OPEN
Compute Project

Why Open Hardware?

Amber Graner
Community Manager

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

Facebook

Jason Waxman

Intel

Don Duet

Goldman
Sachs

Bill Laing

Microsoft

Mark Roenigk

Rackspace

The Open Compute Foundation Overview

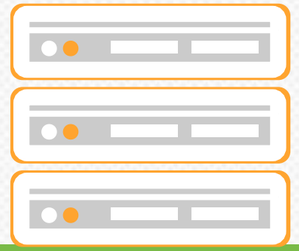
Why?

Freedom
Drive Innovation
Sharing
Quality
Flexibility
Interoperability
Auditability
Cost

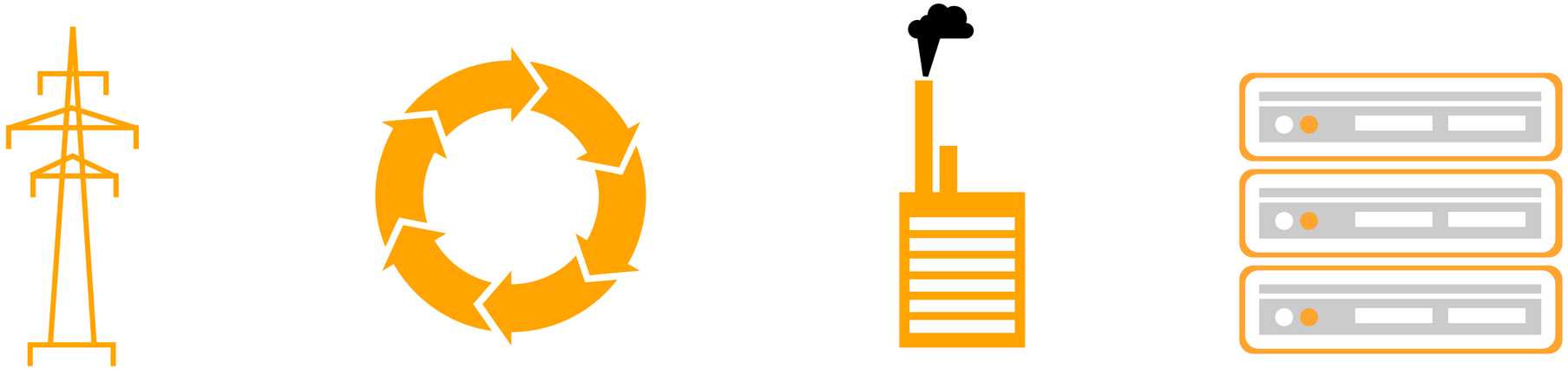
The Open Compute Story

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.

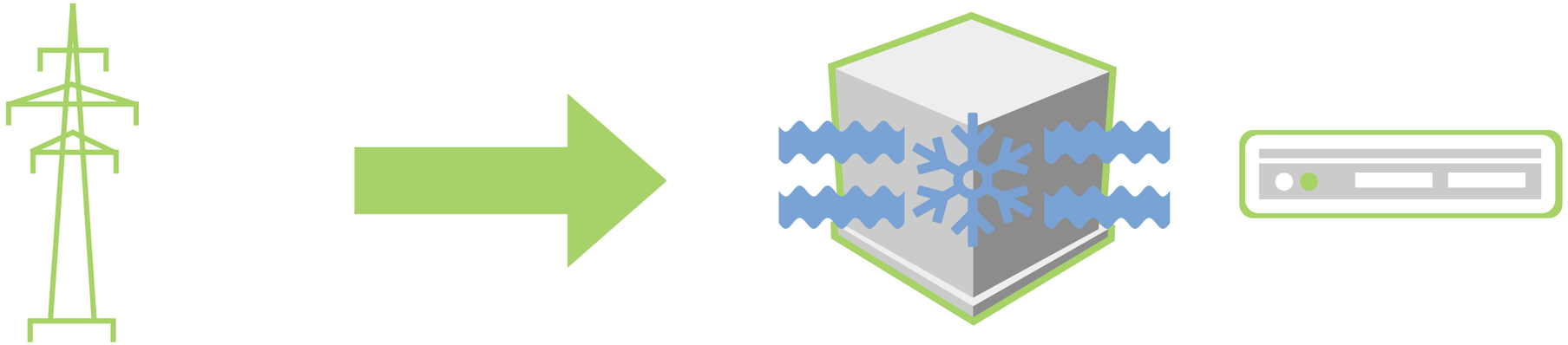


Industry Standard



1.9
PUE

Open Compute Project



1.07
PUE

Projects We Govern

Server

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

Learn More

Storage

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

Learn More

Data Center Design

Designed in tandem with Open Compute servers, the data center maximizes mechanical...

Learn More

Open Rack

The first rack standard that's designed for data centers...

Networking

Designing fully open network technology stacks.

Learn More

Hardware Management

Designing remote management tools...

Learn More

Certification

Designing standards for Solution Providers...

Learn More

HPC

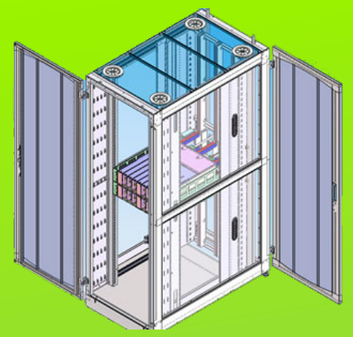
Commoditizing and standardizing HPC interfaces

