

# What is OpenPOWER?

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**IBM Competitive Project Office**  
**Proving the Value of IBM Technology**

# What is OpenPOWER?

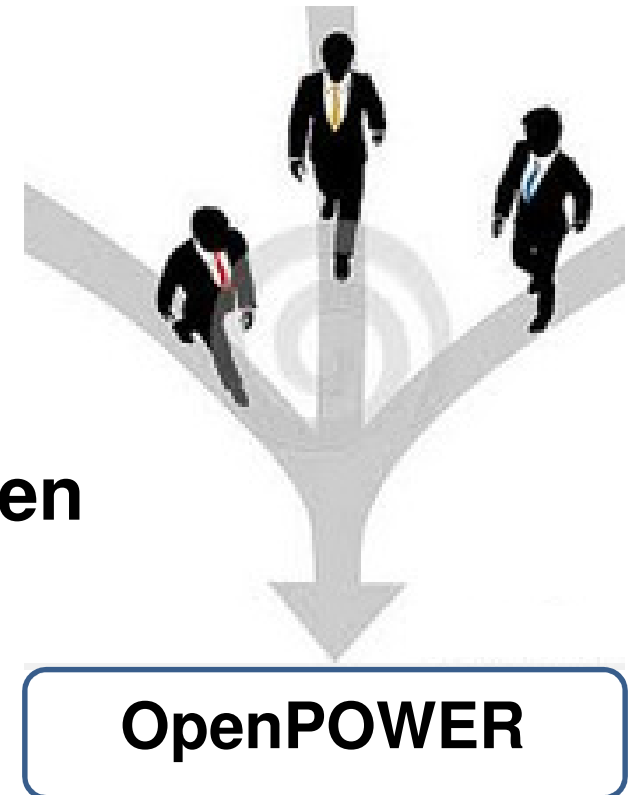
*There are a lot of misconceptions about what it is*

- A.** An attempt to license some of the POWER8 IP to a few special partners only?
- B.** Really good IBM technology based on CAPI? (Coherent Accelerator Processor Interface)
- C.** A marketing gimmick?
- D.** Linux on POWER8
- E.** A published reference platform of API's to interface to POWER8
- F.** A disruptive move by IBM to capture market share from Intel

If you understand **WHY** it was created, that will help explain what it is!

