SEMINAR NOTICE

Preston M. Green Department of Electrical and Systems Engineering

Efficient and Scalable Computing for Resource-Constrained Cyber Physical Systems: A Layered Approach

PhD Preliminary Exam

An Zou
PhD Candidate

Abstract: With the evolution of technology, autonomous cyber physical systems such as self-driving cars, unmanned aerial vehicles, and mobile cognitive robots are heading towards increasing levels of multifunctionality and miniaturization, where they will execute versatile tasks in a resource-constrained environment. Therefore, the computing systems that power these resource-constrained cyber physical systems (RCCPSs) have to achieve high efficiency and scalability with respect to a number of objectives. For example, these computing systems should not only be "power-efficient" given a fixed amount of on-board energy capacity but also exhibit "high-performance" to gracefully handle complex algorithms for learning-based perception and AI-driven decision making tasks. My research is to broadly investigate a set of efficient and scalable computing systems for RCCPSs in a bottom-up layered approach. This layered approach aims at leveraging the characteristics of each system layer (e.g. circuit, architecture, application) and their interactions to explore and discover the optimal system tradeoffs between performance, efficiency, and scalability. Between the circuit and microarchitecture/architecture layers, we investigate the benefits of novel power delivery and management schemes enabled by integrated voltage regulators (IVRs). In particular, I will present a voltage-stacked power delivery system that offers best-in-class power delivery efficiency for manycore systems. At the architecture and system layers, I am developing a real-time resource scheduling framework for heterogeneous computing platforms with guaranteed task deadlines using Graphics Processing Units (GPUs) as a case study. Furthermore, I am also exploring opportunities at the architecture/system cross-layer by studying a learning-based hierarchical power management strategy for fast dynamic voltage and frequency scaling. And finally, to complete my layered approach by connecting the lower-level system designs to the task/application/mission scale, we will build a hardware-in-the-loop experimental infrastructure for end-to-end evaluation of the computing systems in an RCCPS environment as the future work.

Date: Monday, March 2, 2020
Time: 1:00 p.m.
Location: Jolley Hall, Room 309

Dissertation advisor:
Dr. Xuan "Silvia" Zhang

Washington University in St. Louis
James McKelvey School of Engineering