OpenPOWER™

On Chip Controller(OCC) Overview

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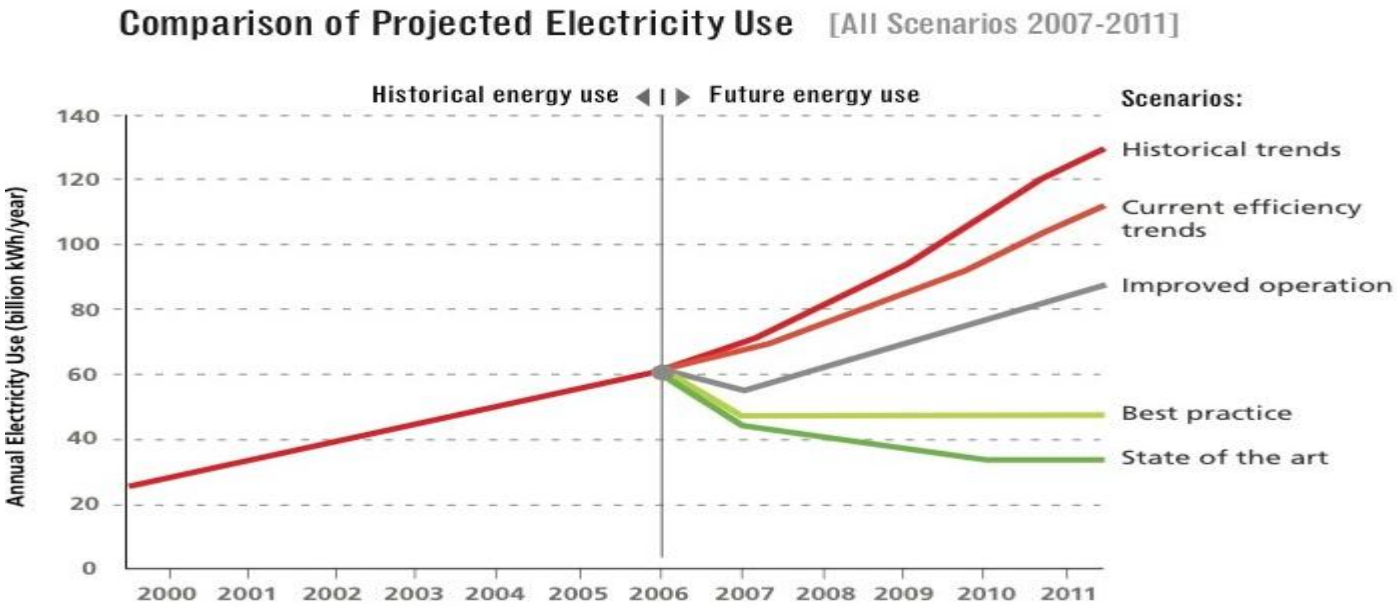
IBM/POWER Firmware Development

Agenda

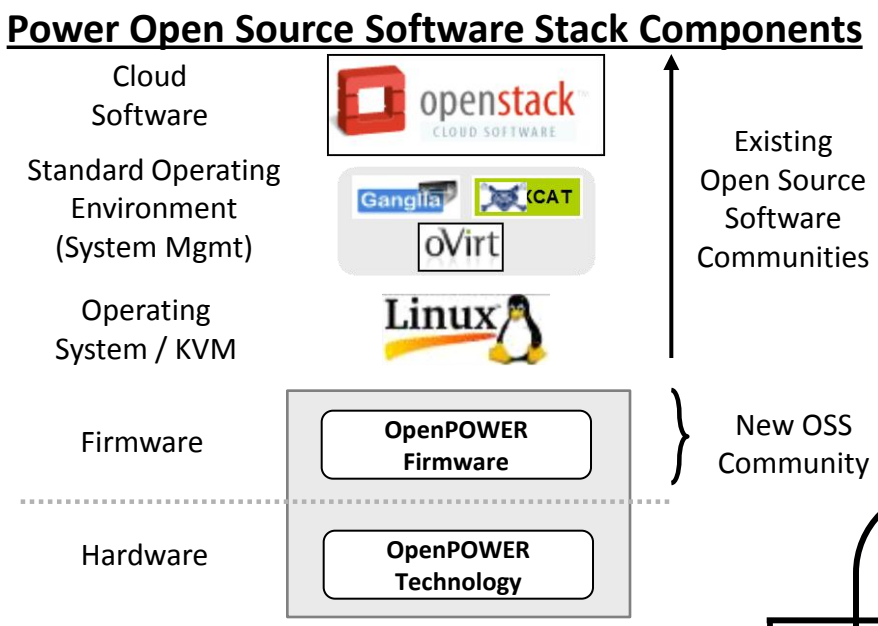
- Introduction/Motivation
- System Stack/Ecosystem
- Video
- OCC Overview
- Hardware Block Diagram
- Firmware Details
- Sample Results – Graphs
- Future Enhancements
- References

