INFOCOM PANEL #2

Networking Challenges in Cyber-Physical Systems

Moderated by:

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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)

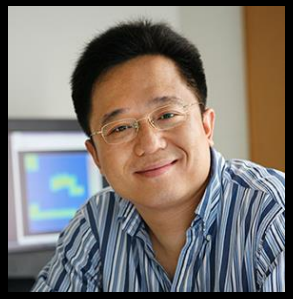
PANELISTS

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.

PANELISTS, CONT'D

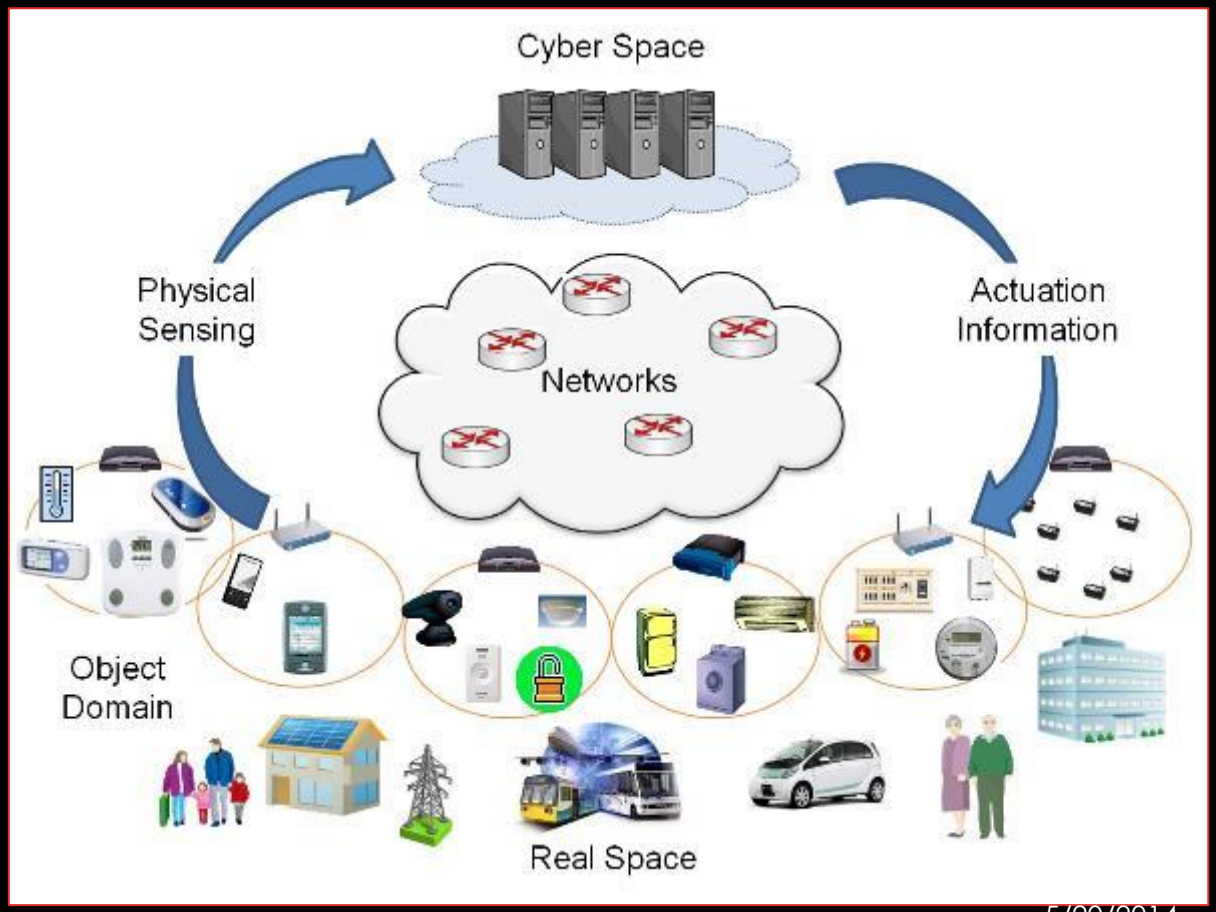


Chenyang Lu is a Professor in CSE dept at Washington University in St. Louis. His research interests include real-time systems, wireless sensor networks and cyber-physical systems. He is Editor-in-Chief of ACM Transactions on Sensor Networks

