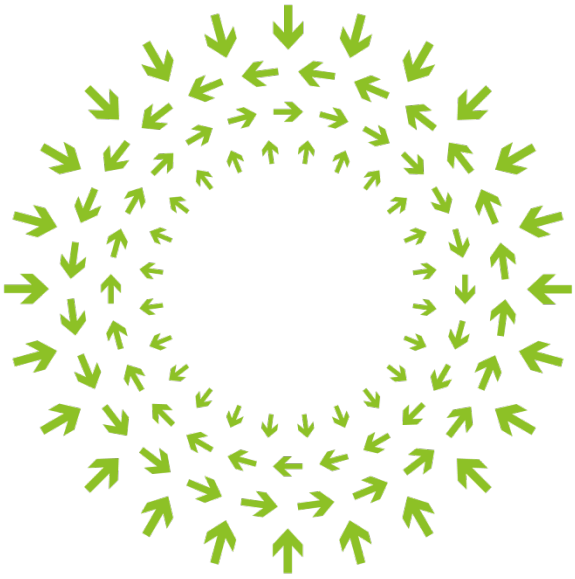

OPEN

Compute Project

Deploying OCP Hardware in a Collocated Facility

Authors: Pierluigi Sarti, Technical Lead, Rack & Power, Facebook and Pete Bratach, Technical Writer, Facebook

1 Scope

This specification describes how a data center operator or tenant can deploy Open Compute Project hardware — the Open Rack or retrofitted 19" DAMAC racks with Intel v2.0 motherboards — in a collocated facility in North America.

2 Contents

3 Overview

When data center design and hardware design move in concert, they can improve efficiency and reduce power consumption. To this end, the Open Compute Project is a set of technologies that reduces energy consumption and cost, increases reliability and choice in the marketplace, and simplifies operations and maintenance. One key objective is openness—the project is starting with the opening of the specifications and mechanical designs for the major components of a data center, and the efficiency results achieved at facilities using Open Compute technologies.

It's important to understand that these technologies are not limited to those who build and run their own data centers. This specification documents how Open Compute technologies can be deployed in a leased data center facility in North America.

3.1 License

4 System Overview

Data center operators and data center tenants whose infrastructure is located in a collocated facility can take advantage of the efficiency gains made by deploying Open Compute technologies.

There are two strategies that can be employed:

- Deploying servers in Open Racks, either single-column or three column "triplet" racks
- Retrofitting 19" racks to accommodate OCP servers

4.1 Reference Documenation

- Open Rack http://opencompute.org/projects/open-rack/ (singlet, triplet specs)
- Battery backup cabinet (for use with the triplet implementation): www.opencompute.org/projects/battery-cabinet/
- Intel motherboard v2.0: www.opencompute.org/projects/intel-motherboard/

5 Deploying the Open Rack

It's pretty straightforward to deploy Open Rack v1.0 in a data center, since it has the same footprint as a 19" rack. Particular consideration should be given to the data center floor weight limitations since the rack can exceed 1000kg fully loaded. To read more about the Open Rack, see the specification on the OCP site:

- http://opencompute.org/wp/wp-content/uploads/2012/09/Open_Compute_Project_Open_Rack_v1.0.pdf

There is an electrical requirement: a 208V line-to-line PDU must be used, similar to the gPDU v0.3 for Open Rack, but at 208V (a specification is forthcoming).

5.1 Deploying Open Rack Triplets

In general, you should be able to deploy an OCP triplet rack into a co-located facility. If you want to use triplets, consider the following items before you do so:

- **Height.** At a little under 95" tall, the triplet rack should fit into most data centers.
- **Width.** A little under 72"
- **Weight.** A fully loaded triplet can weigh more than 5000 pounds (2300kg). If you want to deploy an OCP triplet cabinet, you should verify the weight limitations of the floors in your facility. The triplet sits on 6 casters.
- **Battery cabinet weight** (in the event you can use the OCP battery backup cabinet in lieu of your facility's backup power system). The battery cabinet height is the standard 84", but it weighs more than 2220 pounds (1000kg) fully loaded. Check the weight limitations of the floors in your data center.
- **Power.** You need to install three 208V PDUs for each triplet rack. If you use the OCP battery cabinet, you also need a 208V variation of the battery cabinet and the OCP power supply.