Open Compute Adoption

Open Compute Technology

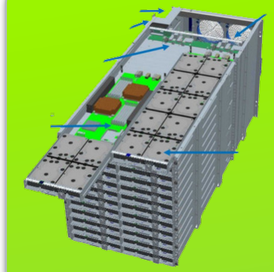
The 5 Pillars of OCP Technology

Racks

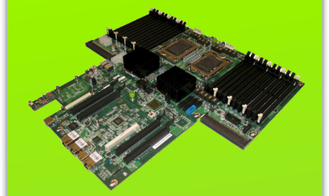


Power

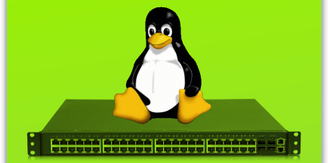
Chassis



PCB



Software



Data Center


Prineville, OR


Forest City, NC

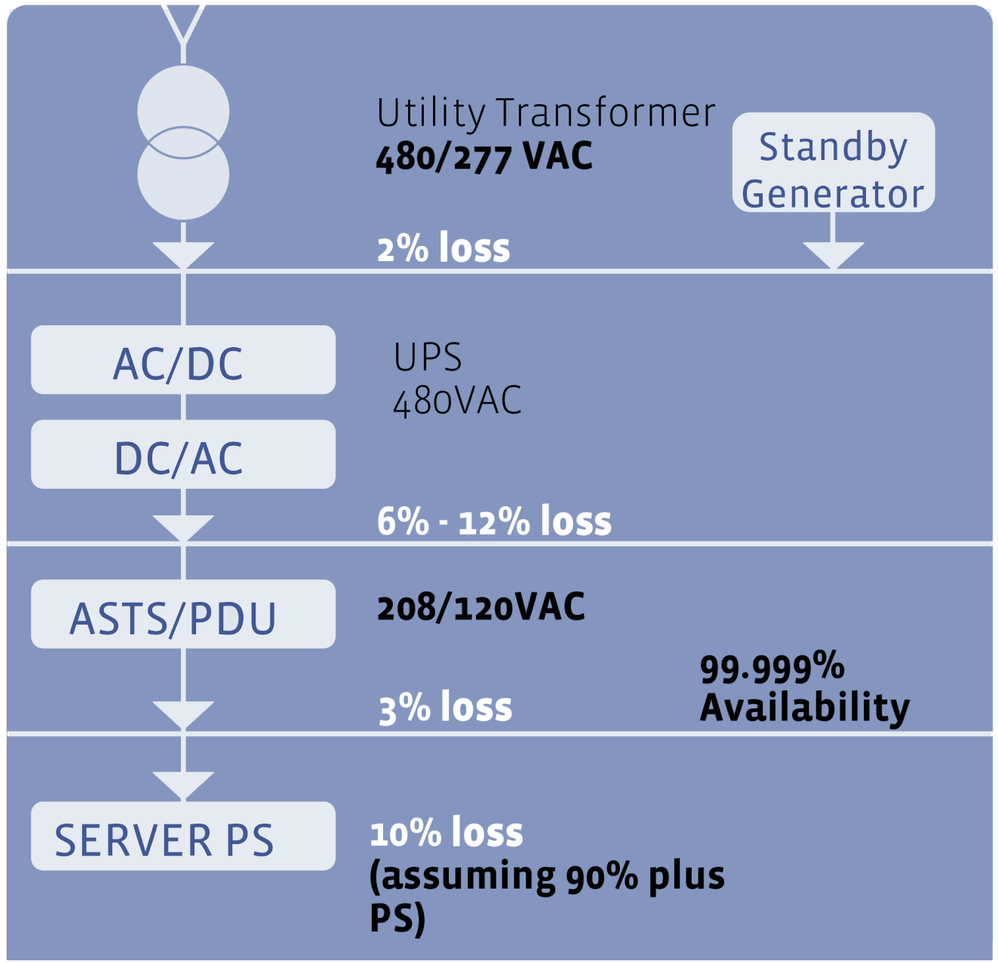

Luleå, Sweden


Altoona, IA
Hodnett
Photographics LLC

Electrical Overview

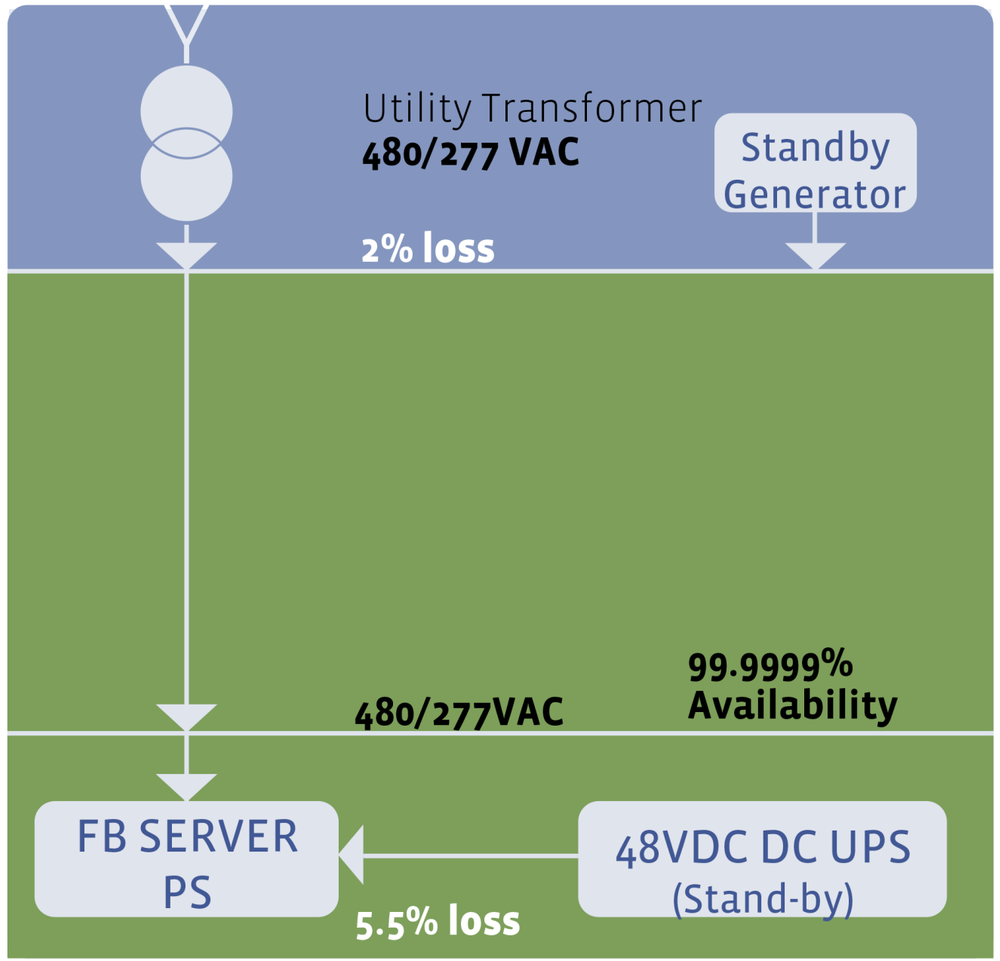
- Eliminate 480V to 208V transformation
  - Used 480/277VAC distribution to IT equipment
- Remove centralized UPS
  - Implemented 48VDC UPS System
- Result a highly efficient electrical system and small failure domain

