

# Preface

Wireless ad hoc sensor networks have recently become a very active research subject as well as a topic of rapid technological progress and large-scale practical development and application activities. However, a solid foundational and theoretical background seems still necessary for sensor networking to achieve its full potential. The provision of relevant abstract modeling, novel algorithmic design, and analysis methodologies toward efficient and robust realizations of such very large, highly dynamic, complex, non-conventional networks is a challenging task for the theoretical computer science community (and that of distributed computing in particular).

Several models, algorithms, and interesting research results have already appeared, in specialized and generic theory journals, conferences and workshops. This book aims to reinforce the emergence of a critical mass of theoretical and algorithmic foundations by bringing together, for the first time in a systematic way, high-quality research contributions (invited book chapters) by leading experts worldwide relevant to important algorithmic and complexity-theoretic aspects of wireless sensor networks and related ad hoc network types.

The intended audience of this book includes researchers and advanced graduate students working on sensor networks and the broader areas of wireless networking and distributed computing, as well as practitioners in the relevant application domains interested to obtain a broader foundational perspective and insight. The book can also serve as a text for advanced university courses and research seminars.

The book is structured into eight themes covering respective common aspects, issues, and methodologies. This division is rather indicative; because of the inherent relations of different topics, layers, and problems, many chapters could be associated to more than one theme, and the themes themselves could have been chosen in a different manner. Still, we hope that the particular structure will be methodologically useful for the reader.

We now briefly describe each theme. The first one discusses characteristic challenges for distributed sensor networking; although the perspective stems from systems methodologies, the implications to algorithms and theory are relevant.

The second theme presents current abstract modeling proposals for sensor networks related to different layers (physical, network), diverse (yet highly related) aspects such as the topology management and mobility plane, as well as the important aspect of network coding.

The next theme concerns basic primitives for distributed computing in sensor networks such as localization, time synchronization, and decentralized coordination. Efficient distributed solutions to such primitives are necessary for higher layer network services, such as the (rather canonical) problem of data routing. Data routing (and information dissemination, more general) is studied in the fourth theme, in terms of both propagating data to a sink destination as well as collecting data from the network nodes.

The fifth theme covers one of the most important challenges in sensor networking, that of energy optimization. Different aspects of energy management are addressed, such as prolonging the network lifetime via probabilistically optimized routing decisions as well as via mobility optimization. This mobility-based approach nicely connects to the next theme which addresses mobility and its complications; also, how to exploit mobility anyway present in the network to, e.g., optimize information spreading.

The important aspect of security in sensor networks is investigated in the seventh theme by addressing complementary aspects, such as the efficient distribution and management of secure keys. The book concludes with an interesting more practical theme on characteristic applications and representative tools for programming sensor networks, as well as the discussion of a use case scenario in the context of a Future Internet perspective.

We hope that this book will be helpful to its readers and contribute to a solid foundation and deeper understanding of the fascinating and rapidly evolving research area of distributed sensor networking.

Patras, Greece  
Geneva, Switzerland  
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Sotiris Nikolettseas  
José D.P. Rolim