WIRELESS NETWORKS AND MOBILE COMPUTING

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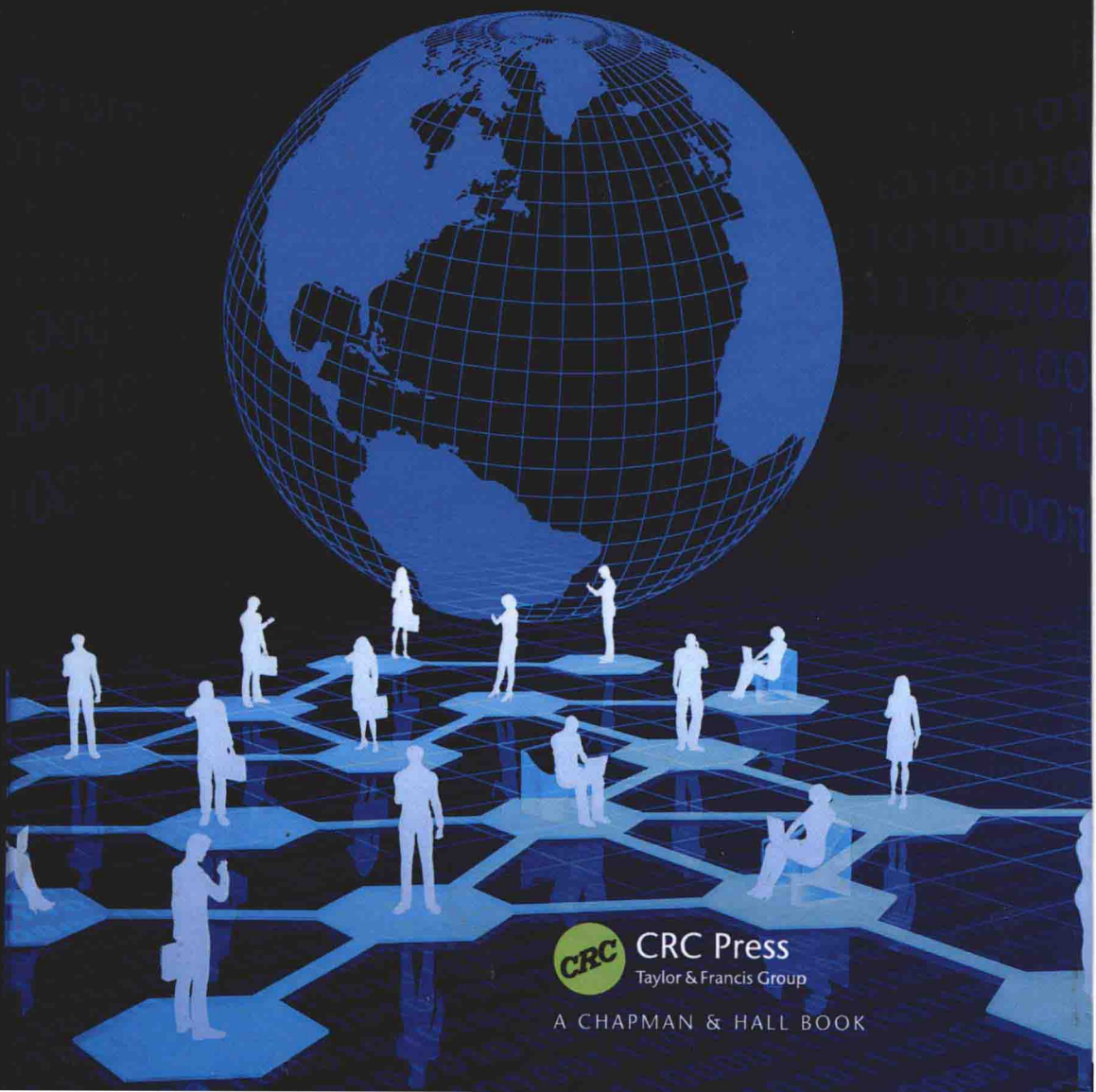

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Preface

Wireless communication constitutes one of the fastest growing industry segments in recent years, encompassing a number of application domains such as cellular mobile networks, ad hoc networks, cognitive radio networks, ubiquitous and pervasive computing, sensor networks and so on. All these applications are becoming increasingly popular these days due to the multifaceted benefits they provide to society ranging from personal communication services, growth of business and economy to healthcare, distant education services, disaster management, security services and defense applications. For sustained growth in these fields, we need trained personnel for further development and research in the areas of wireless networking and mobile computing. In a natural way, such a need has triggered the inclusion of formal courses on these topics in the undergraduate- and graduate-level engineering degree programs of many leading institutes and universities all over the world.