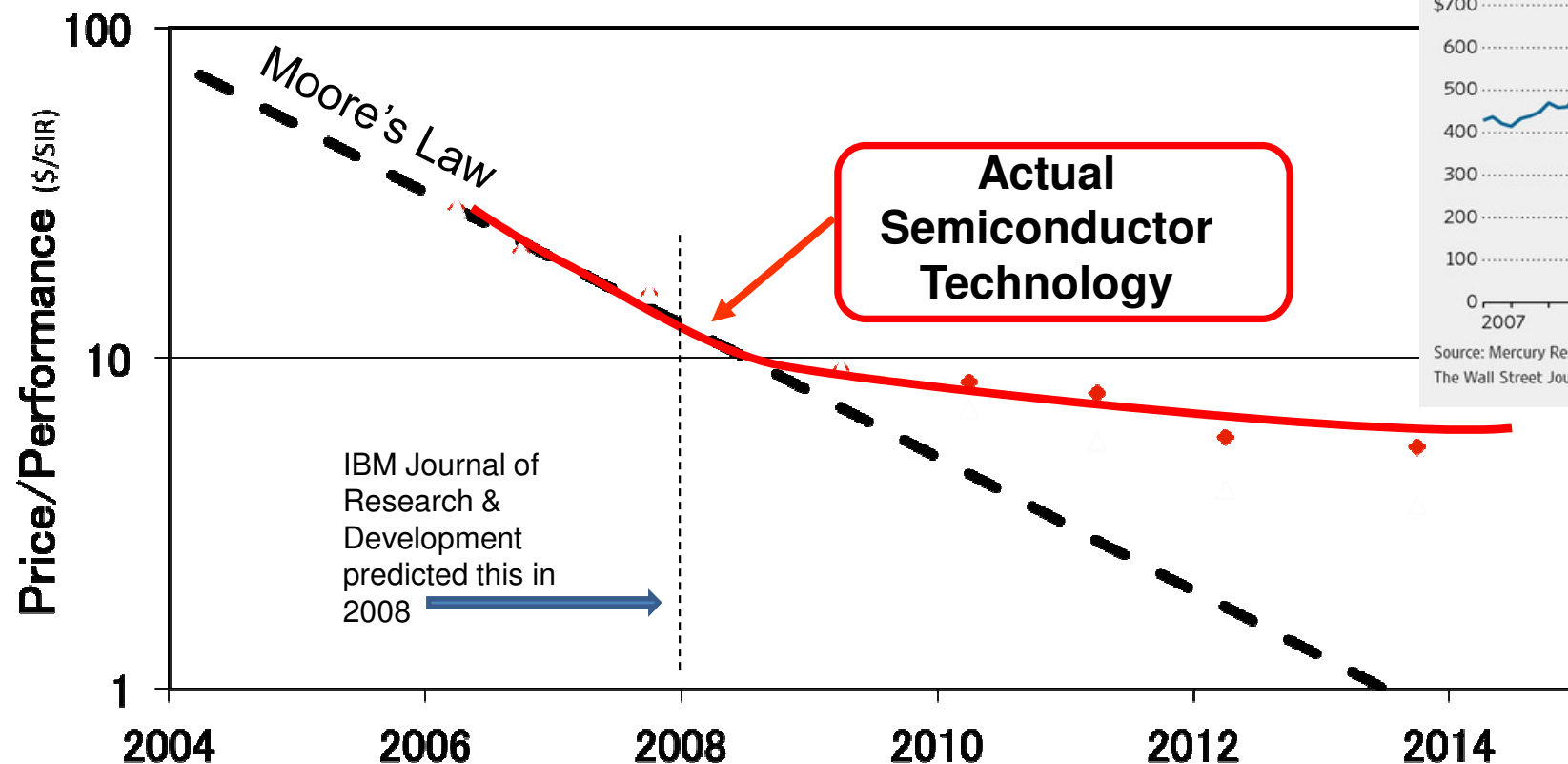
## Three different forces created OpenPOWER

1. Moore's Law
2. Google
3. Extend the “reach” of Power Architecture by making it Open



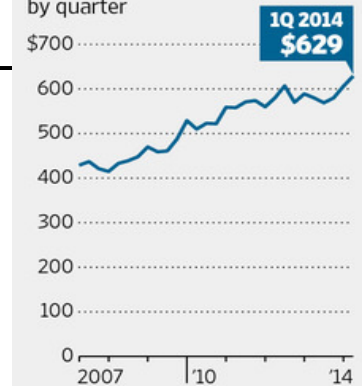
# Moore's Law – We Have Reached the Limits of Physics

*Microprocessors are no longer driving sufficient cost / performance improvements*



