Power Constrained Performance Optimization in Computer Systems

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Abstract—Power consumption has imposed a first-order design constraint to the entire spectrum of computer systems, from the smallest hand-held devices to the largest data centers. Limitations on the power consumption due to the small battery capacity in mobile devices, or the limited cooling capacity in desktops, or the tight electricity expense budget in data centers, require innovations that allow computer systems with larger numbers of cores to dynamically adapt to time-varying needs of modern workloads within a limited power budget. In the first part of my talk, I will provide the background of power management for computer systems. In the second part of my talk, I will introduce Freq-Par, a power management solution that controls the power consumption of a many-core processor under a fixed power budget, as well as to optimize the performance of the processor by dynamically adjusting the frequency of each core on a multi-core processor. In the third part of my talk, I will summarize my previous projects on power management for multi-core processor, GPU/CPU heterogeneous systems, cooling power and computational power co-optimization, and data center power optimization.

Bio—Kai Ma is currently a PhD candidate in the Department of Computer and Electrical Engineering, at The Ohio State University. He is passionate about building practical power/energy-efficiency systems, with a particular interest in multi-core system and GPU/CPU heterogeneous systems. He also enjoys working on Linux kernel hacking and large-scale computer system performance tuning.

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