertise - Architects, IT Specialists
- Destination Facilities - Workshops, Briefings, Port, Test
- Hands-on Infrastructure – Access to the latest IBM HW and SW

Power Development Cloud



North America

Power Development Cloud

- Quick access of porting environments to Linux ISV
- Fast resolution to ISV questions and problems

Regional Ecosystem Initiative



Greater China
 North America
 Europe

Recruiting Key Solutions

- Open Source Tools
- Middleware
- Industry Solutions



Technical Assistance

- Access to Power Hardware
- Chiphopper porting assistance
- Free Eclipse-based development environment

Future of Linux on Power



- **The number of companies designing & building servers is increasing**
 - Traditionally there have been few companies designing systems: HP, IBM, SUN, Dell, etc.
 - Today there are many more: Google, Microsoft, Facebook, Rackspace, Huawei, Sugon, Inspur, etc.
 - A fairly mature ecosystem including the Taiwanese ODMs is a key enabler of this trend
- **Numerous disruptive forces are impacting these custom system designs and driving designers to consider new ways of innovating**
 - Ability to handle rapid growth in Big Data & Analytics based solutions
 - Choice and Innovation
 - CPU SOC integration drive need for chip development
- **These trends create a need for a server targeted “chip-system-software” ecosystem**
 - IBM has technology and a software stack ready to meet these needs
 - IBM recognizes the need to work with partners to create this ecosystem
 - IBM recognizes the need for choice and options in processor sourcing

OpenPOWER™ gives ecosystem partners a license to innovate

- OpenPOWER will enable data centers to rethink their approach to technology.
- Member companies may use POWER for custom open servers and components for Linux based cloud data centers.
- OpenPOWER ecosystem partners can optimize the interactions of server building blocks – Microprocessors, Networking, I/O & other components – tuned for performance.

How will the OpenPOWER Foundation benefit clients?

- OpenPOWER technology creates greater choice for customers
- Open and collaborative development model on the Power platform will create more opportunity for innovation
- New innovators will broaden the capability and value of the Power platform

What does this mean to the industry?

- Game changer on the competitive landscape of the server industry
- Will enable and drive innovation in the industry
- Provide more choice in the industry

