OPEN

Compute Project

Server Chassis and Triplet Hardware v1.0

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1   Scope

This document describes the technical specifications for the custom chassis used in Open Compute Project servers and the custom triplet rack that houses the servers.

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.

Two components of this project are a custom server chassis and three-column cabinet called a *triplet*. The chassis is designed to accommodate the other custom components in an Open Compute Project server, namely the customer motherboard and power supply. The assembled servers are racked in the custom triplet.

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4   Chassis

The chassis is zinc-plated sheet metal. The chassis allows for the easy installation of hardware components without requiring any tools. One screw holds down the custom motherboard, but otherwise, the motherboard snaps into place in a series of mounting holes on the chassis.

The hard drive uses snap-in rails and slides into the drive bay; a plunger holds the drive in place. There is room for three drive bays in total.

Likewise, one plunger holds the custom power supply in place. Cooling fans slide and snap into place and are secured to the chassis with rubber grommets.

Silicone partition rubber between the power supply and the rightmost drive bay allows cables to pass through the base of chassis to the server below. A second partition rubber is located along the divider in the chassis (see Figure 4).
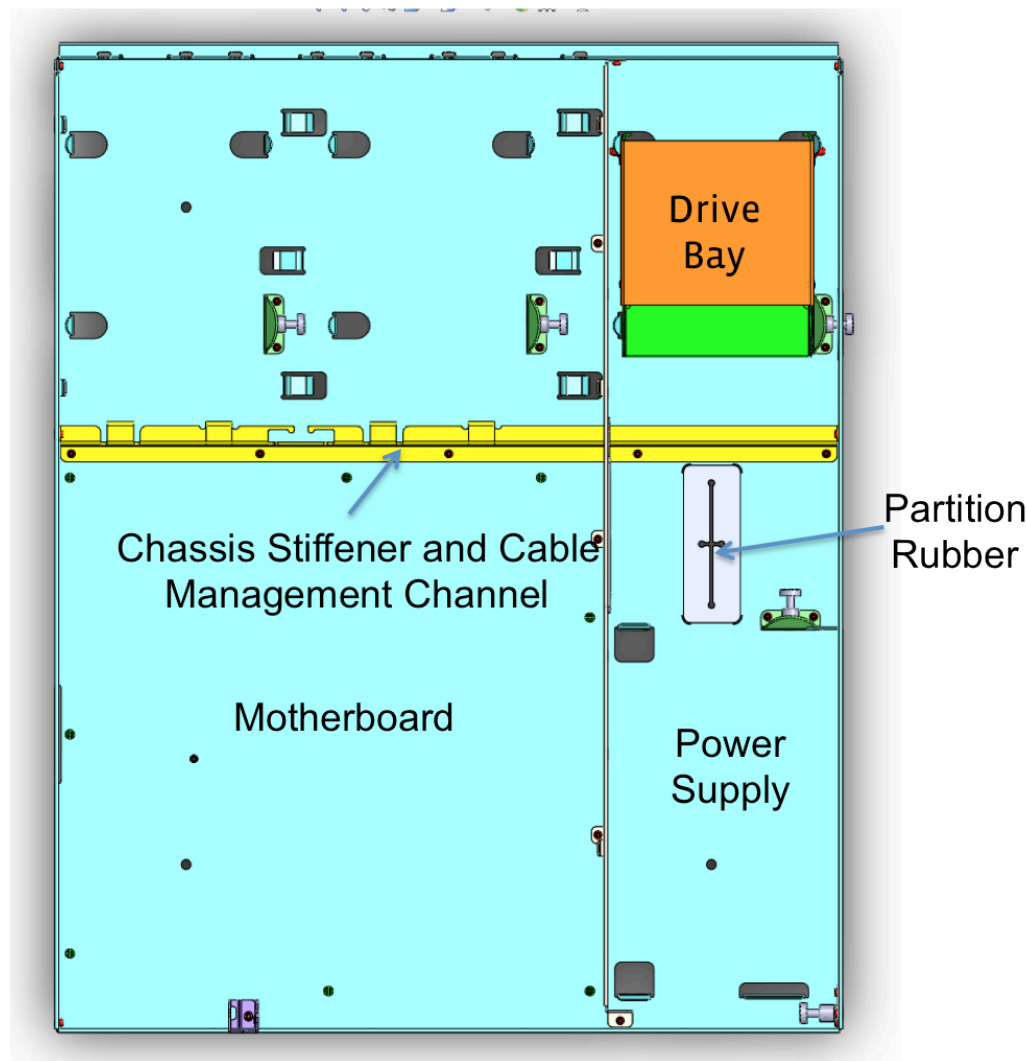

