



OCP
SUMMIT

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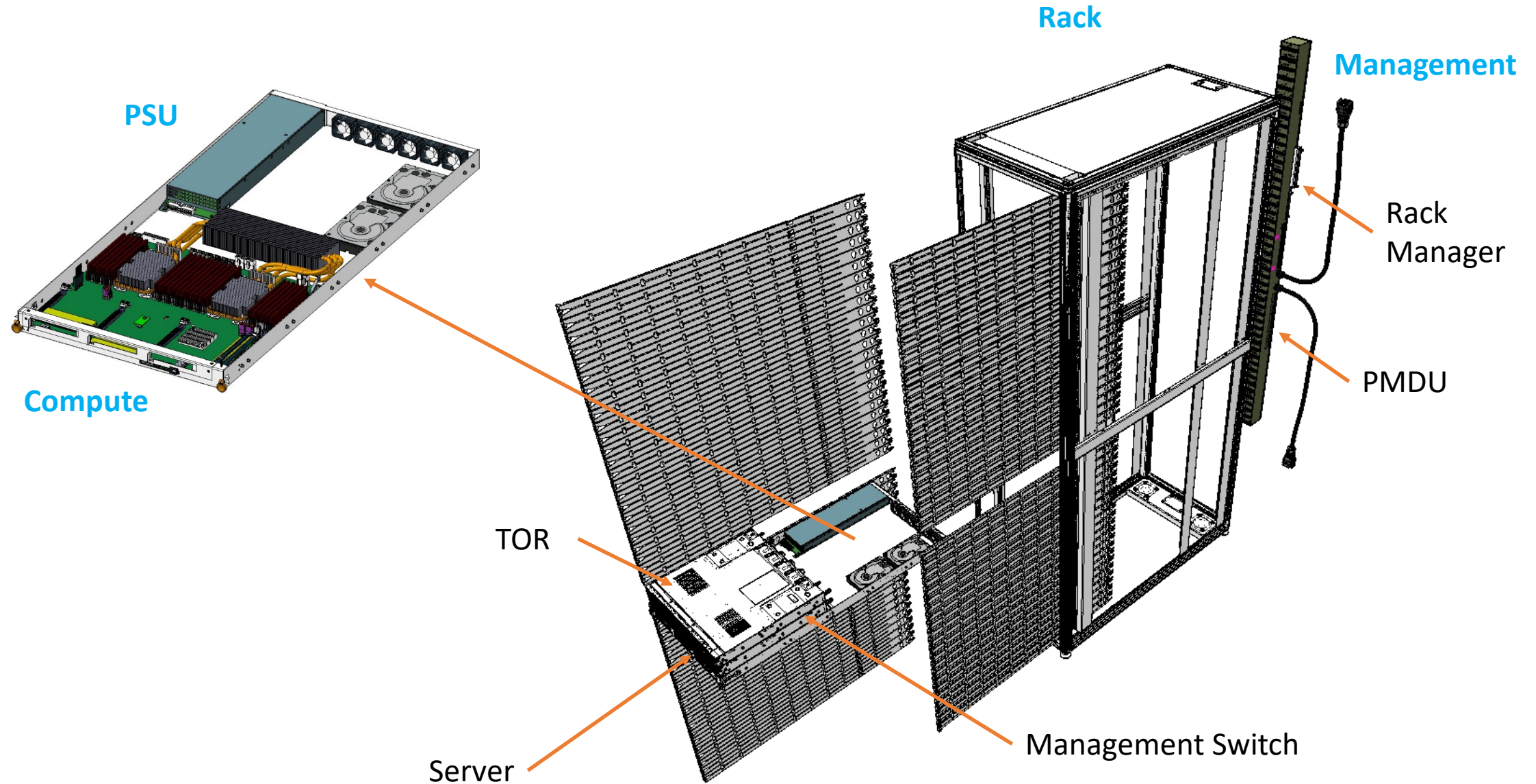
Data Center Server Agnostic Power Management

Bryan Kelly – Principal Firmware Eng Manager

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Project Olympus System Overview