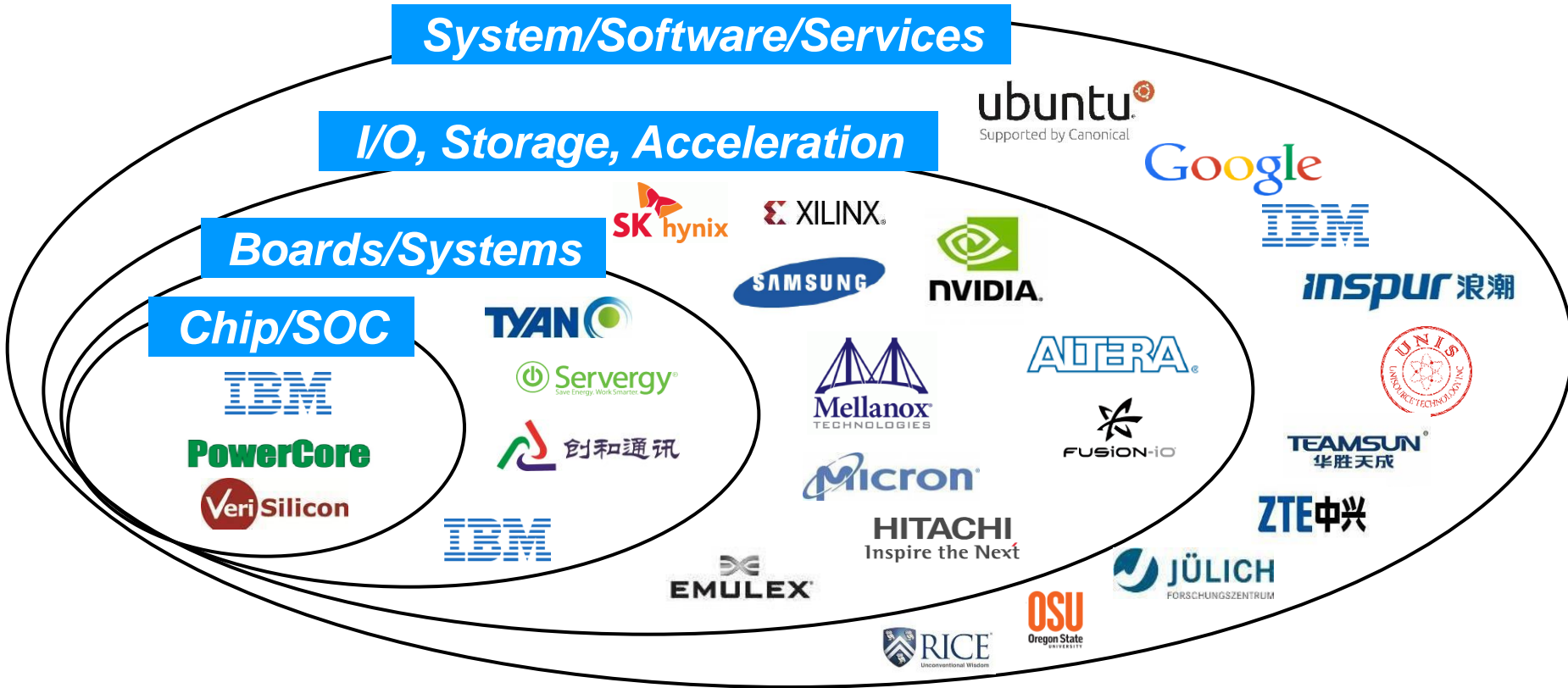
Platinum Members



Suzhou
PowerCore
Technology

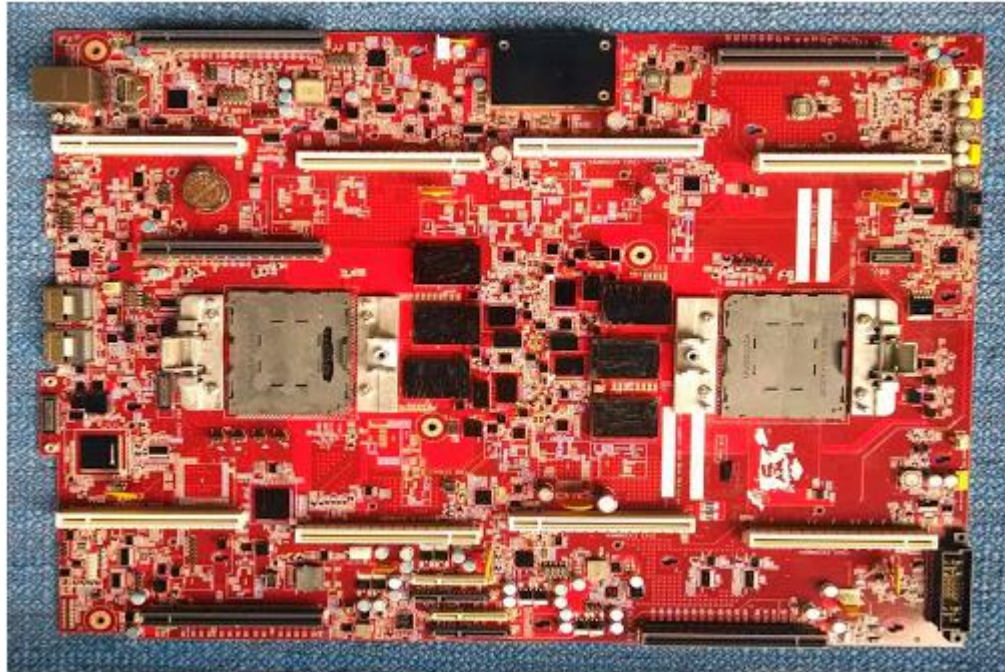


Building collaboration and innovation at all levels



Welcoming new members in all areas of the ecosystem
100+ inquiries and numerous active dialogues underway

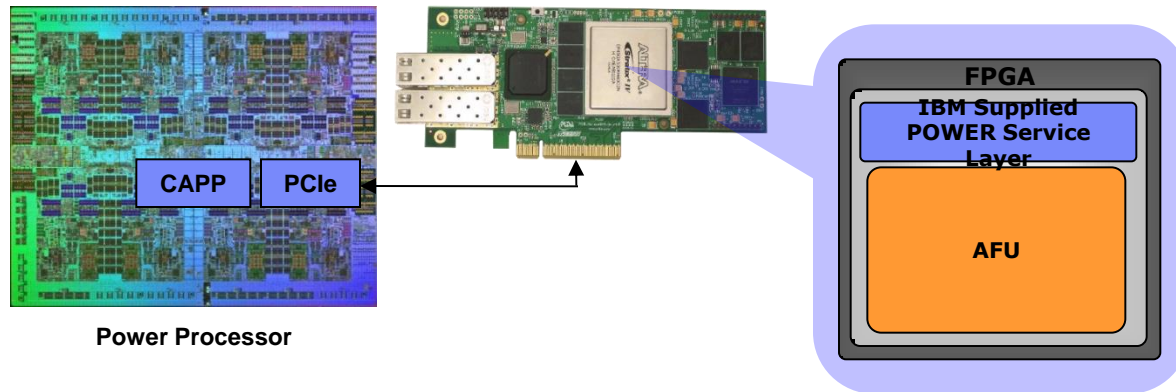
Google Announcement



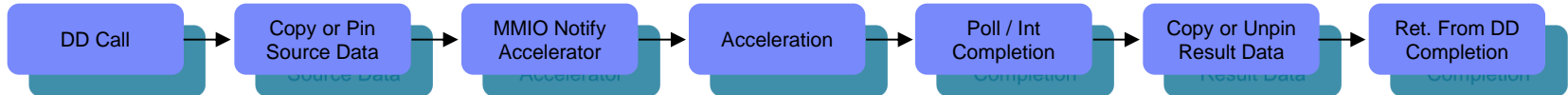
I'm excited to show off a Google POWER8 server motherboard in the OpenPOWER booth at the Impact 2014 conference in Las Vegas. We're always looking to deliver the highest quality of service for our users, and so we built this server to port our software stack to POWER (which turned out to be easier than expected, thanks in part to the little-endian support in P8)

Google's Gordon MacKean: Chairman of the OpenPOWER Foundation

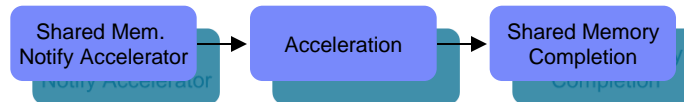
Why CAPI is Better than Traditional PCIe