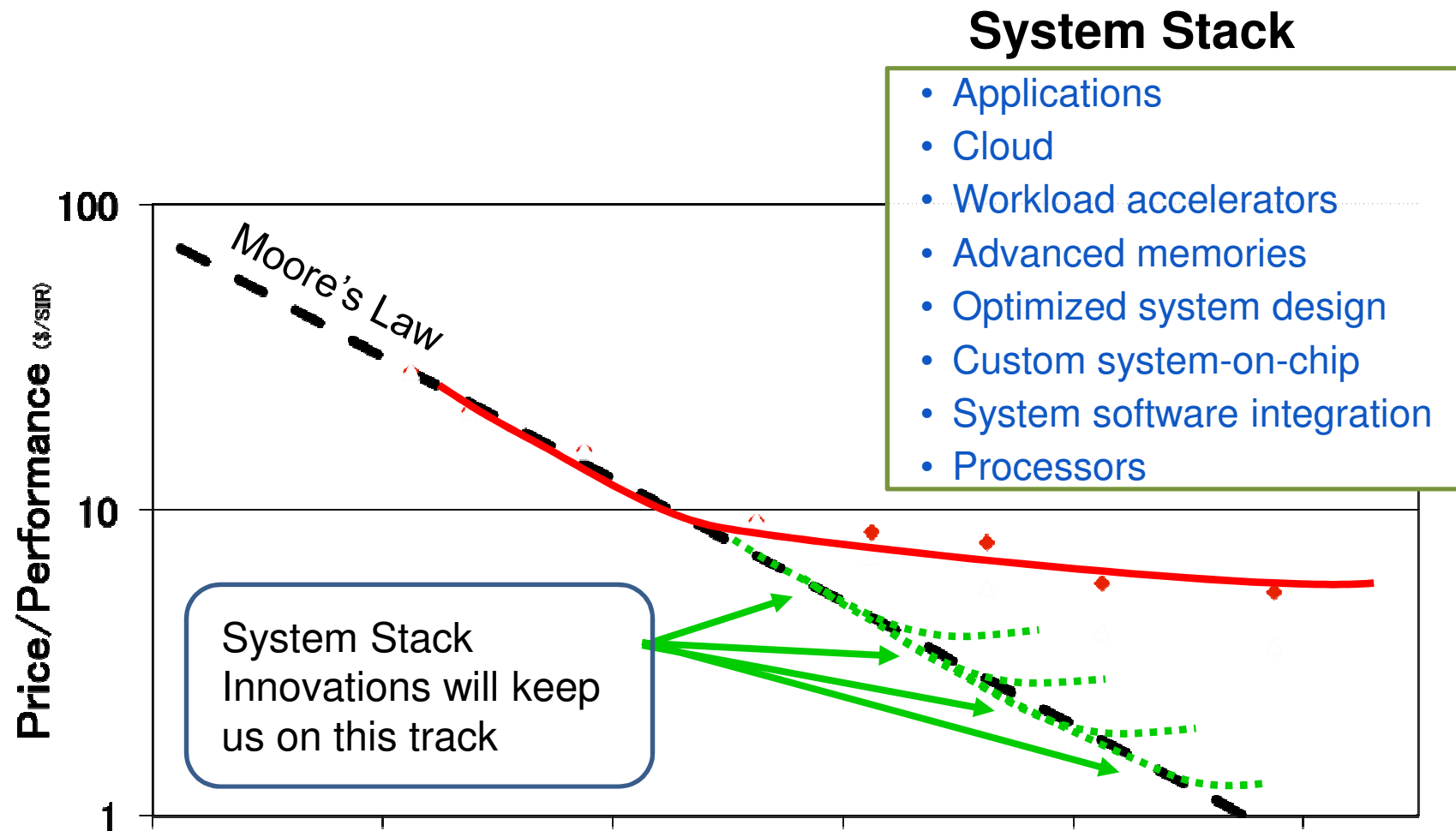
## Server Surge

Intel Corp.'s average selling price of x86 chips for server systems, by quarter



Source: Mercury Research  
The Wall Street Journal

# System stack innovations are required to keep on the cost / performance track



# Google

1. POWER8 technology is “enchanting”
2. x86 is “limited”, costly and is off Moore’s Law track
3. We want to build our own servers for future challenges
4. IBM.....



# Extend the “reach” of the Power Architecture by making it Open

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1. We had just announced \$1 Billion USD investment for Linux on POWER8 (September 2013)
2. Watson (Linux on Power) was still a major accomplishment
3. IBM needed a “bigger” differentiator (besides performance) against Intel in the marketplace
  - IBM needed a major “**disruption**” in the Industry

