Global Computing Lab

HERMIT: Elastic, Resizable Allocations to Improve Resource Utilization

Joseph Teague

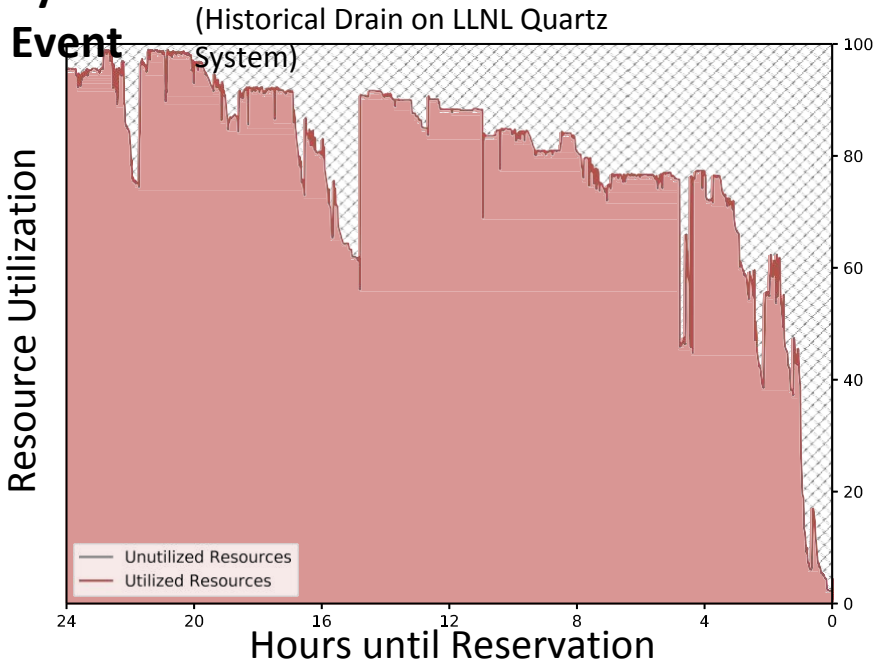
THE UNIVERSITY OF
TENNESSEE
KNOXVILLE
BIG ORANGE. BIG IDEAS.®

Improving Resource Utilization

- Support and sponsorship: Lawrence Livermore National Laboratory
- Mentors: Stephen Herbein (LLNL) and Michela Taufer (UTK)