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

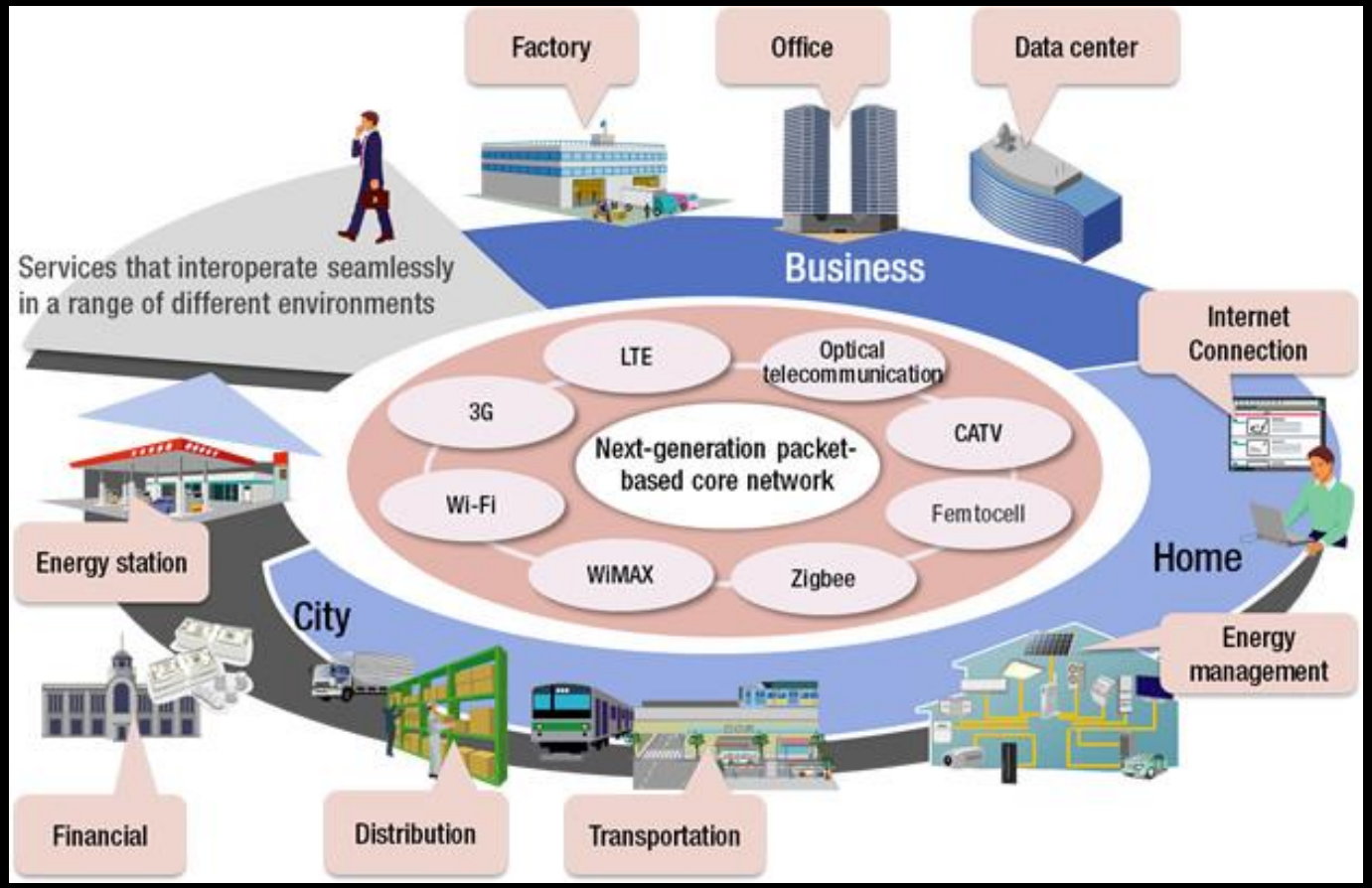
- Human aspect
  - Impact: Life-depends-on-it to convenience
  - Involvement: Fully autonomous to human actuation
  - Familiarity w/ technology, socio-cultural aspects, …
- Physical system
  - Capabilities (smartness) of physical components
  - Spatial scale and heterogeneity
  - Operating environment (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.

SMART CITY NETWORKS

- 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

THANK YOU