

Guide to Wireless Ad Hoc Networks

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Guide to Wireless Ad Hoc Networks

 Springer

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CCN Series ISSN 1617-7975
ISBN 978-1-84800-327-9 e-ISBN 978-1-84800-328-6
DOI 10.10007/978-1-84800-328-6

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library

Library of Congress Control Number: 2008940077

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Printed on acid-free paper

Springer Science+Business Media
springer.com

*Dedicated to
the newborns: Tultuli (Subhas's daughter)
and Babai (Sudip's son)
and
Isaac's grand ma: Maria Happi*

Preface

Overview and Goals

Wireless communication technologies are undergoing rapid advancements. The past few years have experienced a steep growth in research in the area of wireless ad hoc networks. The attractiveness of ad hoc networks, in general, is attributed to their characteristics/features such as ability for infrastructure-less setup, minimal or no reliance on network planning and the ability of the nodes to self-organize and self-configure without the involvement of a centralized network manager, router, access point or a switch. These features help to set up a network fast in situations where there is no existing network setup or in times when setting up a fixed infrastructure network is considered infeasible, for example, in times of emergency or during relief operations.

Even though ad hoc networks have emerged to be attractive and they hold great promises for our future, there are several challenges that need to be addressed. Some of the well-known challenges are attributed to issues relating to scalability, quality-of-service, energy efficiency and security.

This handbook attempts to provide a comprehensive guide on fundamental concepts, new ideas and results in the areas of mobile ad hoc and other ad hoc networking systems. This book has been prepared keeping in mind that it needs to prove itself to be a valuable resource dealing with both the important core and the specialized issues in this area. We have attempted to offer a wide coverage of topics. We hope that it will be a valuable reference for students, instructors, researchers and industry practitioners. We believe this is particularly an attractive feature of this book, as the very limited selection of books available on ad hoc networks we are aware of are written primarily for academicians/researchers. We have attempted to make this book useful for both the academicians and the practitioners alike.

Organization and Features

Altogether there are 21 chapters in the book. Chapter 1 discusses some of the properties of general multihop networks in theory and in practice. The authors

discuss some of the important issues relating to simulation, testbed and theoretical studies in these types of networks. Chapters 2 and 3 discuss some of the characteristic features of ad hoc networks that make them distinct from other types of networks and why/how the issue of cooperation plays an important role in their successful functioning. Chapters 4–8 relate to the important issue of routing (including multicasting and broadcasting) in ad hoc networks. A chapter on formal verification of routing protocols, Chapter 8, written by Câmara et al., will definitely be a chapter of particular attraction to many readers. Chapters 9–11 deal with mobility issues in these networks. Chapters 12 and 13 discuss the quality of service issues, which have been long considered to be challenging in this type of network. In particular, Chapter 13, discussing about delay management is a topic of great interest currently amongst researchers and practitioners alike. Chapter 14 discusses the address allocation mechanisms in ad hoc networks and Chapter 15 discuss congestion control. Chapters 16–19 are dedicated to security and trust issues in ad hoc networks, which again, have drawn considerable concern amongst researchers. Chapters 20 and 21 discuss some trendier issues – vehicular ad hoc networks and the integration of mobile ad hoc networks into IP-based access networks.

We list below some of the important features of this book, which, we believe, would make this book a valuable resource for our readers:

- Most of the chapters of the book are authored by prominent academicians/researchers/practitioners in wireless ad hoc networks, who have been working with these topics for several years and are supposed to have thorough understanding of the concepts.
- The authors of this book are distributed in a large number of countries and most of them are affiliated with institutions of worldwide repute. This gives this book an international flavor. The readers of this book can get absorbed by perspectives, suggestions, experiences and issues projected forward by authors from different countries.
- Almost all the chapters in this book have a distinct section providing *directions for future research*, which particularly targets researchers working in these areas. We believe, this section in each chapter should provide insight to the researchers about some of the current research issues.
- The authors of each chapter have also attempted, to the extent possible, to provide a comprehensive bibliography, which should greatly help the researchers and readers interested further to dig into the topic.
- Almost all chapters of this book have a separate section outlining *thoughts for practitioners*. We believe, this section in every chapter will be particularly useful for industry practitioners working directly with the practical aspects behind, enabling these technologies in the field.
- Most of the chapters provide a list of important terminologies and their brief definitions.

- Most of the chapters also provide a set of questions at the end, which can help in assessing the understanding of the readers.
- In order to make the book useful for pedagogical purposes, almost all chapters of the book also have a corresponding set of presentation slides. The slides can be obtained as a supplementary resource by contacting the publisher, Springer.

We have made attempts, in all possible way we could, to make the different chapters of the book look as much coherent and synchronized as possible. However, it cannot be denied that, as the chapters were written by different authors, it was not possible to fully achieve this goal. We believe that this is a limitation of most edited books of this sort.

Target Audience

The book is written by primarily targeting the student community. This includes the students of all levels – those getting introduced to these areas, those having an intermediate level of knowledge of the topics and those who are already knowledgeable about many of the topics. In order to keep up with this goal, we have attempted to design the overall structure and content of the book in such a manner that makes it useful at all learning levels. To aid in the learning process, almost all chapters have a set of questions at the end of the chapter. Also, in order that teachers can use this book for classroom teaching, the book also comes with presentation slides and sample solutions to exercise questions, which are available as supplementary resources.

The secondary audience for this book is the research community, whether they are working in the academia or in the industry. To meet the specific needs to this audience group, most chapters of the book also have a section in which attempts have been made to provide directions for future research.

Finally, we have also taken into consideration the needs to those readers, typically from the industries, who have the quest for getting insight into the practical significance of the topics, i.e., how the spectrum of knowledge and the ideas are relevant for real-life working of wireless ad hoc networks.

Supplementary Resources

As mentioned earlier, the book comes with the following supplementary resources:

- Solution manual, having sample solutions to most questions provided at the end of the chapters.
- Presentation slides, which can be used for classroom instruction by teachers.

Teachers can contact the publisher, Springer, in order to get access to these resources.

Acknowledgments

We are extremely thankful to the 49 authors of the 21 chapters of this book, who have worked very hard to bring this unique resource forward for help of the student, researcher and practitioner communities. The authors were very much interactive at all stages of preparation of the book from initial development of concept to finalization. We feel it is contextual to mention that, as the individual chapters of this book are written by different authors, the responsibility of the contents of each of the chapters lies with the concerned authors.

We are also very much thankful to our colleagues in the Springer publishing and marketing teams, in particular, Mr. Wayne Wheeler and Ms. Catherine Brett, who tirelessly worked with us and guided us in the publication process. Special thanks also go to them for taking special interest in publishing this book, considering the current worldwide market needs for such a book.

Finally, we would like to thank our parents, Prof. J. C. Misra, Mrs. Shorasi Misra, Mr. John Sime, Mrs. Christine Seupa, our wives Satamita, Sulagna and Clarisse, and our children, Babai, Tultuli, Clyde, Lenny, and Kylian, for the continuous support and encouragement they offered during this project.

June 10, 2008

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Dr. Isaac Woungang
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