

Google 48V Rack Adaptation and **Onboard Power Technology Update**

Xin Li, Technical Lead Manager, Google Shuai Jiang, Staff Power Engineer, Google





Rack & Power



PLATINUM



Agenda

Google's 48V OCP journey • On board OTS machine (chassis) to 48V power architecture

Open-IP 2-stage 48V onboard power architecture





RACK & POWER





Google's OCP Journey

2016 - Announced 48V architecture 2017 - Released OpenRack Version 2.0 spec including 48V power architecture 2018 -Flatbed and STC: On board 12V payload MB to 48V rack and ease 48V power conversion 2019 - On board 12V payload chassis to 48V rack and share progress of 48V on board power technology





Open Rack V2.0



On board OTS machine (chassis) to 48V power architecture

Presenter: Xin Li







Power Delivery Overview

Traditional Power Delivery





Centralized Rack Power Delivery







Machine power interface in these two power delivery system are fundamentally different





Motivation

- Provides an incremental migration path from AC to 48V racks using existing, enterprise AC machines (chassis)
- OpenBMC & modulized design to ease SW re-use by focusing on bridging between open, standard interfaces.



• Fast implementation of a broader range of machines in OpenRack v2.0



Concept Industrial standard AC PSU silver box ╋ Mechanically PSU identical PSU ╋

48V PDB design enables 48V rack compatible OTS solution

48V PDB







Key success matrix

- Fast TTM, keep cost competitive Just enough features
 - Narrow input DC input range Minimize hold up time requirement
 - Hotswap and fuse
 - Power monitoring information
 - Redundancy
 - Compliance requirement Scalable power solution



JMMIT



Call to Action

• OCP vendors to be engaged into 48V PDB (Power Distribution Box) design, and offer 48V system that are compatible with 48v Open Rack in parallel with the Google to collaborate with OCP vendors on releasing the spec and design files through OCP through 2019





Open-IP 2-Stage 48V onboard power update

Presenter: Shuai Jiang





2-stage 48V Onboard Power Architectures

1. 48V-12V PDB + OTS 12V server





JMMIT

2.48V server

- 48V-12V regulated hybrid converters enable the quick adaptation of 12V based work loads to 48V systems
- Fixed-ratio converters enable an optimum 2-stage 48V-to-PoL power architecture







48V-12V Regulated Hybrid Converters



hybrid converter



OCP

SUMMIT



A couple of validated 48V-12V hybrid converter topologies

- Hybrid switched-capacitor-buck topologies with standardized components (drivers, FETs, capacitors, inductors) easy for onboard design
- High density through magnetics volt-sec reduction, coupling and capacitor soft charging
- Efficiency 97%-98%
- Scalable power with easy parallel operation
- Widely applicable to 48V-12V adapter applications with optimal TCO







Fixed-Ratio Bus Converters







600W Gen2 STC with integrated controller drivers



UMMIT

discrete controller drivers



- Fixed ratio design allows maximization for converter efficiency, density and transient performance
- Flexibility with the intermediate bus voltage for end-to-end power system and TCO optimization.
- Efficiency 98%-99%
- Open IP Switched Tank Converter (STC) and LLC with wide supply availability





High Density PoL VR for Future High Current Power Delivery



- Vertically/3D integrated VR modules allow the most efficient space utilization and minimum current path within VR
- Lowering intermediate bus voltage enables efficient multi-MHz switching with very high current density >1A/mm²
- Option to integrate output decoupling capacitors depending on PDN design requirement













Open. Together.



OCP Global Summit | March 14–15, 2019



