Amber Graner
Community Manager

Why Open Hardware?
Hello my name is Amber Graner
Community Manager
Open Compute Team
The Open Compute Team

Corey Bell  CEO
Cole Crawford  Executive Director
Steve Helvie  VP Channel Development
Amber Graner  Community Manager
William Mapp  Strategic Alliances
Stephanie Loayza  Events Coordinator
The Open Compute Board

Frank Frankovsky  
Chairman

Andy Bechtolsheim  
Co-Founder Google

Jason Taylor  
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Jason Waxman  
Intel

Don Duet  
Goldman Sachs

Bill Laing  
Microsoft

Mark Roenigk  
Rackspace

Google

Facebook

Intel

Goldman Sachs

Microsoft

Rackspace
The Open Compute Foundation Overview
Why?

Freedom
Drive Innovation
Sharing
Quality
Flexibility
Interoperability
Auditability
Cost
The Open Compute Story

Founded in 2011 by Facebook, Intel, Rackspace, Goldman Sachs and Andy Bechtolsheim. Our mission is to apply the benefits of open source software to hardware and rapidly increase the pace of innovation to hardware design and engineering. A project started at Facebook over 4 years ago with a pretty big goal: to build one of the most efficient computing infrastructures at the lowest possible cost. We decided to honor our hacker roots and challenge convention by custom designing and building our software, servers and data centers from the ground up – and then share these technologies as they evolve.

The result is a data center full of vanity free servers which is 38% more efficient and 24% less expensive to build and run than other state-of-the-art data centers.
Industry Standard

Open Compute Project

1.9 PUE

1.07 PUE
Projects We Govern

**Server**
Open Compute motherboards are power-optimized, barebones designs that provide the lowest capital and...

**Storage**
Storage is a key component of any data center, and offers many opportunities for efficiency...

**Data Center Design**
Designed in tandem with Open Compute servers, the data center maximizes mechanical...

**Open Rack**
The first rack standard that’s designed for data centers...

**Networking**
Designing fully open network technology stacks.

**Hardware Management**
Designing remote management tools...

**Certification**
Designing standards for Solution Providers...

**HPC**
Commoditizing and standardizing HPC interfaces
Open Compute Adoption
Open Compute Technology
The 5 Pillars of OCP Technology

- Racks
- Power
- Chassis
- PCB
- Software
Data Center
Electrical Overview

- **Eliminate** 480V to 208V transformation
  - **Used** 480/277VAC distribution to IT equipment

- **Remove** centralized UPS
  - **Implemented** 48VDC UPS System

- **Result** a highly efficient electrical system and small failure domain
Typical Power

Utility Transformer
480/277 VAC
2% loss

AC/DC
UPS 480VAC
6% - 12% loss

DC/AC
208/120VAC
3% loss

ASTS/PDU
99.999% Availability

SERVER PS
10% loss (assuming 90% plus PS)

Total loss up to server:
21% to 27%

Prineville Power

Utility Transformer
480/277 VAC
2% loss

Standby Generator

FB SERVER PS
48VDC DC UPS (Stand-by)
5.5% loss

Total loss up to server:
7.5%
Battery Cabinet

- Custom DC UPS
- 56kW or 85kW
- 480VAC, 3-phase input
- 45 second back-up
- 20 sealed VRLA batteries
- Battery Validation System
- Six 48VDC Output
- Two 50A 48VDC aux outputs
Mechanical Overview

**Removed**
- Centralized chiller plant
- HVAC ductwork

**System Basis of Design**
- ASHRAE Weather Data: N=50 years
- TC9.9 2008: Recommended Envelopes

**Built-up penthouse air handling system**

**Server waste heat is used for office space heating**
Typical datacenter cooling

Prineville datacenter cooling
PRN datacenter cooling
Benefits of Open Compute at Facebook

Compared to traditional servers.....

38% Increase in Power Efficiency

24% Reduction in Costs
Rack, Storage, and Servers
OCP Contributions
Open Compute: Open Rack

Well-defined “Mechanical API” between the server and the rack

- Accepts any size equipment 1U – 10U
- Wide 21” equipment bay for maximum space efficiency
- Shared 12v DC power system

http://www.opencompute.org/projects/open-rack/
Open Bridge Rack

- EIA and OCP Compliant
- Ability to respond to changing capacity demands
- Rapid Conversion
- Rack & Power Separation
- Vendor Agnostic

http://www.opencompute.org/assets/OCP-Summit-V-Slides/Mainstage/OCP-Fidelity-Obernesser.pdf
Open Compute servers are racked into triplets composed of three adjoining 42U columns.