Typical I/O Model Flow



Flow with a Coherent Model



Advantages of Coherent Attachment Over I/O Attachment

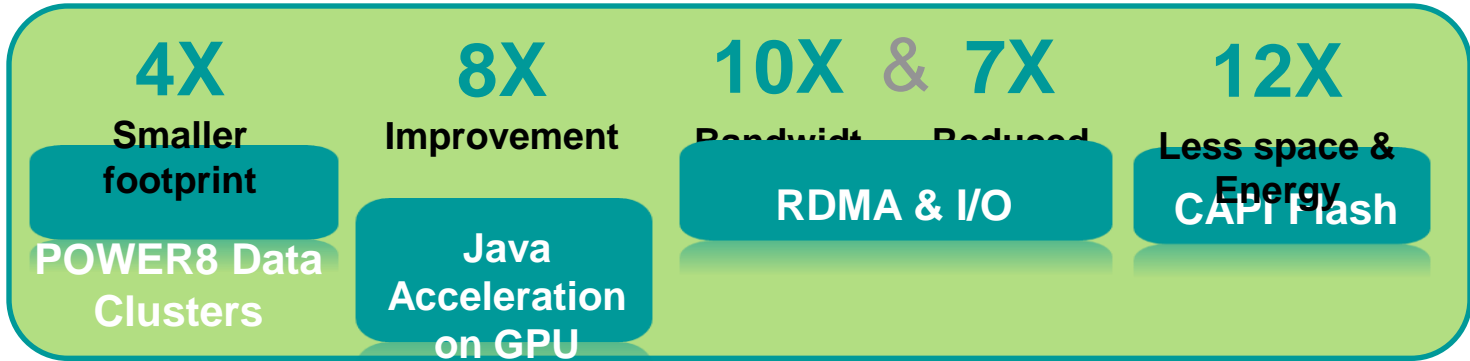
- **Virtual Addressing & Data Caching**
 - Shared Memory
 - Lower latency for highly referenced data
- **Easier, More Natural Programming Model**
 - Traditional thread level programming
 - Long latency of I/O typically requires restructuring of application
- **Enables Applications Not Possible on I/O**
 - Pointer chasing, etc...

Enabling the Art of the Possible on POWER8

CAPI enables I/O devices to operate on memory in the same way that general purpose processors can operate on memory



Even greater results for big data & analytics



CAPI and Linux enable innovation from the OpenPOWER Foundation

Smart Acceleration enabled by CAPI (Coherent Accelerator Processor Interface) Technology



Smart, simplified attach for accelerators: flash memory, networking & FPGAs

Improves performance, reduces latency, and provides more workload for your dollar

Leveraged by emerging applications built on Linux

CAPI Development Platform enables innovators to create entirely new classes of IT solutions

CAPI is evolving with open technology

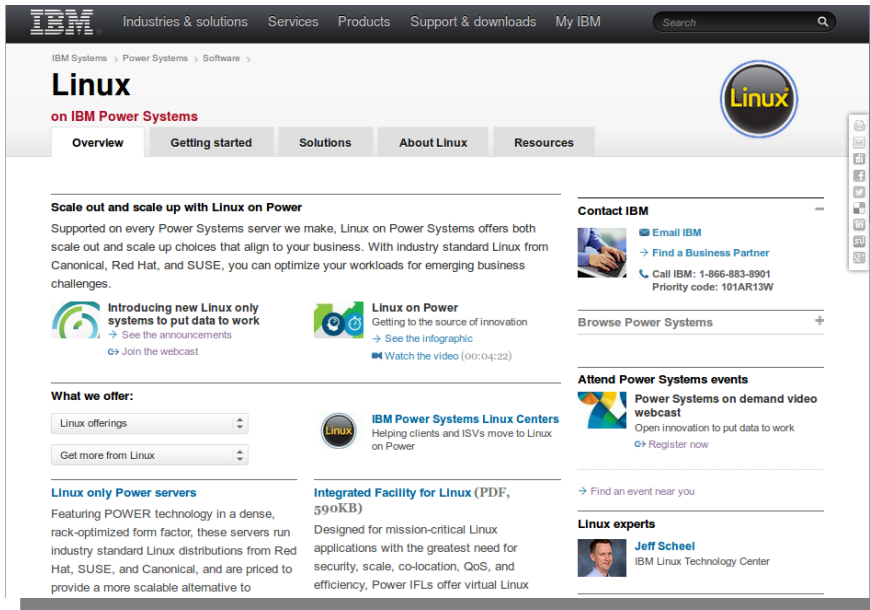
Wrap-up



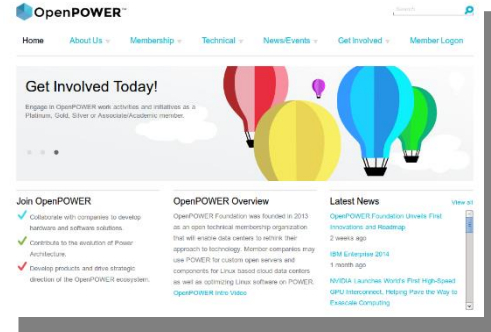
Where to find more information?

Power Systems Linux Portal (Product Information)

www.ibm.com/systems/power/software/linux/



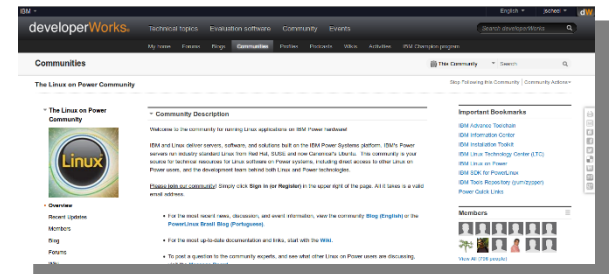
The screenshot shows the IBM Power Systems Linux Portal. At the top, there's a navigation bar with 'Industries & solutions', 'Services', 'Products', 'Support & downloads', and 'My IBM'. Below that, the page title is 'Linux on IBM Power Systems'. There are tabs for 'Overview', 'Getting started', 'Solutions', 'About Linux', and 'Resources'. The main content area is divided into several sections: 'Scale out and scale up with Linux on Power' with a sub-header 'Supported on every Power Systems server we make...', 'Contact IBM' with an email icon and 'Find a Business Partner' link, 'Browse Power Systems', 'Attend Power Systems events' with a 'Power Systems on demand video webcast' link, 'Linux experts' featuring 'Jeff Scheel' from the 'IBM Linux Technology Center', and 'Linux only Power servers' with a sub-header 'Featuring POWER technology in a dense, rack-optimized form factor...'. There are also links for 'Integrated Facility for Linux (PDF, 590KB)' and 'IBM Power Systems Linux Centers'.