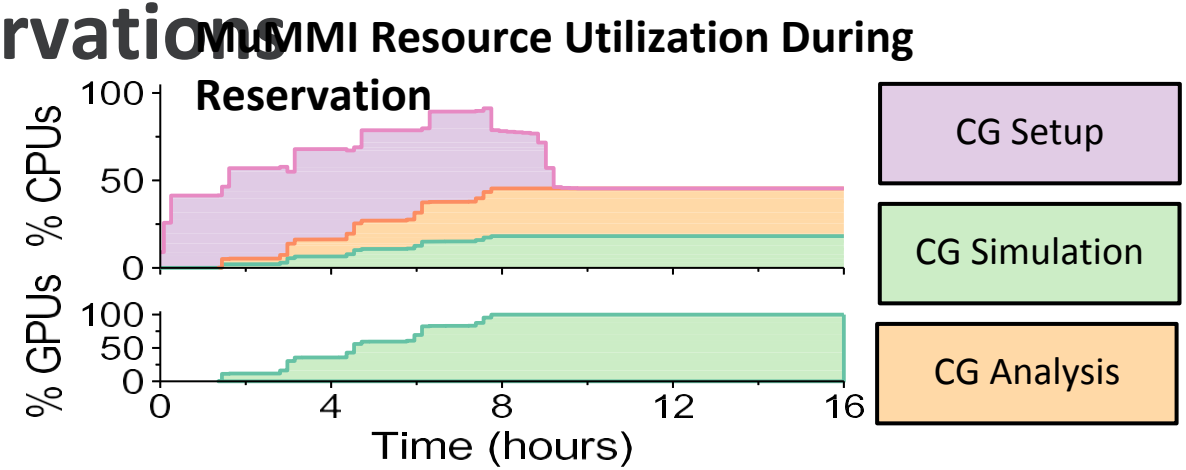
Resource Drains and System Utilization

System Underutilization Prior to Drain Event



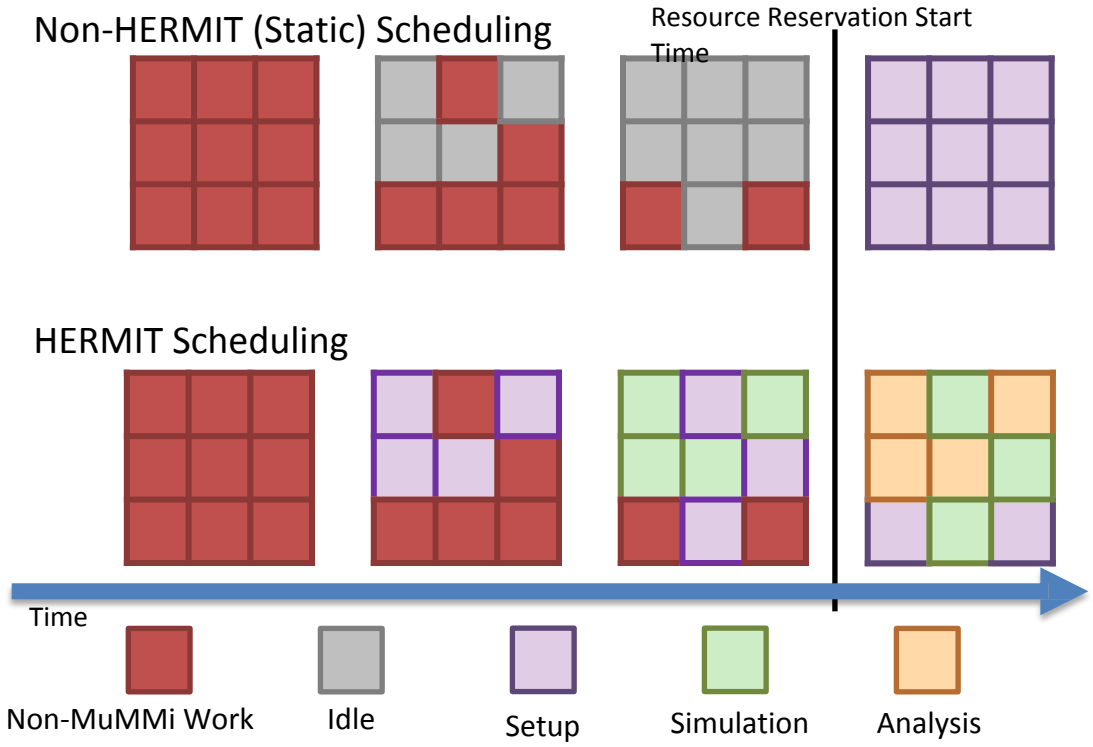
- *Resource drain events* are present in systems using common static schedulers
- Caused by:
  - Resource reservations
  - Shutdowns
  - Need to make room for a large job
- Examined four historical drain events on LLNL systems
- Utilization averages 75-85% for the 24 hours preceding the underlying event

Workflow Utilization During Reservations



- Example workflow: National Cancer Institute PILOT2 Initiative's MuMMI
- Certain requirements, e.g. preprocessing steps, can result in initial underutilization and resource "ramp up"
- **Can underutilization be leveraged to reduce this ramp-up behavior?**

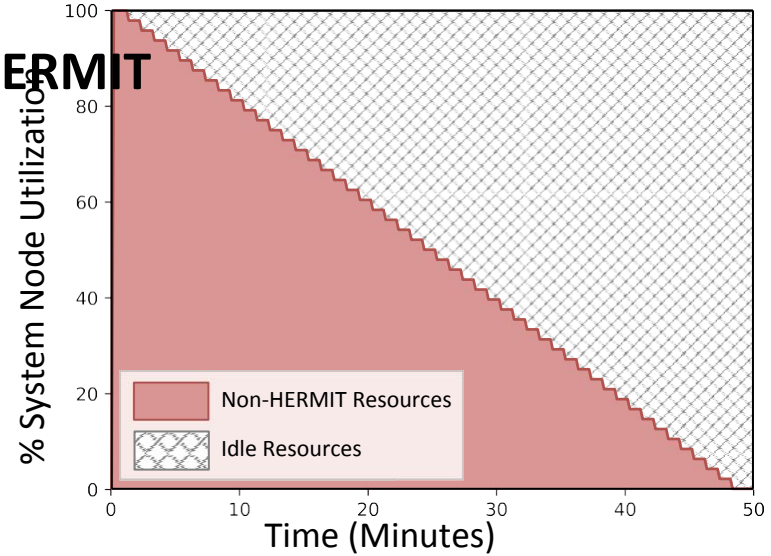
HERMIT vs. Static Scheduling



- Static schedulers allow resources to go idle prior to a *drain event* (in this case a resource reservation)
- Resources remain idle until *after* the drain event
- HERMIT reclaims resources, allowing them to be put to use *prior to* the drain event

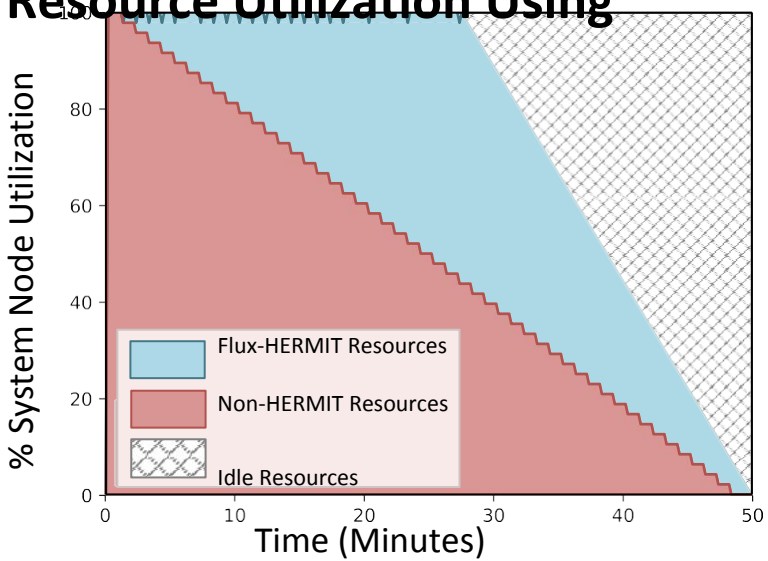
HERMIT Preliminary Results

Resource Utilization Without HERMIT



- Drain emulated on development cluster
- 48-node Xeon system

Resource Utilization Using HERMIT



- Static scheduling stopped on nodes in tiered fashion to induce drain, system utilization examined when using HERMIT

Observations and Future Work

- HERMIT shows promise for improving resource utilization preceding emulated drain events.

Future Work:

- Classify types of drains and system conditions
- Evaluate HERMIT's performance during these realistic drains
- Evaluate HERMIT's benefit to production workflows