Figure 1 Chassis Overhead View

Exact dimensions and location of the cutouts, holes, and plungers are available in the CAD file.

4.1   Mechanical

Figure 2 illustrates the dimensions of the chassis, populated with all its components. Positioning and all physical features are dictated by the CAD model.
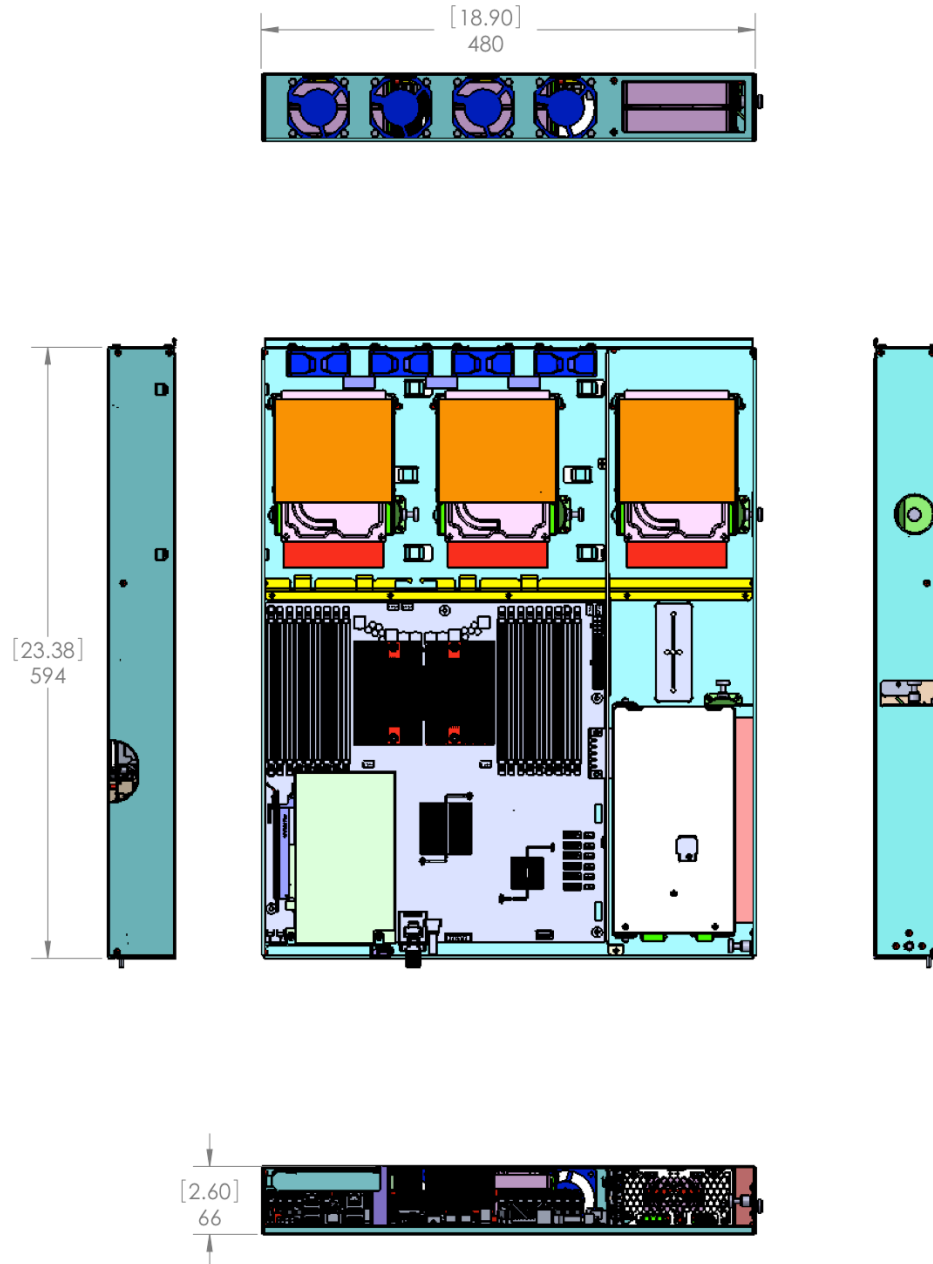