Motivation

- US datacenter energy consumption – 91Billion KWH
- 34 500MW power plants
- State of Minnesota – 68Billion KWH
- Power Usage Effectiveness



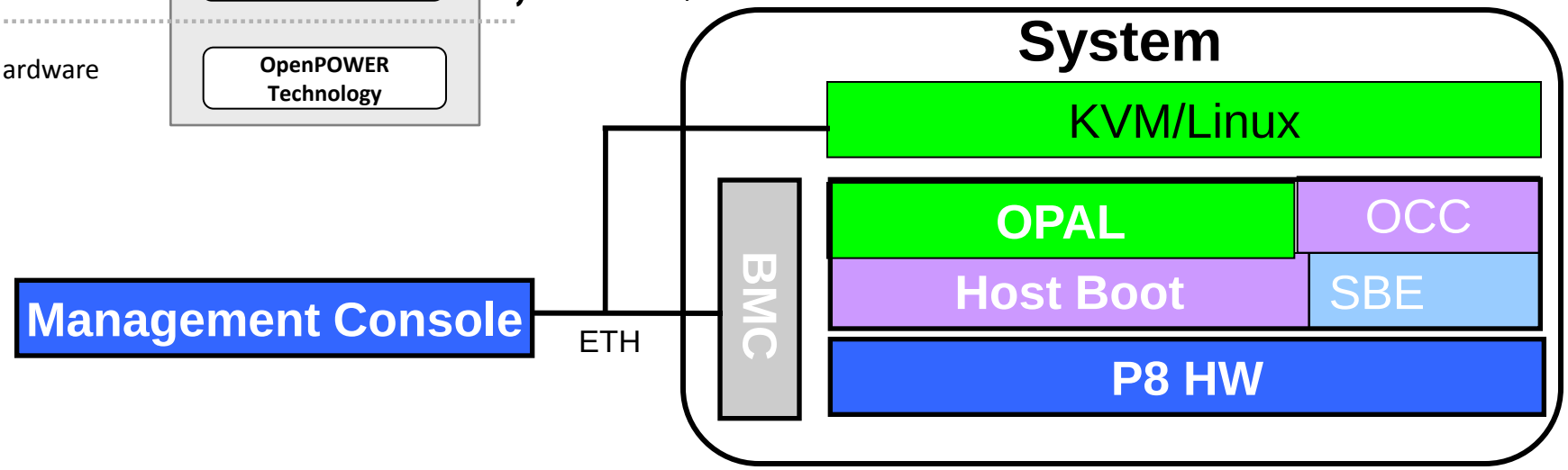
Ecosystem Enablement



July 2014 Power8 open source firmware stack contributed thru GitHub

Toolkits and resources for porting and optimizing, growing repository on website

Firmware Technical Training – OpenPower Pavilion
Thursday 9-11am Architectural Overview
Thursday 12-2pm Hands-on Training