The screenshot shows the OpenPOWER website. The header includes 'OpenPOWER' and navigation links: 'Home', 'About Us', 'Membership', 'Technical', 'News/Events', 'Get Involved', and 'Member Login'. A prominent banner says 'Get Involved Today!' with the text 'Engage in OpenPOWER work, activities and initiatives as a Platform, OAL, Solver or Association/Industry member.' Below the banner, there are three main sections: 'Join OpenPOWER' with a list of benefits (collaborate with companies, contribute to evaluation, develop products), 'OpenPOWER Overview' with a paragraph about the foundation's mission, and 'Latest News' with a list of recent articles and dates.

The OpenPOWER Foundation

<http://openpowerfoundation.org/>



The screenshot shows the 'The Linux on Power Community' page on developerWorks. The page has a header with 'developerWorks' and navigation links. The main content area is titled 'The Linux on Power Community' and includes a 'Community Description' section with a welcome message, 'Important Bookmarks' with links to various resources, and a 'Members' section with a grid of member avatars. There are also sections for 'Recent updates' and 'Blog'.

The PowerLinux Community

([developerWorks](http://developerWorks.com))



plus.google.com/communities/100156952249293416679



[@ibmpowerlinux](https://twitter.com/ibmpowerlinux)

Questions ?

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धन्यवाद

Hindi

多謝

Traditional Chinese

ขอบพระคุณ

Thai

Спасибо

Russian

Gracias

Spanish

شكراً

Arabic

Thank You

English

Obrigado

Brazilian
Portuguese

Grazie

Italian

多谢

Simplified Chinese

Danke

German

Merci

French

நன்றி

Tamil

ありがとうございました

Japanese

감사합니다

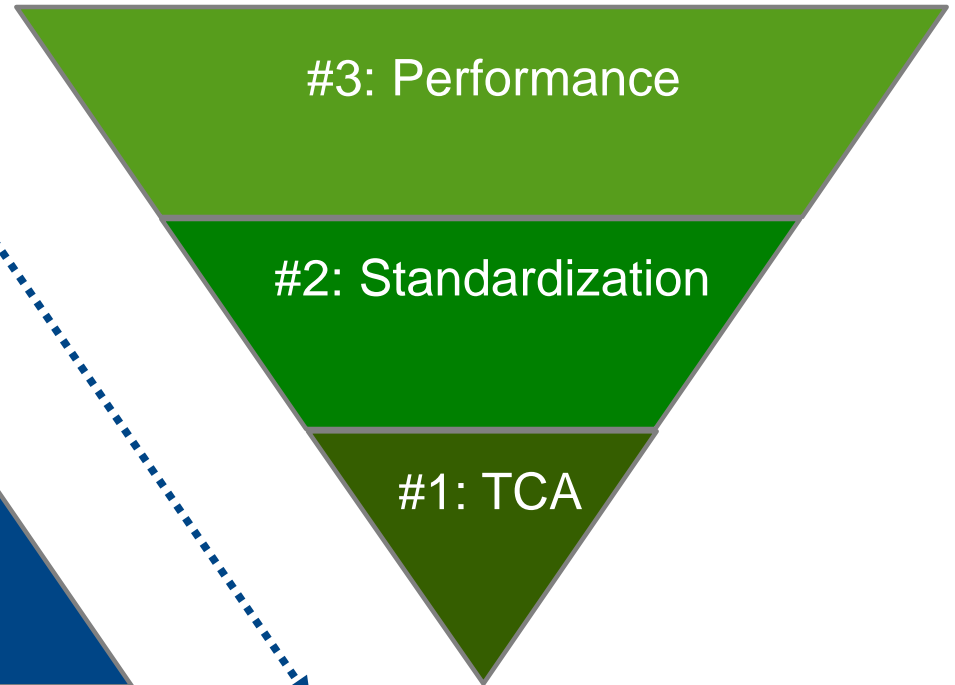
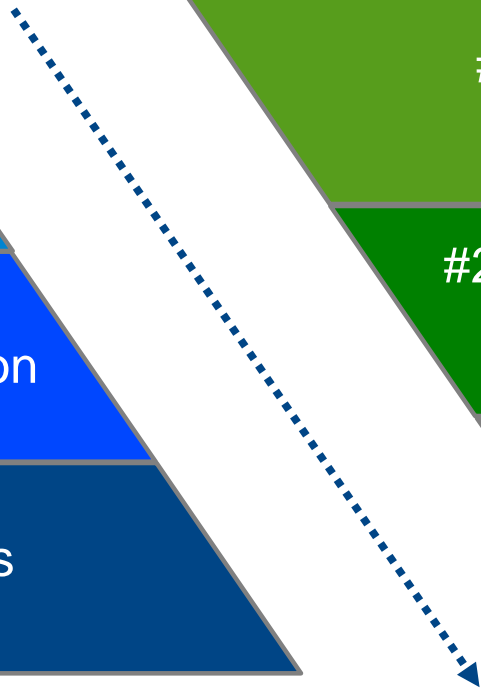
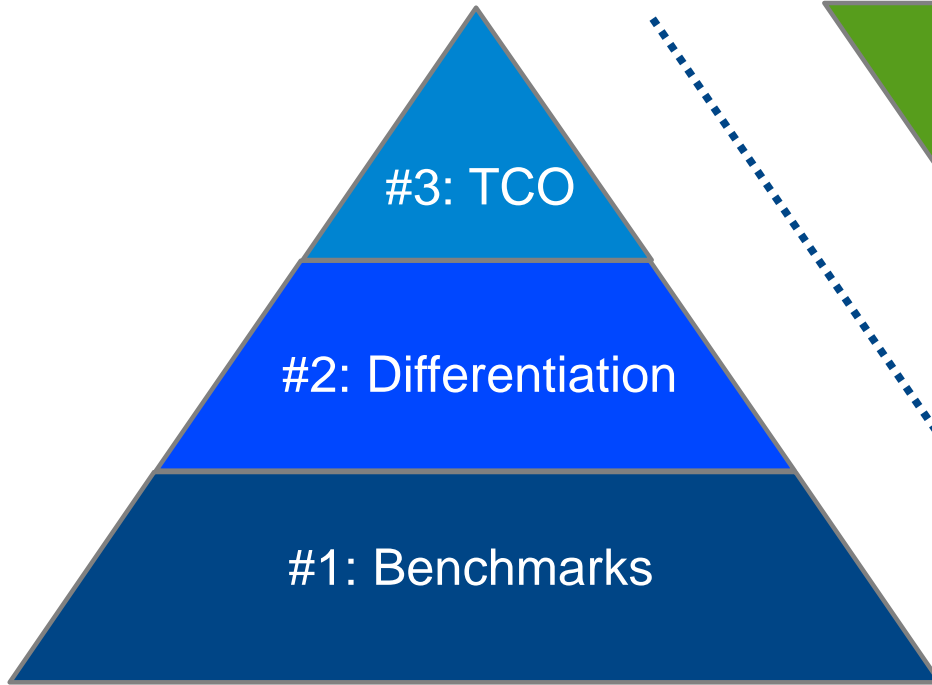
Korean