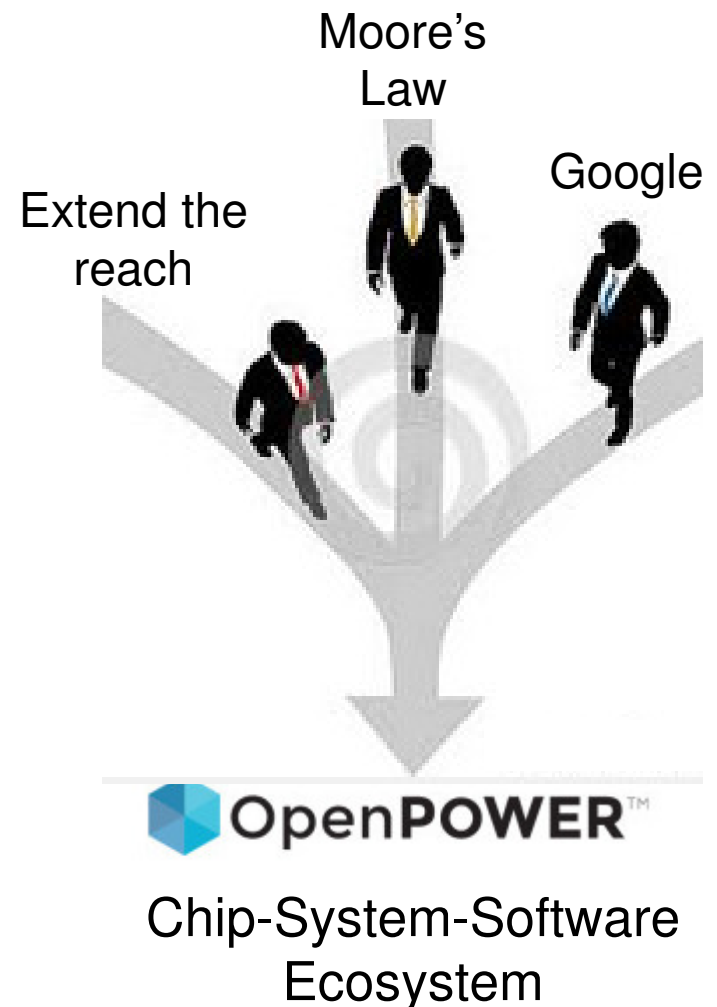
# OpenPOWER Foundation Legally Created

## December 2013 (IBM, Google, Mellanox, Tyan, NVIDIA)

### *Significant points about OpenPOWER*

1. *IBM launched “**open source**” model for hardware\**
2. *Expand the open innovation to a Chip-System-Software platform*
3. *Open models bring unique innovation and value much faster that any single company can*

\* OpenPOWER has similar characteristics to the open source software model but also has some differences





