
OPEN
Compute Project
OCP U.S. SUMMIT 2017
Santa Clara, CA

Overview of Open Rack Specification 2.0 Updates

Steve Mills — Mechanical Engineer, Facebook

Mike Lau — Mechanical Technical Lead Manager, Google

Xin Li — Power Technical Lead Manager, Google

OPEN HARDWARE. OPEN SOFTWARE. OPEN FUTURE.

OPEN Compute Project

Agenda

- Overview
- Mechanical Design Highlights
- Rack Power Highlights
- Rack Management Controller

Overview of Open Rack Spec V2.0

New in OR Specification V2.0:

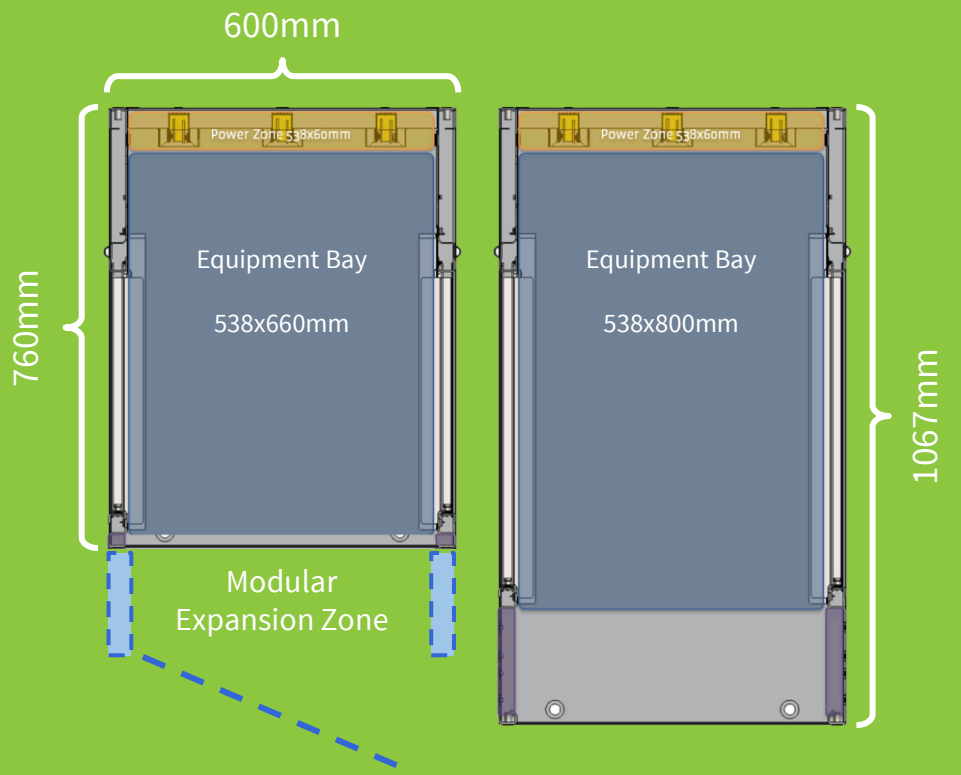
- Additional rack depth option (shallow and V1.2 deep)
- 48V architecture and components
  - Power shelf
  - Busbars
  - IT Gear and IT Tray power interconnects
  - Rack management controller
  - Single phase AC rectifier and battery backup unit
- 12V power shelf details