Typical Power



Total loss up to server:
21% to 27%

Prineville Power



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

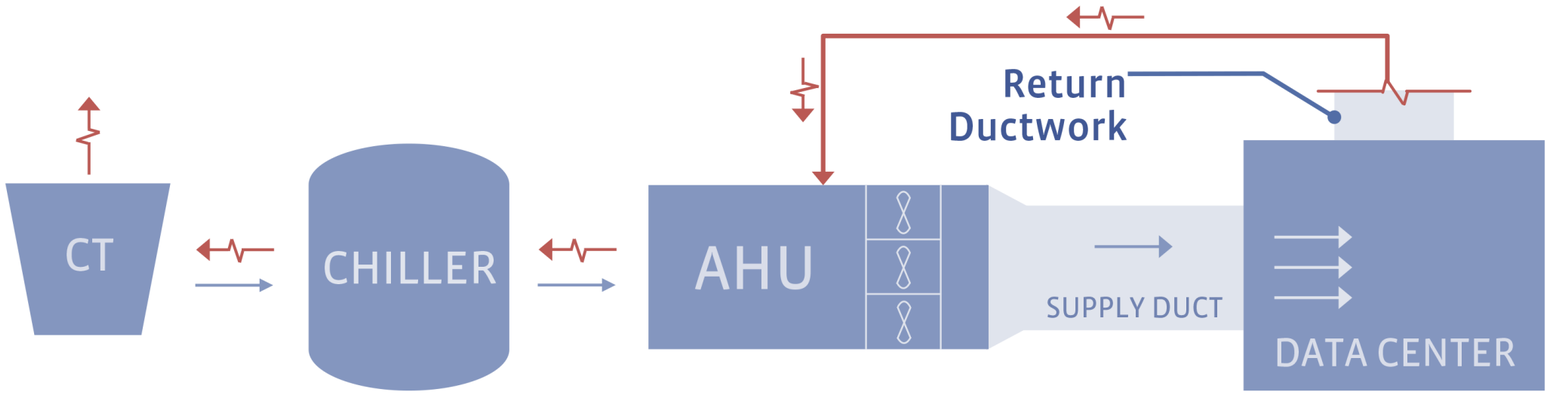
System Basis of Design

- ASHRAE Weather Data: N=50 years
- TC9.9 2008: Recommended Envelopes

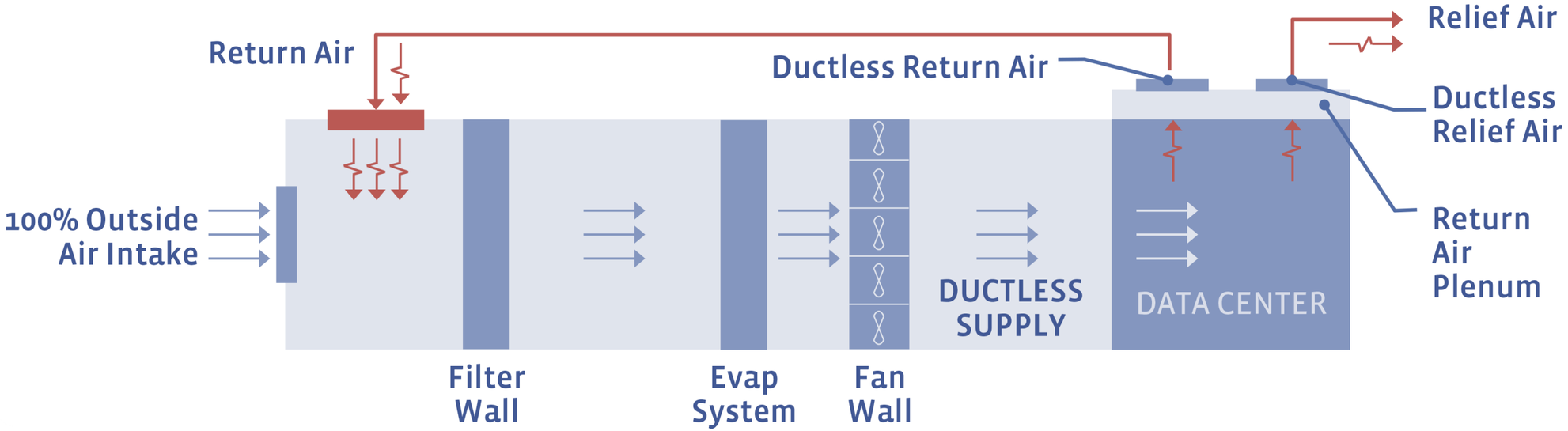
Built-up penthouse air handling system

Server waste heat is used for office space heating

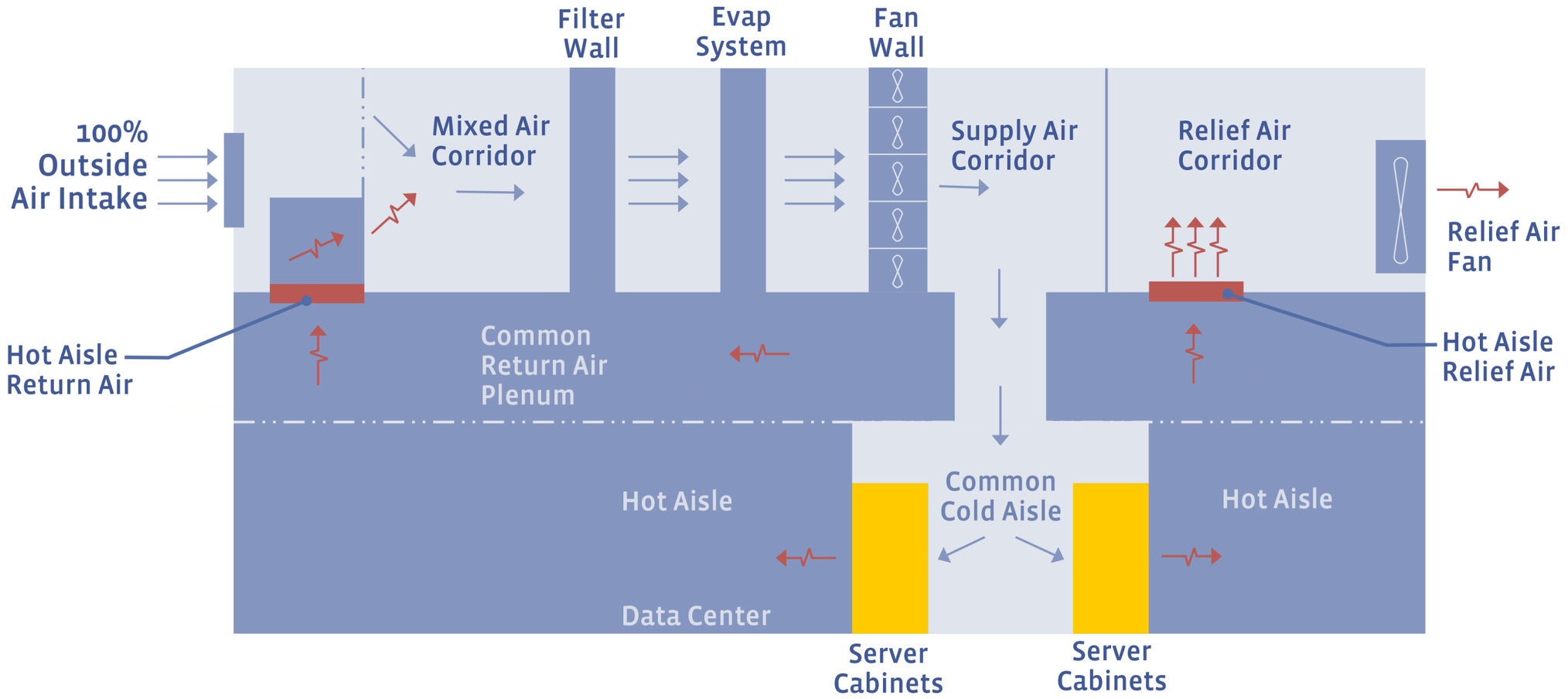
Typical datacenter cooling



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

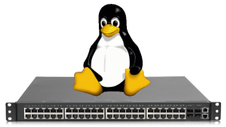
Freedom

Windmill

Winterfell

Microsoft OCS V1

Microsoft OCS V2



Open Network Linux

