Cray Advanced Platform Monitoring and Control

CAPMC, CUG 2015:
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Introduction

- **Overview of CAPMC**
  - Availability
  - Functionality
  - Architecture
- **Applets**
  - Quick walkthrough of the API
- **Near-term roadmap for CAPMC**
  - In-band controls
  - Additional “Platform” use cases
  - As always, **roadmap is subject to change**…

CAPMC Overview

- **Cray Advanced Platform Monitoring and Control**
  - Cray SMW 7.2.UP02 and CLE 5.2.UP02, release in Oct-2014
  - XC30 and XC40 systems

- **Cray Advanced ~~Power~~ Platform Monitoring and Control**
  - Use of CAPMC planned for much more than just power

- **1st CAPMC release enables**
  - Power-aware scheduling and resource management

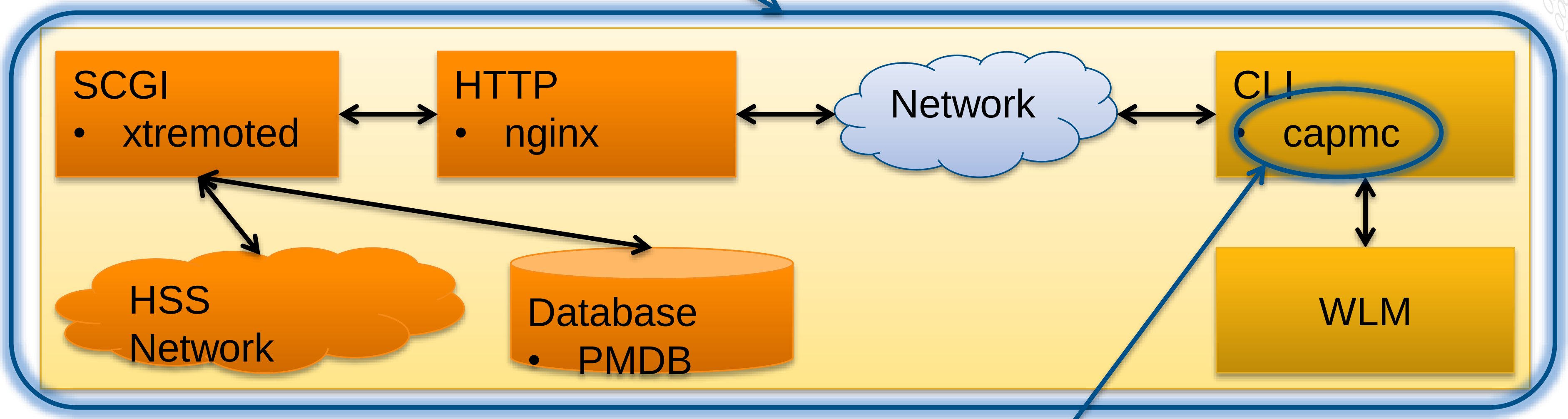
CAPMC Functionality

- Access to system- and cabinet-level power data
- Access to node-, job-, and app-level energy data
- Control of node-, job-, and app-level power capping
- Control to power on and off idle nodes

Cray supplying monitoring & control capabilities

Enabling WLM partners to innovative & manage policy

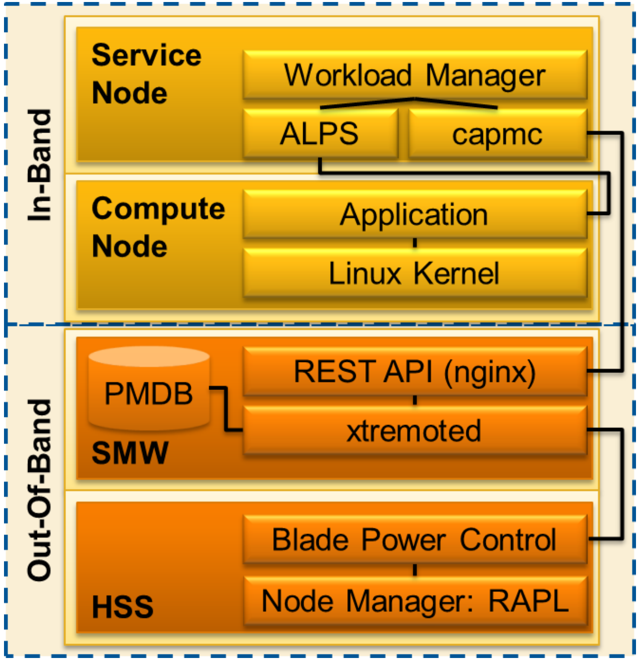
CAPMC Architecture



lower case “capmc” is the Python command line tool

CAPMC Architecture

- **Python CLI (capmc)**
  - Clients installed on select service nodes
  - Enable integration with 3rd party WLM software
- **REST API**
  - JSON data interface(s)
  - Nginx (pronounced engine-x) web server
- **Access control and security**
  - SSL & X.509
- **SMW Backend**
  - Implementing out-of-band monitoring and control functions



CAPMC Applets: System-Level Monitoring

- **get_system_power [-s start_time] [-w window]**
  - Returns system-level power data
    - Minimum, average, and maximum power for the requested time window

Time Format: 'yyyy-mm-dd hh:mm:ss'

