INFOCOM PANEL #2

Networking Challenges in Cyber-Physical Systems

Moderated by:
Krishna Kant, Temple University
kkant@temple.edu

May 01, 2014
NETWORKING CHALLENGES IN CPS

• Panelists:
  • Dr. Ness Shroff, Ohio State Univ.
  • Dr. Vincent Wong, Univ. of British Columbia
  • Dr. Jun-Hong Cui, Univ. of Connecticut
  • Dr. Chenyang Lu, Washington U. at St. Louis
  • Dr. John S. Baras, Univ. of Maryland
PANEL LOGISTICS

• Introductory Remarks
  • Krishna (<10 mins)

• Position Statements by Panelists
  • 10-11 mins each approx, max 60 minutes

• Open Discussion (~20 mins)

• Time management
  • 2 minute warning signal (at 9 minutes)
PANELISTS

Ness B. Shroff is the Ohio Eminent Scholar Chaired Professor of Networking & Comm. at Ohio State Univ. From 2009-2012, he was a Guest Chaired prof at Tsinghua Univ. His research spans communication, social, & cyberphysical networks. He was just named as the recipient of 2014 Infocom Achievement award.

Vincent Wong is a Professor in the ECE dept. at Univ. of British Columbia. His research areas include protocol design, wireless networks, smart grid, machine-to-machine communications, RFID systems, and intelligent transportation systems.

Jun-Hong (June) Cui is a professor in the CSE department at Univ. of Connecticut, and director of NSF IUCRC on Smart Ocean Technology. She has received a number of awards including most recently Outstanding Faculty Mentoring Award for 2013.
Chenyang Lu is a Professor in CSE dept at Washington University in St. Louis. His research interests include real-time systems, wireless sensor networks and cyber-physical systems. He is Editor-in-Chief of ACM Transactions on Sensor Networks.

John S. Baras is a professor in ECE dept at Univ. of Maryland and founding director of Institute for Systems Research (an NSF ERC) and center for Hybrid & Satellite Communication Networks (a NASA space center). He is also the Lockheed Martin Chair in Systems Engineering.
CYBER-PHYSICAL SYSTEMS

• Really cyber-human-physical systems
  • From cognizant of human behavior to human in the loop control
WIDE RANGE OF CHARACTERISTICS

• Human aspect
  • Impact: Life-depends-on-it to convenience
  • Involvement: Fully autonomous to human actuation
  • Familiarity w/ technology, socio-cultural aspects, …

• Physical system
  • Capabilities (smartness) of physical components
  • Spatial scale and heterogeneity
  • Operating environment (underwater, disaster, …)
  • Temporal scale/evolution, emergent behavior

• Cyber infrastructure
  • Data volume, velocity, and QoS requirements
  • Configuration, adaptation, & energy mgmt needs
  • Privacy, security, resilience needs
IMPLICATIONS FOR NETWORKING

• Wide range of networking needs
  • Guaranteed, time-bound delivery before bad things happen
  • A wide range of difficult operating environments
  • Wide range of spatial scale and heterogeneity in technologies, node densities, and node capabilities.
  • A wide range of data rates and QoS requirements.
  • Auto configuration and adaptation
  • Resource limitations (e.g., energy) vs. functionality

• Large smart environments (e.g., smart city) bring many of these challenges together.
• Multiple interacting systems with a wide variety of networking requirements
QUESTIONS TO PANELISTS

• What are the unique networking challenges in the specific application areas of your focus?

• Can we define a common architecture for Cyber-physical networks across diverse sets of application areas?

• How can the notion of situation awareness be integrated into Cyber-physical networking protocols?

• Can Cyber-physical networks provide autonomous configuration and yet retain flexible human control?

• Can we design scalable and efficient mechanisms to ensure security, privacy and trust in the cyberphysical networks?
THE PLAN

• Ness Shroff – Overview of CPS
• Vincent Wong – New technologies in smart grid
• Jun-Hong Cui – Underwater communications
• Chenyang Lu – Real-time wireless control
• John S. Baras – Fundamental networking challenges