QoS Challenges in Wireless Sensor Networks

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Abstract: Quality of Service (QoS) in Wireless Sensor Networks (WSN) is an interesting research topic in the field of computer networks. Many WSN based applications in different allied domains require the support of QoS. However, the development of sensor networks needs to take care of various factors such as: fault handling, increase/decrease in number of nodes, limited hardware capabilities, change in network behavior and energy usage. One of the significant factors is QoS for WSN. In this paper, a comprehensive survey on technologies that provide QoS support for WSN is presented. The QoS challenges in WSN are also discussed. The paper also presents WSN based applications in different domains that require QoS support.

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INTRODUCTION
Quality of Service (QoS) in Wireless Sensor Networks (WSN) is an interesting research area. The QoS is a set of parameters to be satisfied while transmitting data packets from one to another host. The “reliability, robustness, energy, timeliness, availability, security, throughput, end-to-end delay, jitter and packet loss rate” are the important parameters of QoS in WSN.

The QoS considered by different technical communities refers to quality as perceived by the user or application. The QoS is a measure of service quality that the network offers to the end user or application. It is a set of important parameters to be addressed by the network while transporting data packets. In other words, QoS is a quantifiable service delivered to network applications. The QoS can be characterized by packet loss, bandwidth, end-to-end delay, etc. The QoS methods are classified into reservation of networks resources and classification of network traffic. In the first method, handshaking protocol is used to reserve network resources in each node along the path from source to destination. In the traffic classification method, the packets are classified into different classes of service depending on the application needs.

In this paper, a comprehensive survey of technologies that provide QoS support in wireless sensor networks and QoS challenges in wireless sensor networks are presented.

The remaining part of the paper is organized into 4 sections. Section 2 reports technologies on QoS in wireless sensor networks. The QoS challenges in WSN are discussed in section 3. The applications of WSN are given in 4. Finally the paper concludes the work in section 5.

TECHNOLOGIES ON QOS IN WIRELESS SENSOR NETWORKS

The technologies that provide quality of service in wireless sensor networks are summarised in the following. (Joseph E. Mbowe, 2014) described a method on QoS considering parameters such as delay, throughput and jitter for Wireless Sensor Networks. (Sivakumar et al., 2015) proposed a method on QoS routing for Wireless Sensor Networks that maximizes the network lifetime and increases energy efficiency. (Hang Shen, et al., 2013) proposed a method on QoS-Aware Multi-sink Opportunistic Routing for sending multimedia information to reduce energy usage, delay and increase reliability. (Noufal. K.P, et al ., 2015) described a method on QoS Performance in Wireless Sensor Networks. The QoS performance is considering single node energy consumption, node life time, end to end delay and network lifetime.

Saad Ahmad Khan et al., 2009 described a method to for reliable packet delivery service WSN. (Ghalib A. Shah, et al.) presents cross-layer design for QoS in Wireless Multimedia Sensor Networks. The method aims to increase network lifetime and perform admission control of low priority nodes.

Ipsita Panda October, 2012 described a WSNs Routing Protocol and performance analysis to Improve QoS. (Middela Shailaja) described a method on defect identification in WSN.

After the thorough study of literature it is observed that, several challenges/issues needs to be addressed in providing QoS in WSN for applications that deal with text and multimedia data transmission. The identified challenges are described in the ensuing section.

QOS ISSUES/CHALLENGES IN WSN

The QoS challenges for WSNs are as follows:

- Limited Resources: WSNs suffer from lack of sufficient resources such as: low bandwidth, less memory, less processing capability and limited transmission power.
- Traffic Asymmetry: Monitoring traffic where the data move from end nodes to the sink either periodically or a periodically is necessary in WSN.
- Dynamic Network Nature: The Dynamic Changes In The Network Behaviour Results Into Change In The Topology.
- Redundant Data Transmission: Multiple sensor nodes may send the same data especially in densely populated WSNs.
- Scalability: The addition and deletion of nodes may happen due to new node entering into the environment or a node dies due to battery drain.
- Multiple Sinks: Some WSN-Based Monitoring Applications May Need Multiple Sink Nodes, To Gather Different Information’s From The Sensor Nodes.
- Reliability: The transmission reliability is an important index of QoS to calculate the probability of correct transmission.
- Energy Consumption: The energy required for data to be sent from any sensor node to the sink.
- Bandwidth: The capacity of a network for data transmission and reception.
- Delay Metric: The time elapsed for a data packet from the source node to the destination node
- Throughput: The number of bits that can be transmitted by each node to its destination
- Timeliness: Timeliness refers to the occurrence of events at suitable instants of time.

APPLICATIONS

Some of the applications of wireless sensor networks are described below.

- Military: WSNs play many important roles in military system and can be deployed to make future wars with less human intervention.
- Health Monitoring: WSN networks can be used for inspecting health of people at regular time intervals for reducing the cost of maintenance.
- Environment Monitoring: WSN networks can be deployed for weather monitoring, wild life monitoring and disaster monitoring and control etc.
- Home Applications: WSNs can provide more convenient living environment for people. Sensors can be embedded inside the home objects which can interact with each other and can be controlled through internet.
- Other Commercial Applications: Some important commercial applications: smart office, smart house, intelligent traffic control etc.,

CONCLUSION

Wireless sensor network is a set of nodes randomly deployed in environmental area. The performance of the networks is determined using QoS parameters. Many techniques have been developed for performance improvement of network. Many routing and energy management methods have been designed for WSNs where energy consumption and memory are challenging issues. The flexibility, fault handling, easy deployment characteristics of WSNs create applications in many domains. In the future, the WSN technology will become an integral part of our lives. However, these technologies needs to take care of the constraints introduced by factors such as fault detection and handling, dynamic network changes, cost, limited hardware capabilities, and energy management.

REFERENCES AND NOTES

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