Backup

And how has that changed customers? Their buying habits have flipped!



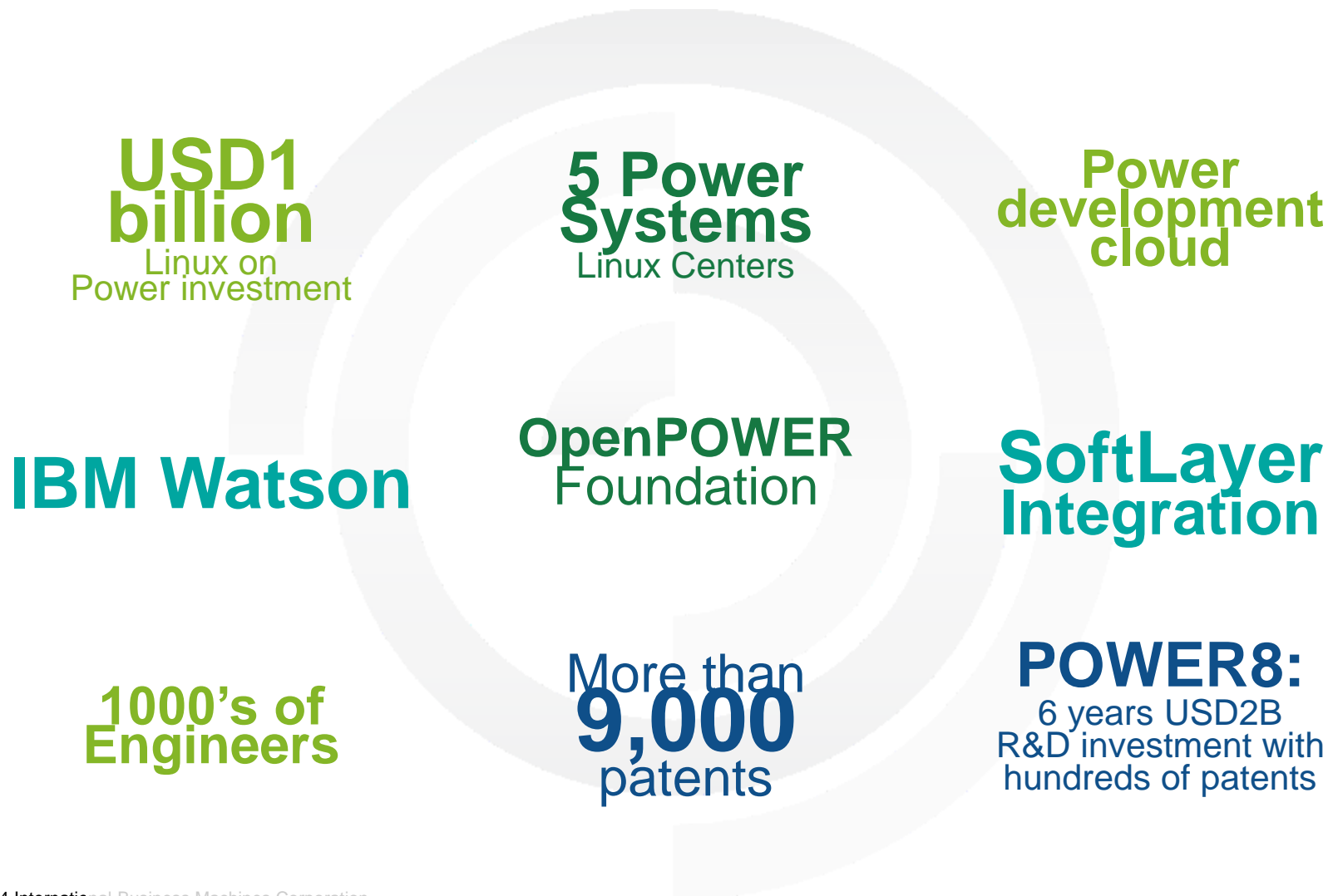
UNIX Market Priorities



Linux Market Priorities

The “Technologist's Challenge” becomes providing value-add in a standard's-based market.