For more information about the Open Rack Triplet, read the following specifications:

- Open Rack v0.6: http://opencompute.org/wp/wp-content/uploads/2012/09/Open_Compute_Project_Open_Rack_v0.6.pdf
- Battery Cabinet Hardware v1.0: http://www.opencompute.org/wp/wp-content/uploads/2011/07/DataCenter-Battery-Cabinet-Specifications.pdf (if you choose to use the OCP Battery Backup Cabinet for backup power instead of facility power, in conjunction with the OCP Power Shelf)
- Power shelf v0.3: http://www.opencompute.org/wp/wp-content/uploads/2013/01/Open_Compute_Project_Power_Shelf_v0.3.pdf

5.2 Mechanical Interface

Details of the mechanical interfaces can be found in the CAD models:

- http://opencompute.org/wp/wp-content/uploads/2012/10/06-000017-with-PDUs.zip

6 Retrofitting 19" Racks

Alternately, you can continue to use the 19" racks already in your colo, but retrofit them to accommodate the OCP Intel v2.0 server.

You use a standard, vanity-free OCP Intel v2.0 server with no changes whatsoever, including the power supply. The power supply is rated down to 190V, so powering the servers with 208V is still within the normal operating range. But at 208V, the current needs to increase to keep constant power, which makes the power supply a little less efficient (~ 0.5% loss of efficiency) than when it's running at 277V. For more information about the Intel motherboard v2.0, read the specification:

- http://opencompute.org/wp/wp-content/uploads/2012/05/Open_Compute_Project_Intel_Motherboard_v2.0.pdf

Facebook already implemented this at one of its data centers, and that process took about 3 months from design to deployment.

The implementation requires only a few modifications from the OCP specifications before we deployed it:

- A **modified server rack**, to support the OCP v2.0 server chassis. Facebook used DAMAC's standard 19" rack (rails and all, part number FS84Z23393-3) and riveted two shelves and side panels from an OCP triplet to it, to provide the right-angle tabs that can accommodate the OCP v2.0 chassis. See the Open Rack triplet specification for details on these panels: http://opencompute.org/wp/wp-content/uploads/2012/09/Open_Compute_Project_Open_Rack_v0.6.pdf
- **New power strips** on the server racks, since the servers run off the data center's 208V line-to-line power instead of the OCP 277V line-to-neutral power. You can buy off-the-shelf strips from Server Technology. Depending upon your implementation, some racks may use both master and slave power strips, while others used only the master. The part number for the master 208V power strip is CS-24VYM313; the part number for the slave 208V power strip is CL-24VYM313. Each power strip can deliver a maximum of 8,640VA; it uses a NEMA L21-30P plug.
- **New power cords** connecting the OCP power supply to the new power strips. Facebook used a Tyco MATE-N-LOK connected to a standard C-13 connector.
- If your facility has its own **battery backup power**, or in-line AC UPS(s) you won't have to use the OCP 48V battery backup system and the OCP power supply.
- **TOR switches** can be powered with 208V if the facility supports AC backup power. Otherwise, they can be powered with 48Vdc from the OCP battery cabinet; in this case, the TOR switches must have a DC power option.

6.1 Efficiency Gains

The servers operate at higher power conversion efficiency than non-OCP servers. The 60mm fans brought about the same thermal efficiencies. The inlet temperatures were cooler than those found in the average collocated facility, but the fans adapt and run more slowly without any changes on the fan controls.

6.2 Serviceability Improvements

The racks have the same serviceability improvements, but fit easily into a collocated facility. The single-column design made for easier maneuvering of the racks in the data halls.

