

# **SIG on Cognitive Communications and Networking in Cyber-Physical Systems (CCNCPS)**

Xianghui Cao, SMIEEE

Southeast University, Nanjing, China

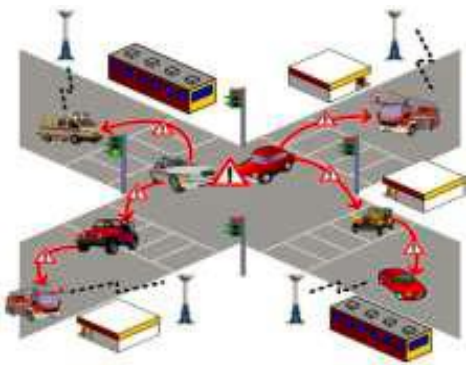
xhcao@seu.edu.cn

# Background

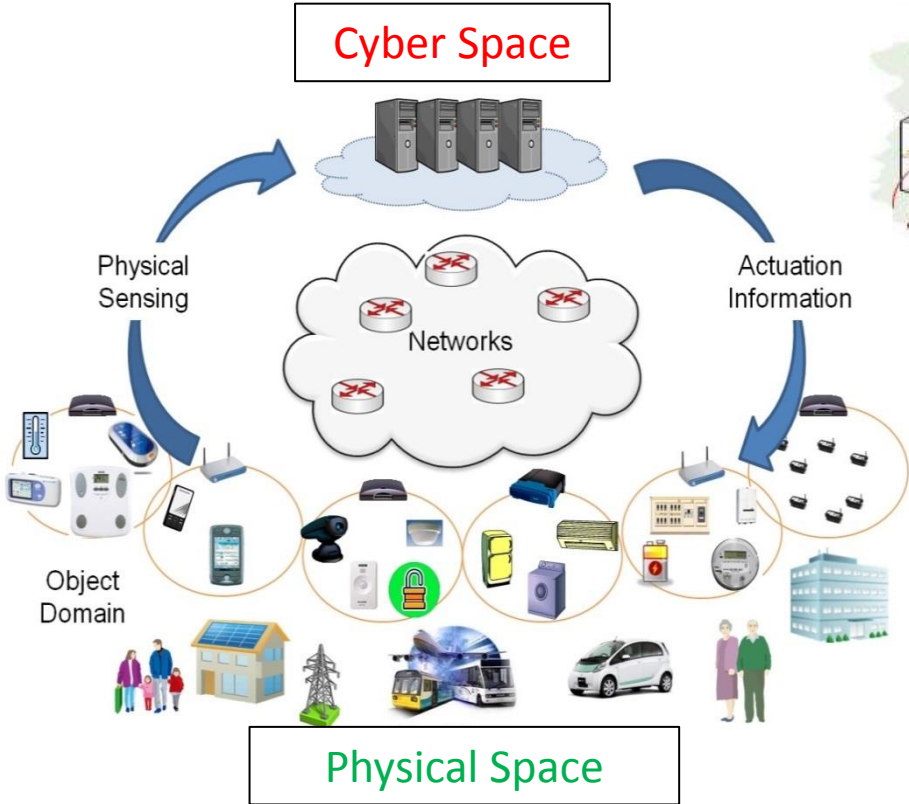
Cyber-physical systems (CPS): an interdisciplinary technology integrates various types of sensing, communication, actuation and computation devices to enable smart interaction between human beings and the physical world