Power Systems delivering on the promise of open innovation





Mobile phone company
700+ million subscribers

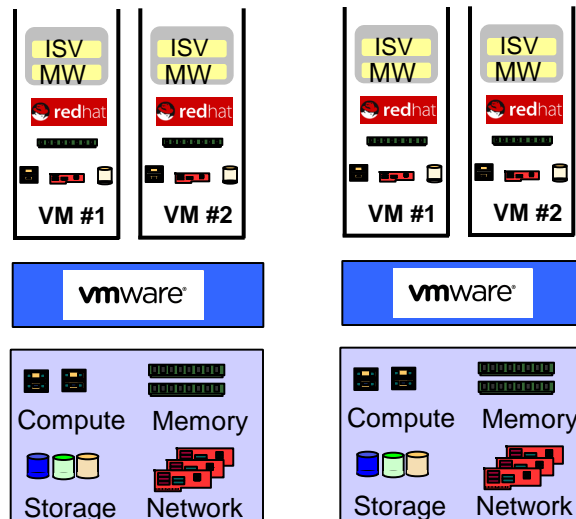
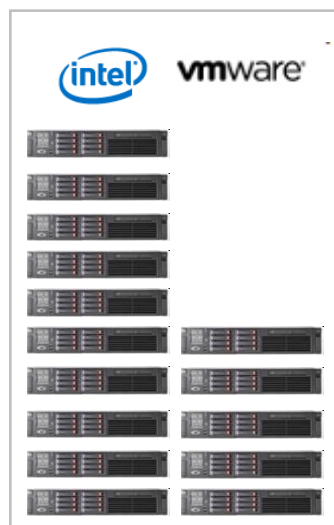
Support more web services for mobile clients with less resources



China Mobile

- Up to 2x more workloads per server with PowerLinux 7R2 and PowerVM
- First non-Intel x86 with VMware platform for Linux Cloud Pool
- Support new value added services for smartphones, tablets and other smart devices
- Significantly better performance for Java and web application workloads
- More efficient, secure virtualization
- Shared pools of CPU, memory, storage can be dynamically allocated

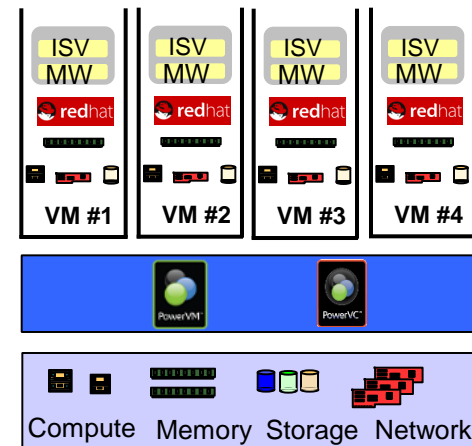
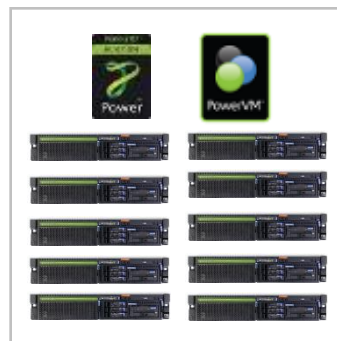
15 - 20