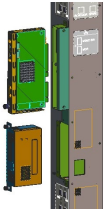
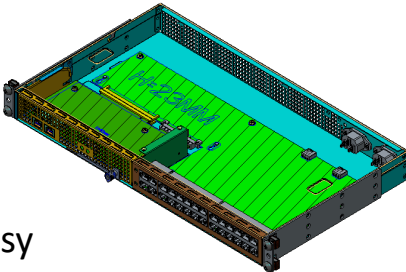


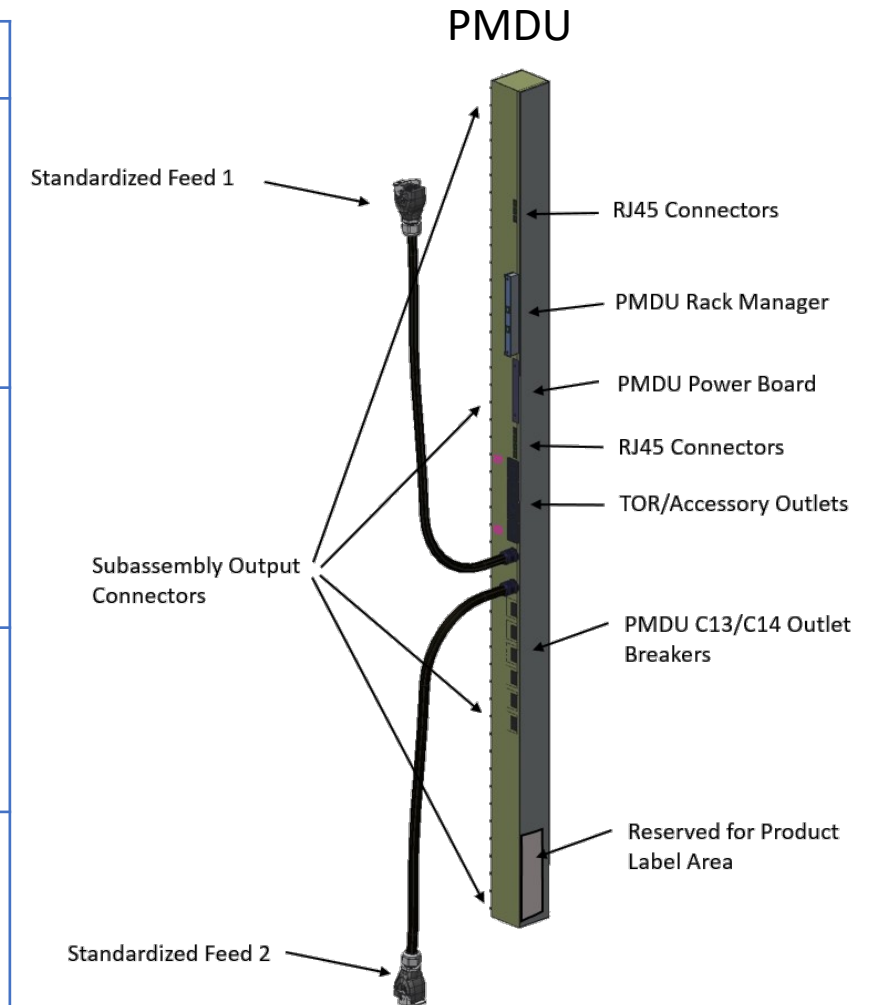
Project Olympus

- System and Rack design
- Manufacturing collateral; schematics and board files open sourced in Feb 2017
- Open Sourced Firmware: Open EDKII, OpenBMC and Open PDU and Rack Manager.



Power Management Distribution Unit

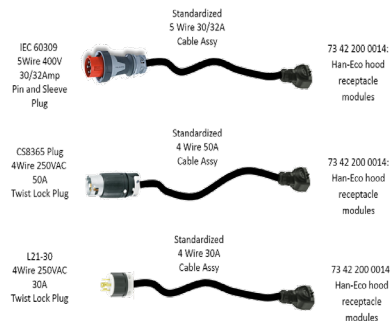
Modules	Features
PMDU	• 48U and 42U support • AC Power for rack devices (FCI and Cable) • Enables blade management and power control • Dual Feed with Circuit Breakers • Hot Plug Rack Manager and AC/DC Converter • No active single point of repair
Rack Manager + AC/DC	• Hot pluggable • 1GbE Management • Power Meter for PMDU • UARTs for switch and Digi • Blade power control 
Management Switch	• COTS 1GbE managed switch • Cold aisle cabling 
Standalone Rack Manager	• 1U Standalone unit • Non-WCS rack management • Row management • Colo management • Reuse of Rack Manager Board Assy 