2011

Tripplet

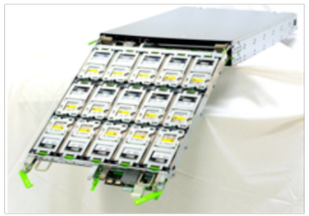
Data Center

2012

2013

Open Rack

Knox



2014

Open Network Install Environment

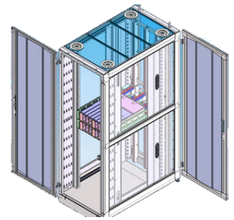
ONIE

2015

Hyve 1500

Seagate Kinetic

Accton
Leaf Switch



Open Bridge Rack

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

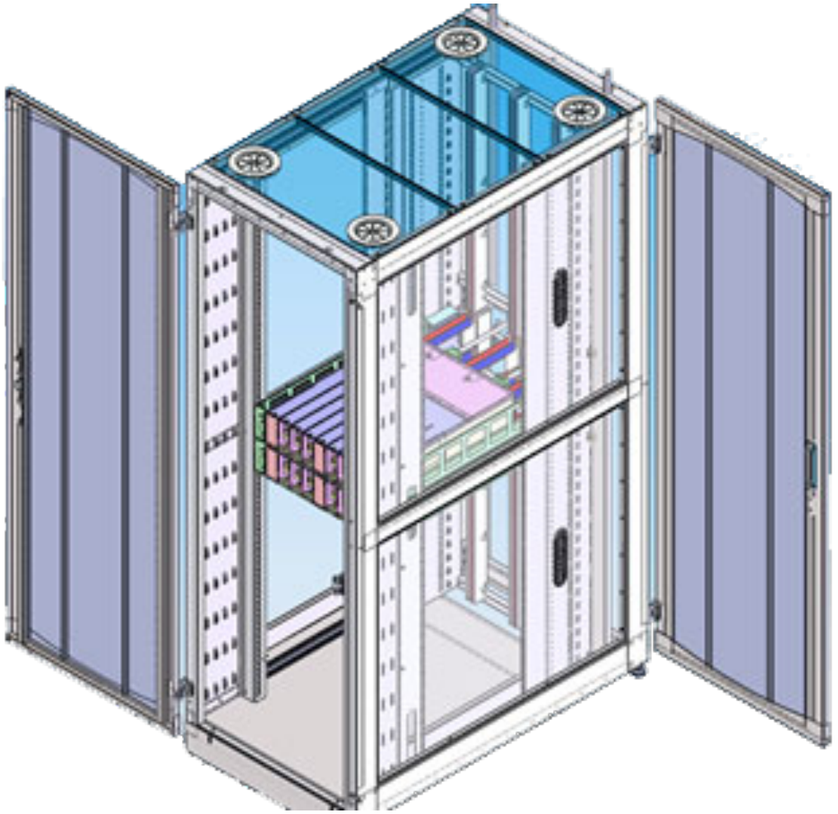
EIA and OCP Compliant

Rapid Conversion

Rack & Power Separation

Ability to respond to changing capacity demands

Vendor Agnostic



http://www.opencompute.org/assets/OCP-Summit-V-Slides/Mainstage/OCP-Fidelity-Obernesser.pdf

Tripplet Rack

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.