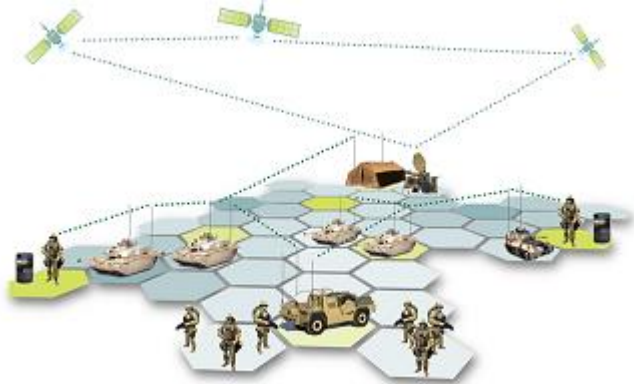
Industrail Internet of Things



Vehicular networks



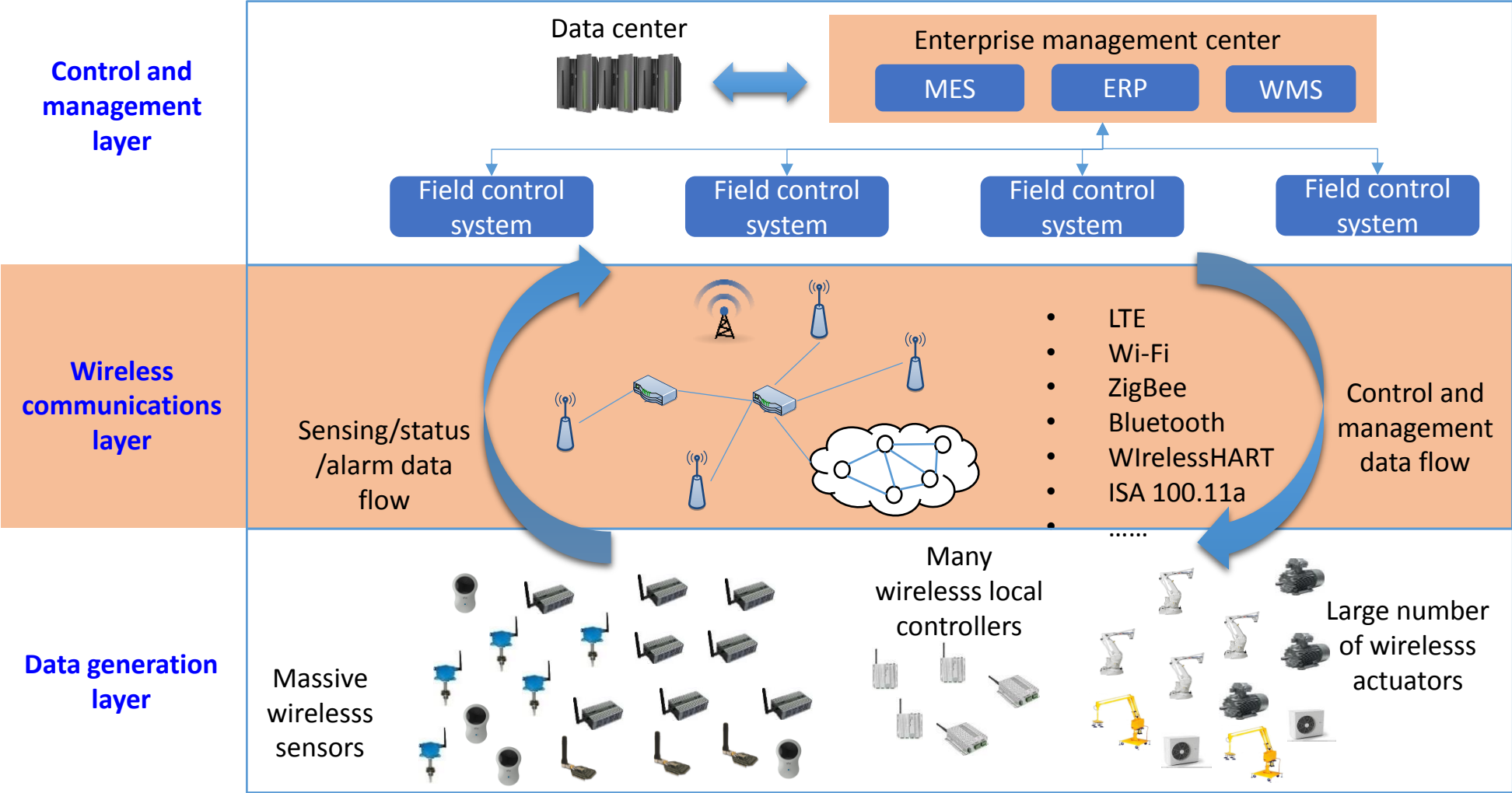
Smart grid



Tactical Internet

# Background

- Typical system architecture



# Communications/networking in CPS

## Characteristics

- Devices have different communication capabilities
- Mixed traffic patterns (periodic and event-based)
- Data have values
- Data are prioritized

## Challenges

- Heterogeneous networks
- Heterogeneous flows
- packets have different importances
- Interplay with the physical systems

| Packet type                         | Volume                        | Flow pattern                | priority |
|-------------------------------------|-------------------------------|-----------------------------|----------|
| Emergency messages                  | Small                         | Event-based                 | highest  |
| Management messages and user inputs | Moderate                      | Regular/on demand           | high     |
| Real-time control commands          | Large                         | Periodic                    | mild     |
| Sensor measurement data             | Very large (may be redundant) | Periodic/event-based/random | lowest   |

# Our scope

- Context-aware cognitive communication and networking

## Design issues

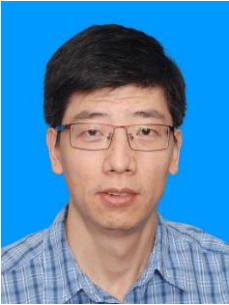
- Spectrum cognition in harsh environments with high interference