Rack Level Power Control Mechanism

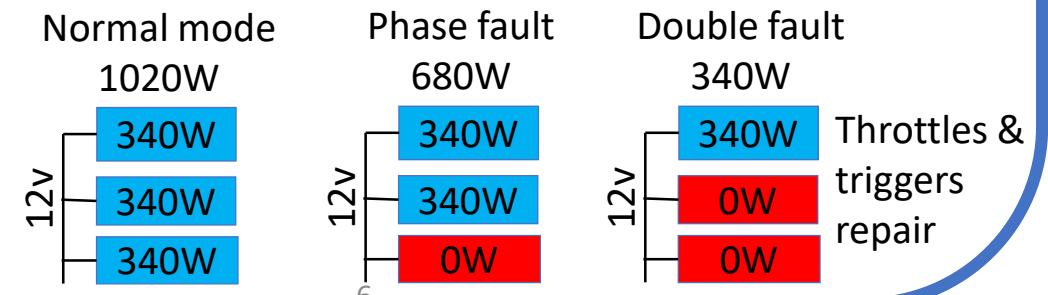
Universal PMDU

- Dual-feed, three-phase Power
- Integrated Rack Management
- Adapter AC whips for Data Centers
 - 208V-50A, 415V-30A, 400V-32A
- Power monitoring and throttle Servers blind-mate – no rear access



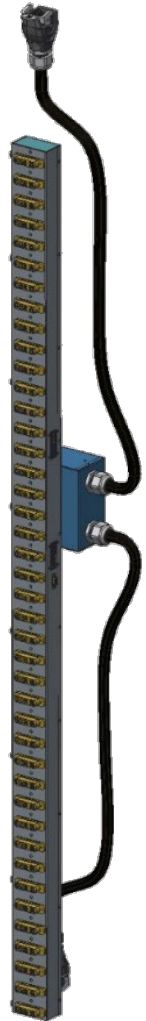
Three Phase Power Supply

- Three x 340W PSUs integrated in one
 - Dual feed, three phase AC power in
 - Auto selection of feed (IVS)
- Fault Mode Resiliency
 - AC feed failure, automatic fail over
 - PSU failure throttles if necessary
 - Double fault will be extremely rare