Mechanical Highlights

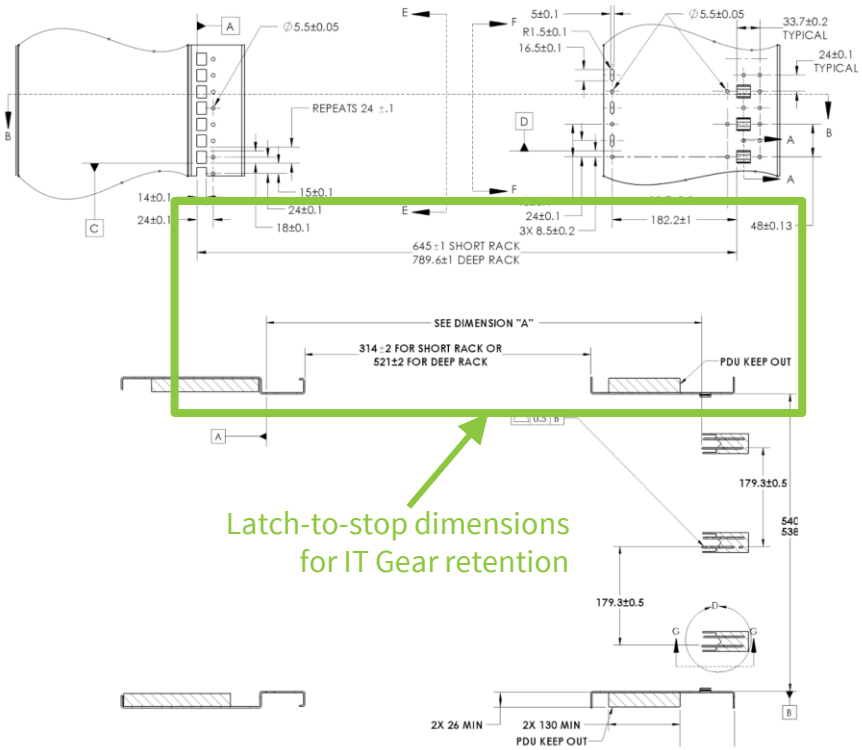
Mike Lau
Mechanical Technical Lead Manager
Google

Rack Form-Factors & Configurations

- Maintains 600mm exterior width of V1.2
- New 760mm depth base rack with provisions for cable management expansion or doors
  - Shallow-depth rack design for increased deployable density



IT Gear Rack Interface



Reduction in exterior rack depth with minimal reduction in IT Gear depth

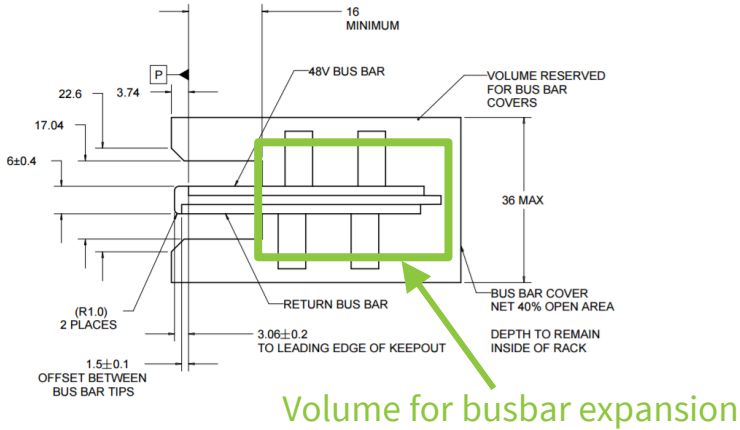
- Exterior rack depth decrease of 307mm
- Only 145mm decrease in payload space