- Value cognition of data by estimating and predicting the status of CPS
- Cognitive communications in CPS
- Cognitive resource allocation (spectrum, time, power, etc.) in CPS
- Cognitive protocol designs (MAC, routing, scheduling) in CPS
- ... ..

## Advanced topics

- Cross-layer designs
- Multi-objective optimization
- Game-based approaches
- Machine learning methods
- ... ..

# Our Team

## Chair



**Dr. Xianghui Cao**  
Associate Professor  
Southeast University, China

## Vice-Chairs



**Dr. Xiangwei Zhou**  
Assistant Professor  
Louisiana State University, USA



**Dr. Enrico Natalizio**  
Associate Professor  
Université de Technologie de  
Compiègne, France



**Dr. Ruilong Deng**  
Researcher  
University of Alberta, Canada

## Advisory Board



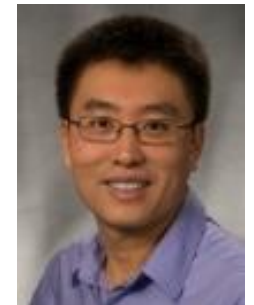
**Dr. Geoffrey Ye Li**  
Professor, IEEE Fellow  
Georgia Institute of Technology, USA



**Dr. Dusit (Tao) Niyato**  
Professor, IEEE Fellow  
Nanyang Technological University, Singapore



**Dr. Yu Cheng**  
Professor  
Illinois Institute of  
Technology, USA



**Dr. Jianhui Wang**  
Associate Professor  
Southern Methodist University and  
Argonne National Laboratory, USA

23 founding members

# Our aim and proposed activities

## Our aim

- We will concentrate on cognitive communications and networking in CPS
- Provide a platform for researchers and practitioners to share their ideas, key technologies, and latest results in this area.