Server #1

Server #2

10



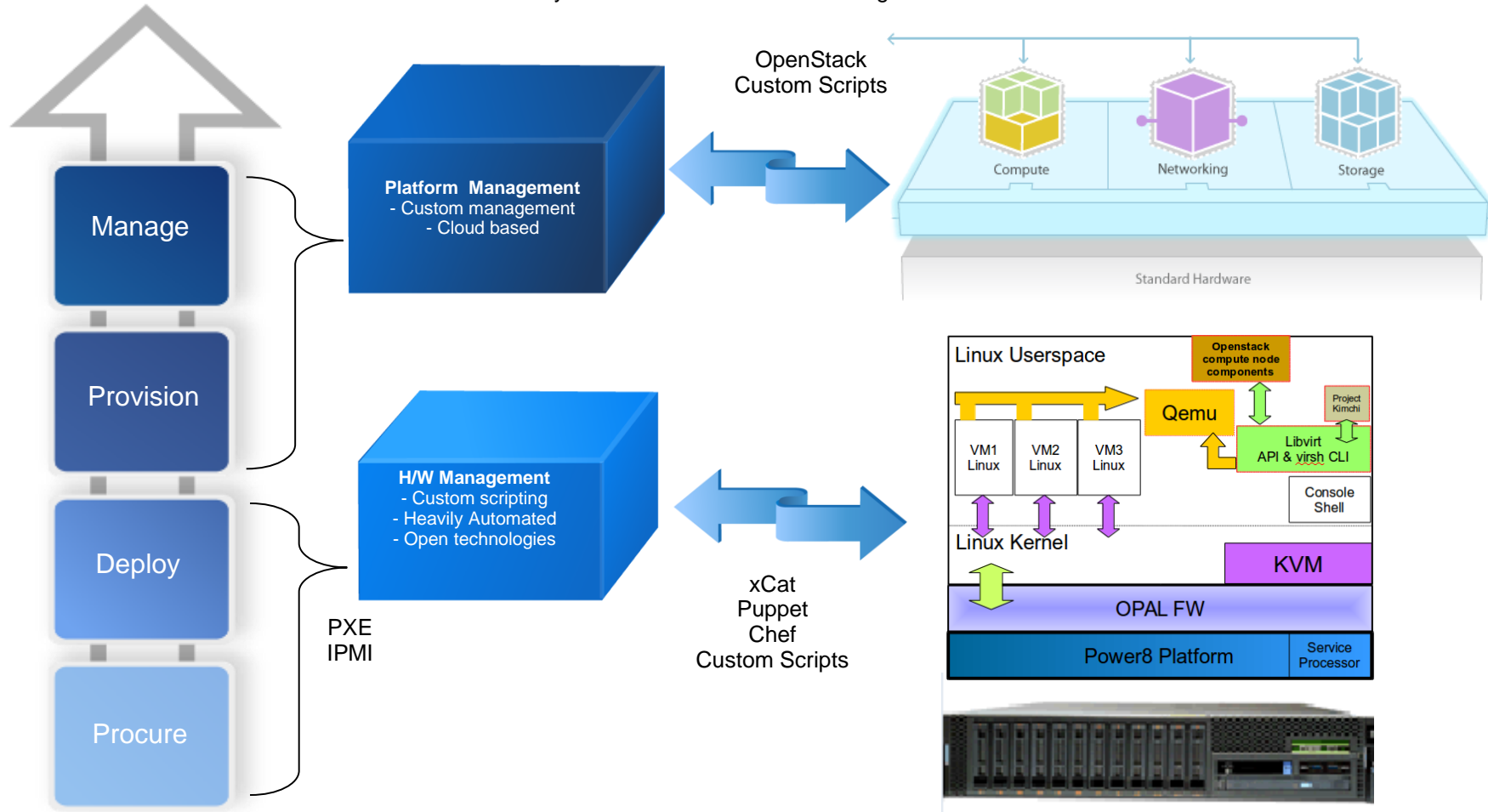
Server #1

PowerKVM supports an open deployment architecture



Enablement strategy:

- Bring base components in parity with KVM on x86 – “KVM should be KVM”
- Co-exists peacefully with other end-points, whenever makes sense.
- Enables hybrid clouds with common management environments



PowerVM to PowerKVM Comparison

PowerKVM 

PowerVM 

Managers

PowerVC, OpenStack, libvirt,
Open Source Tools

HMC, IVM, FSM, PowerVC,
ISD VMControl

Guest VM
Types



Host
Software

Linux MCP/KVM
Hypervisor

VIO Server
IO Virtualization

Firmware

Linux Firmware
Hardware Abstraction
Boot services
Standalone Diagnostics

Phyp Firmware - Hypervisor

Hardware

Power 8 Linux only Hardware

P6, P7, P8 Hardware

Superior performance economics for scale-out Clouds



IBM

Get up and running quickly with fast pre-built and pre-installed solutions

NEW

IBM Power Systems Solution Edition for Scale Out Cloud

Open source Linux solution for scale-out clouds services

- ✓ *Flexibility, agility and interoperability with open source virtualization and cloud management*
- ✓ *Accelerated insights for big data and compute intensive Cloud services*

Features

- Flexible 1 or 2 socket scale-out form factor
- Simplified management stack
- Choice of RedHat, SUSE or Ubuntu Linux
- PowerKVM hypervisor
- Cloud Manager with OpenStack
- Built on POWER8 technology for optimized performance for databases, analytics, Java, and web 2.0 services

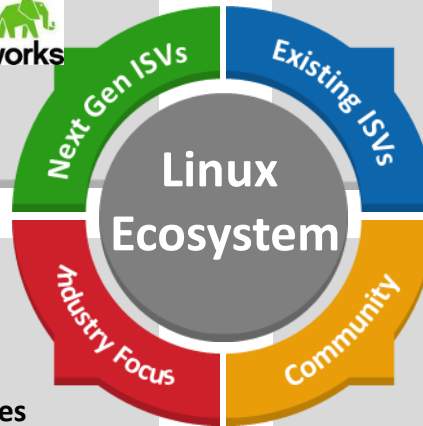


Power Systems 2014 ISV Linux Ecosystem

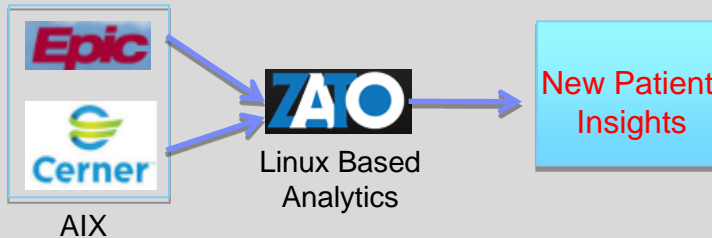
Power Systems will deliver compelling new Linux Solutions capabilities

- 31+ New Linux solutions spanning Data to Insights, Cloud, Open Platform, and Others

- Currently 800 existing ISV solutions on Linux for Power and growing



- Linux on Power solutions capabilities can compliment existing solutions across the Power Ecosystem
- Ex: Zato 's healthcare analytics solution provides powerful new data to insights capabilities by leveraging existing patient data from systems like EPIC and Cerner



- Focus on recruiting ISV partners that brings a broader community of new developers to the Power Ecosystem
- Ex: 9 New Linux ISVs bring along >100,000 Developers to the Power Ecosystem.

