

Dynamic Adaptability in Support of Extreme Scale



UTEP



UW-Madison



Office of Science (DOE)



Jayaraman Suresh Babu (M.S. Candidate), Seetharami Seelam (Ph.D. Candidate), Nidia Pedragon (B.S. Candidate), Alejandro Castaneda (B.S. Candidate), Rodrigo Romero, Ph.D., and Patricia J. Teller, Ph.D.

Department of Computer Science, University of Texas at El Paso

Goals

Generalized resource management with Fixed parameters = **Current Performance**



Customized resource management with Dynamically Adaptable parameters = **Enhanced Performance**



Challenges

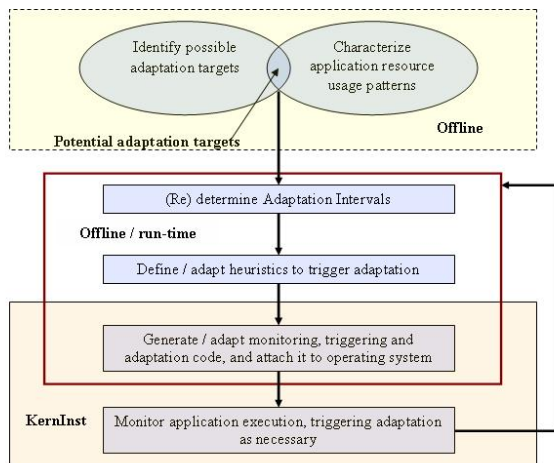
- What to Adapt?
- When to Adapt?
- How to Adapt?
- How to measure effects of adaptation?



Deliverables

- Mechanisms to dynamically sense, analyze, and adjust common performance metrics based on fluctuating workload situations and overall system conditions
- A general-purpose methodology for dynamic adaptation of commodity operating systems

Methodology



Example Adaptations

- Process scheduling** parameters, algorithms (e.g., dynamic adaptation of scheduling policy of processes)
- I/O scheduling** parameters, algorithms (e.g., dynamic adaptation of scheduler algorithms -- prototype in process)
- Memory management** algorithms (e.g., dynamic adaptation of page management thresholds)

Implementation Platform



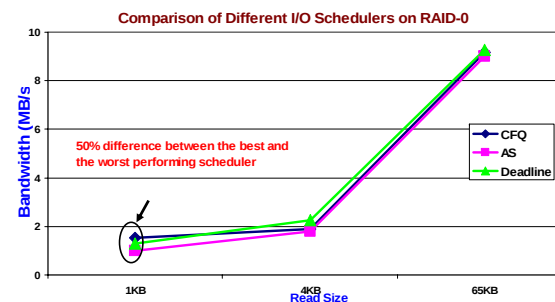
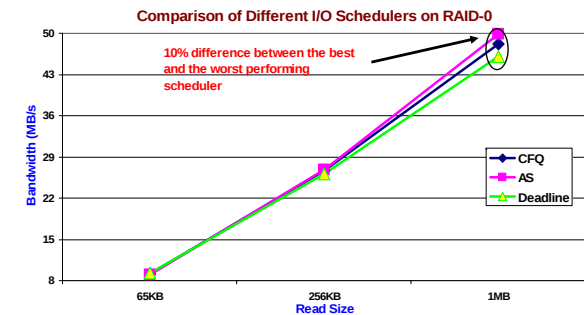
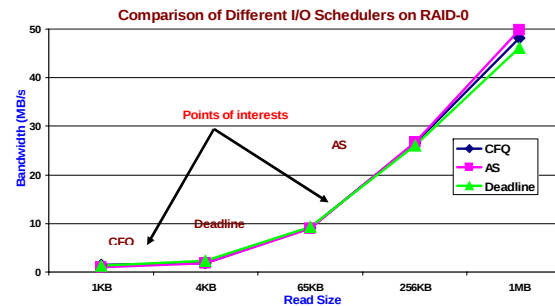
Linux Kernel

Dynamic Adaptation / Self-tuning will be demonstrated via Linux prototypes and experiments for HPC environments



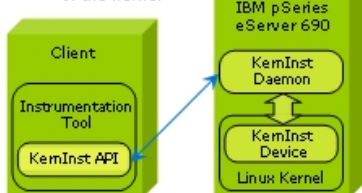
IBM p690 eServer (Hosted at UTEP)

Examples of Adaptation



- Different I/O scheduler algorithms already implemented in Linux 2.6 kernel
- Default scheduler is "AS" since it gives best performance in **most** cases
- But experimentation reveals cases where each scheduler shines -- **No Silver Bullet** in schedulers
- Hence appropriate dynamic scheduler selection necessary to ensure good performance

Dynamic instrumentation of the kernel



Dynamic monitoring and adaptation capabilities of UW-Madison's KernInst and Kperfmon