

New 48V Rack Power Architecture For Hyperscale Data Centers

Why a New Rack Power Architecture is Needed

1

Data Centers are Focused on Reducing Energy Consumption

- 2% of global electricity use today; equivalent to total electricity usage of Spain or Italy
- US data centers alone are forecasted to consume 140B kilowatt-hours by 2020
- Powering IT equipment is one of the largest operating expenses for data centers

2

CPU & Memory Consume Most Power in Rack

- CPU & Memory represent ~80% of total server power
- CPU power & dynamic requirements continue to increase

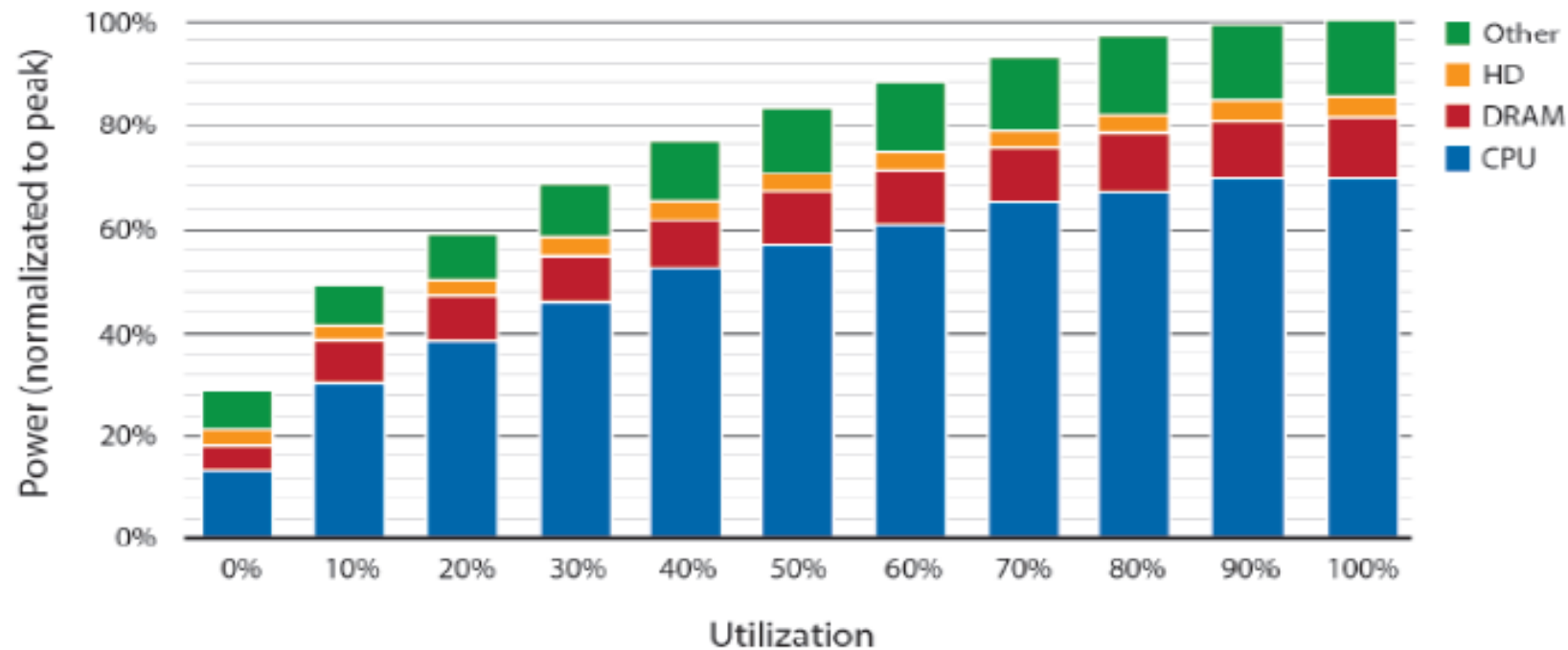
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New 48V Rack Power Architecture

- Google introduced a 48V rack power architecture at 2016 OCP Summit to replace 12V
- Using 48V provides a 16x reduction in power distribution and up to 30% lower conversion losses
- Requires new high efficiency 48V to PoL regulator