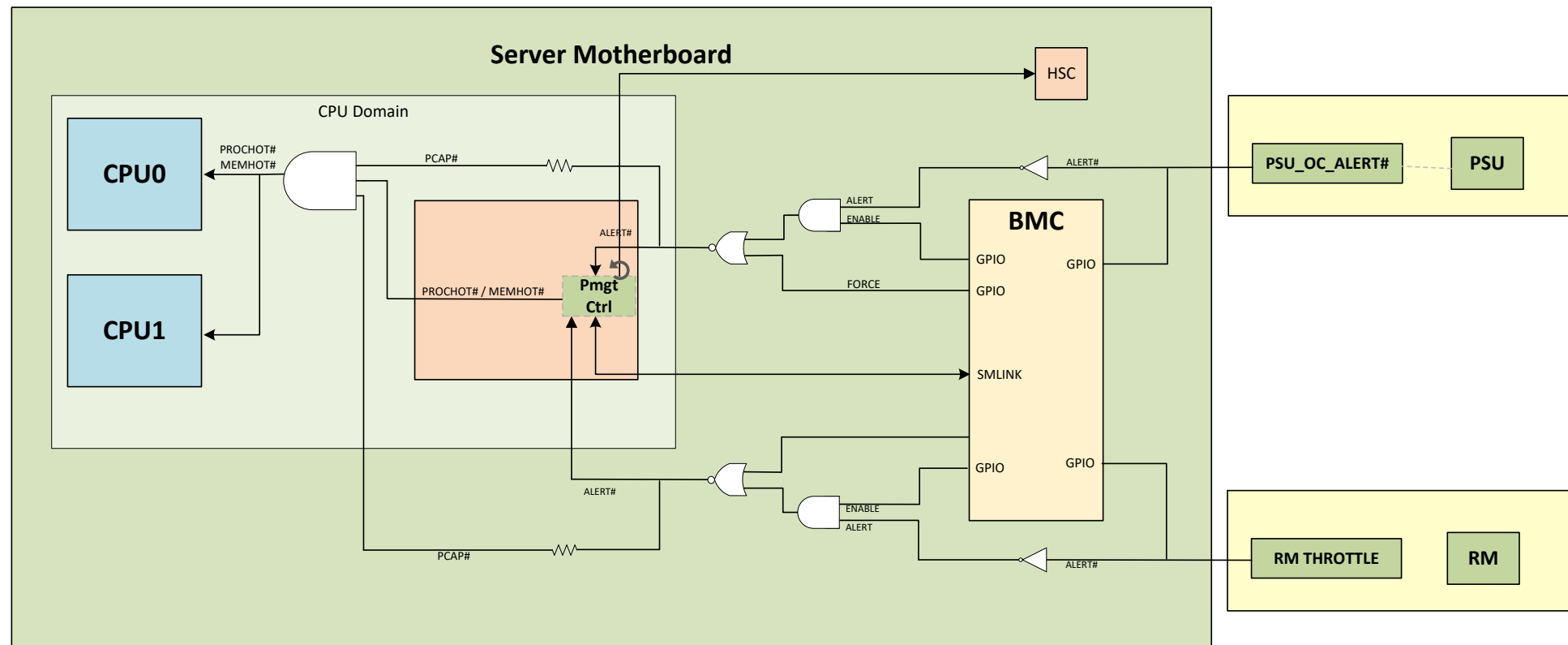
Rack Level Power Control Mechanism

- PMDU fans-out gpio logic from Rack Manager to servers
- Servers are configured with a Power Policy
 - Activated upon alert signal
- Rack Manager contains rack level power meter, that runs in a dedicated real-time coprocessor.
- Rack Manager assigned power limit for the rack
- If limit is reached, signal asserts causing servers to activate their policy (instantly throttle, depending on policy)
- Rack Manager has option for auxiliary in-puts (row,colo)