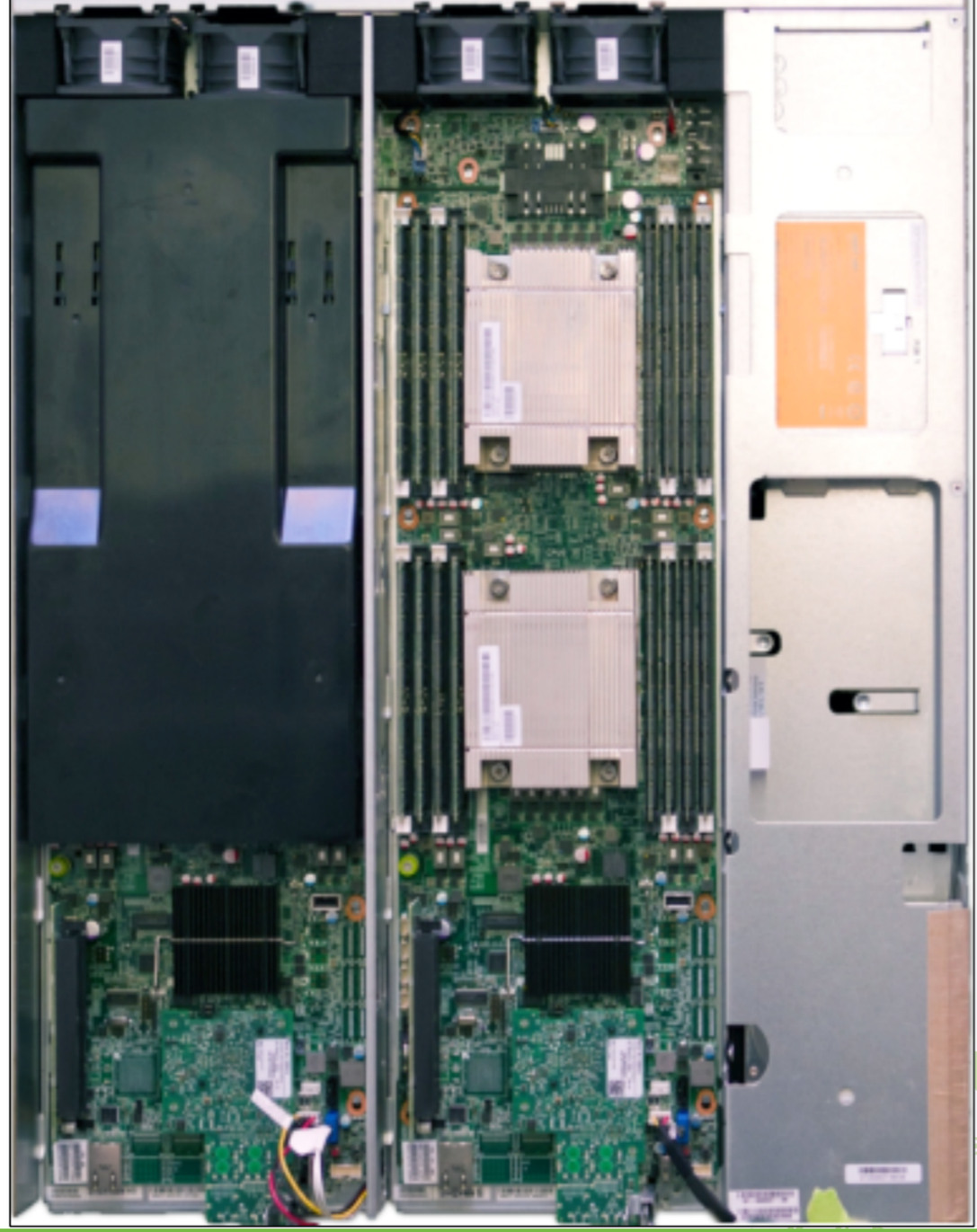
One battery cabinet sits in between a pair of triplet racks in the data center aisle, providing DC power in the event of loss of AC power.

Open Compute Server v2

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

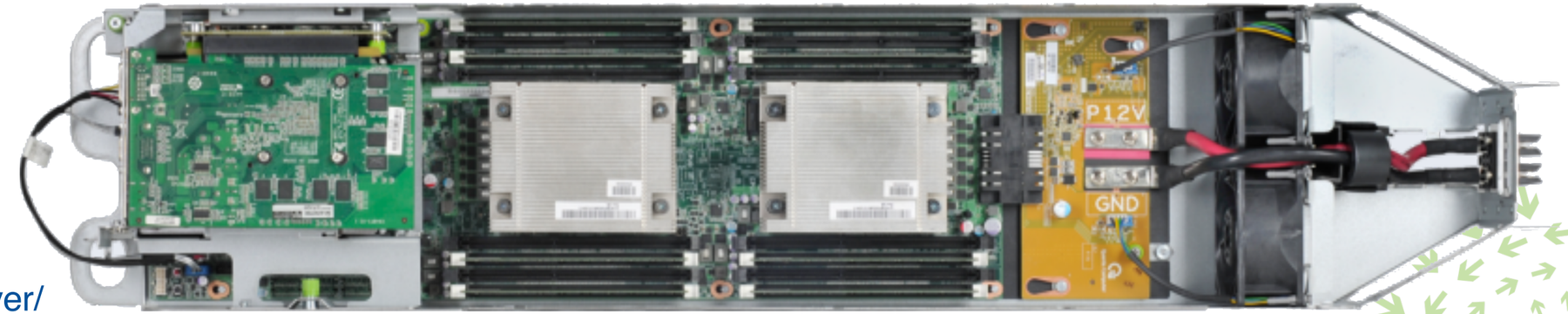
- Increased rack density without sacrificing efficiency or cost
- All new Facebook deployments in 2012 were “v2” servers