Rack interface design unchanged

- Busbar-as-a-module for 48V and 12V
- Upgrade path from 12V to 48V

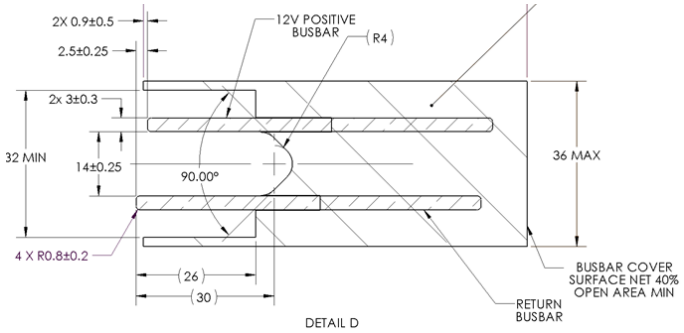
Rack-Level Busbar

48V Busbar



Volume for busbar expansion

12V Busbar



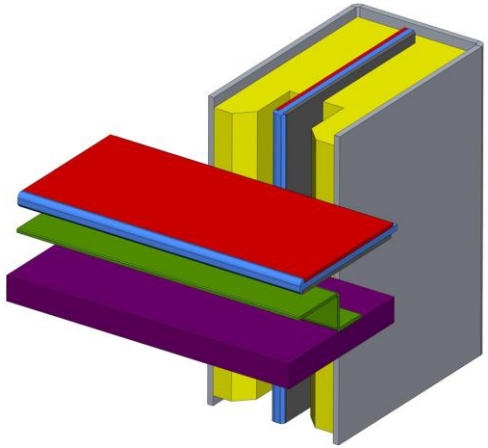
Common volume reserved for busbars for both 48V and 12V configurations

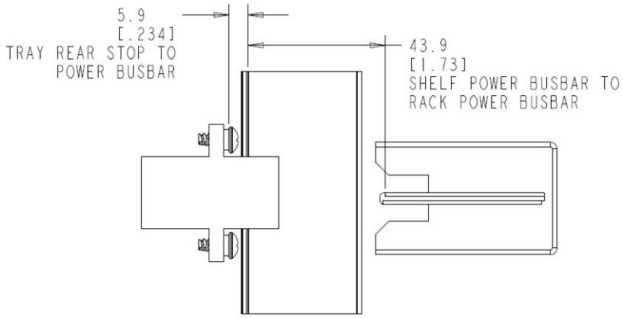
- 48V busbar features alignment-guided power and return busbar assembly
- Scalable power capacity while maintaining mating interface via busbar depth and profile

Power Distribution Interconnects

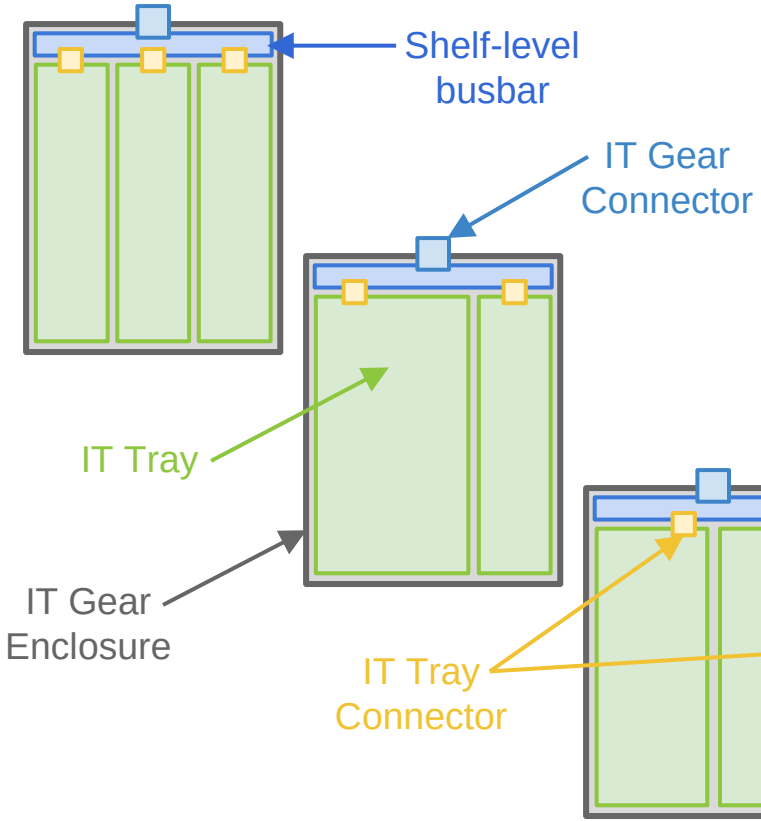
Scalable ecosystem of busbars and connectors

- Low-cost and efficient rack-level and shelf-level busbars
- Scalable and pitch agnostic connectors
- Common power delivery interconnect across payload product lines
- Busbar and connector configuration prevents accidental connection of 12V gear into 48V rack