Figure 2 Chassis Dimensions, in [inches] and millimeters

The chassis has a custom height, a little taller than a 1.5U standard server chassis. The servers are racked in a custom triplet cabinet composed of three adjoining 42U columns (see section 5).

The chassis assembly uses steel rivets to secure the drive bay, channel, divider, and plungers, as shown in Figure 3.
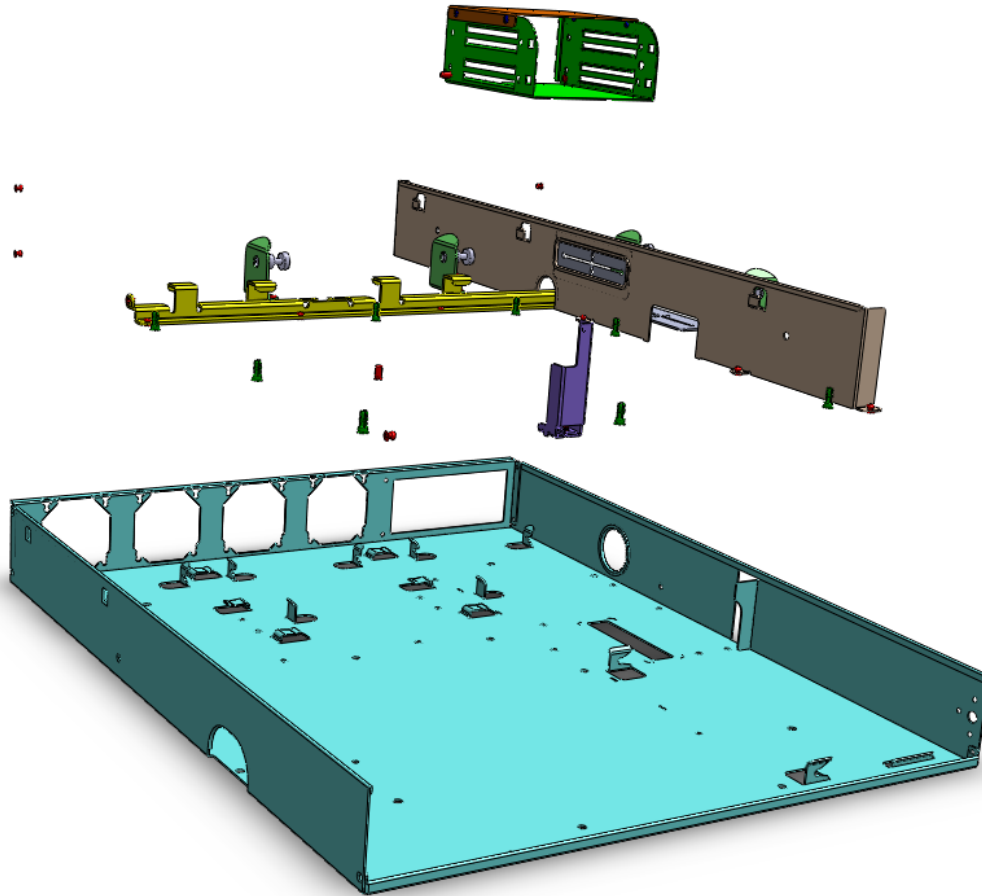
Figure 3 Chassis Exploded View

4.2   Prescribed Materials

The chassis is made from 1.2mm zinc pre-plated, corrosion-resistant steel.

