Abstract:

Energy consumption has become one of the most important design parameters in electronic systems. In high end systems the cost of energy powering the electronics equals the cost of cooling it. Mobile systems have to ensure that there is enough power available to complete their tasks. In this talk I give an overview of the strategies we have developed at UCSD to significantly lower the energy consumption in computing systems.

The most important part of any energy management strategy is detecting when there are opportunities to either slow down the computation or to transition to sleep. We study the interarrival times of workloads on various devices to derive an optimal power management strategy implementable in both HW and SW. Measurements on CPUs, networking and disks show significant power savings for stationary workloads. Run-time adaptation is done via an online learning algorithm that selects among a set of power management policies. We generalize the algorithm to include thermal management since we found that minimizing the power consumption does not necessarily reduce the overall energy costs due to thermal issues in the high end multicore systems. Our implementation on multicore CPUs shows that while reactive strategies, such as voltage scaling when temperature threshold is reached, are effective in lowering the temperature, they come at a high performance cost. With that in mind, we developed a new set of proactive management policies, which predict the future temperature based on currently sensed data and adjusts the thread allocation on the multicore CPU to minimize the impact of thermal hot spots and temperature variations without degrading performance. The experimental results using real datacenter workloads on an actual multicore system show that our proactive technique is able to dramatically reduce the adverse effects of temperature (by 60%) at a very low performance cost.

Time permitting I will also present some of the recent work we had done to address the energy savings in battery powered and energy harvesting systems. We have been developing an adaptive algorithm to tradeoff accuracy of computation versus the available energy. As a result, we show that sophisticated data gathering and analysis previously not possible, can now be done. We give examples in healthcare and structural health monitoring scenarios on how our techniques work. Lastly, I will given an overview of a new energy-efficient scheduling and routing algorithm that delivers good QoS while maximizing battery lifetime in a large scale heterogeneous wireless sensor network we have deployed in southern California. The network covers area of 100x70 miles, and includes various applications, such as emergency use by California Fire Department, to seismic studies and ecology research.
Biography:

Tajana Šimunic Rosing is currently an Assistant Professor in Computer Science Department at UCSD. Her research interests are energy efficient computing, embedded and wireless systems. Prior to this she was a full time researcher at HP Labs while working part-time at Stanford University. At Stanford she has been involved with leading research of a number of graduate students and has taught graduate level classes. She finished her PhD in 2001 at Stanford University, concurrently with finishing her Masters in Engineering Management. Her PhD topic was Dynamic Management of Power Consumption. Prior to pursuing the PhD, she worked as a Senior Design Engineer at Altera Corporation. She obtained the MS in EE from University of Arizona. Her MS thesis topic was high-speed interconnect and driver-receiver circuit design. She has served at a number of Technical Paper Committees, and is currently an Associate Editor of IEEE Transactions on Mobile Computing. In the past she has been an Associate Editor of IEEE Transactions on Circuits and Systems.

Tuesday, May, 06, 2008, ACES 6.304, 11:00 AM-12:30PM
http://www.cerc.utexas.edu/vlsi-seminar/