Overview of Open Rack Standard V2.0

Steve Mills
Technical Lead - Facebook
Goals for Open Rack V2.0 Today

Part 1: Overview of what is changing in V2.0

Part 2: Rigorous review of the Standard details
Overview of Open Rack Standard V2.0: What’s Covered?

Rack Frame

12V:
• Busbar
• Interconnect
• Power Shelf

48V:
• Busbar
• Interconnect
  - Power Shelf
  - Rectifiers
  - IT tray power
• BBU
• Rack Management Controller
48V Motivations

Mike Lau and Xin Li
Technical Lead Managers - Google
Why we’re here...

48VDC Power/UPS
Alternative Form
Factor Support

Open Rack
Why 48V Power Architecture?

- Efficient 48V to PoL VR technologies
- Reduced distribution losses & voltage drop
- Support higher power
- Flexibility in deployment
- “Safe” Voltage - SELV
- Cost-effective and reliable in-rack UPS
Key Technologies Around 48V

- 48V to PoL Conversion
- 48V Hot Swap
- Battery Integration
- High-Efficiency 48V Rectifier

48V Power Architecture
48V to Point-of-Load Technology

Google deployment at scale since 2010

High-efficiency conversion

Isolated and non-isolated versions

Multi-source solutions available

Google enabled suppliers to sell solutions to Industry
Typical Conversion Efficiency

Note: Distribution Loss reductions provide additional efficiency gains @ 48V
Mechanical Highlights

Mike Lau
Mechanical Technical Lead Manager - Google
Rack Sizing and Configurations

Shallow-depth rack design for increased deployed density and optimized cooling

Maintains 600mm exterior width

New 762mm base rack with provisions for cable management expansion
IT Gear Interface Points

Reduction in exterior rack depth with minimal reduction in IT Gear depth
- Driven by latch to rear stop dimension
  - 645mm for high-density designs
  - 789.6mm for existing V1.2

Rack interface design unchanged
- Busbar-as-a-module for 48V and 12V
- Upgrade path to 48V

Shallow latch-to-lock dimensions for dense payloads
Rack-Level Busbar

48V Busbar

12V Busbar

Volume for busbar expansion

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

- 48V busbar features thin Power and Return busbar assembly
- Scalable power capacity while maintaining mating interface via busbar depth and profile
Rack Power Distribution and Interconnect

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

- Horizontal position of connector within IT Tray not fixed to discrete positions
- One shelf; multiple width IT Trays
- Shares power/return busbar interface as Rack-Level Busbar
48V Connector Mount

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
48V Power Requirements List

- Rack electrical requirement
- IT tray power requirement
- 48V rectifier unit power requirement
- 48V battery backup unit power requirement
48V Rack-Level Electrical Highlights

- Operating voltage range: 40V - 59.5V
- Nominal voltage: 54.5V
- Grounding: 48V return grounded at power shelf level
48V IT Tray Highlights

- Operating input voltage range: 40V - 59.5V
- Hot Swappable
- CPU and DDR rails: 48V to PoL VRs are recommended
- Minimum VR efficiency requirement
- Power monitoring
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 of operating as either +48V or -48V system polarity.
- Redundant, parallel operation with load sharing
- Hot swappable
- Firmware Interface
48V Battery Back-Up Unit Highlights

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

Chris Moynihan
Software Tech Lead - Google
Rack Management Highlights

● Optional rack management controller. Open to a range of solutions.

● Minimum features
  ○ 1GE ethernet
  ○ Power shelf management (rectifiers and optional BBUs)
  ○ Hot swappable
Rack Management Highlights: Preferred Features

- Support a variety of rack devices over some or all of the following:
  - RS485
  - CAN
  - Ethernet

- Remote firmware update for all rack devices on serving rack

- Debug/basic management console (RS232)