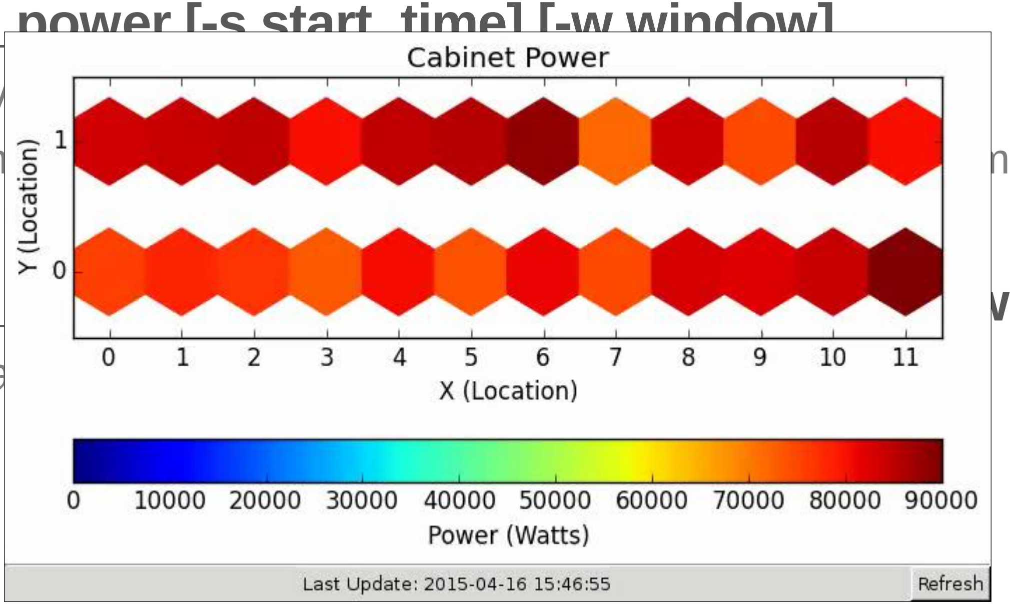
- **get_system_power_details [-s start_time] [-w window]**
  - Returns cabinet-level data for all cabinets in the system

Time in seconds

CAPMC Applets: System-Level Monitoring

- **get_system_power [-s start_time] [-w window]**
  - Returns sy
    - Minimum ne window

- **get_system_ w]**
  - Returns ca



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Use Case: (From our PM workshop earlier this week)
Video playback 40X real time, 24 cabinet system running HPL

CAPMC Applets: Node-Level Monitoring

- **get_node_energy_stats [-s start_time] [-e end_time] \ [--nids nid_list] [--apid apid] [--jobid job_id]**
  - Returns statistics for node-level energy (fixed size response)
- **get_node_energy [-s start_time] [-e end_time] \ [--nids nid_list] [--apid apid] [--jobid job_id]**
  - Returns node-level energy data (one record for each node)
- **get_node_energy_counter -t time [--apid apid] [--jobid job_id] \ [--nids nid_list]**
  - Returns raw accumulated energy counter data (one record for each node)
  - Multiple calls needed, raw counters used for delta calculations

Given an apid, CAPMC can use start_time, end_time, and the nid_list from the PMDB

CAPMC Applets: Node-Level Monitoring

- **get_node_energy_stats [-s start_time] [-e end_time] \ [--nids nid_list] [--apid apid] [--jobid job_id]**

WLM Use Case:

- Supporting interactive user queries on power/energy of their job(s)
- Tracking app-, or job-level power/energy to enable dynamic power scheduling

Additional use cases covered in our paper

- **get_node_energy_counter -t time [--apid apid] [--jobid job_id] \ [--nids nid_list]**
  - Returns raw accumulated energy counter data (one record for each node)
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CAPMC Applets: Node Power ON | OFF

- **node_on --nids nid_list**
  - Turn-on nodes and boot Linux making them ready to run jobs
- **node_off --nids nid_list**
  - Shutdown Linux and power off the nodes
- **node_rules**
  - Returns information to the WLM w/respect to node on/off operations
  - Allows system admin to establish constraints
- **node_status [--nids nid_list] [--filter 'opt|opt|opt|...']**
  - Returns current status for requested nodes
  - Allows WLM to poll for status of nodes it has powered on/off
  - Filters: show_all, show_off, show_on, show_halt, show_standby, show_ready, show_diag, show_disabled

nid_list: ‘1,3,9-11, 100-300'

CAPMC Applets: Power Capping

- **get_power_cap_capabilities [--nids nid_list]**
  - Returns power capabilities per node-type, for requested nodes

- **get_power_cap [--nids nid_list]**
  - Returns current power cap settings, one record per node

- **set_power_cap --nids nid_list [--node watts] [--accel watts]**
  - Set power cap settings

CAPMC Applets: Power Capping

- **get_power_cap_capabilities [--nids nid_list]**
  - Returns power capabilities per node-type, for requested nodes

WLM Use Case:

- Power capping at job launch
- Dynamic power capping at application, job, or system-level
  - Adjust power cap up/or down within limits in ***get_power_cap_capabilities***
  - Respond to external site conditions or changes in workload priorities
- Scheduling for system power/cooling limitations
  - Power capping as a way to implement power as a consumable resource

CAPMC Roadmap

- **Proposed new in-band features**
  - Dynamic c-state limiting
  - Dynamic p-state limiting

Working with ACES on new in-band controls enabled by the HPC PowerAPI

- **Proposed new "Platform" controls**
  - Configuration controls for future blades and processors
  - Enable WLM to configure nodes to match job-level requirements
  - Support WLM orchestration of hardware reinitialization
    - As required to activate requested changes

Q&A

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Additional Resources

Man Page

- capmc (8)
- http://docs.cray.com/cgi-bin/craydoc.cgi?mode=Show;q=;f=man/smwm/72/cat8/capmc.8.html

“Monitoring and managing power consumption on the Cray XC30 system”

- **Cray S-0043-72**
- **http://docs.cray.com/books/S-0043-7203/S-0043-7203.pdf**

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