Electrical & Computer ENGINEERING

SEMINAR

THURSDAY
NOVEMBER 16, 2006

Scaife Hall Auditorium
Room 125

4:30 p.m.
Refreshments—4:00 p.m.

KLARA NARHSTEDT

DEPARTMENT OF COMPUTERSCIENCE,
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Klara Nahrstedt is a professor at the University of Illinois at Urbana-Champaign, Computer Science Department. Her research interests are directed towards multimedia systems and networks, quality of service (QoS) routing, QoS and resource management for distributed multimedia systems over wire-line and wireless networks, multimedia operating systems, and multimedia security. She is the coauthor of the widely used multimedia book `Multimedia: Computing, Communications and Applications' published by Prentice Hall, and 'Multimedia Systems' published by Springer Verlag, the recipient of the Early NSF Career Award, the Junior Xerox Award, and the IEEE Communication Society Leonard Abraham Award for Research Achievements. She is the editor-in-chief of the ACM/Springer Multimedia Systems Journal, the general co-chair of ACM Multimedia 2006 and general chair of NOSSDAV 2007. Currently, she is the Ralph and Catherine Fisher Professor.

Klara Nahrstedt received her BA in mathematics from Humboldt University, Berlin, in 1984, and M.Sc. degree in numerical analysis from the same university in 1985. She was a research scientist in the Institute for Informatik in Berlin until 1990. In 1995 she received her PhD from the University of Pennsylvania in the Department of Computer and Information Science.

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Cross-Layer Adaptation for Quality-Aware and Energy-Efficient Next Generation Mobile Multimedia Devices

Mobile systems primarily processing multimedia data are expected to become a dominant computing platform for a variety of application domains. The design of such systems imposes several new challenges, as it must consider demanding, dynamic and multi-dimensional resource requirements and constraints, with energy becoming a first-class resource. At the same time, the ability of multimedia applications to trade-off output quality for system resources and the difference between their peak and average demands offers a huge opportunity for optimization.

A promising approach to meet the challenges of systems in next generation mobile devices, therefore is to design all system layers with the ability to adapt in response to system or application changes. Furthermore, to get the full benefits of these adaptations, we argue that all system layers must cooperate to reach a system-wide globally optimal configuration.

We have designed such coordinated and cross-layer adaptation framework, called GRACE, that integrates and coordinates the frequency/voltage scaling, soft-real-time scheduling (via GRACE-OS), and application quality adaptation. GRACE seeks first to maximize the system utility (i.e., the overall perceptual quality of applications) and then to save CPU energy. To achieve these goals efficiently, GRACE uses a novel hierarchy of global, per-application, and internal adaptations, balancing the application benefits and cost. We have implemented the first version of GRACE and evaluated it with adaptive AMD processor and multimedia video codecs such as MPEG decoder and H263 encoder. Our experimental results indicate that GRACE can increase system utility up to 98% and save energy up to 95% depending on workload and compared to previous systems adapting only some of the layers or not adapting at all.

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