中央研究院 資訊科學研究所
Institute of Information Science, Academia Sinica

Distinguished Lecture Series

Towards Dependable Cyber-Physical Systems

Monday, November 3rd, 2014 10:00am
Auditorium 106 at New IIS Building

Lothar Thiele

Swiss Federal Institute of Technology Zurich Professor, Computer Engineering and Networks Laboratory

Abstract

Unlike more traditional embedded systems, cyber-physical systems are typically designed as a network of interacting elements with physical input and output instead of as standalone devices. As a prominent example, the area of wireless sensor networks had a huge impact on the research in various fields related to electrical engineering and computer science. Spatially distributed sensor nodes are used as a new kind of measurement instruments to collect physical or environmental data. Much of this work was driven by the early vision of SmartDust. One of the corner stones to achieve the required quality of service in terms of sensing density in time and space was the concept of eliability viaover-provisioning?
The field of cyber-physical systems is now in a stage where serious applications of societal and economic importance are in reach such as internet of things, industrial process monitoring and control, environment monitoring, logistics, healthcare applications, home automation, and traffic control. In many of these applications, all measurements are precious and must not be lost, reliable data must arrive in real-time, sensors are relatively expensive, and deployment of a sensor network and repair/update are very labor-intensive and expensive. We argue that in order to significantly advance the application domains by using a wireless sensor network as a novel means of observation and interaction, it is inevitable that such a tool be created as a quality instrument with known and predictable properties. The talk will introduce new models and methods that lead to predictable and efficient networked embedded systems such as optimized and predictable use of harvested solar energy, data cleaning methods, network tomography, sensor calibration, and new classes of dependable synchronization and communication protocols. We will demonstrate their use in extensive, long-term installations of sensor networks in hostile environments for safety-critical applications (mobile air quality measurements in cities and environmental sensing in permafrost regions).

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