Cray® XC™ Advanced Power Management Updates CUG 2018

Steven J. Martin, Cray Inc.

Cray® XC™ Advanced Power Management (APM) Updates

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Please hold questions for the end of the presentation!

Cray XC APM Updates

- **This will be a quick update on XC APM**
  - Monitoring and control of power and energy is important in HPC
  - The Cray APM team wants to promote open communication

- **This presentation will cover the following**
  - Compute blades supported on the Cray XC50 platform
  - Cray XC50 compute blade APM features
  - Cray XC50 blade featuring Intel® Xeon® Scalable processors
  - Cray Power Management Database (PMDB) updates
  - Cray XC50 APM usage examples

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Compute Blades on the Cray XC50 Platform

- **Cray APM is supported on all XC compute blades!**
- **The Cray XC50 supports the following blade types**
  - NVIDIA® Tesla® P100 PCIe GPUs
  - Intel® Xeon® Scalable processors
  - Cavium ThunderX2™ processors

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Cray XC50 Compute Blade APM Features

- **Power and energy monitoring**
  - Advanced out-of-band (OOB) blade level monitoring
    - Total node, aggregate CPU and Memory, power and energy
  - Publishing power and energy data OOB into PMDB
  - Publishing power and energy data in-band /sys/cray/pm_counters

- **Power and energy control**
  - Node level power capping
  - P-state and c-state limiting
  - Cray advanced platform monitoring and control (CAPMC)

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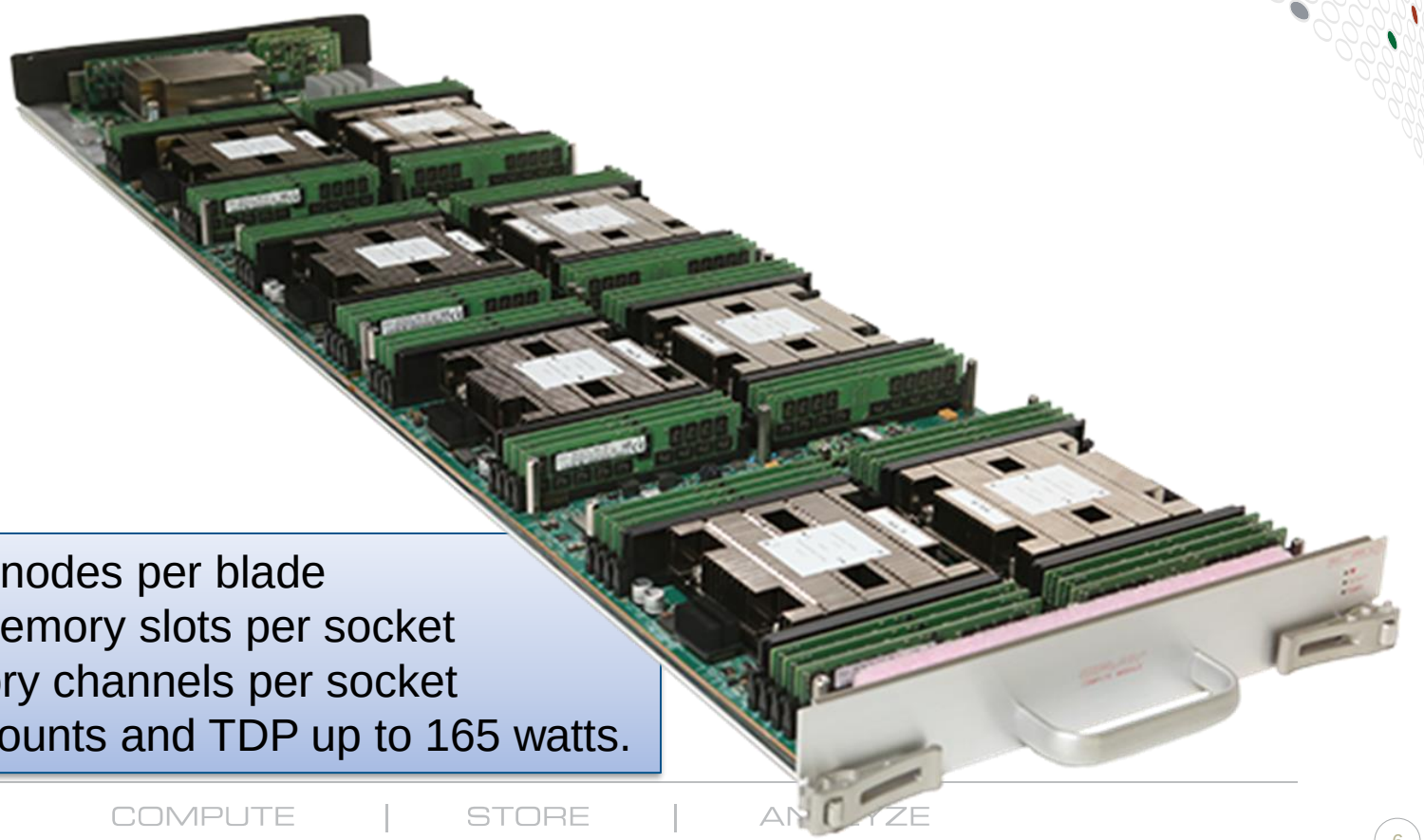
Cray XC50 Blade with Intel Xeon Scalable Processors



- Four 2-socket nodes per blade
- Eight DDR4 memory slots per socket
  - Six memory channels per socket
- Varying core counts and TDP up to 165 watts.

