Interfacing GEOPM with PowerStack

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**Power Stack: Enabling Efficient Power Management Through Hierarchical Design**

- **Facilities**
  - Demand Response, Renewables

- **Cluster**
  - Overprovisioning, Power Scheduling*

- **Job**
  - Adaptive runtimes, Power balancing

- **Node/Domain**
  - Measurement and control (capping)

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*For the scope of this talk, power scheduling does not represent job schedulers such as SLURM or FLUX, but an independent entity that manages cluster power (e.g., PowSched).*
Power Stack Open Questions

1. **Who should apply** the power limit at the node level: power scheduler or Individual GEOPM instances?
Power Monitoring and Limiting

Simultaneous power budget enforcement degrades efficiency
Interfacing GEOPM: Proposed Solution

Power-aware Scheduler (e.g. PowSched)

Interface to exchange job power usage and power budget between (modified) power-aware scheduler and GEOPM
Power Stack Open Questions

1. **Who should apply** the power limit at the node level: the power scheduler or Individual GEOPM instances?
   - Exploratory evaluation shows only GEOPM should apply the power limit
   - Development of the proposed interface between GEOPM and the power scheduler

2. **How much power** budget should the power scheduler assign to GEOPM?
   - Or how much power should GEOPM request?

3. **How often** should the resource scheduler and GEOPM
   a. Sample power usage?
   b. Update power schedule?
On-going and Future Exploratory Work

• Simulation of power-aware job scheduling with GEOPM for hardware overprovisioned systems
  • Explore potential areas to improve the efficiency of Power Stack

• We are working with Intel on the development and deployment of GEOPM on LLNL systems.
Relevant Efforts in ECP Projects

- **STPM14: ECP-PowerSteering**
  - Migrate configuration exploration phase from Conductor into GEOPM
  - Main contributor: Aniruddha Marathe

- **STSS08: ECP-Argo-GRM**
  - Static power-aware plugin for Flux, later to be used for Argo to interface with GEOPM
  - Main contributor: Tapasya Patki
Collaborations

• **LLNL**
  • David Boehme (Caliper)
  • Kathleen Shoga (LC)
  • Stephanie Labasan

• **External Projects**
  • Argo
    • Swann Perarnau
    • Kamil Iskra
    • Kazutomo Yoshii
    • Rinku Gupta
    • Pete Beckman
  • LLNL Flux Team

• **Research Labs/Industry**
  • Intel, USA
  • LRZ/Intel Munich, Germany

• **Academic**
  • University of Arizona: David Lowenthal, Samuel Cotter
  • University of Georgia: Shelby Funk, William Whiteside
  • University of Oregon: Srinivasan Ramesh, Dan Ellsworth (past)
  • TU Munich: Martin Schulz