7 Mechanical Drawings

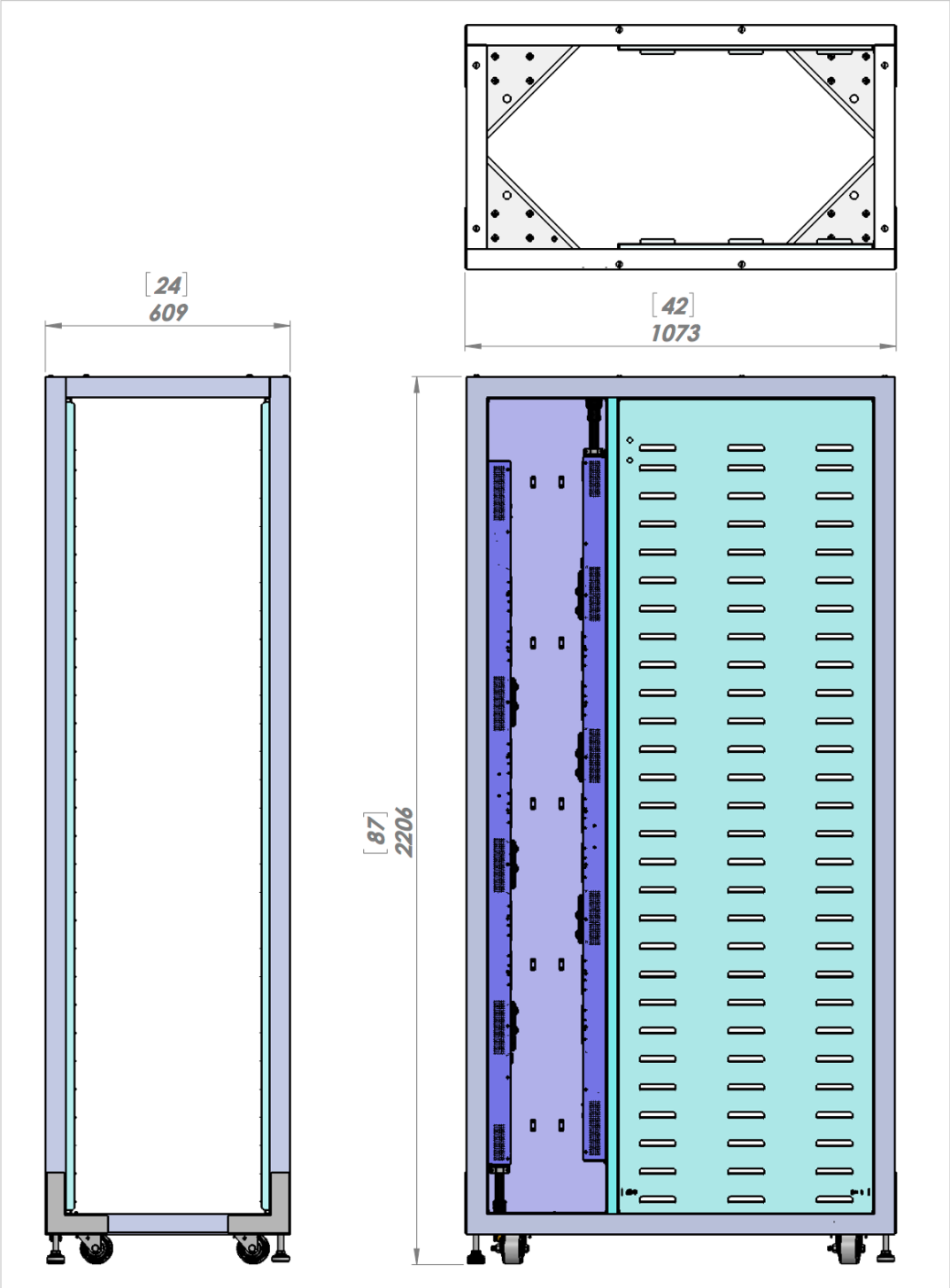

Figure 1 Open Rack with PDUs