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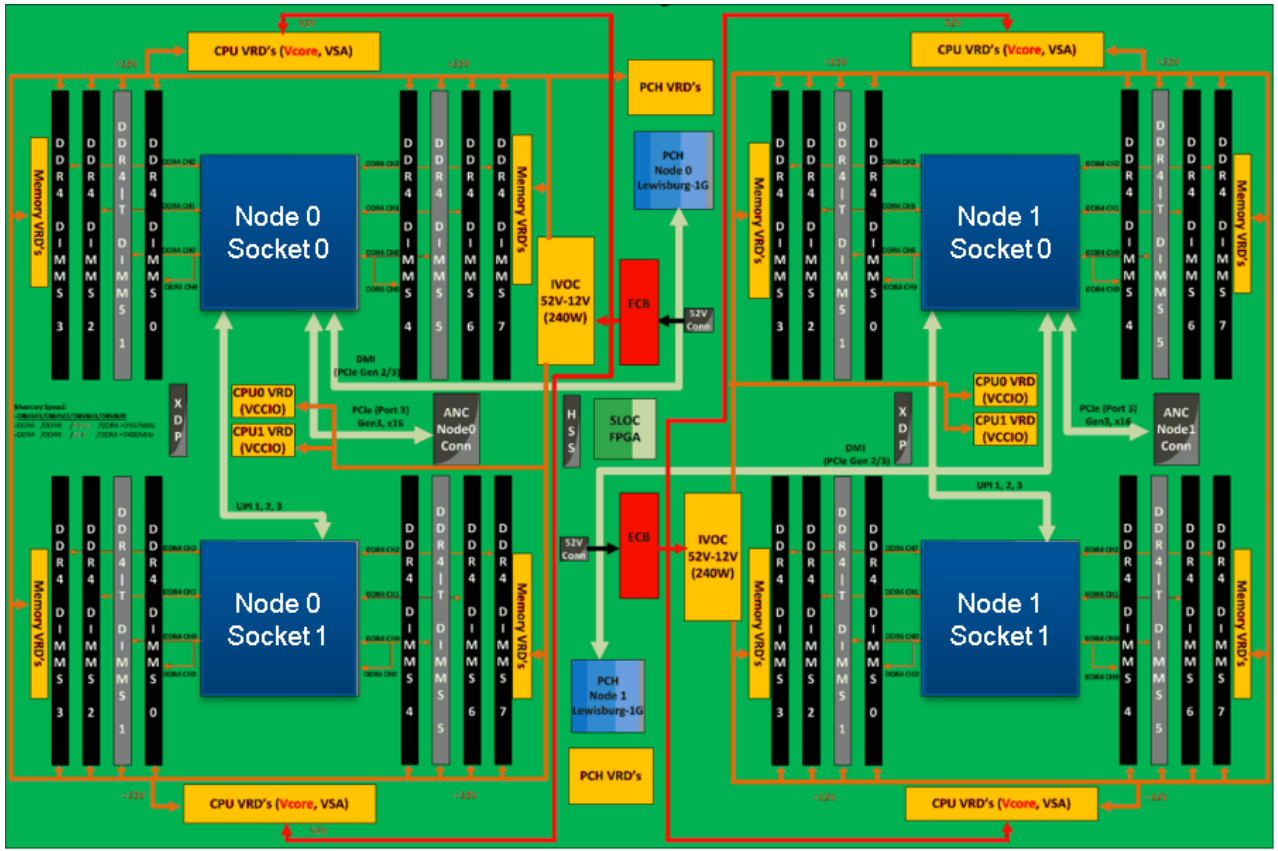
Cray SPDC with Intel Xeon Scalable Processors



