After that introductory part, the authors characterize in more detail different technical aspects. As this research field is in its infancy, various trade-offs and controversies arousing around potential solutions are discussed. Chapter 4 covers the main DTN-related end-to-end protocol (i.e., the bundle protocol idea). Except for general requirements that must be met, the description of the version proposed by the DTNRG is given. On the other hand, in Chapter 5 a protocol to be used link by link is dealt with. It is called the Licklider Transmission Protocol (LTP). Apart from presentation as in the preceding chapter (requirements and some aspects of the IRTF proposal), a few details on three different implementations of LTP are provided. Then in Chapter 6 illustrations of potential protocols for different layers of DTNs are given. Although most of these protocols are rather critically or historically treated (the exception is the transport layer version of LTP) as not fully conforming to the DTN idea, the chapter is quite illuminating, as it allows a reader to better understand the specificity and requirements of the presented paradigm.

Chapter 7 shows some examples of DTN applications. Unlike the presentation given in Chapter 3, now the authors can focus on more detailed issues. For instance, in the description of the lake water quality monitoring system the detailed characterization of the sensor nodes, power budget, and transport conditions is performed. It is a certain deficiency of the presentation that the implementation is not finished, and not all problems have been solved so far. Thus, sometimes the authors cannot be conclusive. However, it is admirable that they elaborate on what should be avoided when a DTN is being implemented. We can only complain that unfortunately some figures are not very legible, which sometimes diminishes the value of the presentation. The next chapter concentrates on challenging problems for DTNs. Those are mainly routing and security. Chapter 9 concludes the book.

Although the book is very short, the overall feeling is very positive. It seems possible that even a person with no knowledge of the DTN topic can find this area interesting and gain some expertise to be able to start his/her own research. Many issues are very interestingly explained from scratch. It is performed in a very compact way, although showing much knowledge and experience. Some very specialized problems, such as astronomy-related ones, are explained to enable a reader, who is presumably a networking specialist, to understand the presented examples. A comprehensive list of problems is addressed: routing, transport mechanisms, and dependability. Broad literature resources and Web pages referring to almost all of them are given. The publication is written in clear and elegant language, with a balanced sense of humor. The book can be recommended for researchers, academics, students, and networking practitioners.

**Wireless Sensor Networks: Technology, Protocols, and Applications**


**Reviewer: Pawel Kulakowski**

The book Wireless Sensor Networks: Technology, Protocols, and Applications, written by Kazem Sohraby, Daniel Minoli, and Taieb Znati, is a survey of topics related to a very important subject: wireless sensor networks (WSNs). The authors concentrate mainly on transmission protocols and network management systems. They describe numerous solutions concerning WSNs, proposed in conference and journal papers over the last decade. This monograph can be treated as a compendium in the area of protocols, middleware, and operating and management systems for WSNs. However, the reader is not bored with the details: the presented concepts are explained briefly but clearly, also for an inexperienced audience.

WSNs (i.e., networks of sensors equipped with radio transceivers) are not an easy subject about which to write a book. There are great expectations, especially in the scientific community, that WSNs will become pervasive and perform many tasks in our everyday life (environmental monitoring, patient tracking in hospitals, security in office buildings, traffic control, etc.). On the other hand, there are severe problems, like the cost of wireless nodes and the lifetime of their batteries, that make this vision distant. Moreover, there are many planned applications for WSNs. As their requirements are usually completely different, it is not possible to define a unique standard for WSNs. The authors of this book do not discuss these issues; rather, they concentrate on existing techniques and solutions.

*(Continued on page 44)*
The whole book is organized as follows. The first three chapters are nonspecific and provide a general view on WSNs. In Chapter 1 wireless sensor networks are introduced, and the challenges in their development are briefly characterized. A historical survey of WSNs is also presented. In Chapter 2 possible applications of WSNs are listed. A few existing implementations are described. The basic functions of sensor nodes and their components are addressed in Chapter 3. Their classification as well as design requirements are also included.

In the next four chapters the authors illustrate standards and techniques that can be applied to WSNs in the first four layers of the ISO/OSI network model. In Chapter 4 the emphasis is on the radio channel issues. The basic radio propagation phenomena are provided in a very simple way. Then the popular standards for wireless communications are summarized and referred to in terms of WSN constraints. At the end of this chapter, an appendix with some general information about modulation techniques is included. Chapter 5 deals with MAC protocols. Well-known techniques such as CDMA, ALOHA and CSMA are briefly explained, and a few protocols designed specifically for WSNs are described. In order to highlight the specificities of WSNs, two cases — the S-MAC protocol and 802.15.4 standard — are studied in greater detail. Consequently, routing algorithms are covered in Chapter 6. As in other chapters, some fundamental information is provided first, and then techniques for WSNs are investigated. Since sensor nodes often know their locations to transmit properly tagged data about their environment, this information can be used to design more efficient location-based routing protocols. In the presented algorithms, such as SPIN, LEACH, or PEGASIS, the emphasis is on energy saving schemes, as it is the major constraint in WSN. Chapter 7 has a similar structure as Chapter 6, but addresses issues of transport protocols. Protocols like CODA, RMST, and GARUDA are considered, and their performance is discussed.

The last four short chapters focus on high-level mechanisms of WSNs. Chapter 8 deals with the idea of middleware for WSNs (i.e., system services that mediate between WSN network protocols and applications). The architecture and functions of WSN middleware are explained, and some examples known from the open literature are provided. Issues of WSN management are covered in Chapter 9. Common management protocols like SNMP are contrasted with MANNA, an example of a management architecture dedicated to WSNs. The next chapter describes operating systems for wireless sensor networks. The most popular one, TinyOS, as well as other systems, like Mantis, EYES OS, and SenOS, are briefly presented. Finally, in the last chapter the overall performance of WSNs is analyzed. Specific metrics appropriate for WSNs are listed, and some models for evaluating the effectiveness of radio transmission are shown.

The book seems to be written for people who want to understand the overall potential and some predictions about wireless sensor networks. Most of its content is very general: vague opinions are presented rather than strict scientific concepts and techniques. Admittedly, Chapters 5–8 and 10 present the protocols and systems designed for WSNs, but they are only listed and briefly described; there is no detailed analysis of these techniques. Much attention is devoted to the well-known techniques and protocols used in other wireless systems. The authors lack an integral view on the subject of WSN: the described protocols are treated separately, without cross-layer interconnections. This book can be considered an introduction to wireless sensor networks.