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

Board Files & Gerbers

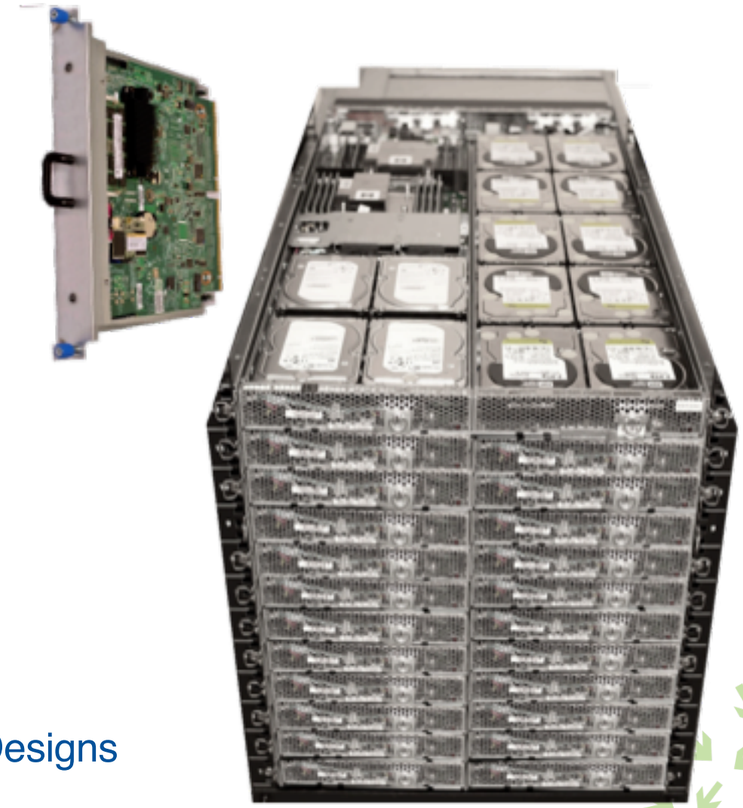
Power Distribution Backplane
Tray Backplane

Specifications

Chassis, Blade, Mezzanines
Management APIs
Certification Requirements

Mechanical CAD Models

Chassis, Blade, Mezzanines



http://www.opencompute.org/wiki/Motherboard/SpecsAndDesigns

Hyve Solutions OCP 1500 Series server

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.

http://www.edge-core.com/ProdDtl.asp?sno=457&AS5712-54X%20with%20ONIE

Seagate Kinetic

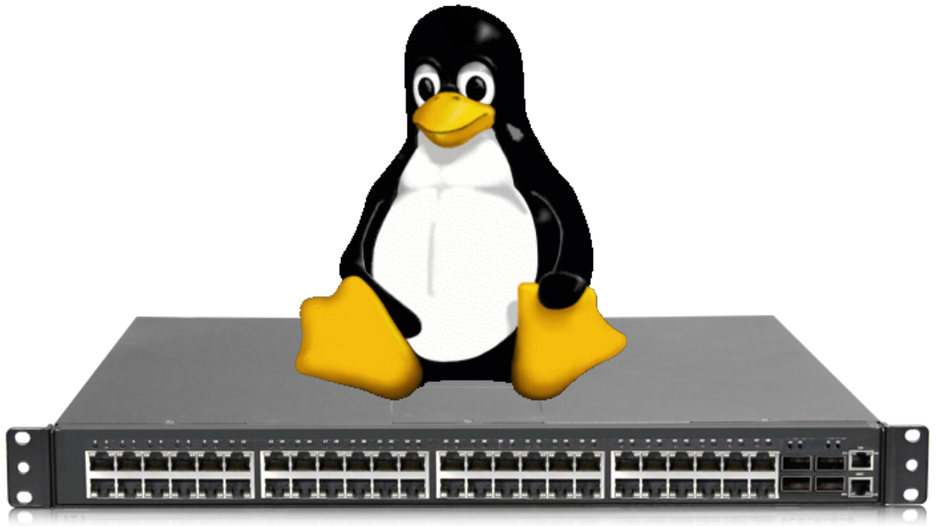
The Seagate® Kinetic Open Storage platform is the first device-based storage platform enabling independent software vendors (ISV) and cloud service provider (CSP), and enterprise customers to optimize scale-out file and object-based storage, delivering lower TCO. Seagate Kinetic Storage comprises storage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

