Google 48V Rack Adaptation and Onboard Power Technology Update

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Agenda

● Google’s 48V OCP journey
● On board OTS machine (chassis) to 48V power architecture
● Open-IP 2-stage 48V onboard power architecture
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
On board OTS machine (chassis) to 48V power architecture

Presenter: Xin Li
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)
- Fast implementation of a broader range of machines in OpenRack v2.0
- OpenBMC & modulized design to ease SW re-use by focusing on bridging between open, standard interfaces.
48V PDB design enables 48V rack compatible OTS solution
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
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 traditional OTS AC system
● 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
   - 48V-12V regulated hybrid converters enable the quick adaptation of 12V based workloads to 48V systems
   - Fixed-ratio converters enable an optimum 2-stage 48V-to-PoL power architecture

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

Open. Together.
48V-12V Regulated Hybrid Converters

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

- 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