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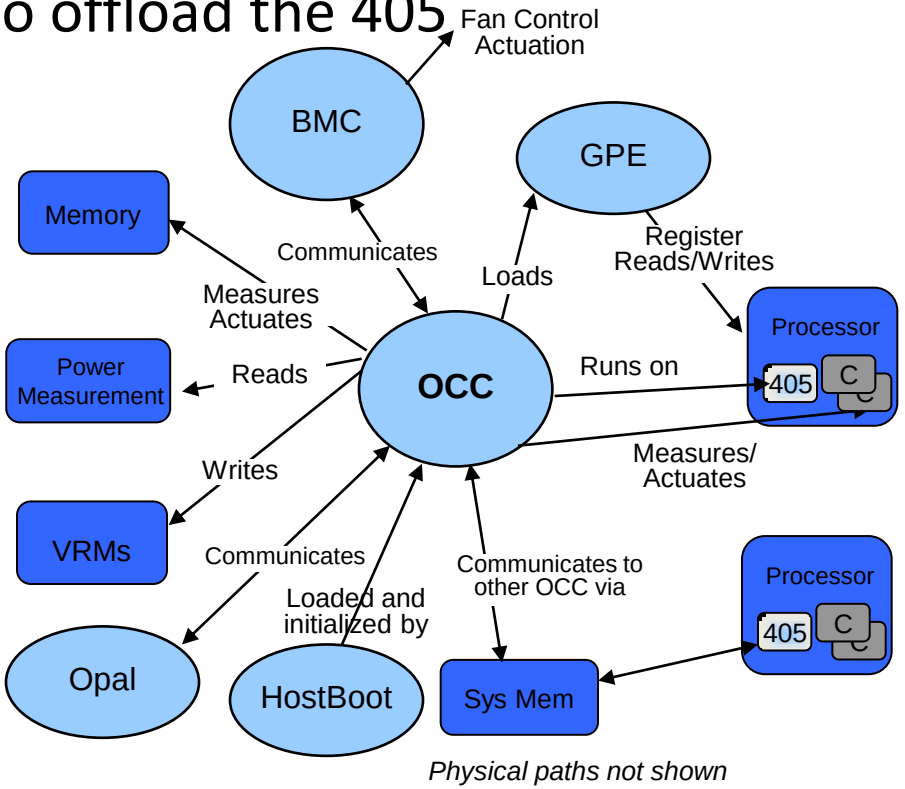
OCC Overview

What is OCC?

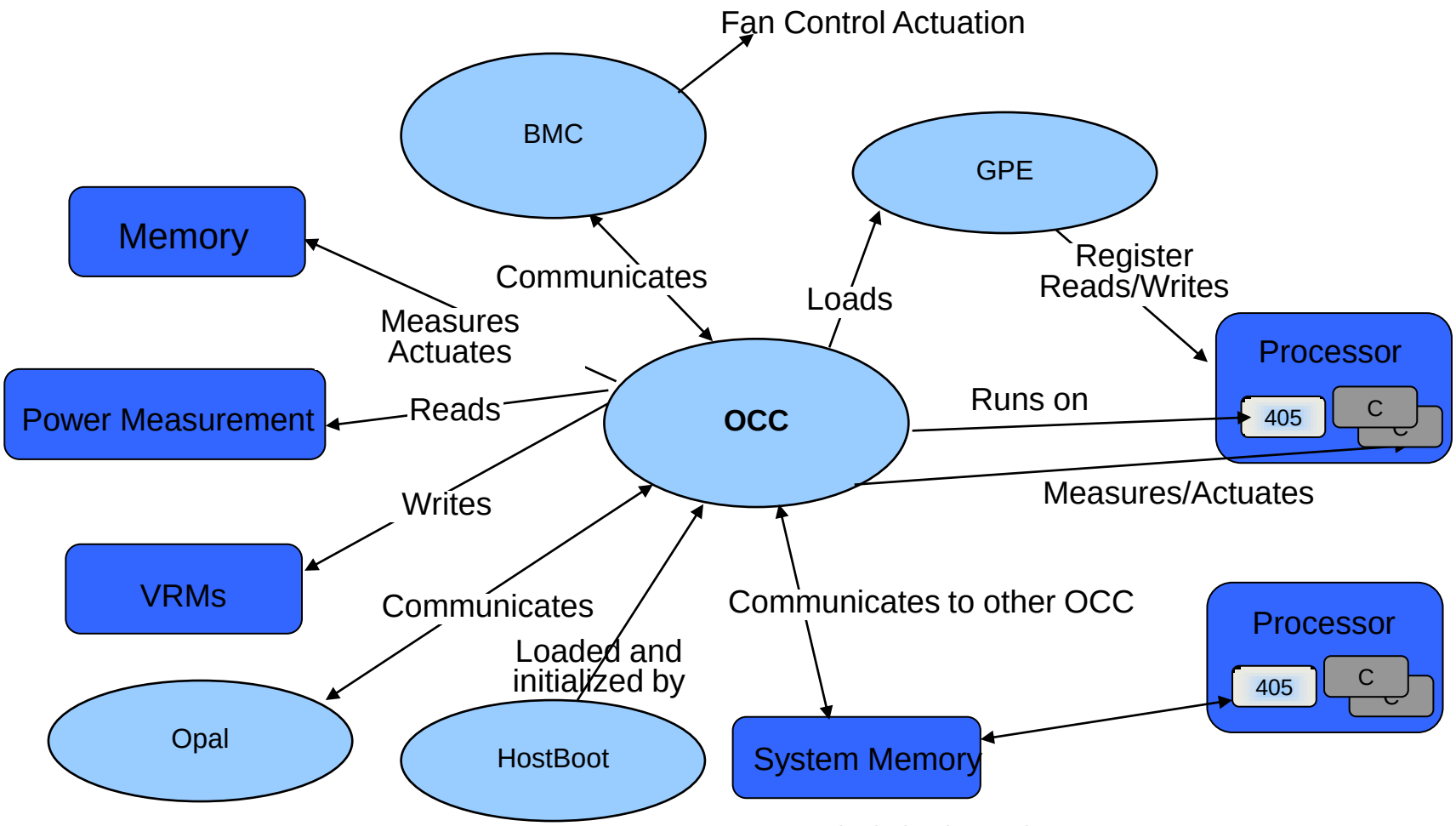
- Hardware/Firmware that controls power, performance & thermal
- 405 processor with 512k dedicated RAM
- General Purpose Engines (GPE) to offload the 405