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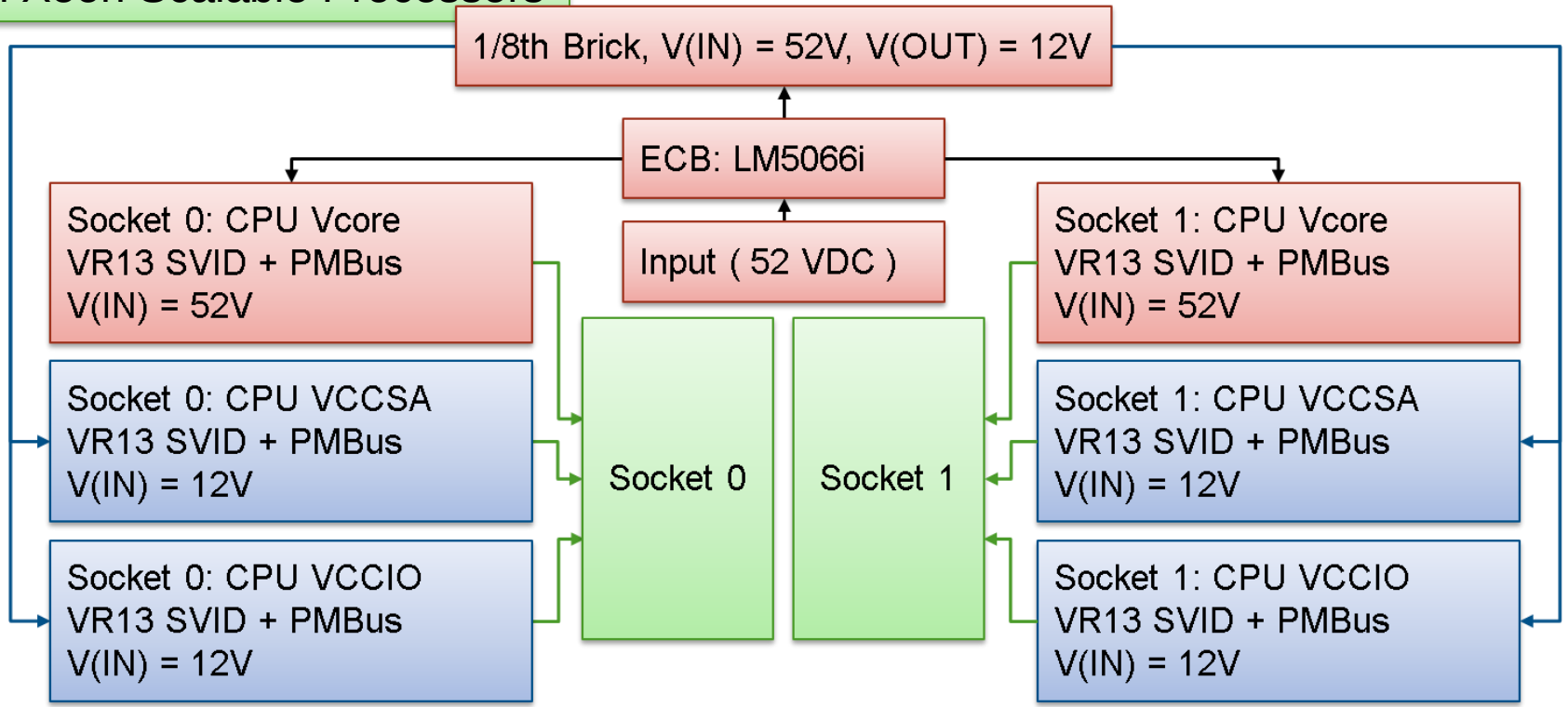
Cray XC50 Vicor VCORE Power Solution

