Electrical & Computer Engineering

S E M I N A R

Louisiana State University

Application Specific HPC from an Operational Standpoint

Chris J. Michael

Naval Research Laboratory, Stennis Space Center

Abstract—There are numerous situations, especially within the Department of Defense, where smaller HPC systems are specified and deployed to handle a moderately predictable workload containing less than a dozen or so special-purpose applications. Typically, these systems are designed in a naive way using rough high-level benchmarking and intuition. In most cases, this results in a system that runs the workload inefficiently, consuming precious resources and unnecessarily increasing the operational cost of the system.

Application-specific HPC involves designing heterogeneous systems with respect to the application workload. This is accomplished through profiling of the applications against the potential hardware candidates such as general-purpose CPUs, GPUs, and FPGAs. Resulting systems can dramatically increase the workload efficiency when considering execution time, cost of operation, power, size, and weight. In this presentation, the basics of application-specific HPC from an operational standpoint are covered. Additionally, case studies that exemplify this methodology are presented, the most thorough of which deals with all-pairs shortest paths graph processing for sparse graphs. Results of this study revealed that employing a CPU/FPGA heterogeneous system rather than a conventional CPU cluster can reduce weight by 88%, power consumption by 94%, and purchase cost by 30% for the same execution wall-time requirement.

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