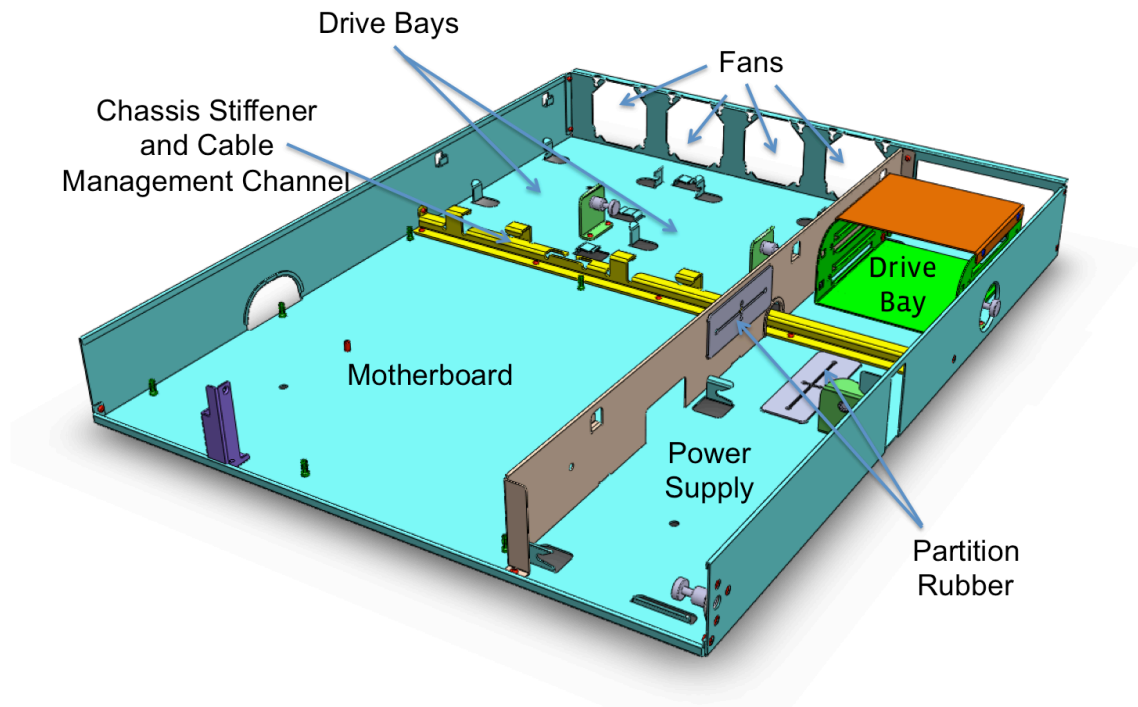The partition rubber is silicone. It is attached using a pressure sensitive adhesive.

Figure 4 Chassis

4.3   Thermal Specifications

The following table indicates the thermal specifications for a given server in the chassis as well as a triplet rack of 90 servers. The triplet figures are based on our observations at our facility in Prineville, OR.

	Server Level	Rack Level
Loading	Idle to 100%	
Inlet temperature	65°F to 95°F (35°C)	65°F to 85°F
Pressure drop within system	Intel motherboard: 0.005 to 0.24" H2O AMD motherboard: 0.004 to 0.22" H2O	
Total CFM requirement for above pressure levels	Intel: 12 to 103 CFM AMD: 14 to 106 CFM	Intel: 864 to 7416 CFM AMD: 252 to 1908 CFM Total: 1116 to 9324 CFM*
Fan RPM	Varies from 1120 to 7600 rpm with 10% tolerance.	
Humidity**	Approximately 30 - 65%	
Altitude	1000m (~ 3300ft)	
Dewpoint**		41.9°F minimum

Figure 5 Thermal Specifications at the Server and Rack Level

* Based on a rack containing 90 Open Compute Project servers: 18 with AMD motherboards and 72 with Intel motherboards. For more information, see the *Open Compute Project Intel Motherboard Hardware v1.0* specification and the *Open Compute Project AMD Motherboard Hardware v1.0* specification.