Intel Xeon Scalable Processors



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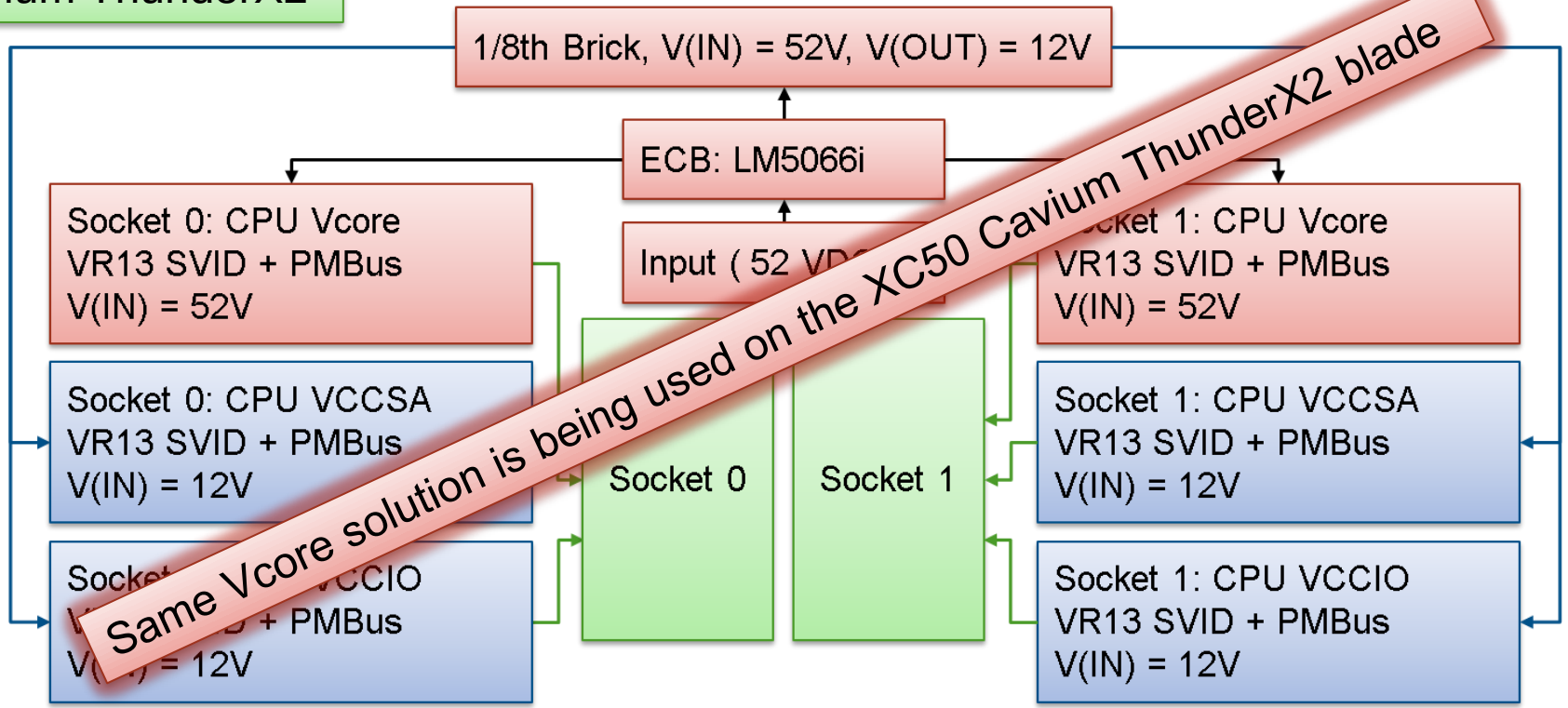
Cray XC50 Vicor VCORE Power Solution

Cavium ThunderX2



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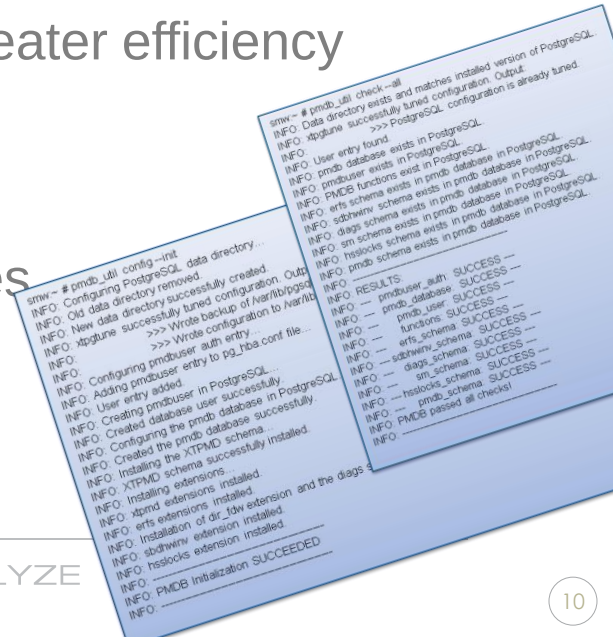
Cray PMDB Updates in SMW 8.0.UP06

- **PMDB time series data changed to use TimescaleDB**
  - TimescaleDB is a fully integrated PostgreSQL extension
  - Replaces previous Cray partition based implementation
  - Integration with SQL query planner results greater efficiency

- **New PMDB configuration utility**
  - New pmdb_util utility replaces previous utilities (pmdb_auto_migrate, init_pmdb, etc.)
  - Provides ability to configure and now check PMDB in single place



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TimescaleDB in Cray PMDB

- **Abstracts idea of a single continuous table**
  - Top level “hypertable” is sharded into many partitions/chunks
  - Treated like standard PostgreSQL table
- **Transparently partitions based on time/space**
  - Each chunk contains a known time interval
- **Allows aggressive query optimization**
  - Only chunks that can contain data are ever scanned
  - Speedup of at least 2x with most queries