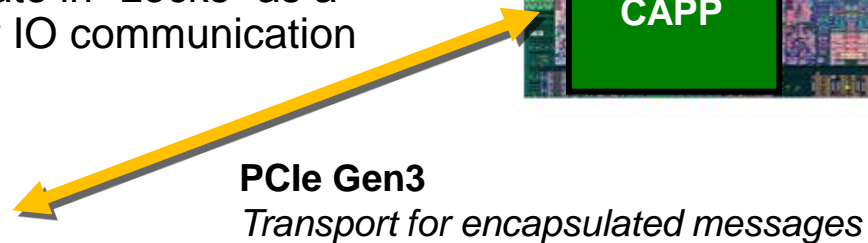
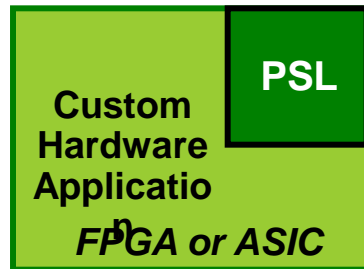
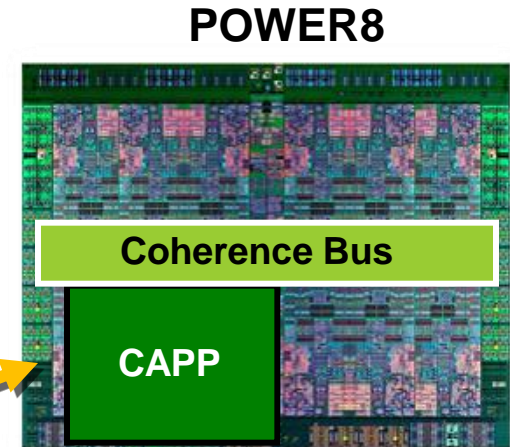
POWER8 CAPI (Coherent Accelerator Processor Interface)

Virtual Addressing

- Accelerator can work with same memory addresses that the processors use
- Pointers de-referenced same as the host application
- Removes OS & device driver overhead

Hardware Managed Cache Coherence

- Enables the accelerator to participate in “Locks” as a normal thread
- Lowers Latency over IO communication model



Processor Service Layer (PSL)

- Present robust, durable interfaces to applications
- Offload complexity / content from CAPP

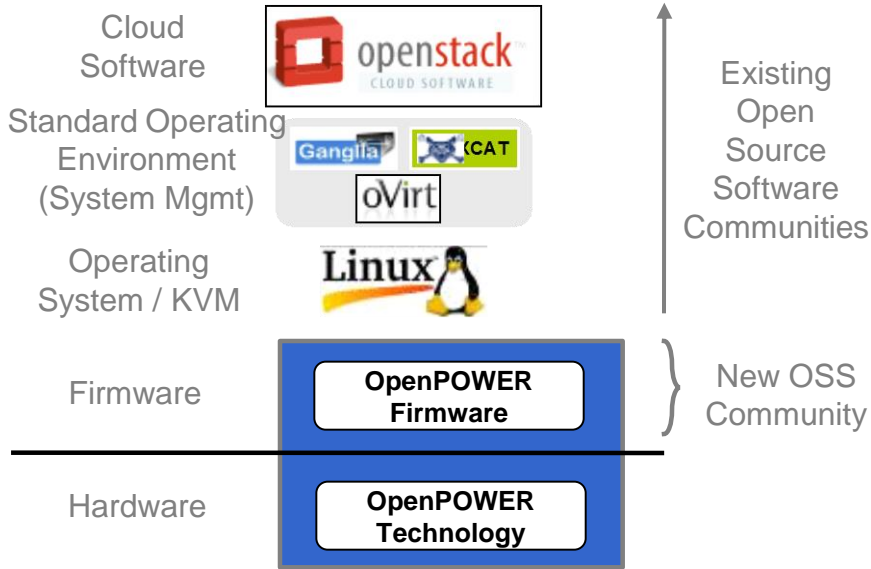
Customizable Hardware Application Accelerator

- Specific system SW, middleware, or user application
- Written to durable interface provided by PSL

OpenPOWER Proposed Ecosystem Enablement



Power Open Source Software Stack Components



System Operating Environment Software Stack

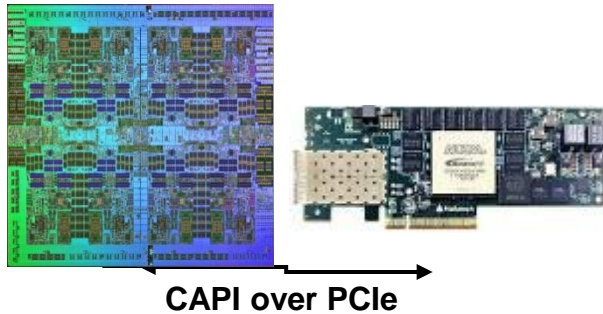
A modern development environment is emerging based on tools and services



Multiple Options to Design with POWER Technology Within OpenPOWER

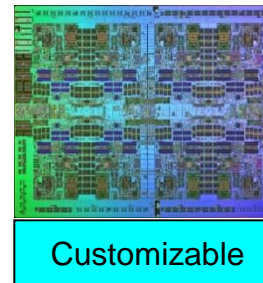
Hardware

POWER8



“Standard POWER Products” – 2014

Framework to Integrate System IP on Chip



“Custom POWER SoC” – Future

Industry IP License Model



Power System S824L

Processor

- 2x 10-core 3.42GHz or
- 2x 12-core 3.02GHz

Memory

- Total 16 DDR3 CDIMM slots
- 16,32,64 GB CDIMM @ 1600 Mbps
- 1TB capacity, 384GB/s bandwidth max

Storage

- JBOD, RAID 0,10,5,6
 - ❖ 12 SFF Disk Drive, 1 DVD

LAN adapters

- 2x 10GBASE-T adapter or
- 2x 10Gb SFP+ Fiber SR plus 2x 1GE adapter

GPU adapter (1 min or 2 max)

- El Capitan nVidia K40 GPU adapter

Power supply

- 2+2 1400W PS



O/S Capable

- Linux Ubuntu (14.10)

Hypervisor Capable

- OPAL, No virtualization

PCIe Gen3 Slots

- 4 PCIe x16 G3 FHFL slots
- 6 PCIe x8 G3 FHHL slots
- CAPI capable on PCIe x16 slots

Native I/O

- USB 3.0 (2 front, 2 rear)
- System Management 1GE (2 rear)
- System port (rear), USB 2.0 (2 rear)