The maximum CFM is expected to be less than 60 for almost every system loading. The fans would have approximately 4500 rpm at this point. Then, the total or maximum expected CFM would be 5400 CFM total (60 CFM * 90 servers).

** Based on regional climate conditions where the data center operates; supply air temperature 64.4°F to 80.6°F, relative humidity 65% maximum, dewpoint 41.9°F to 59°F). For more information, including a psychrometric chart, see the *Open Compute Project Data Center v1.0* specification.

5   Triplet Cabinet

Open Compute Project 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 Open Compute Project battery backup cabinet sits in between a pair of triplets in the data center aisle, providing DC power in the event of loss of AC power. For more information, see the *Open Compute Project Battery Cabinet Hardware v1.0* specification.
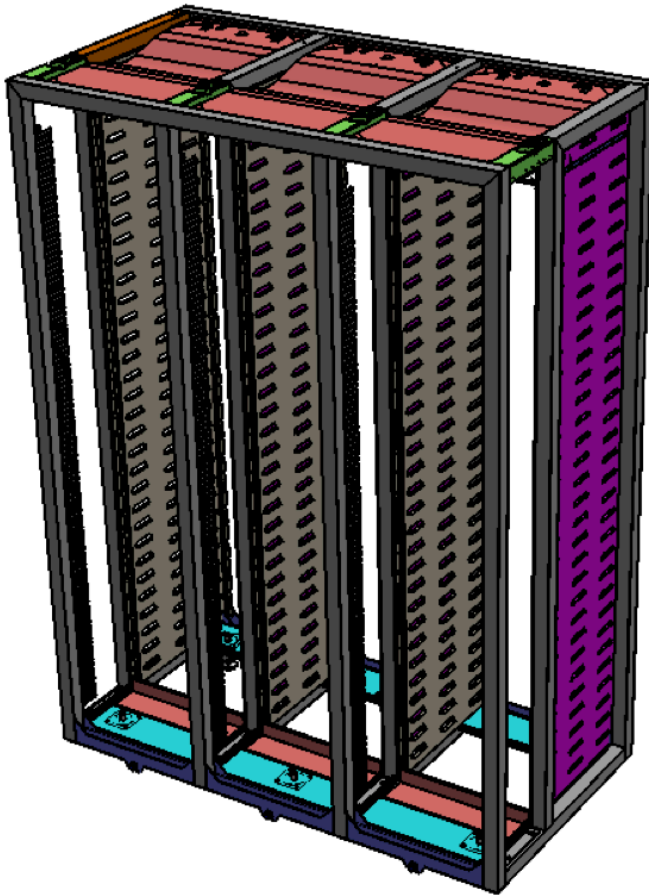

Figure 6 Open Compute Project Triplet

5.1   Mechanical

Primary materials used in construction of the triplet include the following:
- Cold-rolled steel in sheet form
- Zinc pre-plated cold-rolled steel in sheet form
- Plastic cabling ducts
- 2"x2" square raw steel tubing for the frame

See Figure 7 for details, and refer to the CAD model for exact dimension and details.

The rack weighs 500 pounds, and the casters can hold up to 3000 pounds. A fully loaded rack with 90 servers weighs 2600 pounds.

5.2 Rack Assembly

All joining in the rack is done by welding. The raw steel tubing is welded together to form the frame. After welding, black powder coat paint is applied to the weldments.

Next, zinc pre-plated steel panels are screwed onto the rack using large threaded fasteners. The panels are installed on both outer sides and in between each column. One panel is installed at the top of each column; one rivet in each corner secures the panel to the top of the rack. A small zinc pre-plated panel is installed at the bottom of the rack and is held in place by its own geometry. The top and bottom panels are baffles that close off air holes for airflow impedance.