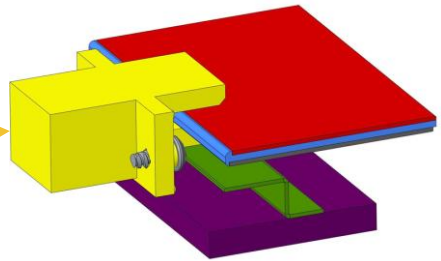


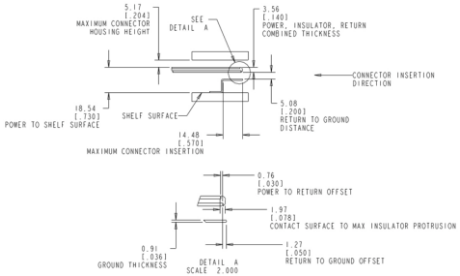
Shelf-Level Busbar



Pitch agnostic IT Tray power delivery

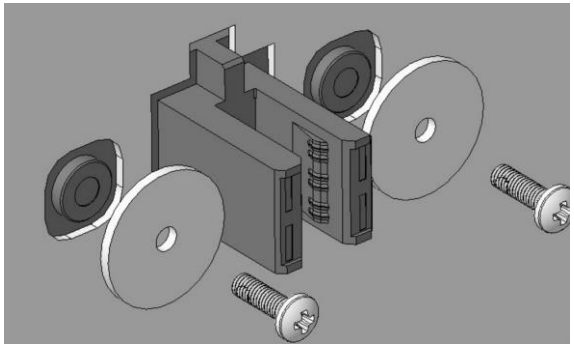
- One IT Gear shelf, multiple width IT Trays
- Shelf-level busbar mounting within IT Gear enclosure
- Flexible horizontal position of connector within IT Tray



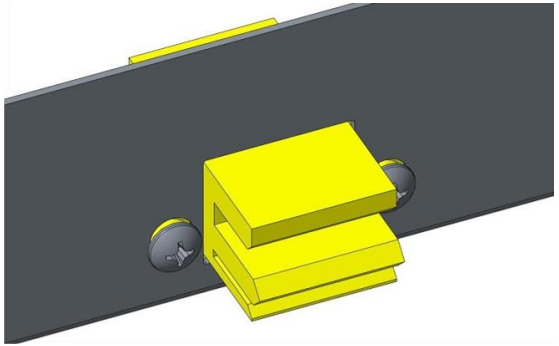


48V Busbar Interconnects

IT Gear to rack-level busbar



IT Tray to shelf-level busbar



Panel-mounted, floating connectors at rear of IT Gear and IT Trays

- Vertical orientation for mating with rack-level busbars
- Horizontal orientation with chassis ground connection for mating with shelf-level busbars

Power Highlights

Xin Li
Power Technical Lead Manager
Google

Power Requirements Overview

- Electrical requirements for 12V & 48V
- IT tray power requirements for 48V
- Power shelf requirements for 12V & 48V
- Rectifier units for 48V
- Battery backup modules for 48V

12V Electrical Requirements Highlights

- 12.2V ±0.4V at any point along the entire length of the busbars
- Output voltage of 12.5V ±0.1V at the connections to the busbar pair(s)
- Output voltage ripple & noise <120mVpp
- Busbar(s) current density <5 A/mm^2

48V Electrical Requirements Highlights

- Operating voltage range: 40V to 59.5V
- Nominal voltage: 54.5V
- Output voltage ripple & noise <500mVpp
- Grounding: 48V return grounding selectable power shelf

48V IT Tray Highlights

- Operating input voltage range
- Hot swappable
- CPU and DDR rails - recommended 48V-to-PoL voltage regulators
- VR efficiency requirement
- Power monitoring

12V & 48V Power Shelf Highlights

- Enclosure of rectifiers and batteries (combined or separated)
- Single shelf or multi-shelf power configuration
- Minimum of N+1 redundancy for rectifier and BBUs
- Front access, position selectable (top, middle, or bottom of rack)
- Specification for DC connection to busbar