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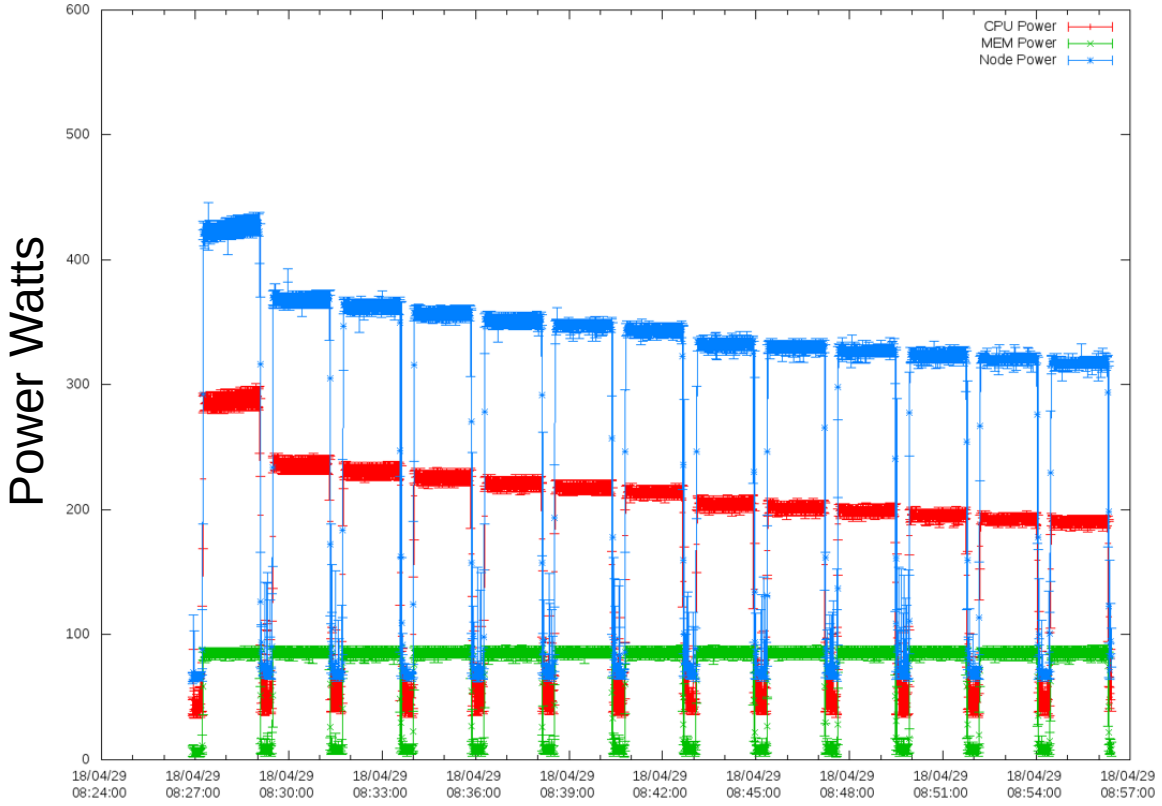
Cray XC50 APM Usage Examples

Stream runs with supported p-states

Xhpl run with power capping

Stream Runs with Supported P-States



ALPS aprun --p-state=<kHz> at job launch over supported frequencies

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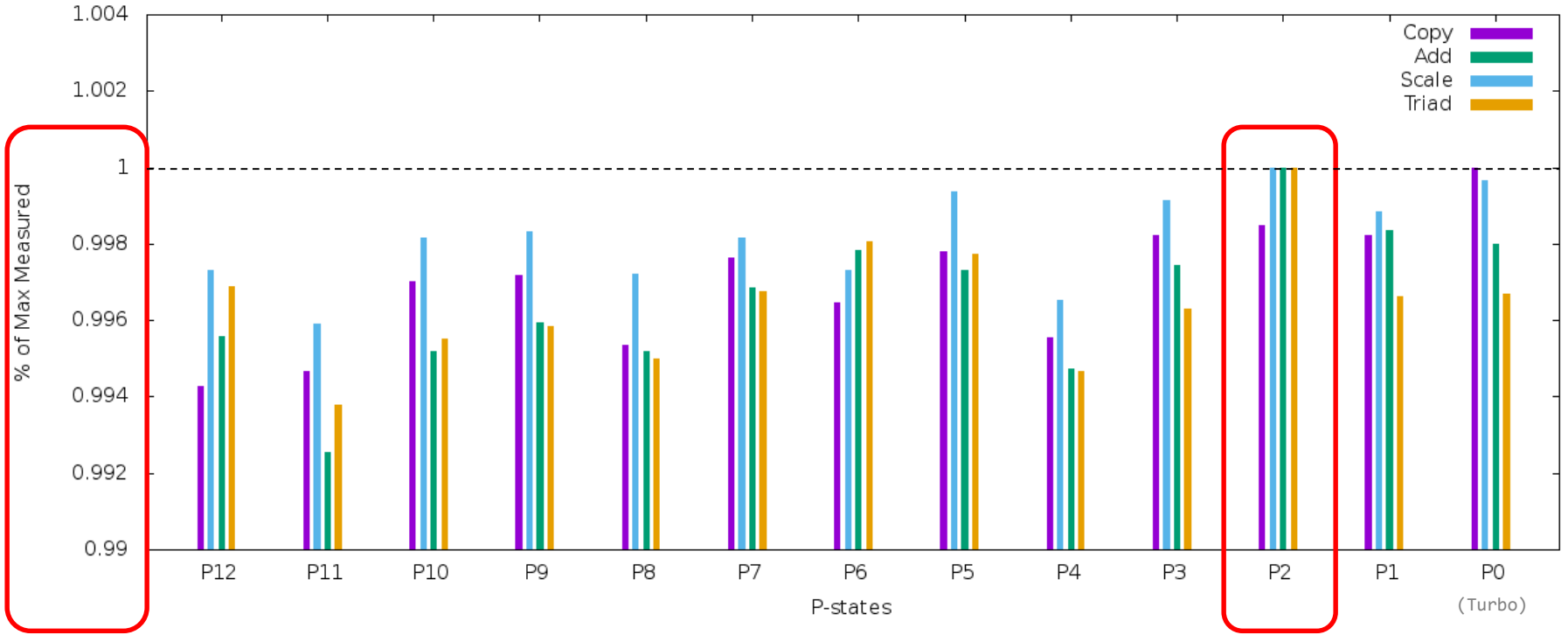
Stream Runs Normalized Performance