What does OCC do?

- Reads/controls system power
- Reads/controls chip temps
  - Enables efficient fan control
  - Provides OT protection
- Power Capping
- Fault Tolerance
- Energy saving
- Performance boost

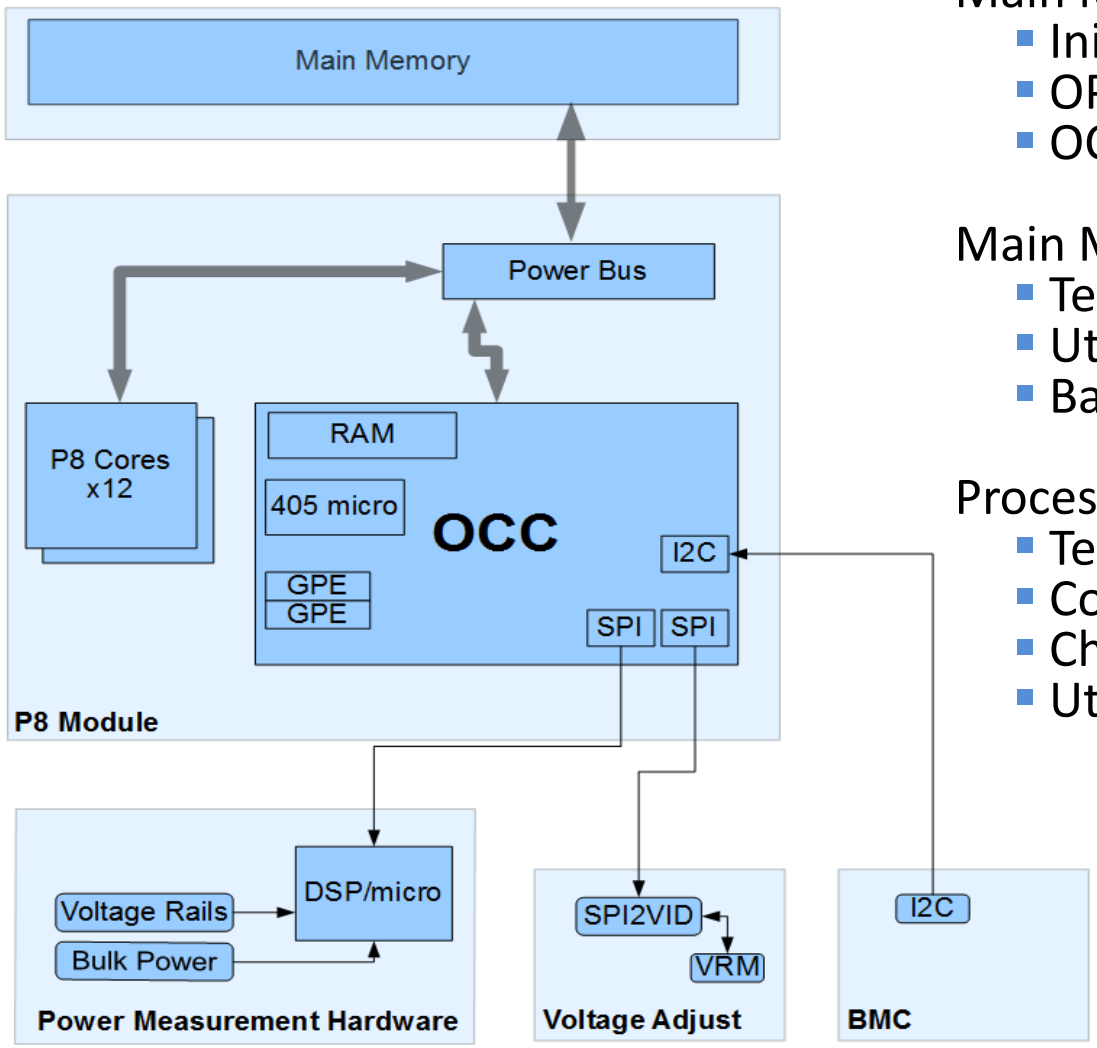


OCC Overview



Physical paths not shown

Hardware Block Diagram



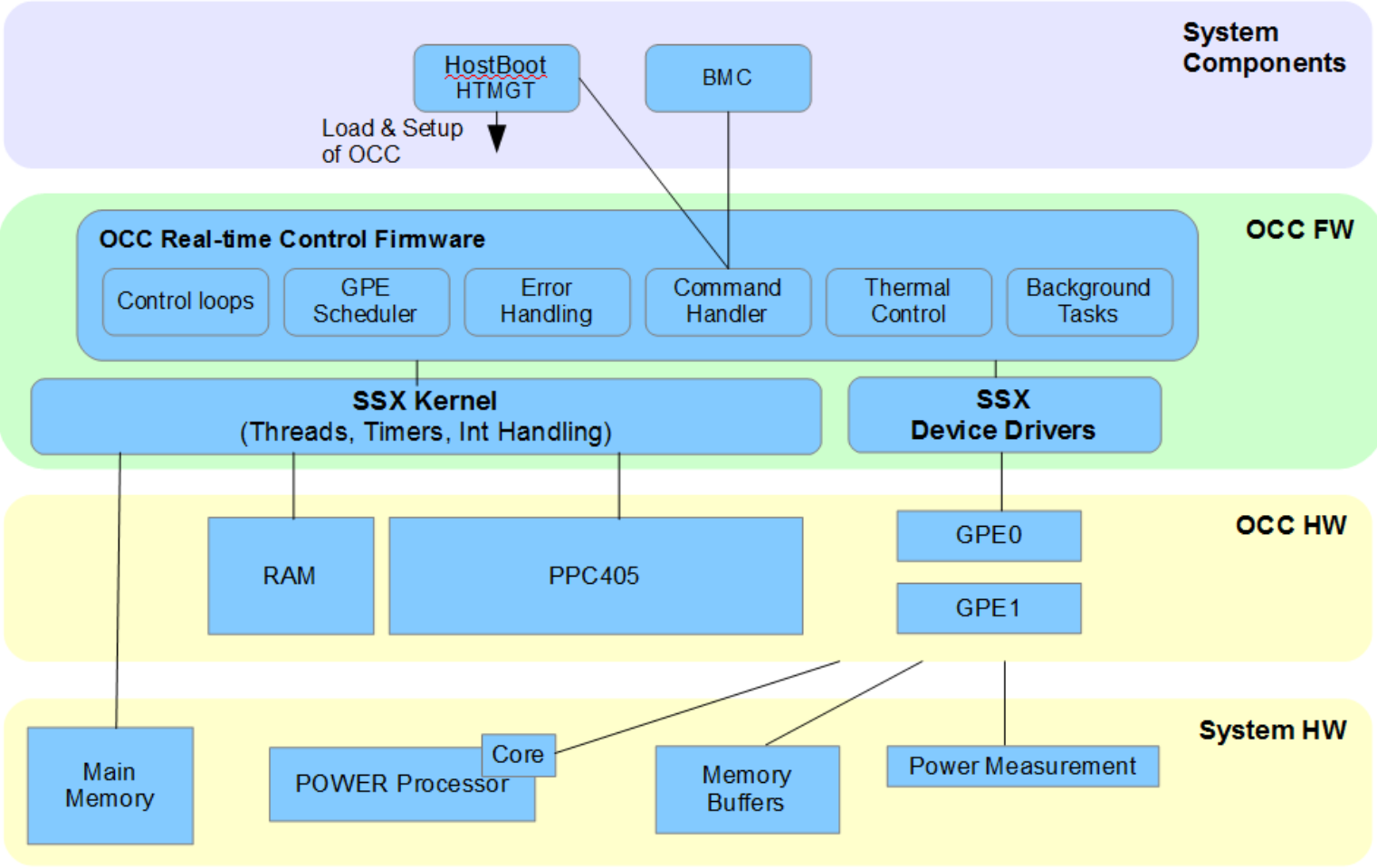
Main Memory Uses
- Initial Load
- OPAL communication
- OCC communication