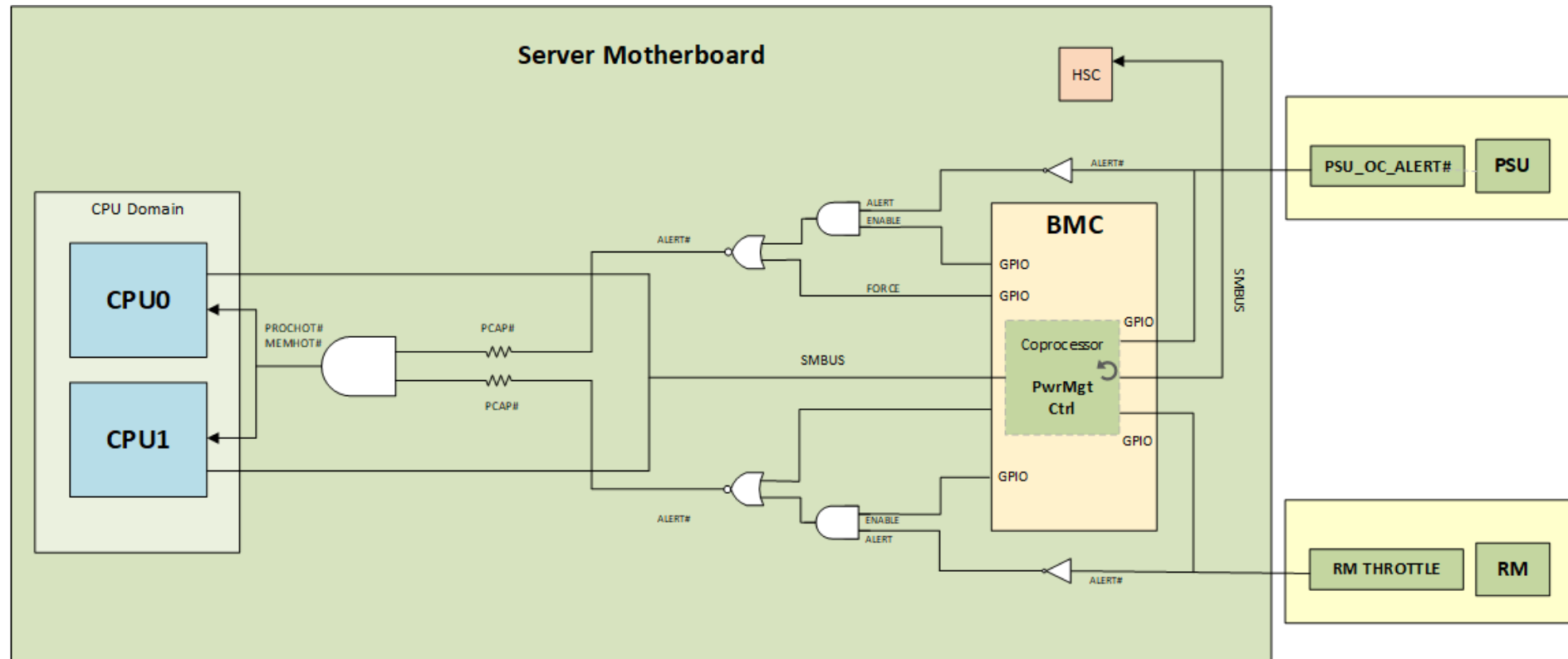
Intel Baseboard Power Control Logic

- Alert logic can immediately throttle CPU power (<1ms)
- BMC intercepts signals and applies power control policy to chipset, then deasserts logical alert
- Chipset implements power/frequency limits on the CPU
- Chipset perpetually polls HSC for platform power, and adjusts CPU limit