Server Power Consumption

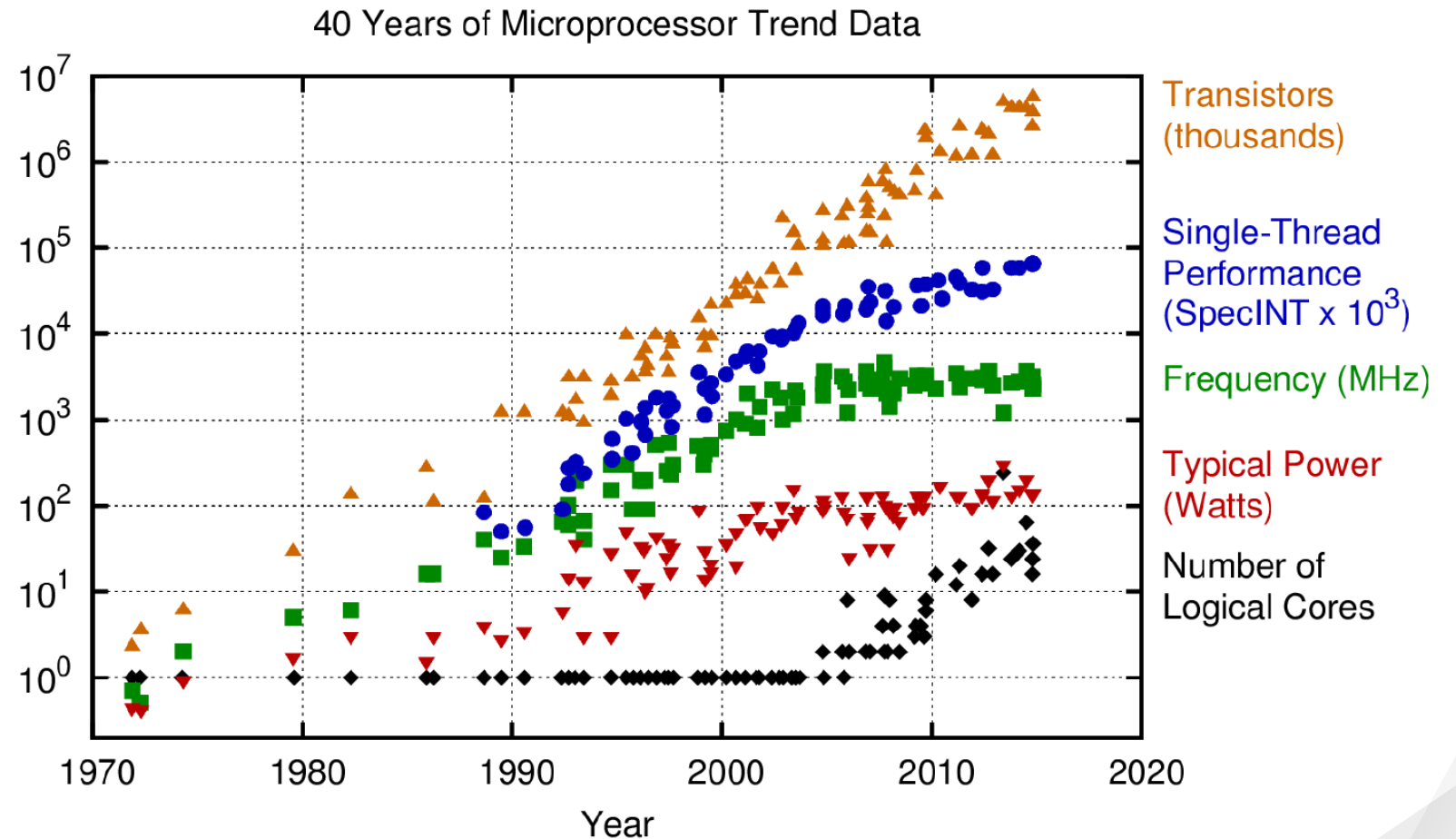
CPU and DRAM memory rails consume over 80% of server power at peak load



Source: [Google Open Compute Summit presentation] The Datacenter as a Computer – Luiz Andre Barroso, Jimmy Clidaras, Urs Holzle