System Implementation Options

- AC single-phase 48V rectifier
- 48V Battery Backup Unit

Compliance Requirements

Compliance: Worldwide Deployment

- The rack and modules shall be **designed to comply with** the latest related safety and EMC standards:
  - Meet compliance in the environment it is intended to function
  - Meet EMC requirements
  - Meet safety requirements
  - Maintain and update the safety reports to current and new released requirements

Rack Management Controller

Rack Management Controller Highlights

- Provides at minimum, 100M Fast Ethernet uplink for remote monitoring of power components
- Provides channel for remote firmware update capability for rack devices

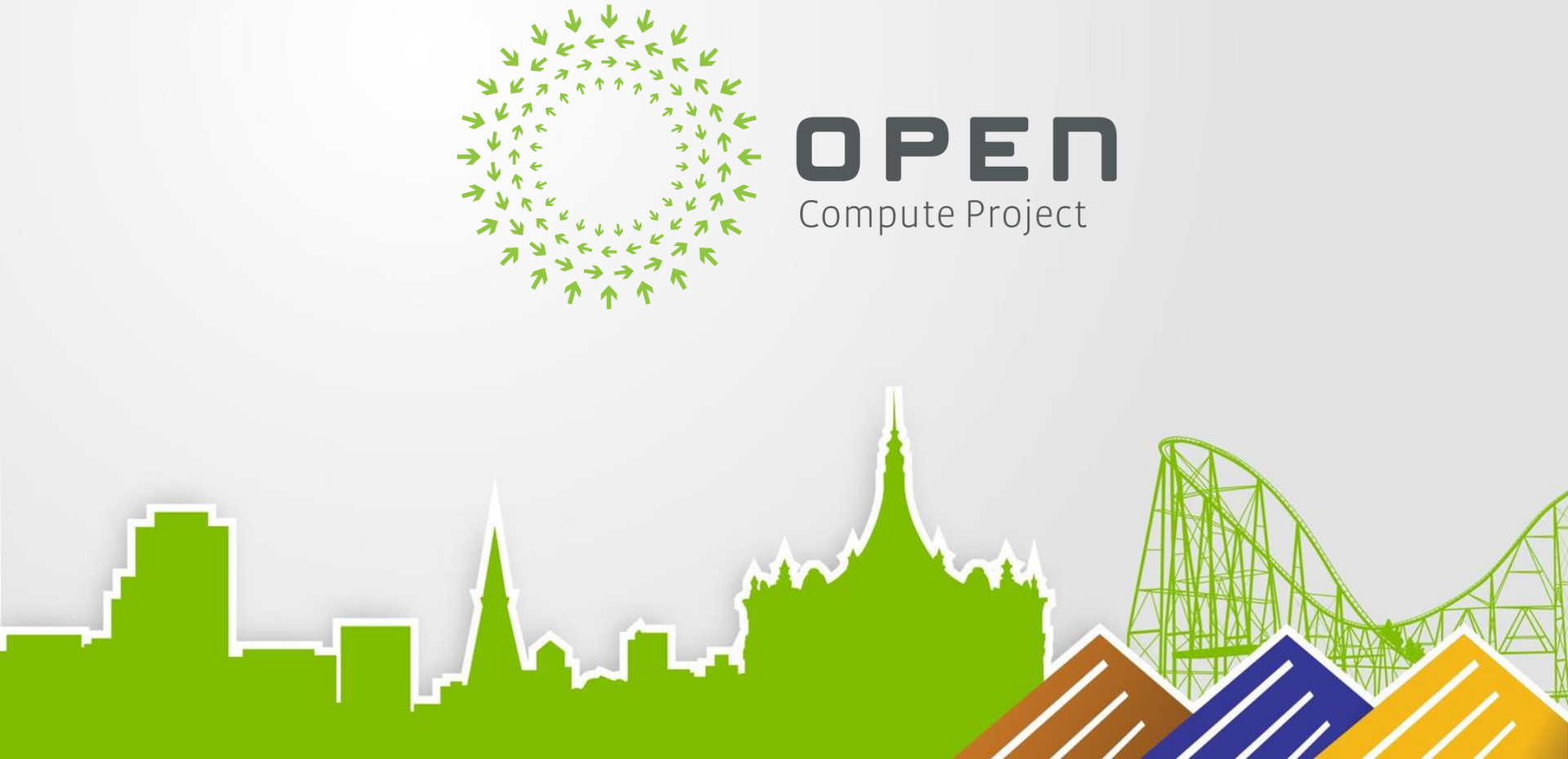
- Optionally integrated into power shelf
- Support for connecting to additional peripherals using other interfaces, such as CAN, RS485, RS232

