Holcombe Department of Electrical and Computer Engineering Seminar Series

Errors: From Foe to Friend

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Abstract

As high-performance computing (HPC) continues to progress, constraints on HPC system design force the handling of errors to higher levels in the software stack. Of the types of errors facing HPC, those that silently corrupt system or application state are among the most troubling. Understanding how applications behave in the presence of these silent errors is critical to gain insight for effective utilization of HPC systems. This can be directed toward developing algorithmic based error detectors guided by application characteristics from error injection and error propagation studies. The realization that applications are tolerant to small errors allows optimizations such as lossy compression, which adds small user controllable amounts of error when compressing data. Reducing data size before transferring improves effective memory bandwidth and power consumption.

In this talk, I present an algorithmic specific detection and recovery scheme for the linear solver algebraic multigrid, and show that this scheme maintains a high probability of convergence with a large number of faults during the solve. Furthermore, I explore how to effectively use lossy compression for checkpoint-restart to reduce the time to checkpoint by leveraging a priori bounds on simulation accuracy when selecting the compression error tolerance.

Biography of Speaker

Jon Calhoun is a Ph.D. candidate in the Department of Computer Science at the University of Illinois at Urbana-Champaign. His research interests lie in fault tolerance and resilience in high-performance computing systems. His work covers silent data corruption and its impacts on applications, fault injection and analysis tools, and lossy compression. His graduate studies have included appointments at Lawrence Livermore and Argonne National Laboratories and selection as a 2014 Blue Waters Graduate Fellow. Jon holds a Bachelors of Science in Computer Science and a Bachelors of Science in Mathematics from Arkansas State University.