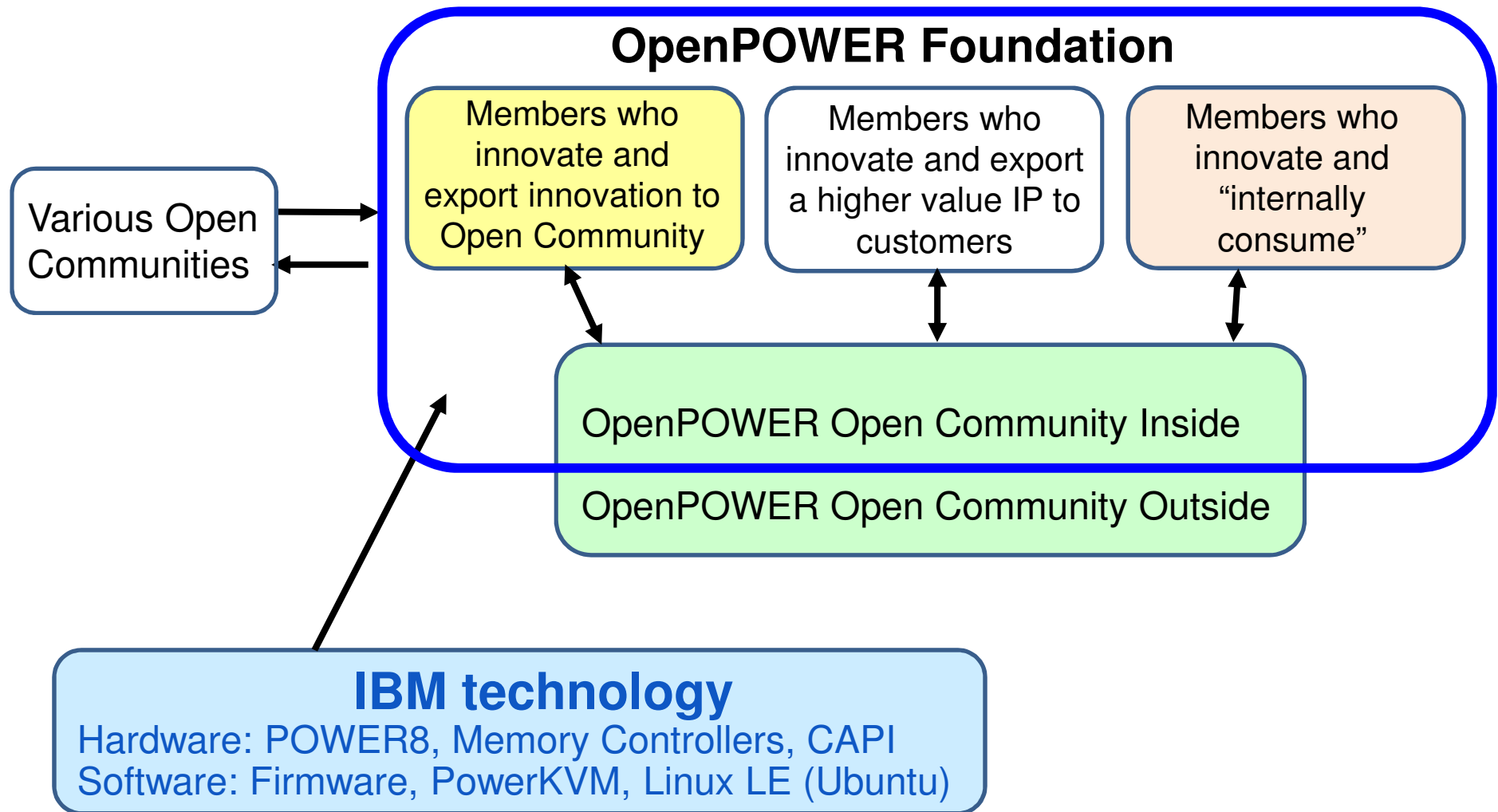
# OpenPOWER – The Official Definition

## Mission Statement:

**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 and industry**

- Simplify system design with alternative architecture
  - Includes SOC design, Bus Specifications, Reference designs, Firmware, Operating System and Open Source Hypervisor
  - Little Endian Linux to ease the migration of software to POWER
- Drive an expansion of enterprise class Hardware and Software stack for the data center
- Build a complete ecosystem to provide customers with the flexibility to build servers best suited to the Power architecture

# OpenPOWER – The Operational Picture



# OpenPOWER Current Working Committees

OpenPOWER Workgroup	Participants
25Gbps Interoperability mode PHY specification PHY = physical layer of the OSI model	Member
Accelerator technologies	Member
Application Software (Open Source)	Public
Compliance (building test-suites for pre and post-silicon compliance testing)	Member
Hardware Architecture Interfaces Examples: CAPI, I/O, PSL, ISA etc.	Member
Memory	Member
Open Server Development Platform (compute and cloud based focus)	Member
System Software (open source) (boot, run, manage) PowerKVM and Power firmware	Public