Stream reported “Best Rate MB/s” normalized over all runs

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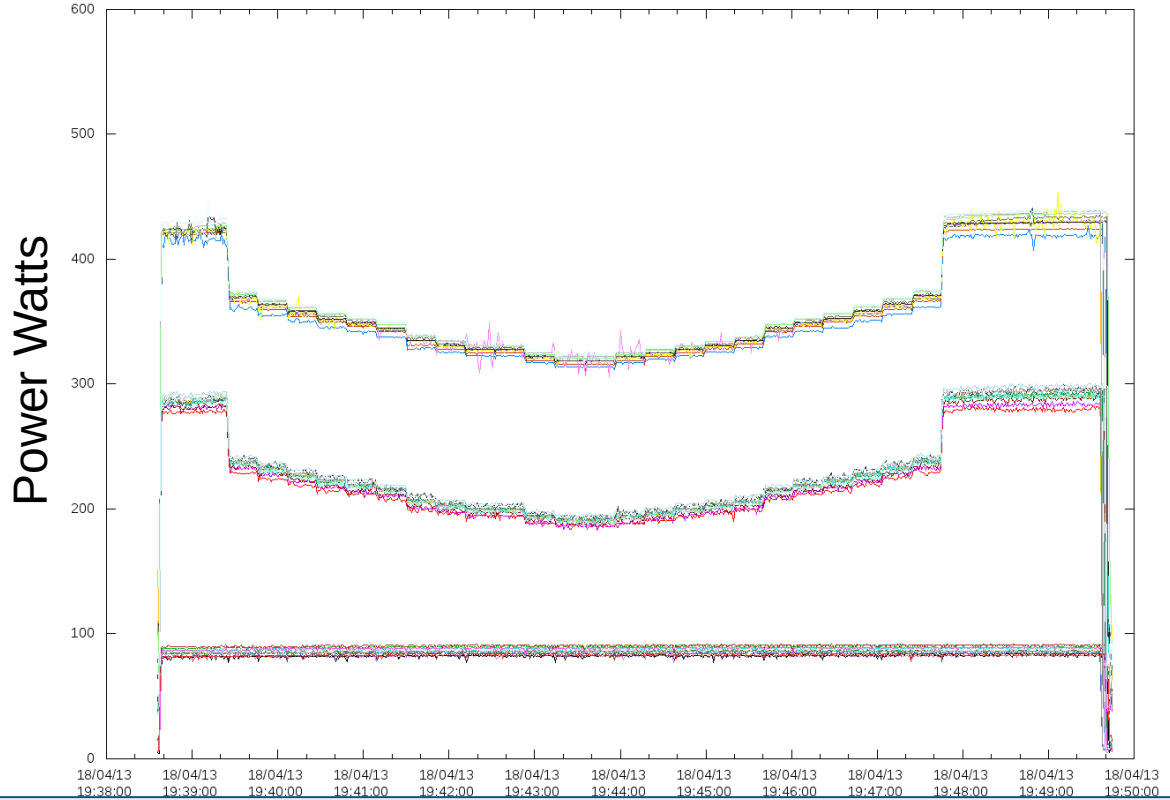
Stream Run with P-States Sweep