Each triplet has 2 top of rack switches, and each of the three columns contains 30 servers, for a total of 90 servers in the triplet.

One battery cabinet sits in between a pair of triplet racks in the data center aisle, providing DC power in the event of loss of AC power.
Open Compute Server v2

First step with shared components by reusing PSU and fans between two servers

• Increased rack density without sacrificing efficiency or cost
• All new Facebook deployments in 2012 were “v2” servers

http://www.opencompute.org/projects/server/
Open Compute Server v3

• Reuses the “v2” half-width motherboards
• Self-contained sled for Open Rack
• 3-across 2U form factor enables 80mm fans with 45 servers per rack

http://www.opencompute.org/projects/server/
Open Vault

• Storage JBOD for Open Rack

• Fills the volume of the rack without sacrificing hot-swap

http://www.opencompute.org/projects/storage/
OCS V1/V2

Open Source Code
Chassis management
Operations Toolkit
Interoperability Toolkit

Specifications
Chassis, Blade, Mezzanines
Management APIs
Certification Requirements

Mechanical CAD Models
Chassis, Blade, Mezzanines

Board Files & Gerbers
Power Distribution Backplane
Tray Backplane

http://www.opencompute.org/wiki/Motherboard/SpecsAndDesigns
The Hyve Solutions OCP 1500 Series server conforms to the OCP v2.0 server standard and meets the demands of hyper-scale data center environments with existing 19” rack infrastructures. It provides a system with efficient cooling, easy maintenance and an abundance of compute power that can be readily deployed in an existing data center.

Each node supports up to two Intel® Xeon E5-2600 series processors, providing high core density and high compute power to handle multi-threaded workloads such as cloud computing, web hosting, database, and real-time transactions. 8 DIMM slots across a quad-channel memory interface per CPU offer up to 512GB of high-performance memory per node.

http://www.hyvesolutions.com/products/ocp/hyve1500.html
Acton Leaf Switch

The Edge-Core AS5712-54X switch meets the high-performance, availability, and network-scaling requirements of enterprise and cloud data centers.

The AS5712-54X provides full line-rate switching at Layer 2 or Layer 3 across 48 x 10 GbE ports and 6 x 40 GbE uplinks. The switch can be deployed either as a Top-of-Rack switch, or as part of a 10 GbE or 40 GbE distributed spine, forming a non-blocking folded CLOS data center fabric.

The switch is rack mountable in either a standard 19 inch rack, or with the Open Rack Switch Adapter in the 21 inch Open Rack.

The **Seagate® Kinetic Open Storage platform** is the first device-based storage platform enabling independent software vendors (ISV) and cloud service provider (CSP), and enterprise customers to optimize scale-out file and object-based storage, delivering lower TCO. Seagate Kinetic Storage comprises storage devices + key/value API + Ethernet connectivity.

http://www.opencompute.org/wiki/Storage/Dev
Network
Open Network Install Environment

ONIE
Example Networking Contribution

Open Network Install Environment

ONIE

Bare Metal Switching

Broad Commercial Adoption from

Big Switch, Broadcom and Pica8
Wedge & FBOSS
Coming Soon
Serviceability
Complex Designs

Typical Large Datacenter:
1000 Servers per Technician
Simple Designs

Typical large datacenter: 1000 Servers per Technician

Facebook datacenter: 25,000 Servers per Technician
 Adoption / Case Studies
$1.2 Billion in savings
40% Cost Savings

15% Increase in Power Efficiency

50% Improvement in Deployment & Service Times
Public Cloud, Private Cloud & Managed Hosting running > 100K servers
Get Open Compute Gear
Get Involved
Member makes a contribution
Including technical documents

Reviewed by community
Voted by incubation committee

Posted on opencompute.org
Available to the public
You or your organization have decided to submit a spec/design.

- **Have you or your organization sign the OCP CLA (Inbound license)?**
  - Yes
  - **Pick an outbound License.**
    - Hardware - OCP HLs
    - Software - OSI Approved License
  - **Community Review**
    - Project Lead/Community
  - IC Review
  - **Yes**
  - **No**

- **Are you or your organization an OCP Member?**
  - Yes
  - **Become an OCP Member by signing the OCP Membership Agreement (Choose Individual or Organizational Membership)**
  - **No**
  - **Spec Process Ends**

- **Did the IC accept the Spec?**
  - Yes
  - **Spec Approved**
  - **No**
Get Involved

http://www.opencompute.org/community/get-involved/

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Thank You!