Chapter 14
Wireless Sensor Networks:
Data Packet Size Optimization

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ABSTRACT

This chapter presents the studies and analysis on the approaches, the concepts, and the ideas on data packet size optimization for data packets transmission in underwater wireless sensor network (UWSN) and terrestrial wireless sensor network (TWSN) communications. These studies are based on the related prior works accomplished by the UWSN and TWSN research communities. It should be mentioned here that the bulk of the studies and analysis would be on the data packet size optimization techniques or approaches rather than on the communication channel modeling, but the channel model is deemed essential to support the optimization approaches. The various optimization solutions proposed in the prior arts are dealt with in depth to explore their feasibilities to accommodate the data packet size optimization algorithm proposed by the various researchers. This chapter starts off with the studies and analysis on prior arts found in UWSN and then moves on to the similar works found elsewhere in the TWSN communications counterparts. A comparison on some important issues related to data packet size optimization approaches used in UWSN and TWSN communications are summarized in a table at the end of this chapter. The findings in this chapter may be helpful to readers who are interested in the R&D of data packet size optimization techniques with the intention to formulate new data packet size optimization framework or algorithms.

INTRODUCTION

It is a known fact in WSN that the data packet size could directly affects the reliability and the quality of the communication between the wireless nodes. For instance, with a certain level of link quality, long packet sizes may be more susceptible to data bits corruption than shorter sizes thus demanding a higher frequency of data packet retransmissions. On the other hand, short packet sizes may increase data transmission reliability since the chances of bit errors over the link are less, but too short a packet size may not be efficient in the context

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of data payload carrying capacity because of the standardized data packet overhead. The ultimate goal of communication between any nodes in WSN is to ensure a successful and efficient delivery of data packets from a source node to a sink node based on certain performance metrics of the network. Data packet size optimization is considered one of the strategies that can be used in WSNs to fulfill that goal.

With the many unique characteristics of WSN affecting the performance of the communication link, the strategies and approaches use to determine the optimal data packet size for effective and efficiency data transmission remains a fundamental problem that needs more in depth research and investigations. In general WSNs can be classified into two broad categories of UWSN (which uses acoustic waves for data transmission) and TWSN (uses radio/terrestrial waves) in which each category comes along with its own unique characteristics. The differences between these characteristics are vastly related to the type of media used to relay the data packets wirelessly among the sensor nodes. Based on these differences, presented in this chapter are several works on data packet size optimization in underwater WSN and terrestrial WSN. The data packet size optimization approaches to be discussed in this chapter are divided into two broad categories. The first category is on data packet optimization for underwater wireless sensor network communications and the second category is about data packet optimization deployable in terrestrial wireless sensor network environment. Three packet size optimization approaches would be discussed and analyzed for each of these categories.

The main objective of this chapter is to expose to readers, who are interested in WSN data transmission, on some of the important R&D works accomplished by the related research communities in data packet size optimization for WSNs data transmission. More specifically, at the end of this chapter the reader should be able to:

1. Understand the different data packet size optimization approaches that may be deployable in UWSNs and TWSNs.
2. Comprehend the performance metrics used in each of the optimization approaches.
3. Understand the important effect of optimal data packet size on the WSNs performance.
4. Know the important comparison between underwater wireless communications and terrestrial wireless communications.
5. Identify the possible research directions for packet size optimization based on other UWSN and TWSN performance metrics or the hybrid of these metrics.

Next section presents a brief description on three approaches that may be used for optimizing data packet size in UWSN and TWSN respectively. The section also highlights the optimizing parameters/metrics used in each of the approaches.

BACKGROUND

Data packet size can be optimized based on different wireless link (communication) criteria. There may not be one best solution to optimize the packet size simply because of the various unique characteristics in WSN data transmission. Therefore there exists several different ways or techniques, as proposed by different researchers, to determine optimal packet size in the context of effective and efficient data packet transmission in wireless data communications. In this section three different data packet size optimizing approaches and their related performance metrics/parameters would be briefly explained for UWSN and TWSN respectively.

1. Data Packet Optimization in UWSN Communications
    a. **Optimal data packet length qualified by maximum throughput efficiency:** In this approach the optimal data