Continued Development

Suppliers are developing rack solutions, busbars, connectors, power shelves, etc. with submissions towards OCP Accepted status

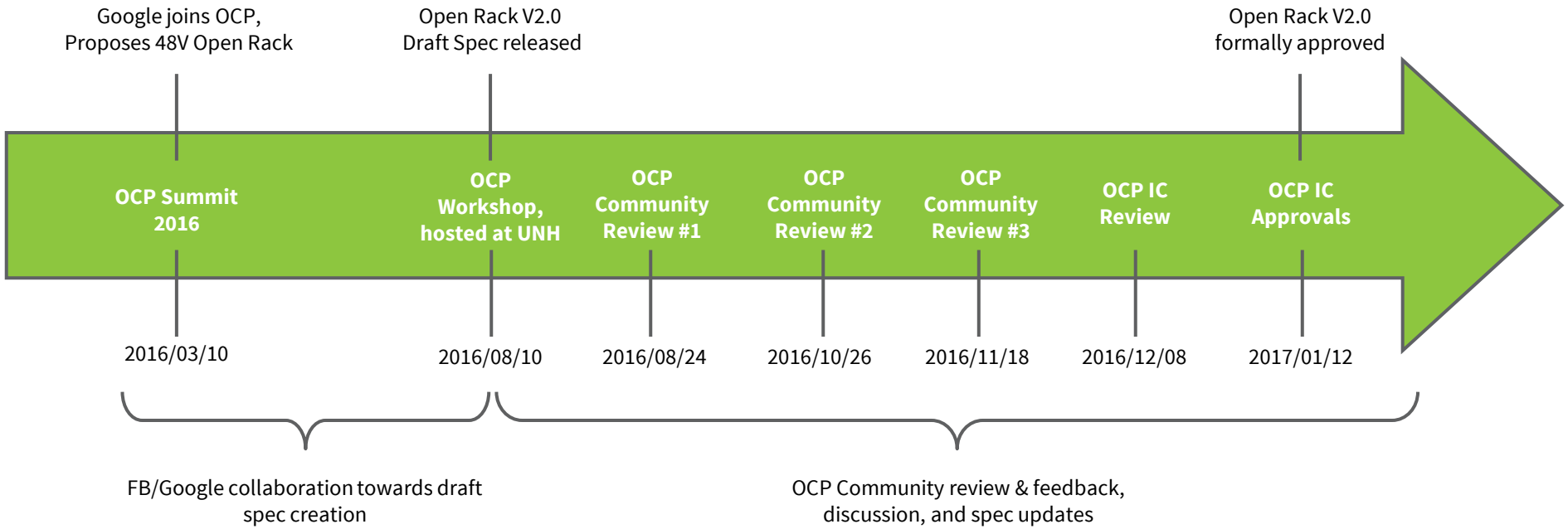
Questions

Thank You

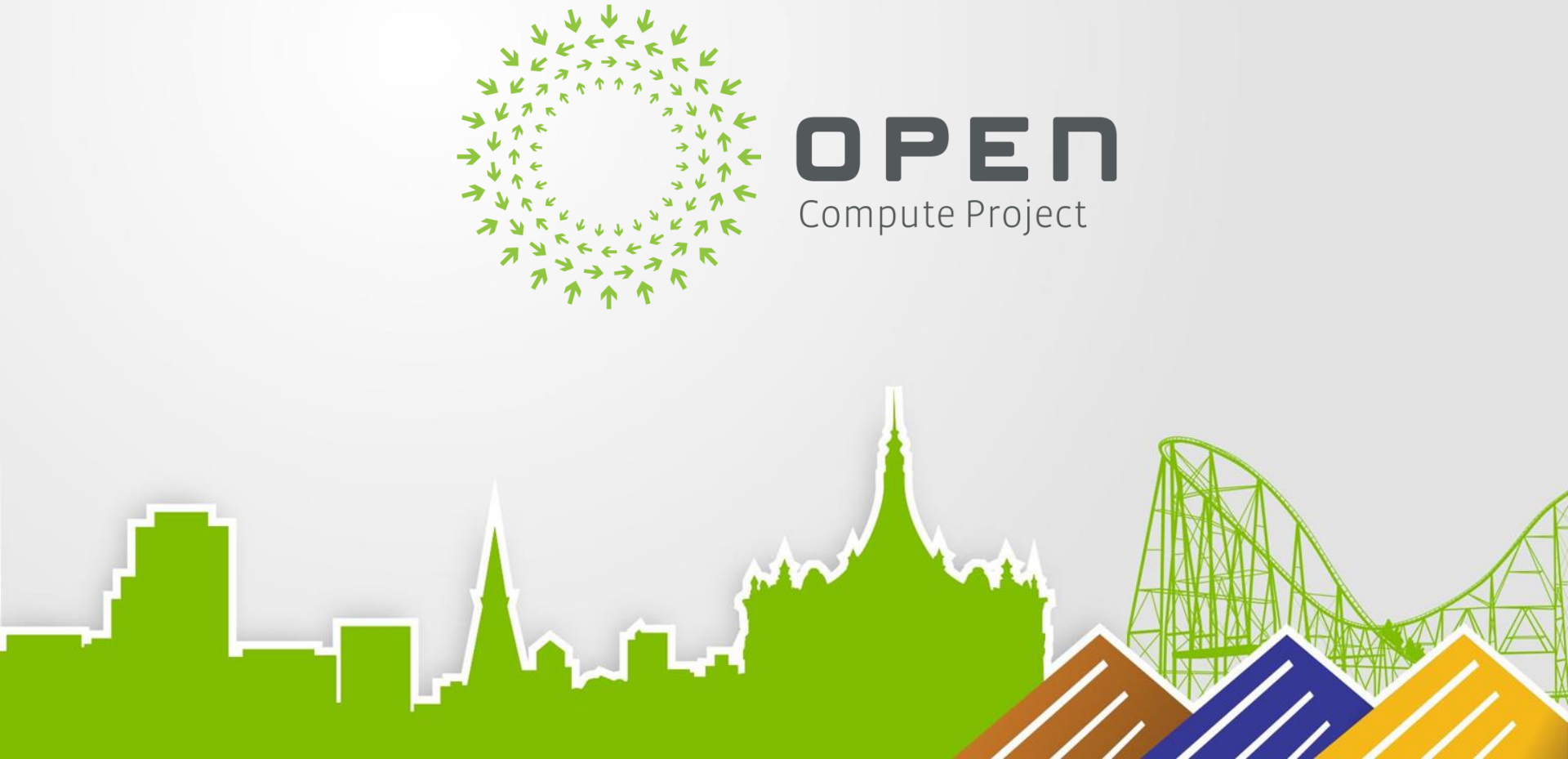

OPEN
Compute Project

Backup

Collaboration & Community Efforts



FB/Google Collaboration & extensive OCP community review


OPEN
Compute Project

AC to 48V Rectifier Highlights

- Input rated voltage 200V to 240V AC or 200V to 277Vac
- Output voltage programmable from 42V – 58 Vdc, output defaulted to 54.5V
- Peak efficiency> 97.0% at Vin = 230VAC, measured with fans
- Capable to operating as either +48V or -48V system polarity.
- Redundant, parallel operation with load sharing
- Hot swappable
- Firmware Interface
- Front to back air cooling

48V Battery Backup Unit Highlights

- Operating input voltage range: 38V - 59.5V
- Hot Swappable
- Multi-operating states
- Remote firmware update