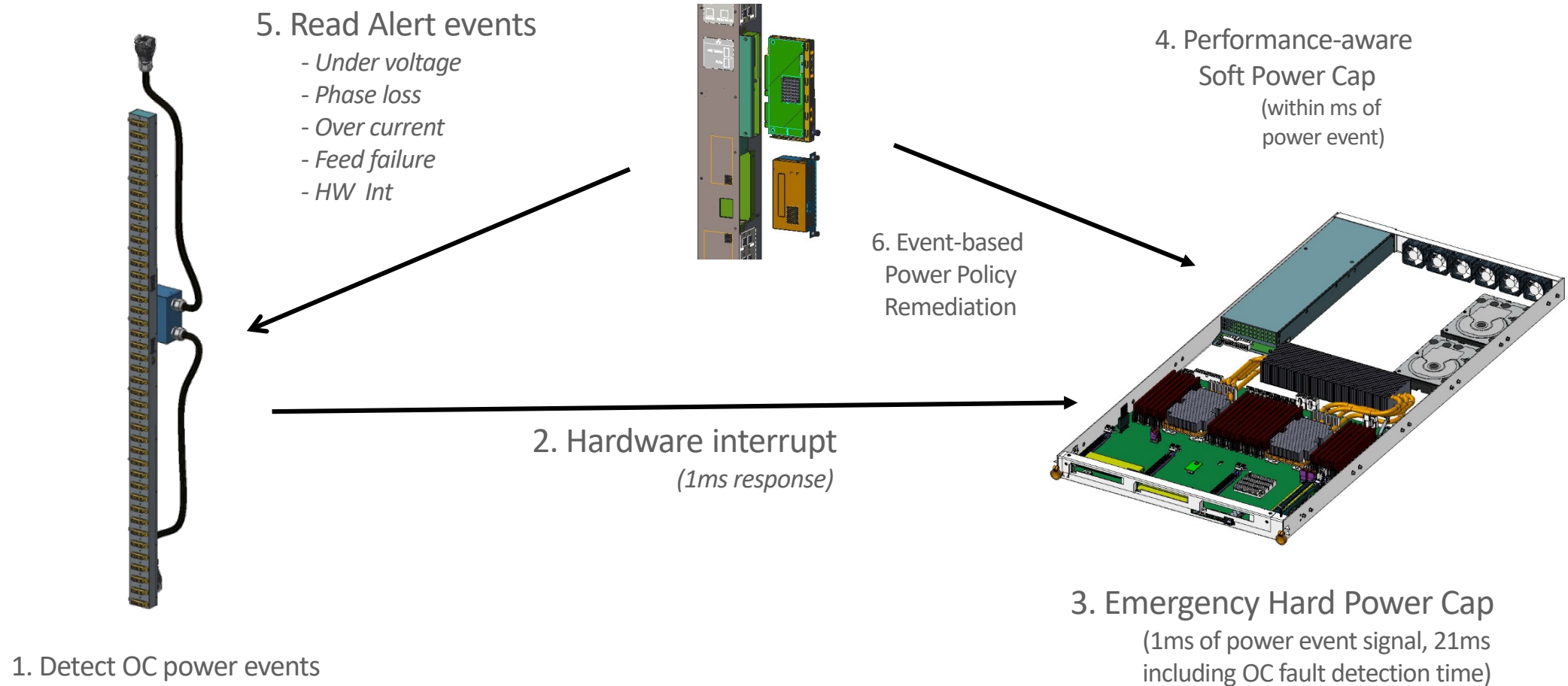


CPU Agnostic Baseboard Power Control Logic

- Alert logic can immediately throttles CPU power (<1ms)
- BMC intercepts signals and BMC co-processor applies power policy to CPUs, then deasserts logical alert
- BMC implements power/frequency limits on the CPU
- BMC perpetually polls HSC for platform power, and adjust CPU limit

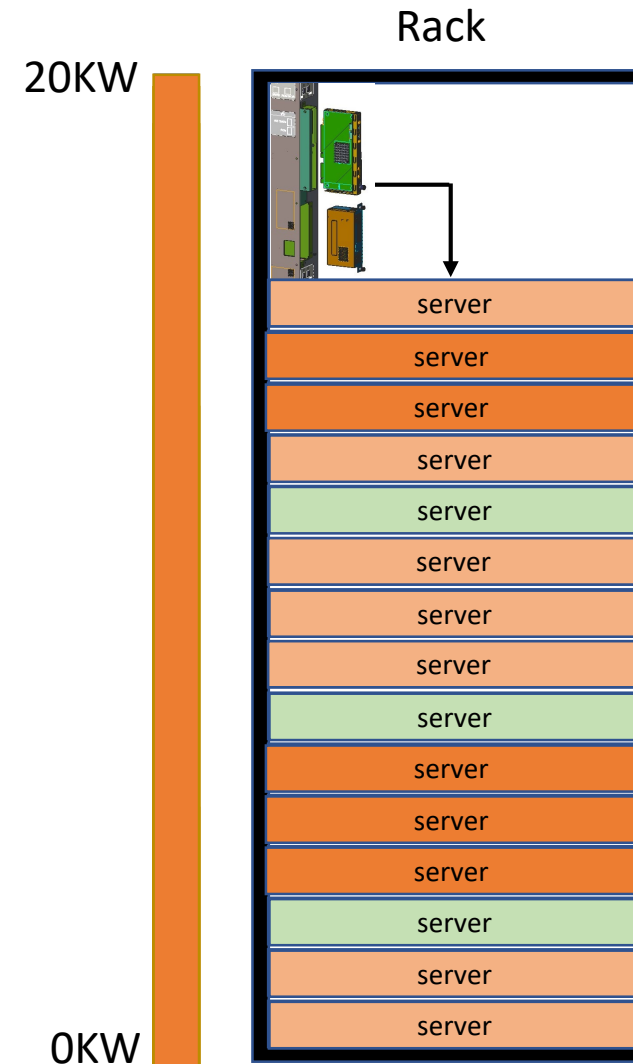


Power Control – Rack Level Interactions



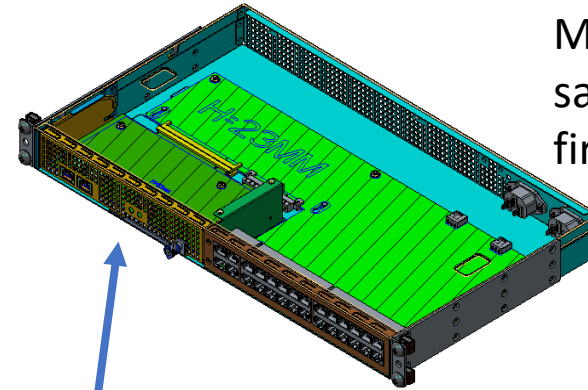
Dynamic Rack Level Power Control

- Static server level limit can impact system performance.
- Rack level permits servers run as high as they like, but cumulatively below the rack limit
- Tighter power provisioning made possible due to internal evitable workloads
- Fabric orchestrates policy, priority given to critical workloads

