Problem Statement

As high performance computing (HPC) continues to grow in scale, energy and resilience become first-class concerns, in addition to the pursuit of performance. These concerns demand significant changes in many aspects of the system stack including resource management and job scheduling (aka batch scheduling). Major issues with existing batch scheduling:

- Static
- CPU focused
- Increasing concern of data movement
- Growing demand for energy efficiency
- Dramatic demand for resilience
- Emerging demand for dynamic time-power-resilience tradeoff

Various walls to go through

Project Goal

We envision smart HPC, in which information about resources and applications will be automatically gathered, analyzed, and acted on for improving performance, resilience, and energy efficiency. Specifically, we aim to design and develop a framework named SPEaR:

- Active learning to automatically discover and predict job behavior and resource availability.
- Intelligent scheduling to adapt job allocation to resource requirement and change.

![SPEaR: Scheduling for Performance, Energy, and Resilience efficiency](image)

Team Members

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Reference


Active Learning

- Exploring void search for hard error detection [1]
- Developing lightweight detectors for SDCs [2]
- Exploring statistic methods for fast power profile learning [3]
- Developing colored Petri nets for tradeoff modeling [4]

Intelligent Scheduling

- Power awareness: dynamic learn job power profiles and control system-wide power consumption under a user-define cap with a minimal impact [3]
- I/O awareness: coordinate ongoing I/O requests from user jobs for available network bandwidth [5]
- Comm aware: to allocate system resources according to coarse-grained application communication patterns [6,7]

Reference


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