MOBILE AD HOC NETWORKING

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PREFACE

Whereas today's expensive wireless infrastructure depends on centrally deployed hub-and-spoke networks, mobile ad hoc networks consist of devices that are autonomously self-organizing in networks. In ad hoc networks, the devices themselves are the network, and this allows seamless communication, at low cost, in a self-organized fashion and with easy deployment. The large degree of freedom and the self-organizing capabilities make mobile ad hoc networks completely different from any other networking solution. For the first time, users have the opportunity to create their own network, which can be deployed easily and cheaply. However, a price for all those features is paid in terms of complex technology solutions, which are needed at all layers and also across several layers.

For all those reasons, mobile ad hoc networking is one of the more innovative and challenging areas of wireless networking, and this technology promises to become increasingly present in everybody's life. Ad hoc networks are a key step in the evolution of wireless networks. They inherit the traditional problems of wireless and mobile communications, such as bandwidth optimization, power control and transmission quality enhancement. In addition, the multihop nature and the lack of fixed infrastructure brings new research problems such as network configuration, device discovery and topology maintenance, as well as ad hoc addressing and self-routing. Many different approaches and protocols have been proposed and there are multiple standardization efforts within the Internet Engineering Task Force and the Internet Research Task Force, as well as academic and industrial projects.

This book is the result of our effort to put together a representative collection of chapters covering the most advanced research and development in mobile ad hoc networks. It is based on a number of stand-alone chapters that are deeply interconnected. It seeks to provide an opportunity for readers to find advances on a specific topic, as well as to explore the whole field of rapidly emerging mobile ad hoc networks. In addition, the historical evolution and the role of mobile ad hoc networks in 4G mobile systems are discussed in depth in the first chapter.

In most of the past research, mobile ad hoc networks are seen as part of the Internet, with IP-centric layered architecture. This architecture has two main advantages: it simplifies the interconnection to the Internet, and guarantees the independence from (heterogeneous) wireless technologies. The layered paradigm, which has significantly simplified the Internet design and led to the robust scalable protocols, can result in poor performances when applied to mobile ad hoc networks. In fact, in mobile ad hoc networks several functions can hardly be isolated into a single layer. Energy management, security and cooperation, quality of service, among the others, cannot be completely confined in a unique layer. Rather, their implementation results are more effective by exploiting and interacting with mechanisms at all layers. A more efficient and performing architecture for mobile ad hoc networks thus should avoid a strict layering approach, but rather follow an integrated and hierarchical framework to take advantage of the interdependencies among layers. This book goes in this new direction by presenting *cross-layering* chapters. Most of the chapters do not focus on single-layer mechanisms, rather they present and discuss functions that are implemented by combining mechanisms that, in a strict layered architecture, belong to different layers.

Inside the ad hoc networking field, wireless sensor networks play a special role, as they are used mainly for phenomena monitoring. The solutions for mobile ad hoc networks are rarely suitable for sensor networks, as the latter are rarely mobile in a strict sense, and prone to different constraints deriving by the sensing devices' features and by application requirements. This generated an extensive literature that could hardly be accommodated in this book without being reductive.

This book is intended for developers, researchers, and graduate students in computer science and electrical engineering, as well as researchers and developers in the telecommunication industry. The editors of this book first discussed the selection of problems and topics to be covered and then discussed the choice of best authors for each of the selected topics. We believe that we have achieved a balanced selection of chapters with top quality experts selected for presenting the state of the art on each topic. The editors envision the introduction of a number of computer science and electrical engineering graduate courses in ad hoc networks, and believe that this book provides textbook quality for use in such courses.

The editors are particularly grateful to the authors who have agreed to present their work in this book. They would also like to express their sincere thanks to all the reviewers, whose helpful remarks have contributed to the outstanding quality of this book. Special thanks go to Stephen Olariu and Sergio Palazzo; we have benefited enormously from their comments and suggestions. Finally, we are immensely grateful to Catherine Faduska and Christina Kuhnen for their invaluable collaboration in putting this book together.

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