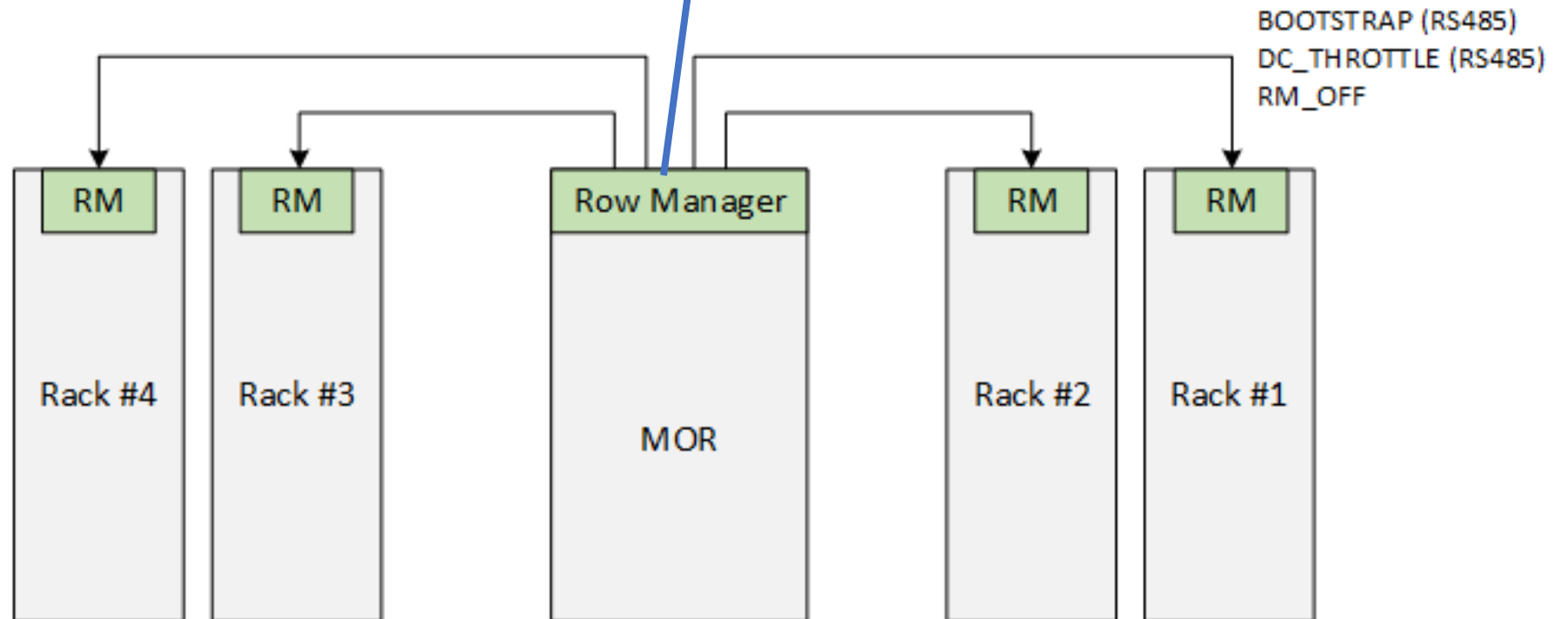


Row Management

- Standalone Rack Manager located in MOR
- Controls up to 24 Rack Managers
 - Remote Power Control
 - Bootstrap
 - Rack Level Throttle
- RJ45 Cables
- RM Throttle bypass

