

Chapter 16

Wireless Sensor Network: Quality of Service (QoS) Issues and Challenges

Noor Zaman

King Faisal University, Saudi Arabia

Azween Abdullah

University Technology PETRONAS, Malaysia

Khalid Ragab

King Faisal University, Saudi Arabia

ABSTRACT

Wireless Sensor Networks (WSNs) are becoming common in use, with a vast diversity of applications. Due to its resource constraints, it is hard to maintain Quality of Service (QoS) with WSNs. Though they contain a vast variety of applications, at the same time they are also required to provide different levels of QoS, for various types of applications. A number of different issues and challenges still persist ahead to maintain the QoS of WSN, especially in critical applications where the accuracy of timely, guaranteed data transfer is required, such as chemical, defense, and healthcare. Hence, QoS is required to ensure the best use of sensor nodes at any time. Researchers are trying to focus on QoS issues and challenges to get maximum benefit from their applications. With this chapter, the authors focus on operational and architectural challenges of handling QoS, requirements of QoS in WSNs, and they discuss a selected survey of QoS aware routing techniques by comparing them in WSNs. Finally, the authors highlight a few open issues and future directions of research for providing QoS in WSNs.

INTRODUCTION

WSN is a wireless network consisting of small nodes with sensing, computation, and wireless communications capabilities (Al-Karaki & Kamal, 2004), operating in an unattended environment,

with limited computational and sensing capabilities. Normally nodes route data back to the base station BS (Akyildiz, Su, Sankarasubramaniam, & Cayirci, 2002a). Data transmission is usually a multi-hop, from node to node toward the base station or gateway. Sensor nodes are equipped with small, often irreplaceable batteries with limited power and computation capacity. Impor-

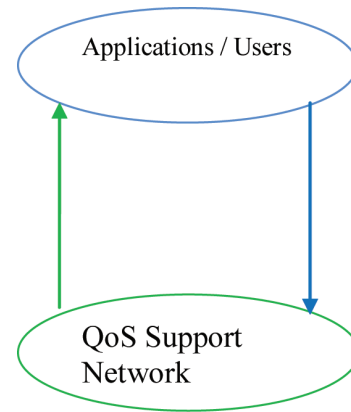
DOI: 10.4018/978-1-4666-0101-7.ch016

tant concern is the network lifetime and QoS as nodes run out of power, congestion may be caused, the connectivity decreases and the network can finally be partitioned and become dysfunctional (Akyildiz, Su, Sankarasubramanian, & Cayirci, 2002b), (Bhardwaj & Chandrakasan, 2002), (Ettus, 1998), which directly involved to reduce the QoS of network. The minimum energy routing problem linked to QoS has been addressed in (Rodoplu & Meng, 1999), (Estrin, Govindan, Heidemann, & Kumar, 1999), (Hac, 2003), (Wood & Stankovic, 2010), (Sadek, Su, & Liu, 2007), (Sadek, Su, & Liu, 2010). The service is bound to the data and to the application QoS vs. QoI (Quality of Information), QoS_u (Jeong, Sharafkind, & Du, 2009) (Quality of Surveillance) and data delivery can be continuous, event-driven, query-driven, or hybrid. An important concern is the QoS of network. QoS model can be defined as under, what the users have required from the network. User demands for guaranteed data transfer timely, guaranteed bandwidth in case of image and video data, data accuracy timely in case of any critical applications such as defense or health application. Resulting sensor nodes' network must satisfy requirements of users as shown in figure 1 with QoS simple model.

RELATED WORK

Quality of Service (QoS) always has very key role for all types of applications in networks, including conventional, wireless ad hoc and wireless sensor network. QoS routing is performed usually through resource reservation in a connection oriented communication in order to meet the QoS requirement for each individual connection. While couple of different mechanisms have been proposed for routing QoS constrained image and video type of data in wire based network (Lee et al, 1995)(Wang & Crowcraft, 1996)(Ma & Steenkiste, 1997)(Zhang, et al. 1993)(Crowley, et al., 1998), they cannot be directly applied to wireless sensor network,

Figure 1. QoS model of WSN (Bhuyan, et al., 2009)



because of its different architecture, structure and resource constraints. Therefore several new protocols have been proposed for QoS routing in wireless networks taking the dynamic nature of the network into account (Querin & Orda, 1997) (Chen & Nahrstedt, 1999)(Srivakumar, et al., 1998)(Lin, 2000)(Zhu & Corson, 2002). Some of the proposed protocols consider the imprecise state information while determining the routes (Querin & Orda, 1997)(Chen & Nahrstedt, 1999).

QOS REQUIREMENT IN WSN

Requirements of QoS in wireless sensor networks is different from wired networks. e.g. traditional end-to-end QoS parameters may not be sufficient to describe them with WSN. As a result, new parameters are used to measure the QoS performance in WSN (Jaballah & Tabbane, 2009). The existing researches related to the QoS in WSN can be classified in three categories (Chen & Varshney, 2004): traditional end-to-end QoS, reliability assurance, and application-specific QoS. QoS always have very important role in all types of network, including conventional, wireless ad hoc and wireless sensor network. QoS routing is performed usually through resource reservation in a connection oriented communication in order

7 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:

www.igi-global.com/chapter/wireless-sensor-network/62744

Related Content

Energy Efficient Clustering using Modified Multi-Hop Clustering

Vimala M. and Rajeev Ranjan (2019). *International Journal of Wireless Networks and Broadband Technologies* (pp. 18-30).

www.irma-international.org/article/energy-efficient-clustering-using-modified-multi-hop-clustering/243659

An Overview of Cognitive Radio Networks: A Future Wireless Technology

Pooja Joshi and Ashish Bagwari (2019). *Sensing Techniques for Next Generation Cognitive Radio Networks* (pp. 1-26).

www.irma-international.org/chapter/an-overview-of-cognitive-radio-networks/210266

A Cross-Layer Predictive and Preemptive Routing Protocol for Underwater Wireless Sensor Networks Using the Lagrange Interpolation

Manel Baba Ahmed, Moussa Ali Cherif and Sofiane Boukli Hacene (2021). *International Journal of Wireless Networks and Broadband Technologies* (pp. 78-99).

www.irma-international.org/article/a-cross-layer-predictive-and-preemptive-routing-protocol-for-underwater-wireless-sensor-networks-using-the-lagrange-interpolation/282474

Impact of Frame Duration and Modulation Coding Schemes With WiMAX Bandwidth Asymmetry in Transmission Control Protocol Variants

Kailash Chandra Bandhu and Ashok Bhansali (2019). *International Journal of Wireless Networks and Broadband Technologies* (pp. 35-45).

www.irma-international.org/article/impact-of-frame-duration-and-modulation-coding-schemes-with-wimax-bandwidth-asymmetry-in-transmission-control-protocol-variants/237190

An Integrated GIS and Knowledge-Based Automated Decision Support System for Precision Agriculture Using IoT

Raja Lavanya, G. Vinodh Chakkaravarthy and P. Alli (2020). *IoT and WSN Applications for Modern Agricultural Advancements: Emerging Research and Opportunities* (pp. 86-98).

www.irma-international.org/chapter/an-integrated-gis-and-knowledge-based-automated-decision-support-system-for-precision-agriculture-using-iot/231106