## Proposed activities

- Propose workshops
- Propose special issues
- Organizing regular meetings and advertisings
- Invite talks

# Progress

## Established in November 2017

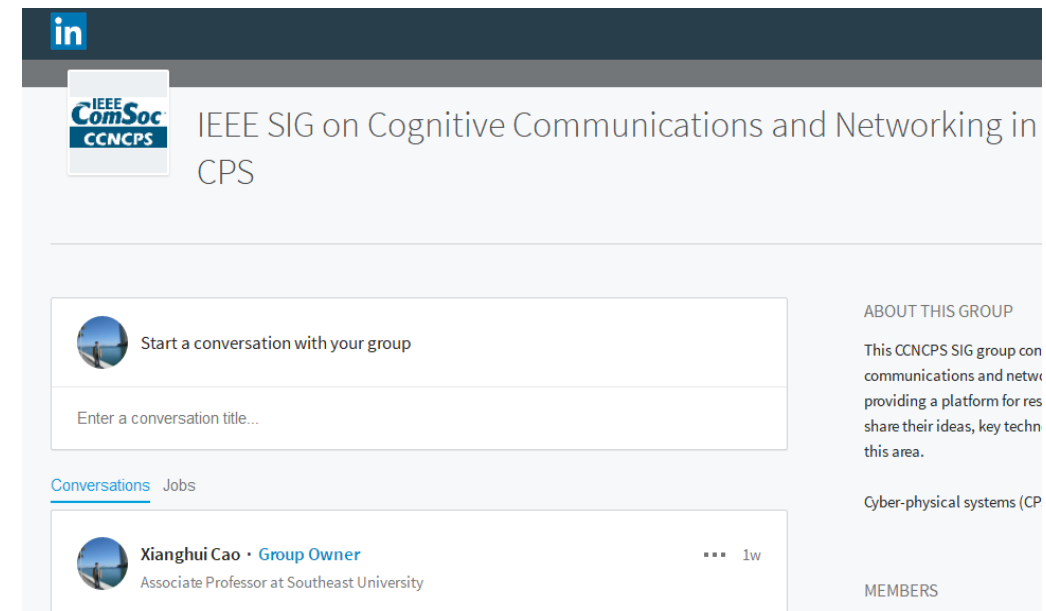
- Nov. 3, Our SIG proposal got approved; official webpage was created
- Nov. 4, LinkedIn group web was created

## On-going work:

- built connections with the committee of WiSARN 2018, start to discuss collaboration details
- Special issue proposals



The screenshot shows the IEEE ComSoc website for the Cognitive Networks Technical Committee. The header includes the IEEE ComSoc logo and the IEEE logo. Below the header is a search bar and a navigation menu with links for Home, Officers, News, Meetings, Awards, SIGs, Call for Papers, Newsletter, Membership, and Mailing List. The main content area features a sidebar with a list of SIGs, including 'SIG on Cognitive Communications and Networking in Cyber-Physical Systems' which is highlighted. The main content area displays the title 'SIG on Cognitive Communications and Networking in Cyber-Physical Systems' and a section titled 'Scope and Objectives' with a detailed paragraph about Cyber-physical systems (CPS). Below this, there is a 'Chair' section listing Dr. Xianghui Cao, and a 'Vice-chairs' section listing Dr. Xiangwei Zhou, Dr. Enrico Natalizio, and Dr. Rulong Deng.



The screenshot shows the LinkedIn group page for the IEEE SIG on Cognitive Communications and Networking in CPS. The header includes the LinkedIn logo and the IEEE ComSoc CCNCPS logo. The main content area features a search bar and a navigation menu with links for Home, Officers, News, Meetings, Awards, SIGs, Call for Papers, Newsletter, Membership, and Mailing List. The main content area displays the title 'IEEE SIG on Cognitive Communications and Networking in CPS' and a section titled 'Start a conversation with your group' with a text input field. Below this, there is a 'Conversations' section with a link to 'Jobs' and a profile card for Xianghui Cao, Group Owner, Associate Professor at Southeast University. The right sidebar contains an 'ABOUT THIS GROUP' section with a description of the group's purpose and a 'MEMBERS' section.



**SIG on Cognitive Communications and Networking in Cyber-Physical  
Systems (CCNCPS)**

**Thanks and welcome to join us!**