

MOBILE AD HOC NETWORKING

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MOBILE AD HOC NETWORKING

Cutting Edge Directions

Second Edition

Edited by

**STEFANO BASAGNI
MARCO CONTI
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PREFACE

The mobile multihop ad hoc networking paradigm was born with the idea of extending Internet services to groups of mobile users. In these networks, often referred to as MANETs (Mobile Ad hoc NETWORKS), the wireless network nodes (e.g., the users' mobile devices) communicate with each other to perform data transfer without the support of any network infrastructure: Nearby users can communicate directly by exploiting the wireless technologies of their devices in ad hoc mode. For this reason, in a MANET the users' devices must cooperatively provide the Internet services usually provided by the network infrastructure (e.g., routers, switches, and servers).

At the time we published our first book, "Mobile Ad Hoc Networking" (IEEE-Wiley, 2004), mobile ad hoc networking was seen as one of the most innovative and challenging areas of wireless networking, and was poised to become one of the main technologies of the increasingly pervasive world of telecommunications. In that spirit, our first book presented a comprehensive view of MANETs, with topics ranging from the physical up to the application layer.

After about a decade, we observe that the promise of ad hoc networking never fully realized, and that MANET solutions are not used in people's life. *What happened, and why?*

We start from these questions to write this second book. Our main interests here are

- to highlight the reasons of MANET's failure;
- to illustrate how the mobile ad hoc networking paradigm gave birth to several cutting-edge research directions;
- to present the emerging technologies that derived from MANET, their challenges, and their current development;

- to show that these new technologies successfully penetrated the market and exist in everybody's life.

We initially analyze the reasons of the lack of success of the generic ad hoc technology, and show how the derived new technologies did not repeat the same mistakes:

- The multihop ad hoc networking paradigm is extended to include some infrastructure to provide a cost-effective wireless broadband extension of the Internet. *Mesh networks* constitute the most relevant example of this approach.
- Node mobility is not considered as a problem to face, but as a feature to exploit, allowing the design of a completely new networking paradigm. *Opportunistic networks* constitute one of the most relevant examples in this sense.
- The multihop ad hoc networking paradigm is applied to specialized fields where the self-organizing nature of this paradigm and the absence of a pre-deployed infrastructure are a plus, and not a limitation. Notable examples of this approach are application-driven networks such as *vehicular networks and sensor networks*.

In order to create a common background for understanding the challenges and the results in the field of the emerging networking technologies illustrated in this book, we give general descriptions of their enabling technologies and standards, application scenarios, the need for securing their communications, and their architectural solutions for mobility.

We then present the new challenges and the most advanced research results in mesh networks, opportunistic networks, vehicular networks, and sensor networks.

This book is intended for developers, researchers, and graduate students in computer science and electrical engineering, researchers and developers in the telecommunication industry, and researchers and developers in all the fields that make use of mobile networking, which can potentially benefit from innovative solutions. We believe that this book is innovative in the topics covered, relies on the expertise of top researchers, and presents a balanced selection of chapters that provides current hot topics and cutting-edge research directions in the field of mobile ad hoc networking.

We take this opportunity to express our sincere appreciation to all the authors, who contributed high-quality chapters, and to all invited reviewers for their invaluable work and responsiveness under tight deadlines. A special thank goes to the Associate Editor of Wiley-IEEE Press, Mary Hatcher, who has been truly outstanding in supporting us through all the book construction phases, and to the teams at Wiley and Thomson Digital.

Enjoy your reading!

STEFANO BASAGNI
MARCO CONTI
SILVIA GIORDANO
IVAN STOJMENOVIC

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