Future Power Challenges for IT Equipment

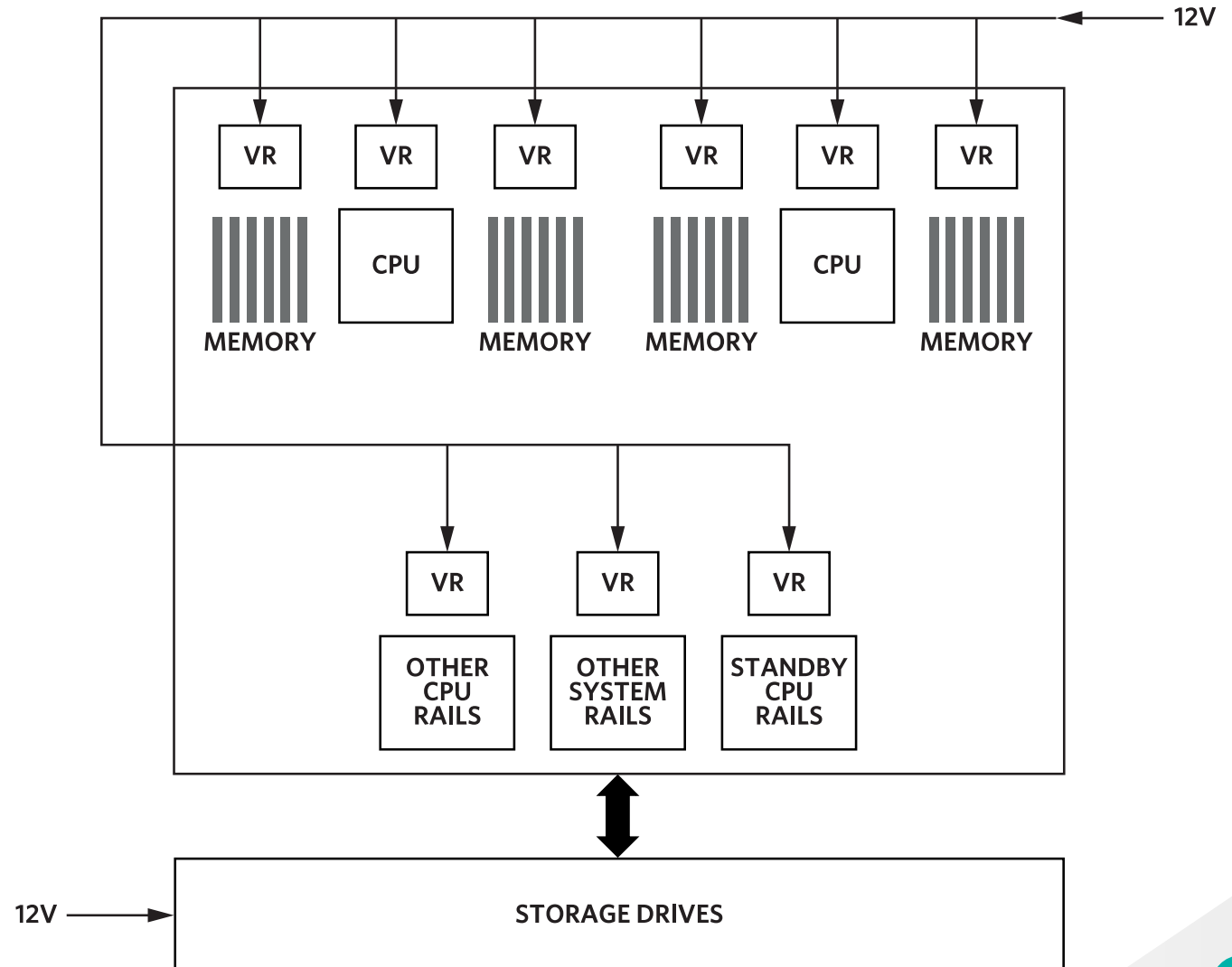
- CPUs
 - > Higher power
 - 150W+
 - > Faster transients
 - 500v/ μ S
- Memory
 - > Higher power
 - Faster & more DIMMs
- Accelerators
 - > Similar trends as CPUs
 - > GPUs, FPGAs, ASICs



Source: [Google Open Compute Summit presentation] Original data up to 2010 by M.Horowitz et al, 2010 to 2015 by K.Rupp

12V Server Motherboard Power Architecture

- CPU & Memory
 - > 12V to PoL VRs
 - Multiphase buck topology
 - Around for 20+ years
 - > Focus is on cost reductions
 - > Efficiency gains limited
- Other PoLs
 - > 12V to PoL VRs
 - Lower power