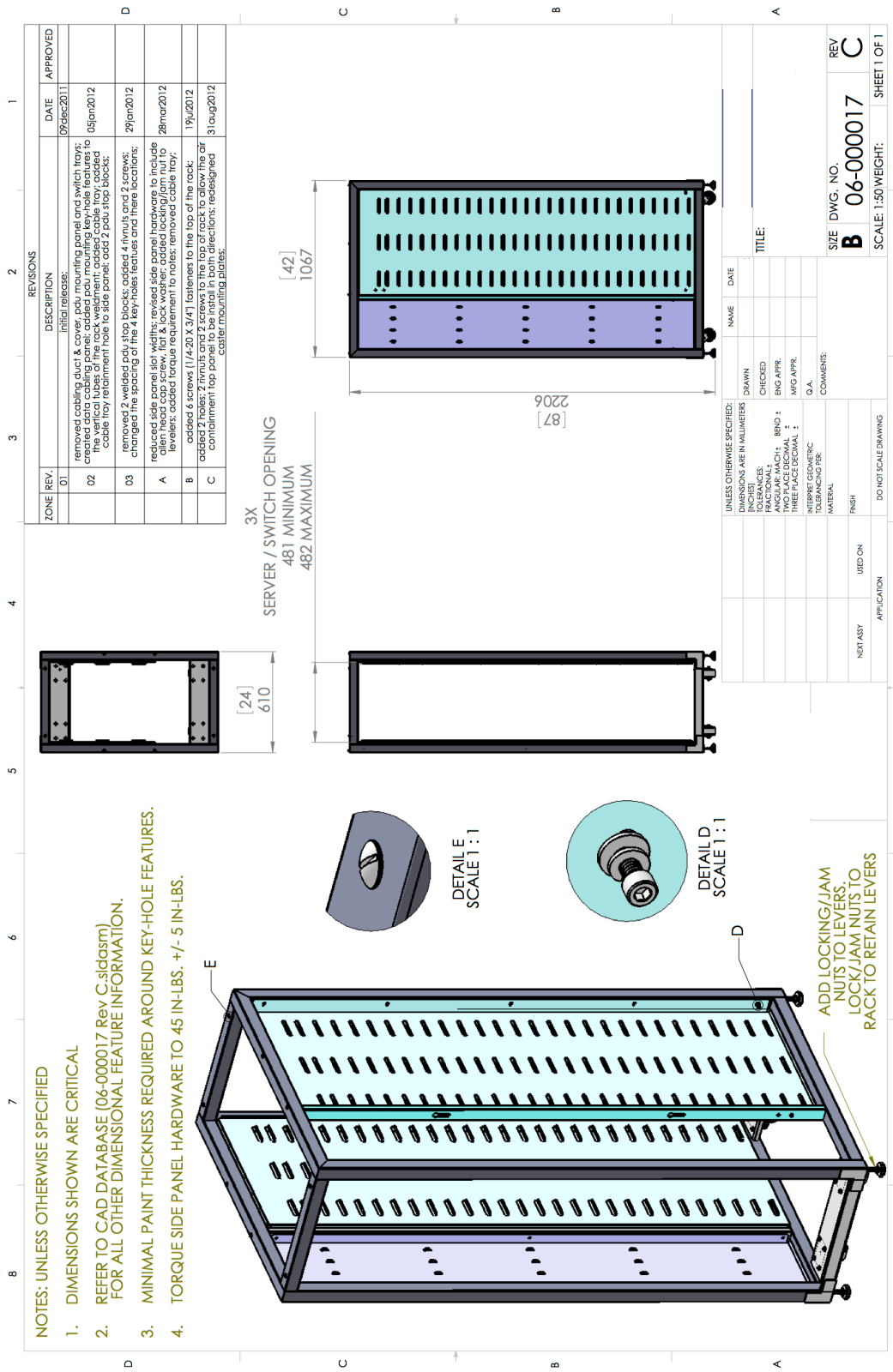

Figure 2 Open Rack Implementation Deployed in a Collocated Facility