Wireless Sensor Networks - Where Parallel and Distributed Processing Meets the Real World

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Abstract: Vast networks of intelligent sensors that are deeply embedded in physical world will revolutionize practices in the life sciences, civil engineering, manufacturing, security, agriculture, ubiquitous computing, and many other areas. They also present a wonderful new venue for parallel and distributed processing. Bandwidth, storage, and energy limitations make in-network processing essential – within the node and among collections of nodes. The algorithms should be resource efficient, but also deal with noise, uncertainty and dynamically changing connectivity. Ideally, application programming will be done at the level of unstructured ensembles, rather than individual nodes. To explore these issues, we have built a series of inch-scale wireless sensor platforms, along with an operating system and networking substrate for vast collections of tiny, power-constrained devices – TinyOS. This open experimental platform is being used by hundreds of research projects internationally in a wide range of disciplines. This talk describes the challenges in making networks of such devices robust and programmable, including platform architecture, operating system design, network discovery and routing, and explores novel distributed algorithms developed for such networks.

Biographical Sketch: David E. Culler is a Professor of Computer Science at the University, where he has been on the faculty at Berkeley since 1989 and has served as Vice Chair for Industrial Relations and Vice Chair for Computing and Networking. He was founding director the Intel Research Lablet in Berkeley, which works in collaboration with the University. David received his B.A. from Berkeley in 1980, M.S. from MIT in 1985 and Ph.D. from MIT in 1989. He was selected in the Scientific American Top 50 Researchers and in Technology Reviews Top 10 Technologies that Will Change the World and awarded the NSF Presidential Young Investigator, NSF Presidential Faculty Fellowship, and ACM Fellow. His research addresses vast networks of small, embedded wireless devices, internet service architectures, parallel computer architecture, parallel programming languages, and high performance communication. He is well known for his work on TinyOS, PlanetLab, Networks of Workstations (NOW), Internet services, Active Messages, Split-C, the Threaded Abstract Machine (TAM), and dataflow systems. He has published widely in leading conferences and journals, co-authored a graduate text on Parallel Computer Architecture, obtained three patents and has served as program-chair for several leading conferences.

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