ERCIM "Alain Bensoussan" Fellowship Scientific Report

Fellow:	Jianguo Ding
Visited Location:	Norwegian University of Science and Technology (NTNU), Norway
Duration of Visit:	April 23, 2009 – Jan. 22, 2010 (9 months)

I - Scientific activity

This is my second stay for ERCIM fellowship. I was involved in the research project: MELODY (Medical Sensing, Localization, and Communications using Ultra Wideband Technology), which is supported by the Research Council of Norway. The project will develop ultra wideband (UWB) technology for improved wireless health technology, for both improved network communication and improved and possibly novel medical applications. Three major research directions are pursued, namely short range sensing and imaging of human body, improved sensitivity for short range localization and tracking, and distributed signal and communications for dynamic autonomous resilient networks for both in-vivo and ex-vivo medical applications.

My research topic for the project is: Management of Wireless Sensor Networks.

The emerging wireless sensor networks and services have some of the following features: mobility, diffusion of heterogeneous nodes and devices, mass digitization, resource constraints, multi-federated operations, scalability, dependability, context awareness, security, probability, new forms of user centered content provisioning, new models of service and the interaction with improved security and privacy. These features produce new technologies and networking architectures and exhibit huge challenges to render robust services, security and management. Therefore new management standard, architectures, theory and technologies should be investigated to match the current requirements to manage wireless sensor networks and their services. A set of enabling technologies is recognized as potential candidates for the management of wireless sensor networks and can be based on policy-based management strategies, artificial intelligence techniques, probabilistic approaches, bio-inspired approaches, etc. The project aims to investigate efficient strategies and technologies to improve the management of sensor networks and eventually to obtain autonomic management, context-aware management and self-management systems in which technology itself is used to manage technology.

Other academic work includes the international conference organization, paper review for international journals and conferences.

I thank Prof. Ilangko Balasingham (The Interventional Centre, Rikshospitalet/NTNU), Prof. Tor Ramstad (NTNU), and all the colleagues in the group of NTNU and the group in Rikshospitalet, Oslo. The regular discussion and cooperation helped me a lot in my research work.

II- Publication(s) during your fellowship

*1. **Jianguo Ding** (Author): Advances in Network Management (book), 390 pages. Taylor & Francis, ISBN-10: 1420064525; ISBN-13: 978-1420064520, 2010.*

Summary:

Over the past two decades, business volume of hardware and software in the U. S. has decreased by about seventy percent, while the cost of management and support has grown from $20 billion to $140 billion. With close to seventy percent of this growing figure being spent on the management of legacy systems and only thirty percent on new systems, improvements in the development of self-managing systems have become a cost-saving priority for many corporations and an issue of strategic importance for many economies.

Investigating the latest theories, methods, and technologies, **Advances in Network Management** provides the insight of a recognized expert into the fundamental concepts and contemporary challenges in network management. From basic concepts to research-level material, it details the evolution of network management solutions in network management paradigms, protocols, and techniques. The book also addresses dependencies between network management and application-level service management.

This forward-looking resource investigates advanced networks and network services including—autonomic computing, context-aware systems management, and automatic techniques aiming at self-management (self-configuration, self-healing, self-optimization, and self-protection). With its breadth and depth of coverage in theoretical, technical, and research topics, this book provides time-tested guidance for dealing with the growing complexity of network services while improving cost efficiencies in your IT department.

*2. **Jianguo Ding**, Ilangko Balasingham and Pascal Bouvry: Management Challenges for Emerging Networks and Services. Proceedings of the International Conference on Ultra Modern Telecommunications & Workshops, ICUMT '09, pages 1-8. IEEE communication society press, 2009.*

Abstract:

Recent years, requirements in network management and control have been amended by emerging network and computing models, including wireless networks, ad-hoc networks, overlay networks, Grid networks, optical networks, multimedia networks, storage networks, the convergence of next generation networks (NGN), etc. The network management has to meet resource constraints, multi-federated operations, scalability, dependability, context awareness, security, mobility, probability, etc. This paper presents a survey of the evolution of networks and their trends, the challenges of management for emerging networks and services, and the evolution of network management strategies and solutions in network management.

*3. **Jianguo Ding**, Ilangko Balasingham and Pascal Bouvry: Management of Overlay Networks: A Survey. Proceedings of the 3rd International Conference on Mobile Ubiquitous Computing Systems, Services and Technologies, pages 249-255. IEEE computer society press, 2009.*

Abstract:

Overlay networks are becoming widely used for content delivery and file sharing services because they provide effective and reliable services by creating a virtual topology on top of existing networks. However, the management of overlay networks meets new challenges in the structure, security, services and deployment. This paper presents a survey of the overlay networks and correlated management. The management issues of two typical overlay networks: peer-to-peer and Virtual Private Network are investigated. As a conclusion, the management of overlay networks must import self-management (self-*) and intelligent strategies to deal with

the complex management tasks, which are to deal with the dynamic, scalability, resilient and security challenges on overlay networks.

III -Attended Seminars, Workshops, and Conferences

1. Workshop of SAMPOS/WISENET: Strategies for seAMless deployment of mobile Patient mOnitoring Systems/WIreless biomedical Sensor NETwork, Dec. 2-3, 2009, NTNU, Trondheim, Norway.

2. International Conference on Ultra Modern Telecommunications 2009 (ICUMT09), St.-Petersburg, Russia. Dec. 12-14, 2009. Meanwhile, I worked as the chair of the 1st International Workshop on Management of Emerging Networks and Services (MENS2009), which is in conjunction with ICUMT09.

3. Wireless Communications Workshop, May 4-5, 2009 at Rikshospitalet, Oslo, Norway.