

Preface

In the past few decades, a technological revolution has occurred that has changed the way we live in dramatic ways. This technological revolution is the result of the emergence and evolution of a wide variety of new wireless networking technologies. Now people using these technologies are able to access the network and control many applications at will with their handheld devices anywhere, anytime. Although these technologies have made a long lasting impact in the revolution, it has also opened up various challenging issues which are yet to be resolved to make them more efficient and cost-effective. Wireless technologies are used in mobile cellular networks, wireless access network, Mobile Adhoc Networks (MANET), Wireless Sensor Networks (WSNs), Wireless Mesh Networks (WMNs), Vehicular Adhoc Networks (VANETs) and more recently Internet of Things networks. For readability and understanding, we have divided this book into three sections. Part I will discuss about trends and challenges of emerging wireless networks. In Part II, recent and advanced applications based on wireless communications are discussed. In our last section, we focus on future internet systems such as Internet of Things and other Internet-based systems.

Part I: Trends and Challenges of the Emerging Wireless Networks

Trends and Challenges of the Emerging Wireless Networks A wide variety of technologies have been proposed in recent years, of which most are based on user applications and demand. New applications and technologies bring in more challenges for researchers, which need to be standardized for more interoperability. The new technologies need to be well-studied and understood before they are accepted and widely used by consumers. This section gives academics, technologists, and industrial audiences up-to-date standards, technical challenges, and recent advances in the emerging wireless technologies.

Cooperative and Mesh Networks Cooperative and Mesh Networks are new architecture for network convergence and solve some recent problems like load balancing, routing, and handover. This chapter is dedicated to recent trends, proposals, and architectures for Cooperative and Mesh Networks. In many cases these networks can also be used to save energy which also makes them energy efficient networks.

Cooperation in Delay Tolerant Networks A new class of networks, known as Delay Tolerant Networks (DTN), may violate one or more fundamental assumption of performance characteristics of the underlying links, but will achieve smooth operations. There are many routing, message dissemination, peer-to-peer systems designed for DTN networks, which are widely discussed in this chapter.

Wireless Multimedia (4G and Beyond) Multimedia communications and applications have been growing rapidly since the introduction of smart mobile phones. With the next generation networks such as LTE (Long Term Evolution) which is just deployed, wireless multimedia have picked up strength and will belong to the most widely used applications. This chapter gives an overview of recent coding techniques, algorithms, and protocols providing multimedia support.

Part II: Wireless Communications and Applications

This section covers wireless communications and applications that have been receiving a lot of attention recently. The focus areas will be vehicular communications, broadband wireless technologies, RFID technology, and energy-efficient wireless communications which are specifically chosen to match the main theme of the book. The chapters will be written in a style that will be appropriate for: (a) readers wishing to learn the basics and fundamentals, (b) as well as for those readers who are already familiar with the fundamental concepts but are very interested to learn about state-of-the-art results in the field as well as emerging challenges in those specific areas. Developing the chapters this way will make the book appealing to undergraduate/graduate students, engineers, developers, etc. and increase its impact on the widest possible audience.

Vehicular Communications An Introduction is given, Overview of Vehicular Communications (vehicle-to-vehicle and vehicle-to-infrastructure communications, Intelligent Transportation Systems (ITSs), VANET research areas (broadcasting, routing, security, QoS, MAC), Performance metrics for VANET, Standards such as DSRC, IEEE 802.11p, architectures and solutions that have been proposed for research areas (broadcasting, routing, security, QoS, MAC), and a discussion of the challenges that still need to be addressed followed by concluding remarks.

Broadband Wireless Technologies We will cover primarily HSPA+, WiMAX, LTE, LTE-A, and the multiple access technologies/protocols they use, their design architectures and the protocols they use, application areas these technologies are expected to support, deployment/interoperability issues, future challenges of multi-hop wireless networks, cloud-based radio access networks, and reliability.

RFID Technology We will treat drivers of RFID technology and application, RFID trends and growth, fundamentals and principles of RFID technology (include protocols, design, architecture), near-field/far-field RFID versus barcodes, RFID security/privacy issues, RFID applications, RFID benefits, and next-generation RFID challenges—cost, design, and deployment.

Energy Efficient Wireless Communications We describe the importance of energy efficiency in networks (wired and wireless) and more specifically for wireless communications, drivers/motivations for energy-efficient wireless communications, energy-efficient approaches and solutions proposed for sensor networks, mobile ad-hoc networks, wireless LANs, broadband wireless networks (e.g., WiMAX, LTE), energy-efficient communication protocols for wireless communications, and future challenges for energy-efficient wireless communications.

Part III: Future Internet Systems

Designed services over the Internet evolved depending on the identified needs from person-to-person interaction as email or phone services to meet other interactions like person-to-machine, machine-to-person and lately machine-to-machine, where no human interaction is needed; thus building the ubiquitous and pervasive computing. Ubiquitous and pervasive computing has started a long time ago with the ambition of offering computing all-pervading for more tasks automation; building a smart world. Introducing RFID technology in building new services over the network has pushed what is called the Internet of Things as a meeting point between the real world and the virtual world especially when combined with other technologies as sensor technology or mobile communication.

The Internet of Things appears to be one step further on the path to ubiquitous computing. This will be possible with the introduction of the technologies as RFID or sensors but also other technologies as robotics, nanotechnology and others that makes Internet of Thing services an interdisciplinary field where most of the human senses are somehow reproduced and replaced in this virtual world.

In this part we plan to provide the building blocks of different emerging concepts and technologies such as machine-to-machine, Internet of things, emerging wireless technologies especially in healthcare area and the security issues related to these emerging concepts.

We will then present the future Internet of Things from the communication and the service point of views, showing the main directions in short and long term, explaining different concepts, functions, usage, and related technologies.

We also present the ongoing machine-to-machine communication model and expected services, the strengths and limits of these systems will be presented, showing what the industry could use from this M2M paradigm and what is still in the research perspective.

We will present also the emerging wireless technologies applied in the health-care domain, as this is identified as a very important domain where researchers and industrials are making more and more efforts.

We cannot ignore the security part related to these emerging technologies, so in this section, we will also present an overview of the related security issues of these emerging technologies and networks.

Melbourne, Victoria, Australia
Washington, DC, USA
Evry, France

N. Chilamkurti
S. Zeadally
H. Chaouchi

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Chilamkurti, N.; Zeadally, S.; Chaouchi, H. (Eds.)

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