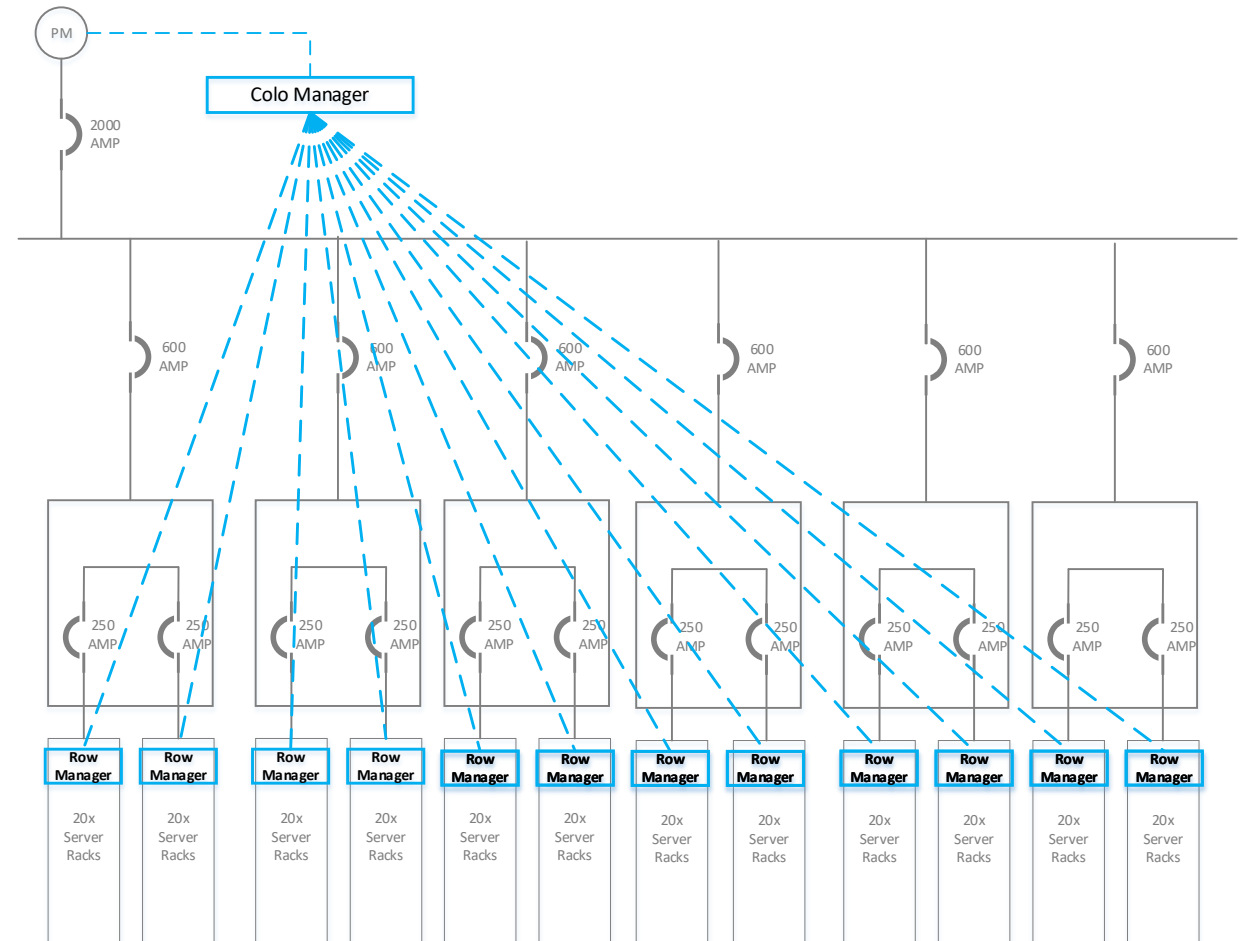


Middle of Row Manager,
same hardware and
firmware, different role.



Colo Power Management

- Redundant Colo Managers at Power Source (same device, firmware, different role).
- Standalone Rack Manager located in Row distribution panels
- Hierarchical design
- Alert signal distribution propagates from data center infrastructure to server infrastructure



Further Information

- Project Olympus:
 - [https://github.com/opencomputeproject/Project Olympus](https://github.com/opencomputeproject/Project_Olympus)
- Rack Manager
 - <https://github.com/Project-Olympus/rackmanager>
- OpenUEFI
 - <https://github.com/tianocore/edk2-platforms/tree/devel-MinPlatform/Platform/Intel/PurleyOpenBoardPkg/BoardMtOlympus>

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