cumulus networks

Broad Commercial Adoption from

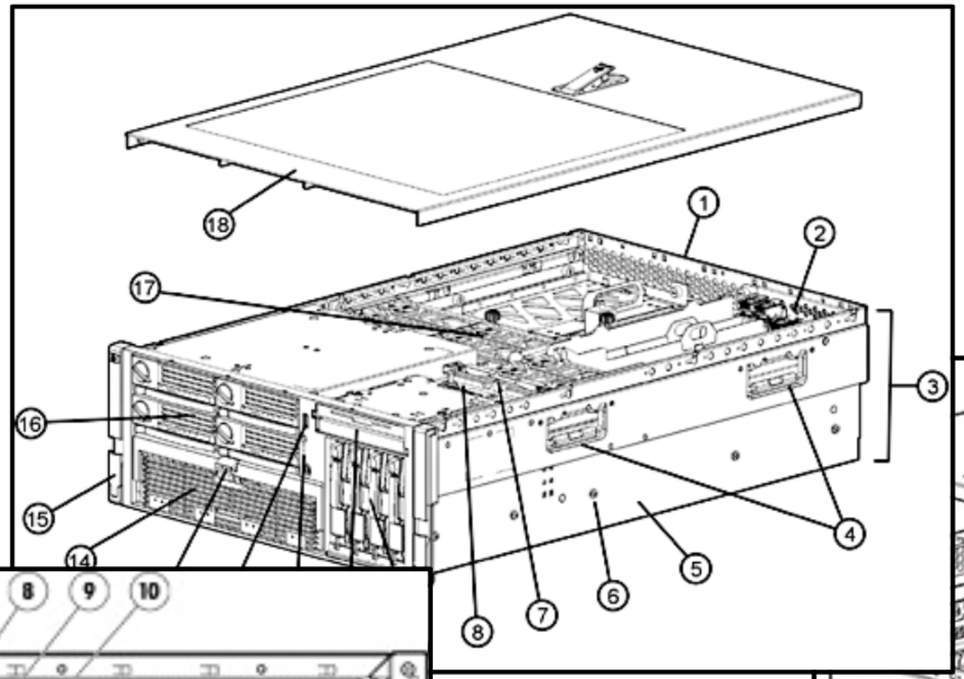
Big Switch, Broadcom and Pica8

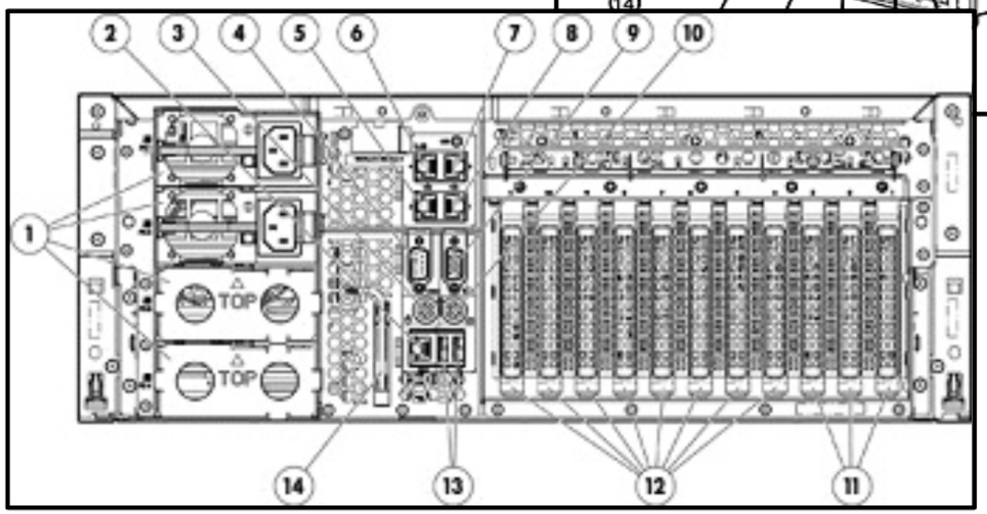
Wedge & FBOSS
Coming Soon

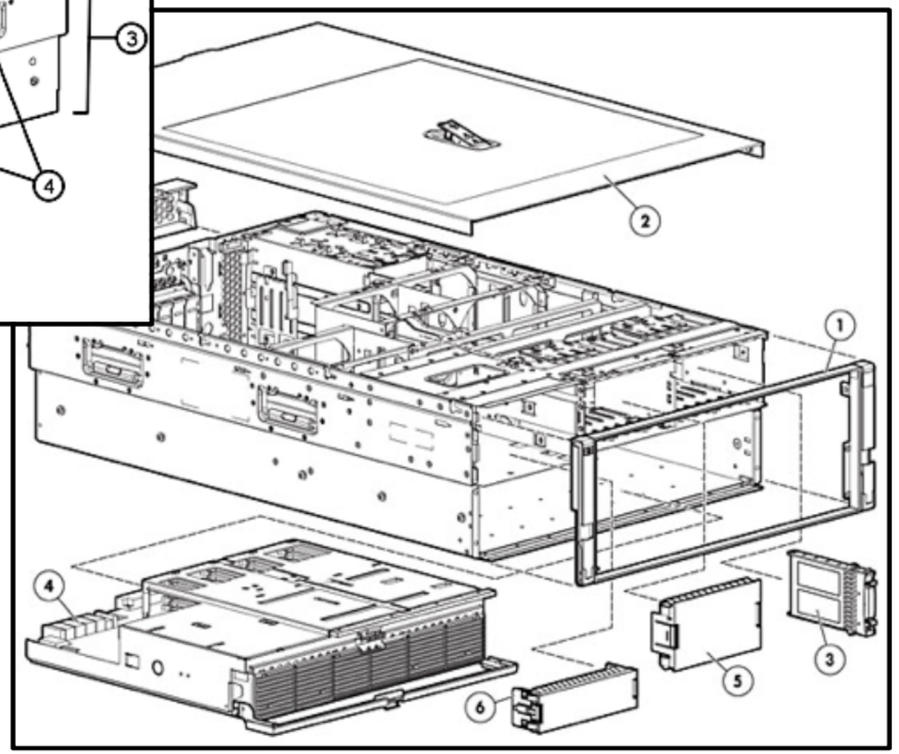
Serviceability

Complex Designs

Typical Large Datacenter:
1000 Servers per Technician







Simple Designs

Typical large datacenter:
1000 Servers per Technician

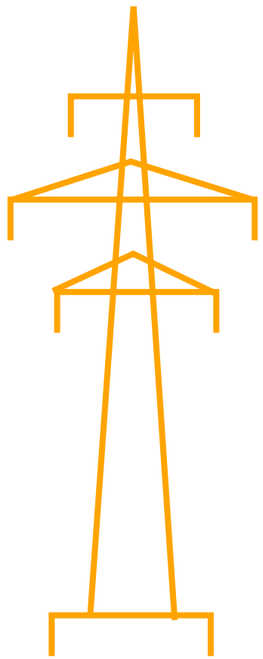
Facebook datacenter:
25,000 Servers per Technician