# 2014 - Incredible Momentum

## 2015 – Revenue & Growth

2013

2014

2015

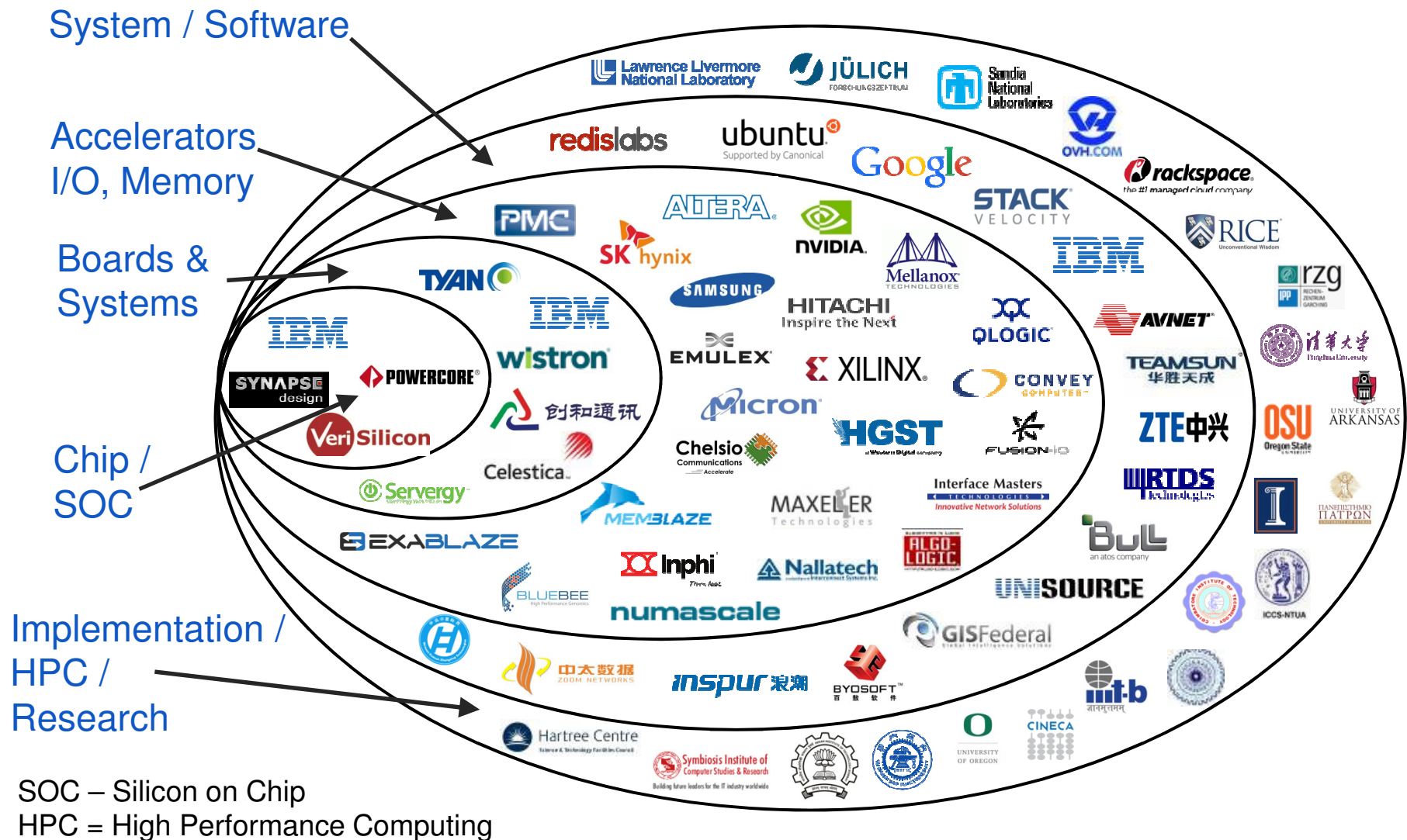
### 2014 Accomplishments

- IBM. New POWER8 Systems with CAPI, published ABI specs
- Canonical. Ubuntu Little Endian Linux distro
- Tyan. Single-socket reference system with POWER processors
- Mellanox. Network acceleration 10x improved with high speed RDMA
- Xilinx. KVS acceleration with Xilinx CAPI attached FPGA accelerator
- Altera. Monte Carlo simulations on FPGA accelerator utilizing CAPI
- NVIDIA. GPU 8x accelerated Big Data segmentation, POWER8 systems with GPU acceleration
- IBM and Google. Released 420,000+ lines of firmware code
- Convey Computer. Building an image analytics platform on CAPI
- Inspur. Planning new servers from OpenPOWER reference design
- Nallatech. Integrating FPGA acceleration
- OVH. Launched OpenPOWER Cloud offering
- Algo-Logic. Application solutions with FPGA acceleration
- IBM, NVIDIA, and Mellanox. Won DoE \$325M supercomputing bid
- Rackspace. Designing OpenPOWER, Open Compute, OpenStack system

### 2015 Preview

- First OpenPOWER Symposium – March 2015
- Major Announcement-March
- Collaborative solutions, standards, and reference designs available
- Independent members solutions and systems
- Sector growth in technical computing and cloud
- Global growth
- Broad adoption across hardware, software, and end users

# OpenPOWER: 113+ Members at All Layers



# Accelerator Card Value for IT Business

Monte Carlo Simulations

**250**

Completions

**1**

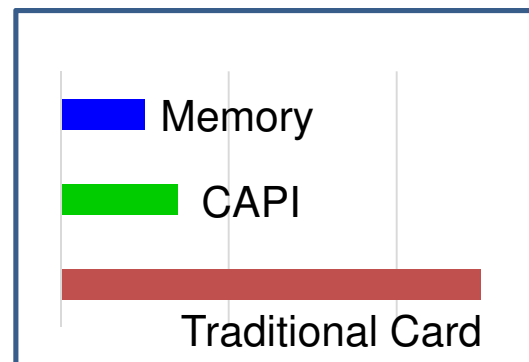
Completions



**24 to 1  
less servers**



Moving Analytic Data  
**5-10x faster**



**10x faster**  
RDMA Network



# Demonstrations of OpenPOWER innovation

## NoSQL Key Value Store Acceleration with CAPI Flash

NoSQL based solution with IBM Flash and CAPI. Attaching large flash arrays to the processor, without overhead, to drive down costs of large NoSQL deployments.