The plastic cabling duct is adhesively mounted to one of the vertical columns. It allows cables to enter and exit the rack.

Six casters all are bolted into place on the bottom of the rack. Six leveling feet are threaded into nuts welded into the bottom of the rack.

Finally, the rack is shipped to an assembly facility where the electrical components get applied and network switches put into place. Slots for the servers are installed at this time.
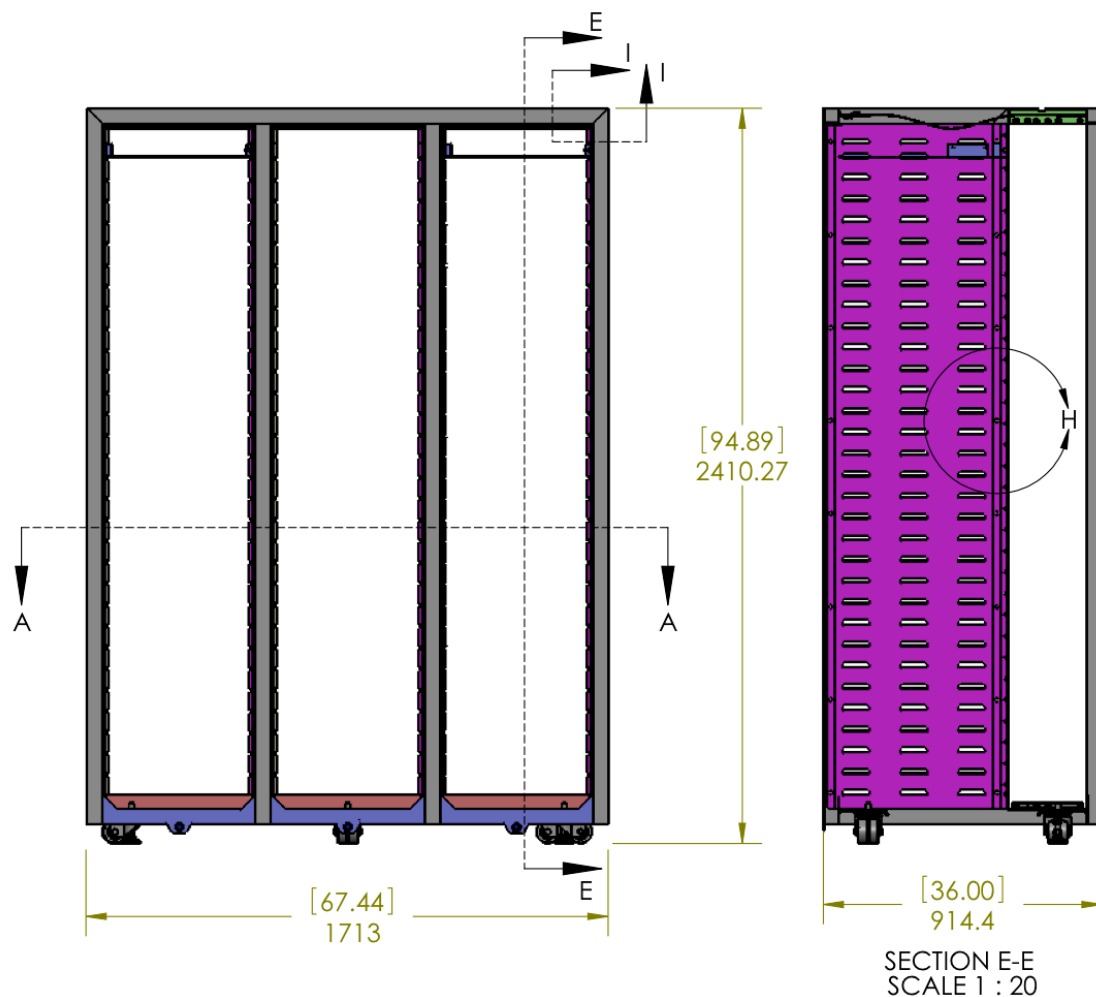

Figure 7 Open Compute Project Triplet Dimensions