Main Memory Measurement
- Temperature Sensing
- Utilization Measurement
- Bandwidth control

Processor
- Temperature Sensing
- Core Frequency Control - PSTATES
- Chip Voltage Control – PSTATES
- Utilization Measurement

BMC
- Report power/temperature
- Provide Power Cap
- DCMI compliance

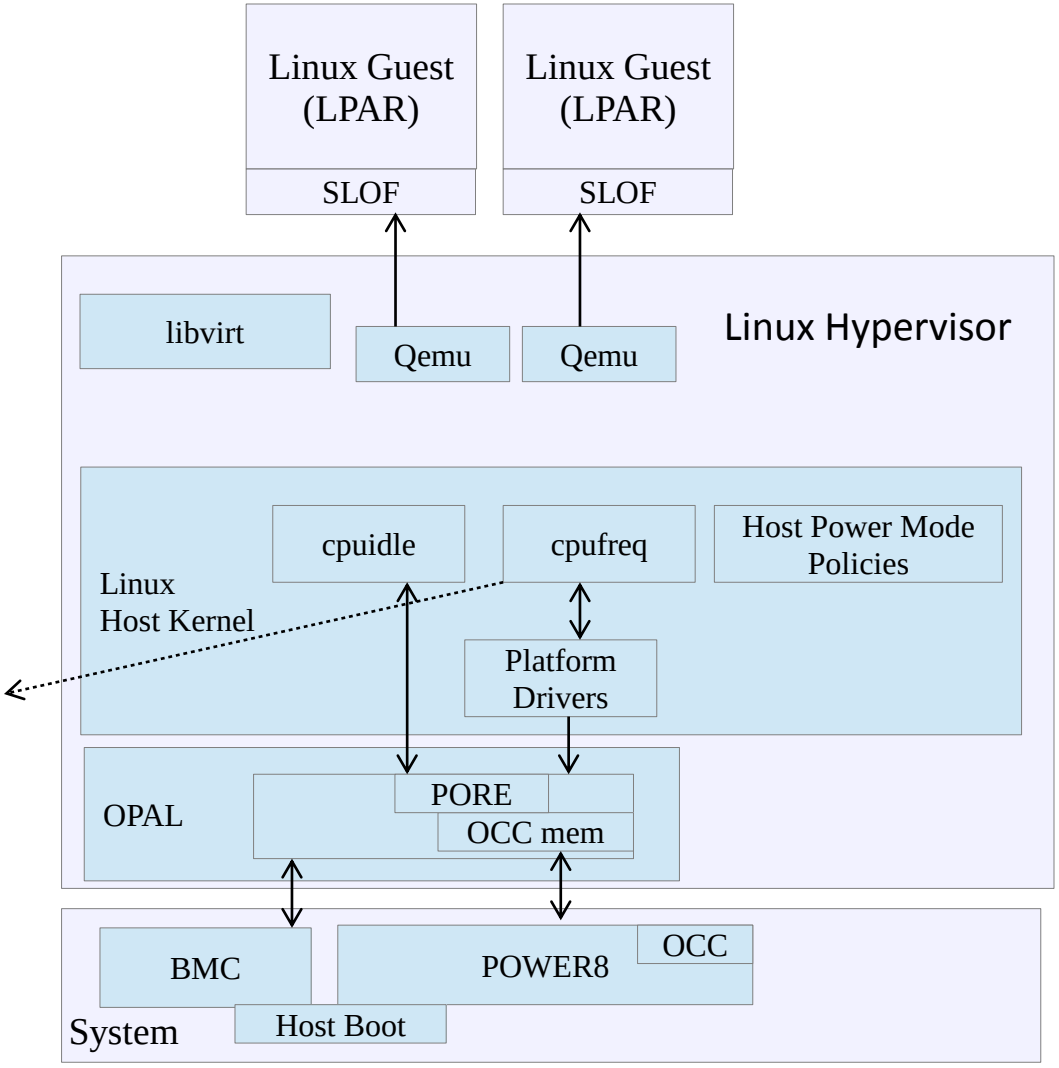
OCC Internal Details



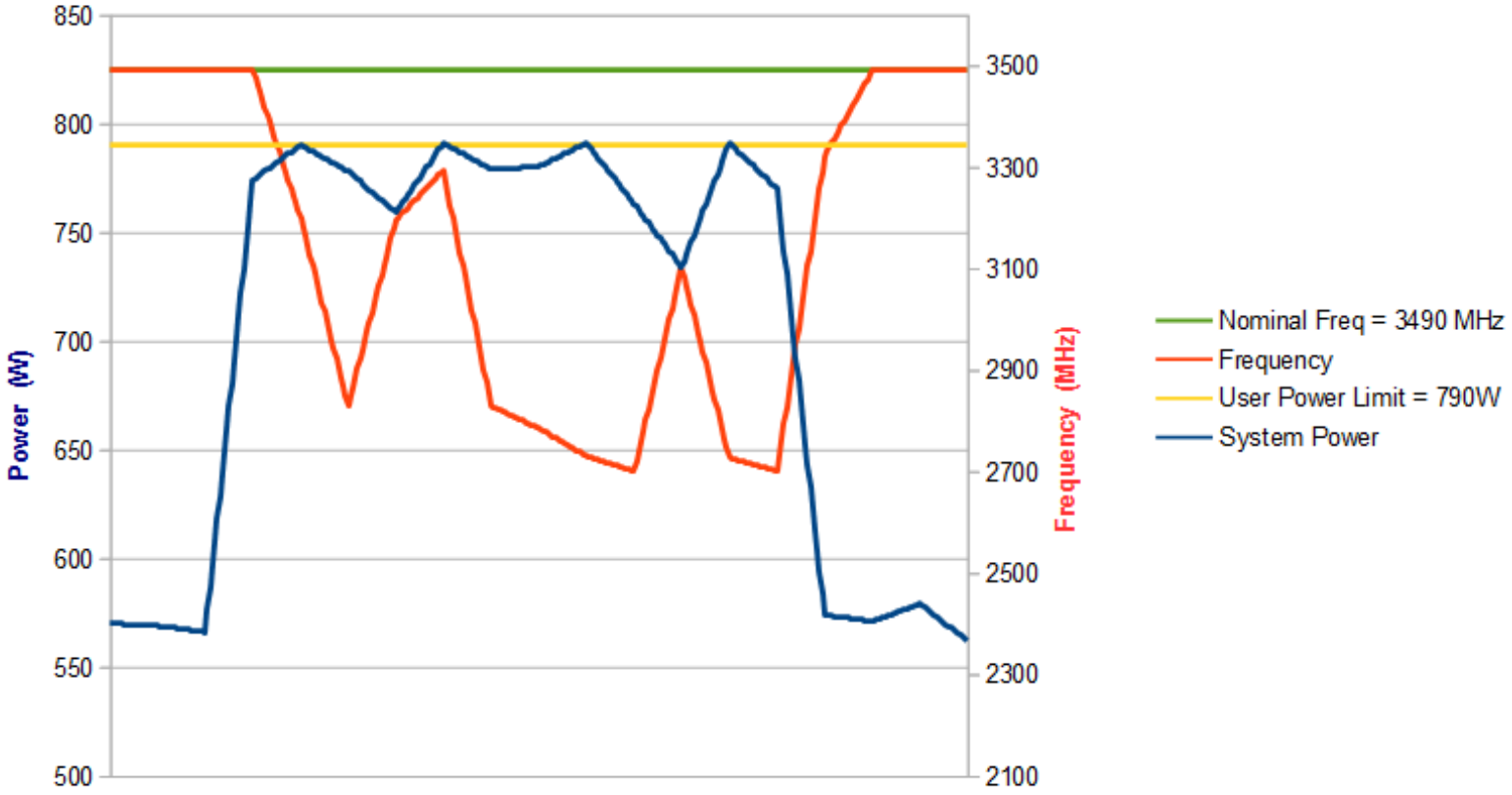
PSTATE Details

Utilization and governor policy are inputs to cpufreq in Hypervisor

