# Query Processing for Data Streams and Sensor Networks

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Emerging sensor technology such as wireless sensor networks and low-cost RFID tags and readers are on a fast track to widespread deployment in applications such as environmental monitoring, asset tracking, telemetry-based remote monitoring, and real-time supply chain management. Driven by both technological and market forces, these technologies raise the promise of taking computing from its current, user-driven mode, to one of direct and continuous interaction with the physical world.

Monitoring applications that exploit sensors and other sources of continuous data impose requirements on data management that differ substantially from those of more traditional enterprise applications. These requirements include coping with the severe resource constraints of wireless sensor networks, processing large volumes of data on-the-fly as it flows through the network, and providing timely and high-quality answers to queries over distributed systems that span many orders of magnitude in terms of time, geography, capacity, and reliability.

In this short course, we will cover recent database and query processing research that is addressing the unique challenges of emerging sensor-rich applications. While surveying the larger context of current research in these areas, we will draw heavily on our own experiences in developing the TelegraphCQ stream processing system and the TinyDB sensor network query processor.

The topics we will address include:

1) Introduction to monitoring and streaming applications.
2) Query processing over data streams: systems and research issues.
3) Sensor network challenges and research directions.
4) Structure and programming of sensor network applications using TinyOS and TinyDB (including hands-on programming exercises for both).
5) Emerging architectures for large-scale sensor/stream query processing.

**Instructors**:

**Michael Franklin** is a Professor of Computer Science at the University of California, Berkeley where his research focuses on the architecture and performance of distributed databases and information systems. His recent projects have included the TelegraphCQ stream processing system and the TinyDB sensor network query processor. He worked in industry as a database systems developer for several years prior to receiving his Ph.D. from the University of Wisconsin, Madison in 1993. More recently, he spent part of 2003 as an Executive-in-Residence at the Mayfield Fund, a venture capital firm in Menlo Park, CA. He served as Program Chair for SIGMOD 2002 and is Program Co-chair for ICDE 2005. He is currently on the editorial boards of ACM Transactions on Database Systems and the VLDB Journal. He received the ACM SIGMOD "Test of Time" award in 2004, and the NSF Career award in 1995.

**Wei Hong** is a Senior Researcher at Intel Research, Berkeley. His current research focuses on data management in sensor networks. He leads the Tiny Application Sensor Kit (TASK) project at Intel Research and co-designed/developed TinyDB, an open-source, in-network sensor database system. Prior to joining Intel Research, Wei co-founded and architected the products of two startup companies: Illustra Information Technology Inc. and Cohera Corp. Illustra developed the first successful commercial Object-Relational database system. It was acquired by Informix, now part of IBM. Cohera provided electronic catalog management solutions based on a novel federated database system that it developed. Its technology was acquired by PeopleSoft. Wei earned a Ph.D. in computer science from UC Berkeley and holds a master and two bachelor degrees from Tsinghua University in Beijing, China.