Ninth Annual Workshop for the EE HPC WG: Panel Discussion

Software for Energy Efficiency
PowerStack, PowerAPI, READEX, GEOPM
Steven J. Martin, Cray Inc.
Staff Engineer, Hardware Management Group

PANEL MODERATOR
Panel Agenda

• Introductions (3 min)
• Short panelist presentations (12 min)
• Open Q&A (45 min)
Panel Introductions

- GEOPM: Jonathan Eastep, (Intel)
- PowerAPI: Grant, Ryan Eric, (Sandia)
- PowerStack: Siddhartha Jana, (Intel)
- READEX: Andreas Gocht, (TU-Dresden)
Introduction to **GEOPM**

- **Global Extensible Open Power Manager**
  - Community collaborative open source project, started + supported by Intel
  - Project page: [https://geopm.github.io/](https://geopm.github.io/)
  - Principal Investigator: jonathan.m.eastep@intel.com

- **Product-grade job-level runtime**
  - Globally coordinates optimizations to HW or SW control knob settings across compute nodes in a job
  - Promises to increase performance or energy efficiency by 5-30%
    - Depending on selected optimization plugin
    - And depending on application characteristics, controls + monitors available
Key Technologies

- In-band, feedback-guided optimization of control knob settings: application profiling data from HW performance counters plus PMPI and OMPT
- Global application awareness: analysis of long history of profile data for forecasting exploitable patterns such as application phases and load imbalance across nodes
- Scalable global optimization: coordinated tuning of control knobs within and across nodes leveraging application analysis above; tree-hierarchical / recursive optimization algorithms and aggregation of profile data
- Flexibility and extensibility through plugin architecture: vendor HW-neutral (cross-platform) and customizable to each center’s individual performance vs energy efficiency preferences
GEOPM Project Status

- Long-running collaboration with PowerAPI and PowerStack teams
- GEOPM Beta release available: https://geopm.github.io/
- GEOPM v1.0 release candidate available before Christmas
- 1st production deployment is imminent: Argonne Theta system
- Work in progress on additional deployments at LRZ, CINECA, LLNL, ...
- Broader deployments via OpenHPC and TOSS
  - GEOPM Beta and msr-safe included in latest OpenHPC release (v1.3.6)
  - Work in progress on integrating GEOPM into future TOSS releases
- New course at TUM leveraging GEOPM for course project infrastructure
- Discussions beginning with system builders to co-develop GEOPM enhancements that give their systems a competitive edge
The HPC PowerStack (1/2)

[https://powerstack.lrr.in.tum.de](https://powerstack.lrr.in.tum.de)  [https://gitlab.com/powerstack/](https://gitlab.com/powerstack/)

- Collaboration towards a well-defined, community-wide stack that accounts for power-awareness across various layers of the HPC software ecosystem
- Collaborators include vendors, academia, and govt. labs.

- **Charter:**
  1. Identify different actors that play a role in energy- and power-aware job scheduling and resource mgmt
  2. Reach a community-wide consensus on the roles and responsibilities of the different actors, their interoperability, and communication protocols
  3. Work towards prototypes and full-scale production-grade solutions that are adaptive and feedback-driven
Next Steps:
• First Round of Working Group Meetings in the coming weeks
• Topic-specific working-groups : Periodic Meetings
  • Once every 1.5 months (~ 6 weeks)
  • Subscribe to Mailing lists
  • Subscribe to the GitLab project
• SC-18 BoF, Nov 15 (Thursday), 12:15 - 1:15pm, Room D167

Mailing list names:
• PowerStack Announcements powerstack-announce@googlegroups.com
• PowerStack Development powerstack-dev@googlegroups.com
• PowerStack Adaptive Runtime and Control powerstack-runtime@googlegroups.com
• PowerStack Platform Interaction powerstack-platform@googlegroups.com
• PowerStack Site Policy and Verification powerstack-sitepolicy@googlegroups.com
Power API

Ryan Grant
Principal Member of Technical Staff
Sandia National Laboratories

Chair of the Power API Specification Committee

Working on: Power API Spec, Community Reference Implementation

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New Advances in the Power API

• Community model
  – New Specifications Document
  – Open meetings
  – Multi-institution involvement

• New convenience functions
  – Streamline writing code with object name length queries

• New reporting functions
  – Allow multiple statistics to be gathered in a single object (forthcoming)

• New notification methods between Interface hierarchy
  – Upcoming

Power API and Redfish BoF
Wednesday 12:15-1:15
Room: D227
• Finished 08/2018
• Funded by the European Union’s Horizon 2020 research and innovation programme under grant agreement No 671657
• Website: www.readex.eu
Energy Consumption

- Default Energy Consumption
- Energy Consumption With READEX
- RRL runtime related to default

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Q&A

Thankyou for participating!