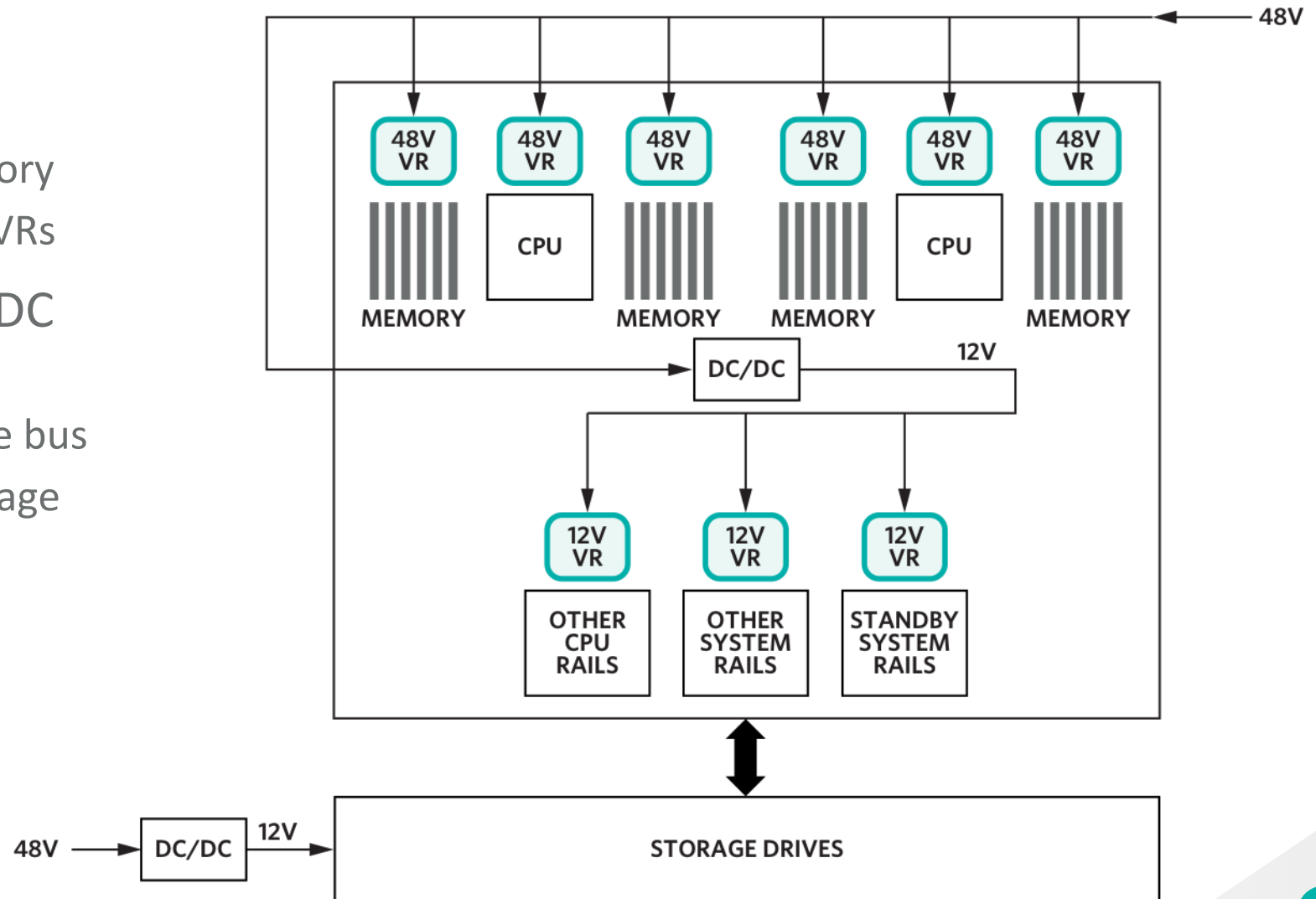
Definitions

PoL (Point of Load): End user of power

VR (Voltage Regulators): DC/DC conversion

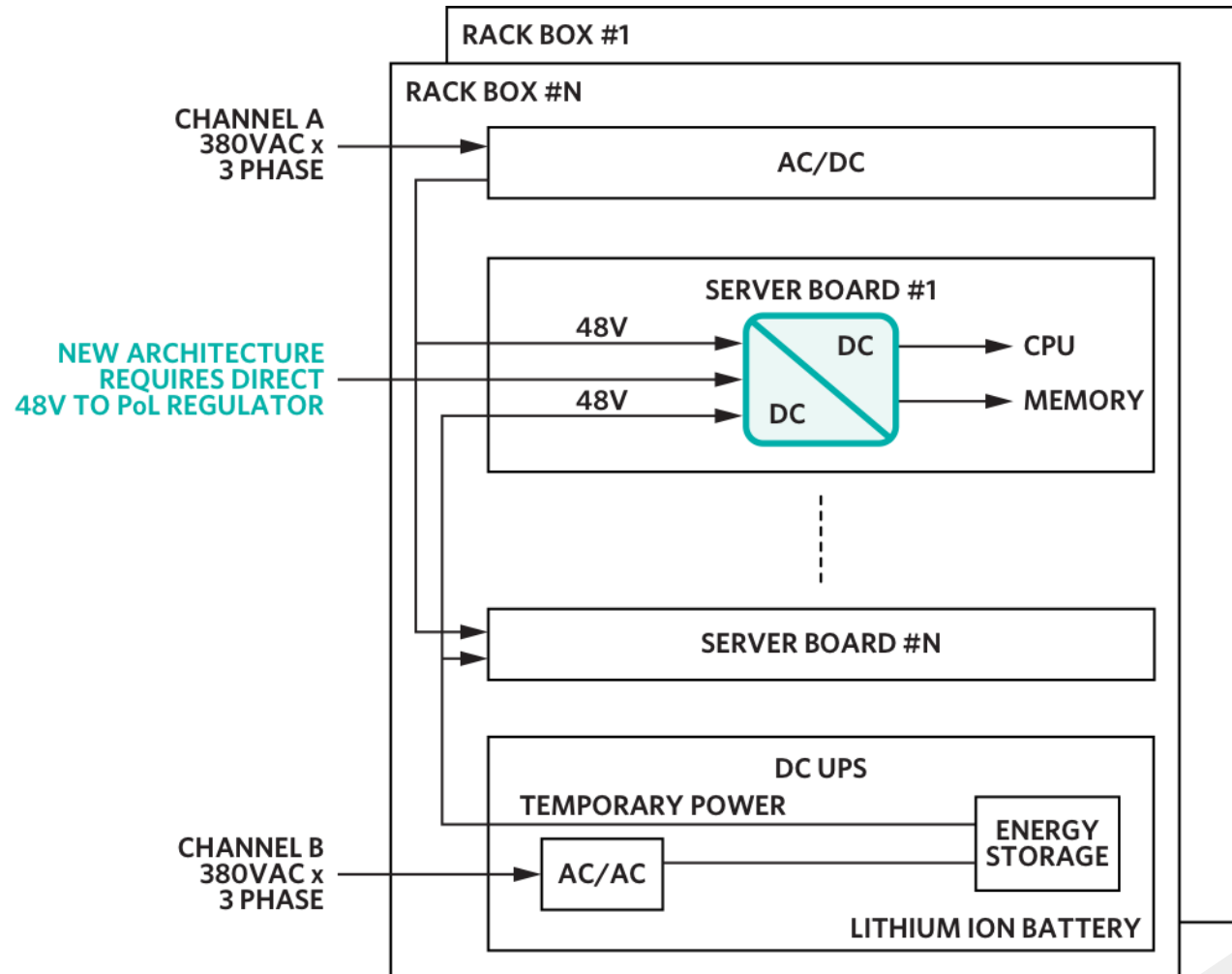
Maxim's 48V Solution

- New 48V to PoL DC/DC Voltage Regulators
 - > High power CPU & Memory
 - > 6 direct 48V conversion VRs
- Existing 12V to PoL DC/DC Voltage Regulators
 - > Intermediate 12V voltage bus
 - > Lower power rails & storage



New 48V Architecture Benefits

- Energy Savings
 - > Up to 30% less conversion losses
 - > 16x less power distribution losses
 - Connectors, cables, board
 - > Upstream conversion & distribution
 - Power losses reduced
- Efficient & Cost Effective UPS
 - > Co-located & high density
 - > No boost conversion required
- Existing Infrastructure
 - > Telecom ecosystem



Definitions

UPS: Uninterruptible Power Supply



- Large data centers are incentivized to move from 12V to higher voltages
- Google presented compelling case at OCP Summit for new 48V rack architecture
- 48V direct to PoL voltage regulators for CPU & Memory are key enablers
- Maxim's integrated power & magnetic solution meets these requirements