Also, there exist various issues and challenging research problems in all these areas which need urgent attention of scientists and engineers. In the area of cellular mobile networks, the major research areas include bandwidth management, mobility management, network security and energy-efficient communication, amongst others. Over the last decade, the number of such cellular mobile users has been increasing almost exponentially. Further, with the advances in technology, there has been an increasing demand from mobile users for providing multimedia services like voice, text, still-image and video through wireless networks. On the other hand, the available bandwidth required for such multimedia data communication for a large number of mobile users is very limited. Such limited availability of the radio spectrum, signal distortion and the interference caused by the environment and other mobile users imposes an inherent bound on the capacity of such wireless networks. Developing methods to utilize the scarce radio spectrum efficiently is more critical than ever. Along with this, secure communication through wireless and energy-efficient communication through the cellular mobile environment constitute other important problems which need immediate attention of scientists for an effective solution. In the same way, in the area of ad hoc networks, the challenging research problems include network security as well as energy-efficient communication requirements.

Similar to these cellular and ad hoc mobile networks, sensor networks also play a vital role in many real-life applications ranging from agriculture, health care, habitat monitoring, environmental monitoring, defense applications, and so on. Due to the limited battery life as well as limited computing and communication abilities of the constituent sensor nodes, efficient design and management of these sensor networks, handling user queries in various application domains over streaming sensor data and

also network security appear to be challenging problems to researchers. Summarily, there are various research problems in all these application domains of wireless communication, solutions of which are urgently demanded for the benefit of society.

The purpose for writing this book is two-fold. The primary objective is to introduce the basic concepts of wireless networks and mobile computing which will be enough for an engineering student at the undergraduate or graduate level to build a solid background in this area to enter into a professional life or to take up a research career. We have presented the materials in various chapters in a cohesive manner so that there will be a natural flow of concepts from one chapter to the next, which will be easy for a student to follow. This is in contrast to books whose chapters are written by different sets of authors, each with a different style and notations which often become difficult to follow during course work, as experienced by the authors while teaching this course to the students using available books in the market.

The second but no less important objective is to include recent research results along with the challenging problems in the areas mentioned above with extensive references to the existing literature at the end of each chapter. Recent results on various topics including those by the authors from their research endeavors over one and a half decades, are presented for comprehensive knowledge of the topics. This will certainly help researchers in these areas to get state-of-the-art pictures in the relevant fields and motivate them to innovate novel ideas for solutions to the unsolved challenging research problems for future generation wireless networks and mobile computing systems.

Taking into account the previously mentioned ideas this book has been surprisingly written containing only nine chapters. Chapter 1 gives an overall introduction to wireless networks and mobile computing. Chapter 2 deals with mobility management issues, discussing location management, handoff management and mobility models. Chapter 3 is devoted to bandwidth management in cellular mobile networks, starting from the basic concepts to various existing techniques, critical comparisons of their performances and future research challenges in the context of next-generation mobile communication systems. Chapter 4 discusses the localization issue in detail. In Chapter 5, we discuss the various existing techniques and protocols for message communication in ad hoc networks and future directions of research in this area. In Chapter 6, we introduce wireless local area networks (WLANs) along with recent research results and future directions of research in this area. Chapter 7 is devoted to the placement of base stations in a cellular network as well as deployment of sensor nodes in a wireless sensor network where we first model the problem from a geometrical point of view and then discuss existing techniques for an efficient solution to this problem. In Chapter 8, we address energy efficiency in wireless communication, with special emphasis on physical, MAC and network layers. Chapter 9 covers various aspects related to secure wireless communication including authentication, jamming, intrusion detection and stream cipher generation.

Exercises are given at the end of each chapter which will help the students get a better insight of the topics while solving those problems. Star (*) marked problems in the exercises indicate a higher level of difficulties and are, in fact, research problems that may be taken up by the researchers in the respective areas.

The authors are grateful to Ansuman Bhattacharya, Dibakar Saha, Pratham Majumder and Sayan Sen Sarma for their generous help in drawing a few figures and formatting some tables and algorithms while preparing the LaTeX source file for the book.

We will consider their efforts worthwhile if this book is found useful to the academic community, for both teaching and research, in the discipline of wireless networks and mobile computing.

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