

# Middleware for Pervasive Computing

Speaker:

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## Abstract

Pervasive computing aims at creating smart environments providing people with services that are convenient, seamless, intelligent, and invisible. The environments consists of seamlessly interconnected smart devices deployed to every corner of our life, sensing for people and their surrounding contexts and providing functionalities that are composed as services. Pervasive computing applications include smart spaces, assisted environments for individuals with special needs, Emergency services, social networking, intelligent logistics and information systems, and entertainment.

One big barrier to the wide spread development of pervasive computing applications lies in the increased complexity of the programming task. There is a big gap between high-level application requirements, and low-level complex system organization and operations. Middleware can help bridge the gap – supporting rapid development and deployment of applications by domain experts with minimal programming expertise. However, pervasive computing poses new challenges to middleware research. In this tutorial, I will describe the main functionalities of middleware, namely programming abstractions and interfaces, system services, and runtime support, present the design dimensions. discuss the key challenging issues, and describe the state of art of research in developing pervasive computing middleware, including the major research projects. I will also describe the open problems and point out future research directions.

## Tutorial Outline

1. Introduction to pervasive computing
  - a. What is pervasive computing?
  - b. Applications of pervasive computing
  - c. Research issues in pervasive computing
2. Pervasive computing middleware
  - a. Why and what?
  - b. Challenges and design considerations
  - c. Existing projects
3. Design dimensions
  - a. Application domains
  - b. Programming abstractions and interfaces
  - c. System services
  - d. System architectures
4. Taxonomy and case studies
  - a. Service management middleware

- b. Context-aware and adaptive middleware
  - c. Data management middleware
  - d. Other features
5. Future directions and open issues
- a. Application requirements
  - b. Middleware paradigms and architectures
  - c. Context and content reasoning and understanding
  - d. Protocols & algorithms tailored to PvC
  - e. Autonomic and trustworthy services

### **About the Speaker**

Jiannong Cao received the BSc degree in Computer Science from Nanjing University, Nanjing, China, and the MSc and the Ph.D degrees in Computer Science from Washington State University, Pullman, WA, USA. He is currently a professor and associate head in the Department of Computing at Hong Kong Polytechnic University, Hung Hom, Hong Kong. He is also the director of the Internet and Mobile Computing Lab in the department. Before joining Hong Kong Polytechnic University, he was on the faculty of Computer Science at James Cook University and University of Adelaide in Australia, and City University of Hong Kong. His research interests include mobile and pervasive computing, computer networking, parallel and distributed computing, and fault tolerance. He has published over 250 technical papers in the above areas. His recent research has focused on wireless networks and mobile and pervasive computing systems, developing test-bed, protocols, middleware and applications. His research is supported by grants from HK RGC, HK ITC, HK PolyU, Huawei, and Nokia. Dr. Cao is a senior member of China Computer Federation, a senior member of the IEEE, IEEE Computer Society, and the IEEE Communication Society, and a member of ACM. He is the Coordinator in Asia of the Technical Committee on Distributed Computing (TPDC) of IEEE Computer Society. He is also a member of the IEEE Technical Committees on Distributed Processing, Parallel Processing, IEEE Fault Tolerant Computing, and Self-Organization and Complex Distributed Systems. Dr. Cao has served as an associate editor and a member of editorial boards of several international journals, including Pervasive and Mobile Computing Journal, Wireless Communications and Mobile Computing, Peer-to-Peer Networking and Applications, and Journal of Computer Science and Technology. He has also served as a chair and member of organizing / program committees for many international conferences, including IEEE Percom, MASS, ICDCS, IPDPS, ICPP, RTSS, SRDS, PRDC, ICC, Globecom, WCNC, UIC, and EUC.