Dynamic p-state limiting with CAPMC of running stream job

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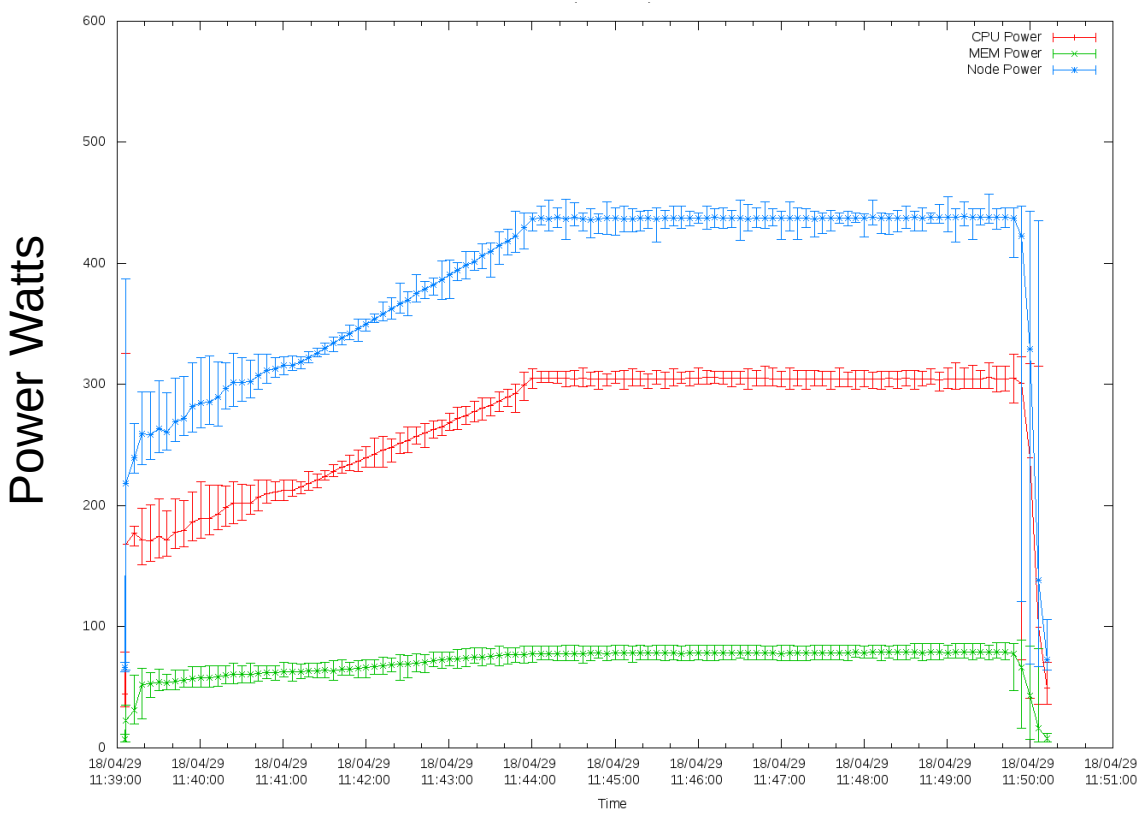
Xhpl with Power Capping (Ramp Up)



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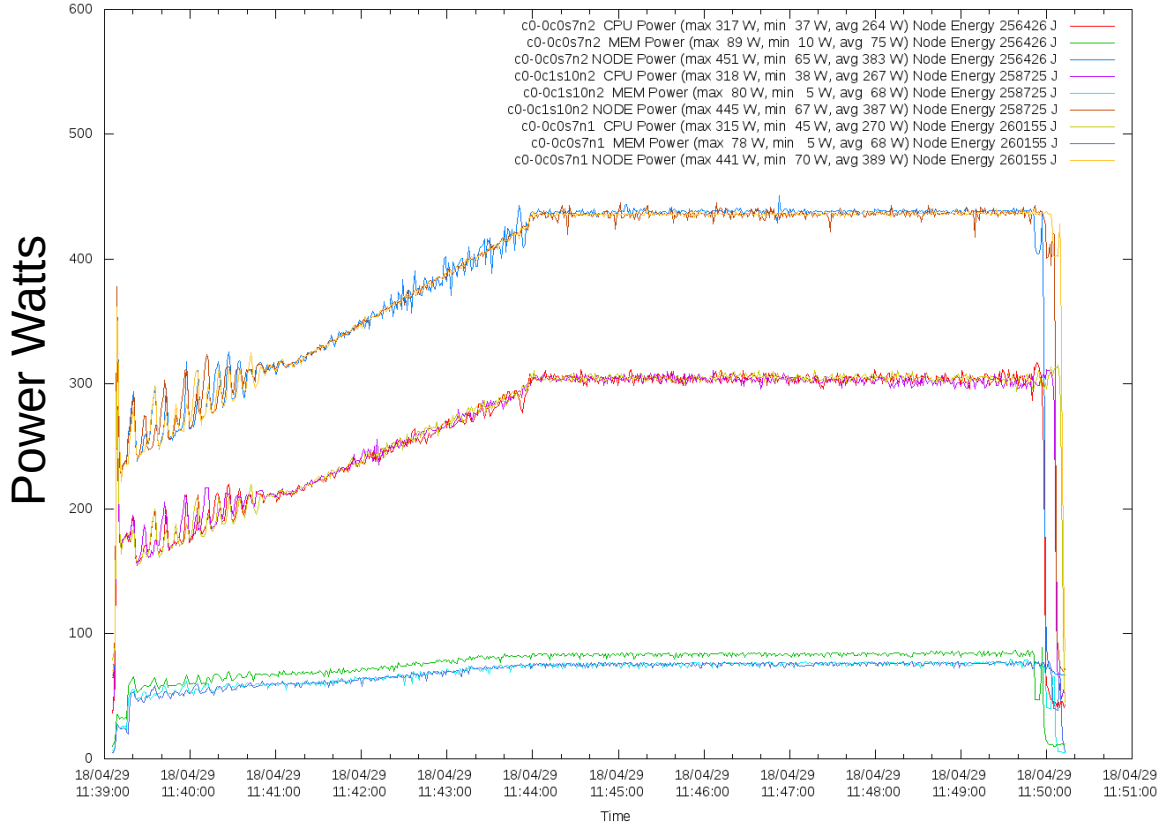
Xhpl with Power Capping (Ramp Up)