## Financial Risk Modeling with CAPI Accelerator (Monte Carlo)



Monte Carlo financial simulations run on an Altera FPGA accelerator via CAPI compared to published non-CAPI best case performance for dedicated workload acceleration.

## KVS Acceleration with RDMA

POWER8 network acceleration for Big Data utilities high speed RDMA networking with acceleration technology to reduce latency by 10x when working with big data, reducing infrastructure requirements.



## Big Data and Java Workload Acceleration

Exploit GPUs for Apache Hadoop/Mahout acceleration directly from Java. Ideal for Big Data and Analytic Java workloads. Demo uses GPU exploitation for 8x acceleration of a machine learning algorithm for Big Data segmentation.



## KVS Acceleration with CAPI FPGA

Compare performance of Key Value Store on a normal configuration, to an acceleration using a Xilinx CAPI attached FPGA accelerator.

## Watson on Power in SoftLayer (Tornado)

SoftLayer is now providing Watson as a service on a Power System, and Tornado demonstrates that service with an application.



POWER8 Evaluation System is single socket ATX form factor, BMC based evaluation board. Designed and fulfilled by Tyan Corporation.

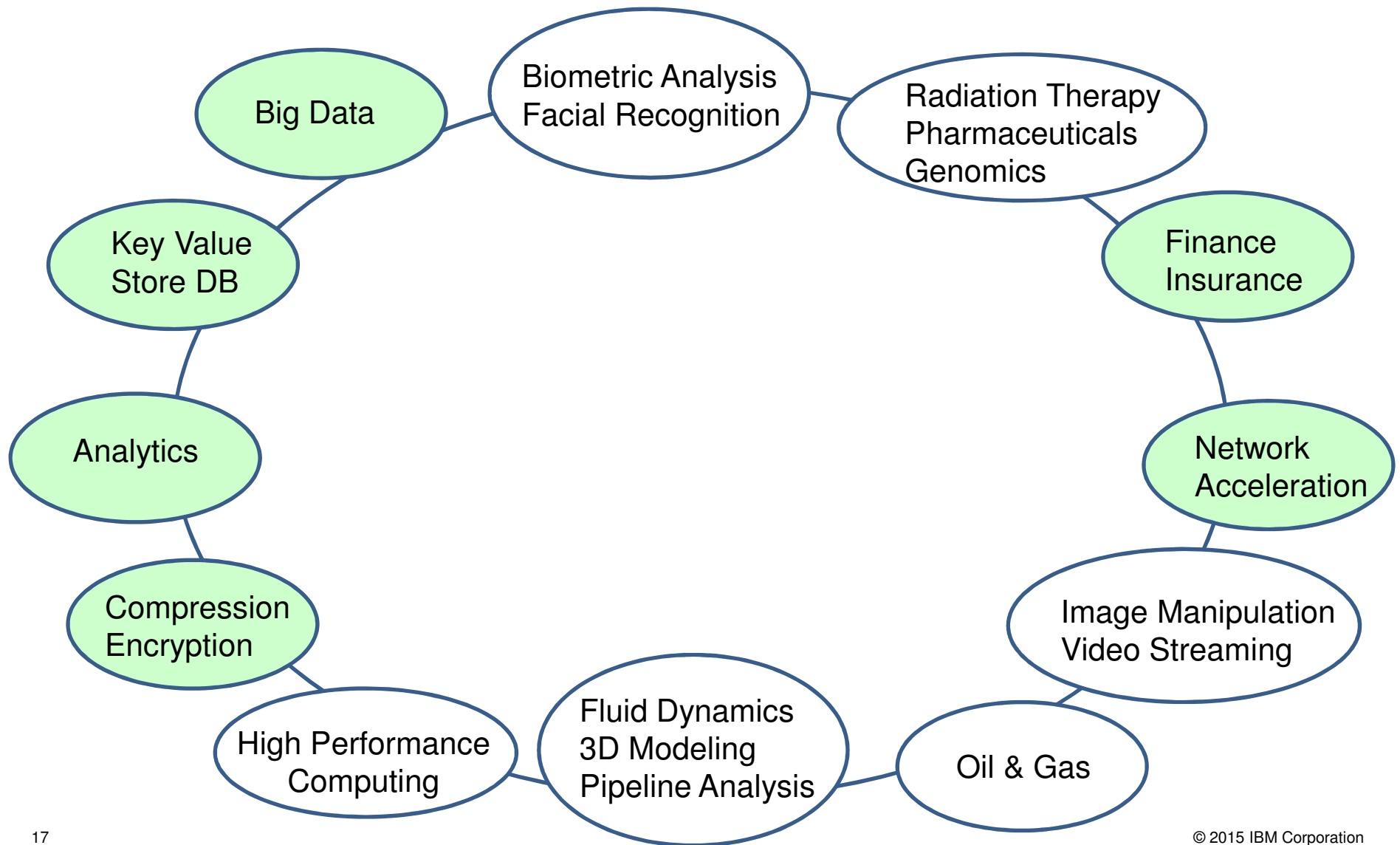
# OpenPOWER 03/18/15 Announcements

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1. **ChuangHe 1U/1S POWER8 Server** – One of four products under development in China.
2. **Cirrascale 1S POWER8 / NVIDIA GPU Developer Platform** – OpenPOWER-based GPU developer platform.
3. **IBM Memory Technology Innovation using Altera FPGAs** – New memory technologies / combinations of Flash and DRAM.
4. **IBM 2U/2S POWER8 / Nvidia GPU Server** -- IBM and Wistron are jointly developing this HPC server using technology from NVIDIA and Mellanox; to be released later in 2015.
5. **Inspur 2S POWER8 Server** -- This comes with brand-new high end data center and application optimization. It supports two OpenPOWER processors.
