Editorial

Xiaohua Jia* and Hongwei Du

Department of Computer Science,
City University of Hong Kong,
Kowloon, Hong Kong
E-mail: csjia@cityu.edu.hk
*Corresponding author

Biographical notes: Xiaohua Jia received his BSc (1984) and MEng (1987) from the University of Science and Technology of China and DSc (1991) in Information Science from the University of Tokyo, Japan. Currently, he is a Professor in the Department of Computer Science at City University of Hong Kong. His research interests include distributed systems, computer networks, internet technologies and mobile computing.

Hongwei Du received his BSc (2003) in Computer Science from the Central China Normal University. Currently, he is a PhD candidate in the Department of Computer Science, City University of Hong Kong. His research interests include computer networks and internet and mobile computing.

1 Introduction

This special issue contains 11 selected papers from the 1st International Conference on Mobile Ad hoc and Sensor Networks (MSN05), December 2005, Wuhan, China. MSN05 has received 512 submissions in total, among which 103 papers were accepted for presentation at the conference. The selected papers have undergone careful extensions and revisions based on their conference versions.

In recent years, the research and development of wireless sensor networks have been fuelled up by the fast growth of wireless communications technologies and many potential applications of sensor networks. Research on sensor networks has been focused mainly on four subareas:

1 *Efficient MAC layer protocols*: new MAC protocols are required to facilitate sleep/active mode, real-time data collection and energy efficiency of sensor nodes.

2 *Network organisation and routing protocols*: routing in sensor networks is different from traditional wireless networks due to the limited hardware capability and energy capacity of sensor nodes and the data centric routing nature of sensor networks.

3 *Data processing and data management*: sensor networks have brought many new challenges to data management, such as in-network processing, location-sensitive database, distributed data storage and queries.

4 *Security in wireless sensor networks*: sensor networks are vulnerable to security attacks and it is difficult to design effective security protocols for sensor networks due to the resource limitation of sensor nodes.

The 11 papers in this special issue are organised into four groups. The first three papers address the MAC layer scheduling mechanisms and time synchronisation functions. The next four papers discuss network clustering and routing and data management schemes. The two papers after that are about multicast/broadcast routing algorithms. The last two papers discuss security in sensor networks.

The first paper, by Chen and Sun discusses the MAC layer support for real-time QoS in sensor networks. A dynamic priority scheduling-based MAC protocol is proposed to schedule packets transmission by using dynamic priorities. The next paper, by Mayank and Ravishankar discusses a communication environment where there is a broadcast server constantly broadcasting information and a set of clients that need to communicate with each other, as well as the information from the server. It proposes a mechanism that allows the broadcast server and the set of clients to share the medium access and reduce the access delay for both the server and the clients. The third paper proposes a time synchronisation protocol for sensor networks. Time synchronisation is important for MAC layer functions. The proposed protocol is simple and can achieve better precision compared with the existing methods.

The next group has four papers. The first two papers discuss energy efficient clustering mechanisms. The first one presents a spatially uneven density clustering method to support aggregation queries aiming to prolong the lifetime of sensor networks. The main strategy of this clustering method is that the nodes nearby a central base station are grouped into smaller clusters and distant nodes need to be clustered into larger groups to save resources. By this strategy, the energy consumption of sensor nodes could be balanced. The second paper achieves the same objective for prolonging the lifetime by a different method. It uses a deterministic cluster-head management algorithm to evenly distribute the workload among the nodes within a cluster. Nodes within a cluster

make local decisions on the fair-share length of their duty cycle according to their remaining energy supply and thus all nodes would deplete their energy supply at roughly the same time. The third paper discusses the sensor coverage and network connectivity issues for directional model. It proposes deployment strategies for satisfying a given coverage probability in directional sensing model and mechanisms for checking and repairing network connectivity in directional communication model. The paper, by Li and Li, is about data processing in sensor networks. It reduces the data processing and communication load of sensor nodes by three methods:

1 adjust sampling frequency dynamically based on application needs

2 compress sensed data according to the nature of the data and

3 employ an approximate query processing algorithm to reduce query processing time.

The proposed three methods are integrated into a system to improve the overall system performance.

The next two papers are about distributed multicast/broadcast routing algorithms. The paper, by Zhao et al., proposes a distributed multicast routing algorithm that can maximise the lifetime of the network. The algorithm first identifies the bottleneck nodes in terms of lifetime in an initial multicast tree and then replaces the bottleneck nodes by other nodes such that the lifetime of the tree can be maximised. The second paper proposes a distributed algorithm for computing energy-balanced Connected Dominating Set (CDS) in sensor networks. Since a CDS of a network can be used as a backbone for communication and it is also a good structure for broadcasting, a CDS with minimum number of nodes would be an energy efficient backbone for the network. The proposed algorithm is decentralised, energy-efficient (small size of CDS) and energy-balanced (with nodes in turn serving as CDS nodes).

The last two papers address the security of sensor networks, a primarily important issue for sensor networks. The paper, by Kim et al., proposes two efficient and secure password authentication schemes that are able to withstand replay and denial-of-service attacks. The proposed schemes require low computation, which are suitable for low-power and simple computing devices as sensor nodes or smart card or PDAs. The last paper, by Lee et al., discusses secure localisation and location proving scheme that allows the base station to verify the location reported by sensor nodes. This scheme can be used for location-based access control. This paper proposes a secure localisation scheme by using an efficient one-way hash function, which makes the scheme applicable to resource-constrained sensor networks.