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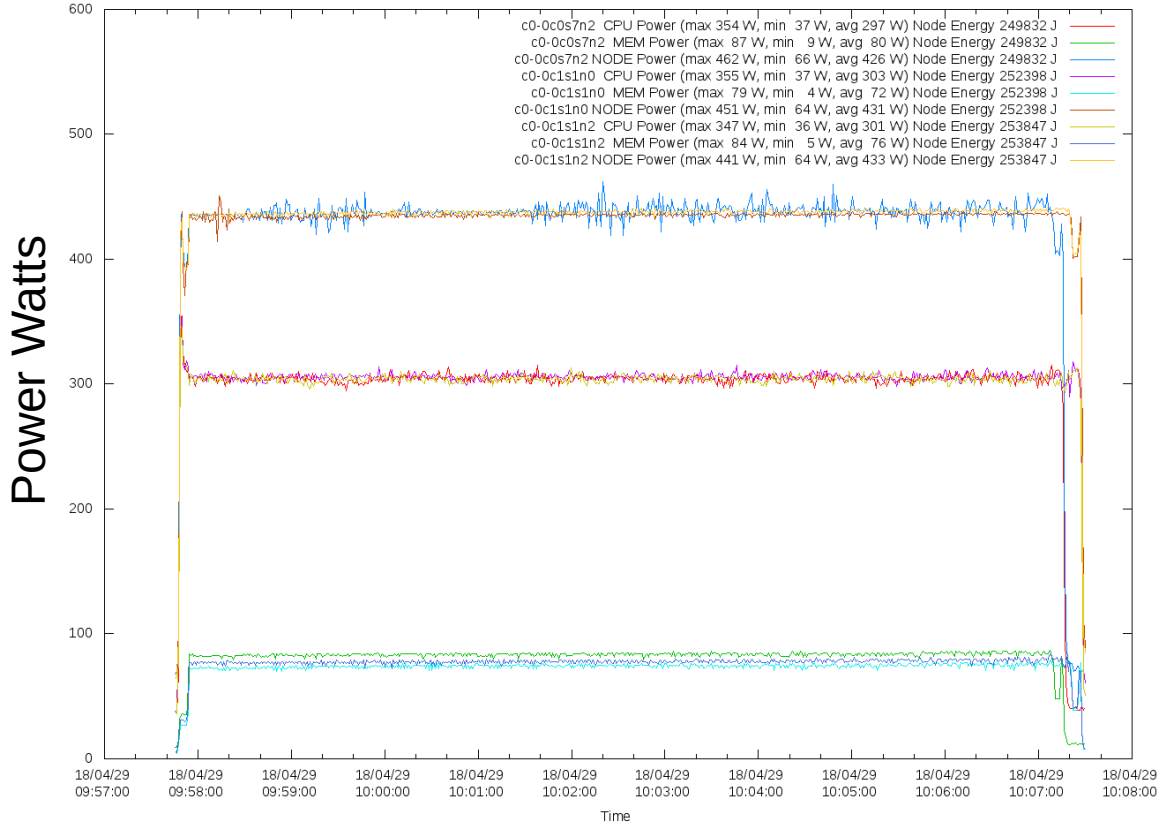
Xhpl (Not Power Capped)



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Cray APM Supported on All XC Compute Blades

- **Advanced monitoring and control**
  - Telemetry data published into PMDB and CLE:/sys/cray/pm_counters
  - CAPMC enables dynamic monitoring and control
- **New XC50 blades using new 52VDC → VCORE solution**
  - Smaller footprint, full PMAX power
  - More accurate monitoring , and reduced power distribution losses
- **Cray PMDB Updates in SMW 8.0.UP06**
  - PMDB now using TimescaleDB (fully integrated PostgreSQL extension)
  - Utility pmdb_util replaces previous utilities to manage & configure PMDB

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Q&A
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