6. **Rackspace POWER8 OpenCompute Form Factor Planar** – The **first** open server design combining OpenPOWER, Open Compute and OpenStack; which will be incorporated into Rackspace data centers.
7. **Suzhou PowerCore CP1 mechanical sample** -- Soon to be the **first** China "local" POWER derivative chip in the market.
8. **Tyan 2U/1S POWER8 Server** – The **first** commercially available OpenPOWER third-party server.
9. **Zoom's RedPower 2U/2S POWER8 System Planar + Memory Riser** -- Soon to be the **first** China "local" OpenPOWER server in the market.
10. **Convey's CAPI Developer Kit for Xilinx FPGAs**- Brings the power of Convey's Eagle line of coprocessors and Xilinx Virtex-7 FPGAs to IBM POWER8 systems. By offloading functions to application specific hardware on the coprocessor, developers can increase performance and reduce power consumption for data intensive applications.



# Accelerator Cards and CAPI Solutions



# References

## <http://openpowerfoundation.org>

- **Latest Announcements:** <http://openpowerfoundation.org/newsevents/#category-press-releases>
- [Google, IBM, Mellanox, NVIDIA, Tyan Announce Development Group for Data Centers](#)
- [IBM opens up Power chips, ARM-style, to take on Chipzilla](#)
- [Open and Collaborative Development is the Future of Cloud Computing - IBM's A Smarter Planet blog](#)
- [IBM's OpenPower consortium with Nvidia, Google aims to advance datacenter](#)
- [IBM Forms OpenPower Consortium, Breathes New Life Into Power](#)
- [Chipmaker Nvidia Unveils High-Speed GPU Interconnect](#)
- [Open Sourced BIOS Helps Power8 Compete With X86](#)
- [IBM intros next-gen Power8 microprocessor, servers along with OpenPower roadmap](#)
- [IBM Gets Allies to Chip Away at Intel](#)
- [Altera Brings FPGA-based Acceleration to IBM Power Announces Support for OpenPOWER Consortium](#)
- [Suzhou PowerCore to Start Using IBM POWER Tech for New Chip Design in China](#)
- [IBM Announces that Samsung Electronics Joins OpenPOWER Foundation](#)
- **[OpenPOWER Gains Momentum Heading into Second Year](#)**