Adoption / Case Studies

facebook

$1.2 Billion in savings

Microsoft



40% Cost Savings

15% Increase in Power Efficiency

50% Improvement in Deployment & Service Times

rackspace®

the #1 managed cloud company

Public Cloud, Private Cloud & Managed Hosting running > 100K servers

Get Open Compute Gear

Get Involved

Technology Contribution Process

Member makes a contribution

Including technical documents

Reviewed by community

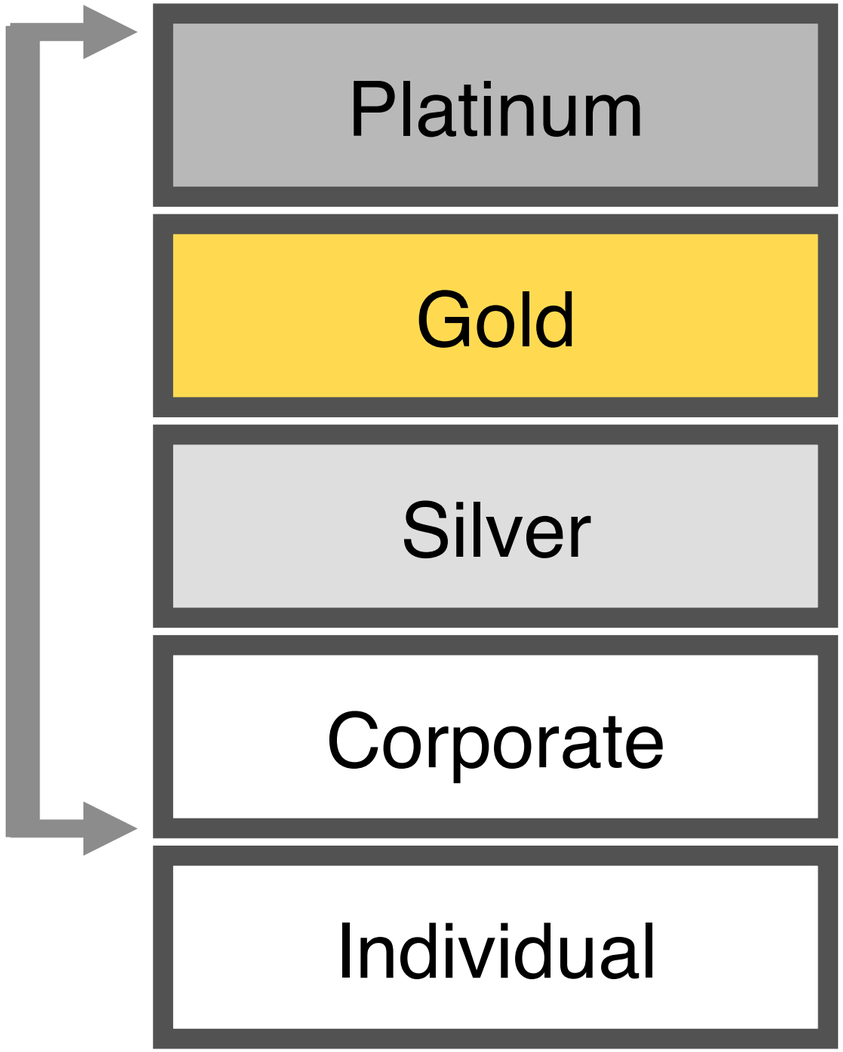
Voted by incubation committee

Posted on opencompute.org

Available to the public

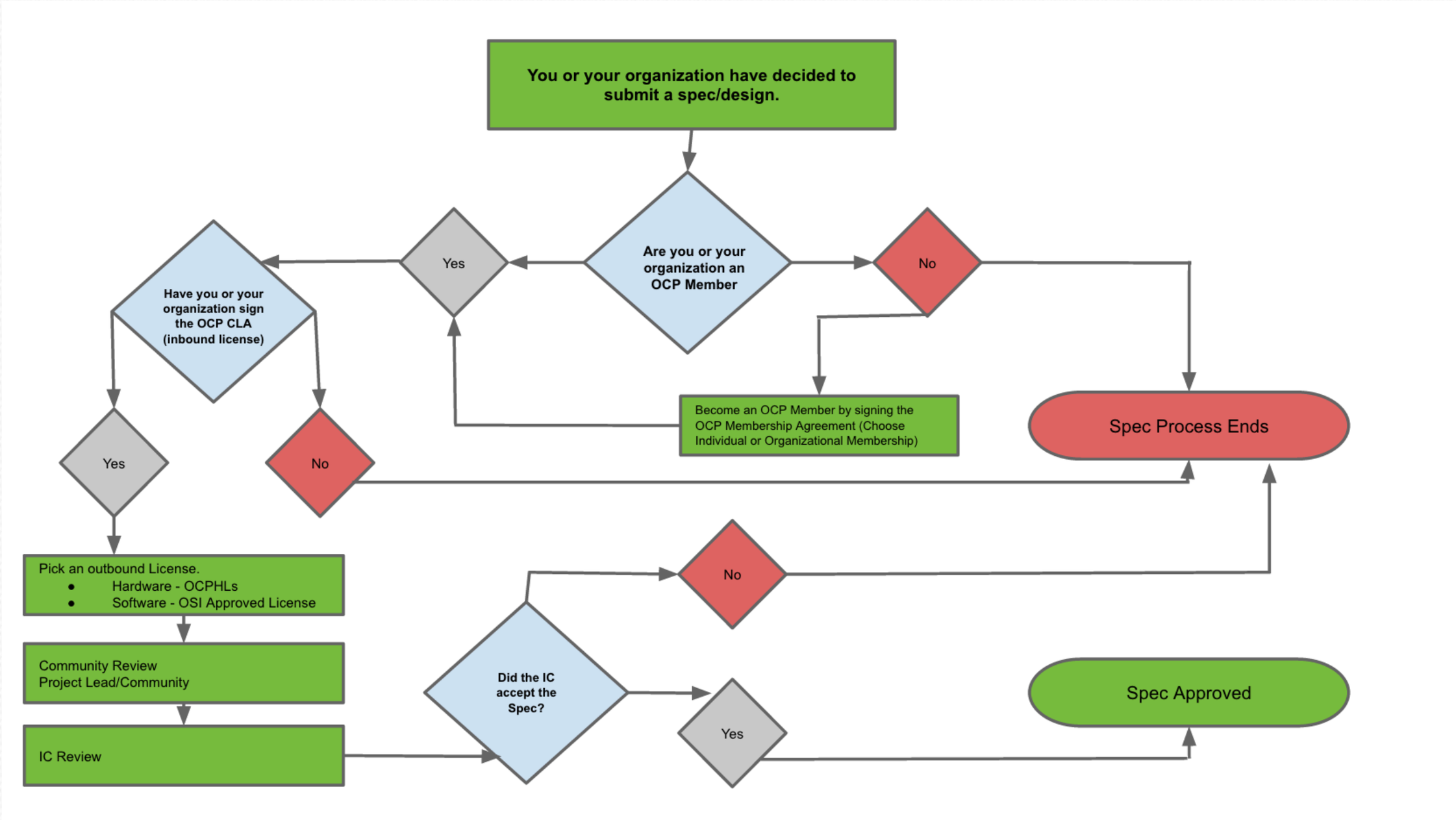
Membership Structure

Tiered Membership



opencompute.org

“Get Involved Section”


You or your organization have decided to submit a spec/design.
Are you or your organization an OCP Member
Yes
No
Have you or your organization sign the OCP CLA (inbound license)
Yes
No
Become an OCP Member by signing the OCP Membership Agreement (Choose Individual or Organizational Membership)
Spec Process Ends
Pick an outbound License.
Hardware - OCPHLs
Software - OSI Approved License
Community Review
Project Lead/Community
IC Review
Did the IC accept the Spec?
No
Yes
Spec Approved

Get Involved

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

akgraner@opencompute.org

Thank You!