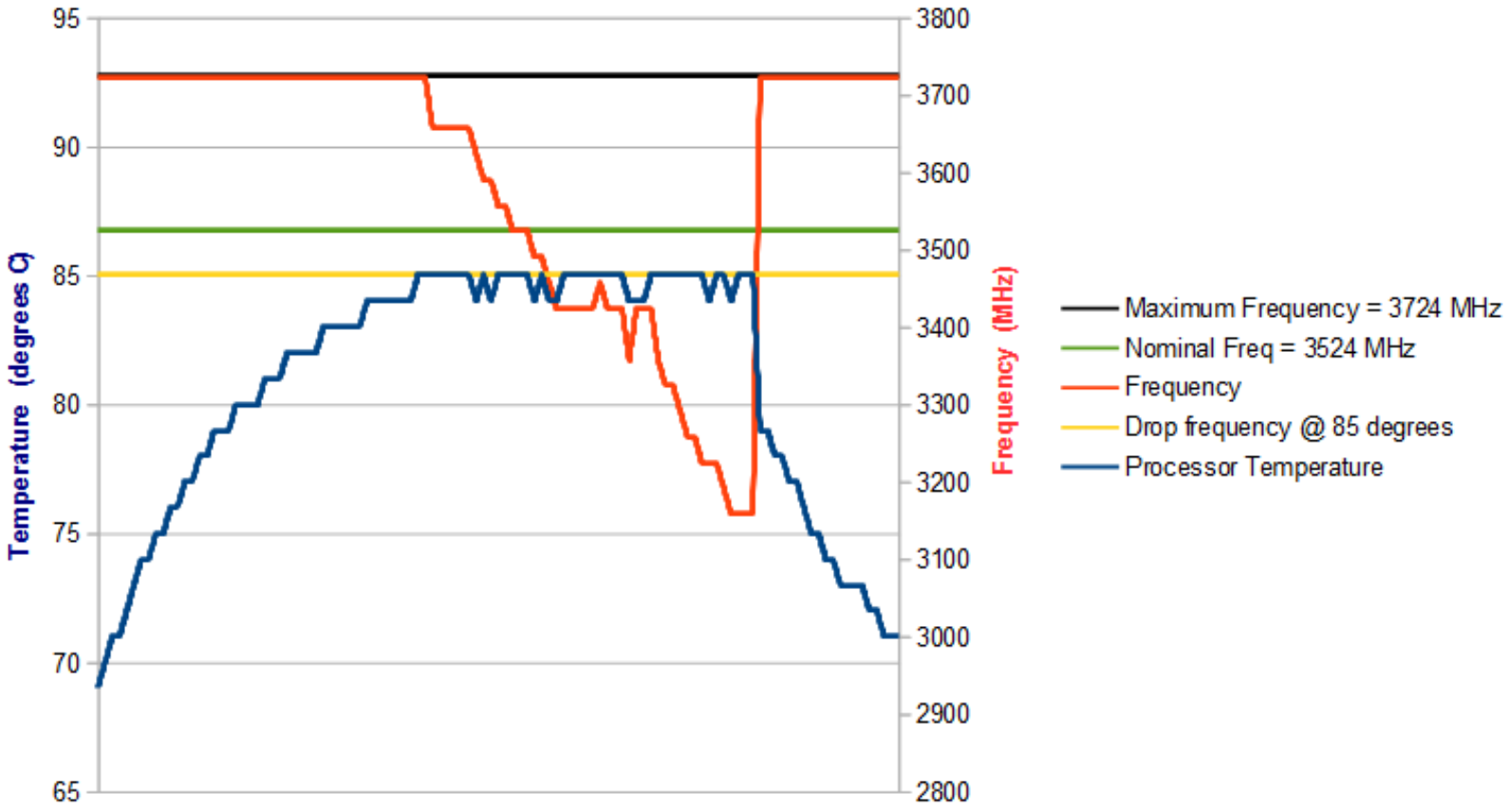
Cpufreq – exploits SPR based P-state change



User Set Power Limit



Processor Over Temperature



Potential Future Enhancements

- Power Shifting Improvements
  - Memory Bandwidth % vs Processor Frequency
  - Power Shift between other devices
- Modify Controls
  - Run processors at higher speeds
  - Run processor/memory at higher temperatures
- Adjust loop times
  - Increase responsiveness to workload changes

References

Open Power Blog link:

- http://openpowerfoundation.org/press-releases/occ-firmware-code-is-now-open-source/

GitHub pages:

- OpenPOWER project: https://github.com/open-power
- OCC: https://github.com/open-power/occ
- Building OpenPOWER: https://github.com/open-power/op-build

Technical Firmware Training – OpenPOWER Pavilion:

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- Thursday 12-2pm Hands-on Training – Build/Modify

Reference Platform (Palmetto) – TYAN GN70-BP010