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A Study of Delay Reliability Tradeoff in Wireless Sensor Network

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Abstract: The recent study in Wireless sensor network (WSN) has produced a good number of protocols, mechanisms and schemes but reliable and on time communication is still the challenging problem in these networks. Therefore, in WSN applications, it is essential to use precise mechanisms, schemes and protocols in order to these communication challenging issues and discuss the desired minimum delay and reliability objectives. In this paper we study the comparison of both end to end delay and reliability is studied and proposed a scheme to improve the reliability by increasing the number of transmission threshold. Furthermore we also discuss the bit errors in the transmission phase and resend only the failure packs to avoid long delay in the retransmission. Simulation results are shown to illustrate the benefits of our proposed scheme.

Key words: Wireless Sensor Networks · Quality of Services (QoS) · Reliability

INTRODUCTION

In the last few years Wireless sensor Network has got much attraction of the researchers and have come with excellent applications such as observing harsh surroundings and defending national boundaries. While providing real-time application with required reliability is the most challenging issue in such networks which results in the long delay of data packets [1]. The complexity of Wireless sensor network increases when providing delivery with less delay for heterogeneous traffic and dynamic changes of network with different quality of service requirements [2, 3]. [4] A delay maintenance scheme is proposed to provide guaranteed End to End delay by increasing the transmission energy. But here they did not consider the reliability in case of transmission failure [2]. In particular, the sinks need accurate data from the sensor nodes to execute corresponding actions where reliability and delay are important concerns in the sensor communication [5].

[6] A multi objective approach is proposed based on slicing communication range in order to compromise on three contradictory goals of sensor networks where the range of communication is decomposed into circular groups and categorize them to achieve the aim of minimum end to end delay, consumption of energy and depletion [7]. The problem of reliability is still left open here as to reduce delay and to maximize the network lifetime a remarkable effect utters on the data delivery.

In this paper we discuss the comparative study of delay and reliability and propose a technique for both reliable communications and data retransmission in wireless sensor network.

Related Work: EDCA in IEEE 802.11 has presented significant enhanced performance in delay [8]. [9] Over IEEE 802.11 network a deadline-aware adaptive retry limit approach has been proposed for video streaming. The method time stamp has been used for preventing out-dated packet retransmission and which performs very well in terms of channel utilization, packets loss but packet length of the node, density and channel error are not taken into account. [5] A very much related framework is addressed for the process of event reporting and data integrating in order to achieve the required reliability. In this approach they come with a technique which removes the redundancy of events data after aggregating data and is then forwarded to actuators. But they have not considered the energy consumption in filtering process which can cause the increase in delay and packet loss ratio [10]. Proposed a code attestation probability model to analyse the energy consumption and the effect of code attestation false positives and false negatives, in order to improve reliability and lifetime of sensor nodes. But here the delay factor is not considered as it is the most important part of a sensitive network like intrusion detection system.

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The reliability of a network can be increased by increasing the number of retransmission threshold [11]. But with increasing the number of retransmissions the delay gets affected and is maximized [12]. This is a good approach proposed to provide reliable communication by using the coding technique combination with broadcasting channels. However they only consider this technique for general class of applications [13]. A DR-BP protocol based on transmission power Control technique is proposed here for to provide the reliable data delivery in vehicle networks with guaranteed delay. In the proposed scheme, they only consider selected relay vehicle to transmit power and forward time varying.

Proposed Scheme: In the proposed scheme we come up with the retransmission threshold (RTT) of packets in order to provide reliability. The RTT is controlled by defining the RTT value for all the nodes in the network in case of transmission failover. If transmission failover or a packet fails to be sent to a node the sender node will have to retransmit it by using the RTT value. It can cause the end to end delay to be higher but guarantee the reliable data delivery to the receivers. We assume a network which requires high reliability while it can compromise on end to end delay. The RTT scheme is used to achieve the required reliability as RTT will be on the basis of competing number of sensor nodes and the value of SNR.

Network Model: In our proposed approached we assume the network of N nodes deployed in the 200 by 200 M area, where the reliability is the targeted QoS parameter of our proposed approach and network is assumed to accept a small increase in the end to end delay but to provide the reliable communication. The packet loss ratio is controlled by increase the number of retransmission of packets in case of an error in transmission. With the low value of RTT in the network can provide the reliable communication with respect to both packet loss and end to end delay but as the real network application can have noise overheads and transmission errors. So to avoid the loss in the packet delivery we increase the RTT value. In the retransmission phase we focus on the forwarding only the failure packets and ignore the control packets as it also causes the delay in processing.

Simulation parameters (NS2)

Parameter	Value
Area	200 × 200 M
Number of nodes	20
Data Rate	1 Mbps
PHY Header	24 Bytes
MAC Header	28 Bytes
Packet size (ACK)	14 Bytes
Slot Timing	20 µs

Simulation Results: The simulation tool NS2 has been to get the results the experimental results which are shown in Fig 1 and Fig. 2 for delay and packet loss respectively. It is seen that when with the increase of RTT the reliability gets improved Fig (1) while at the cost of end to end delay as shown in Fig. (2).

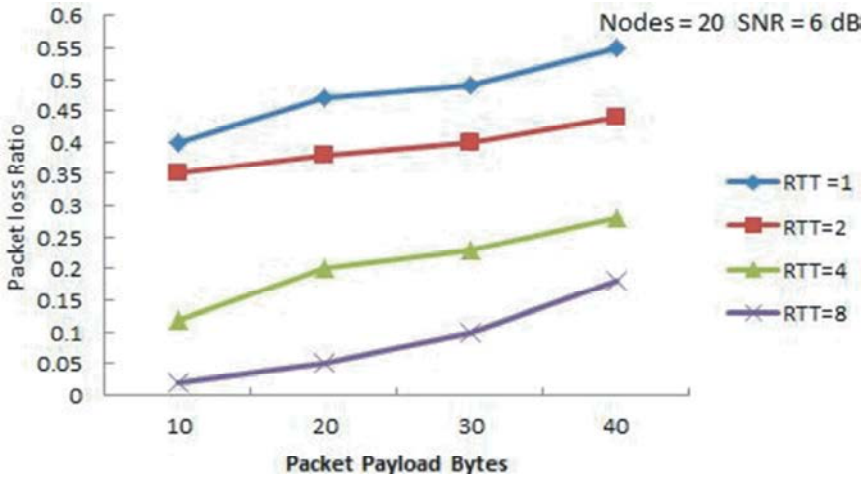

Fig. 1. Packet loss ratio with different number of retransmissions

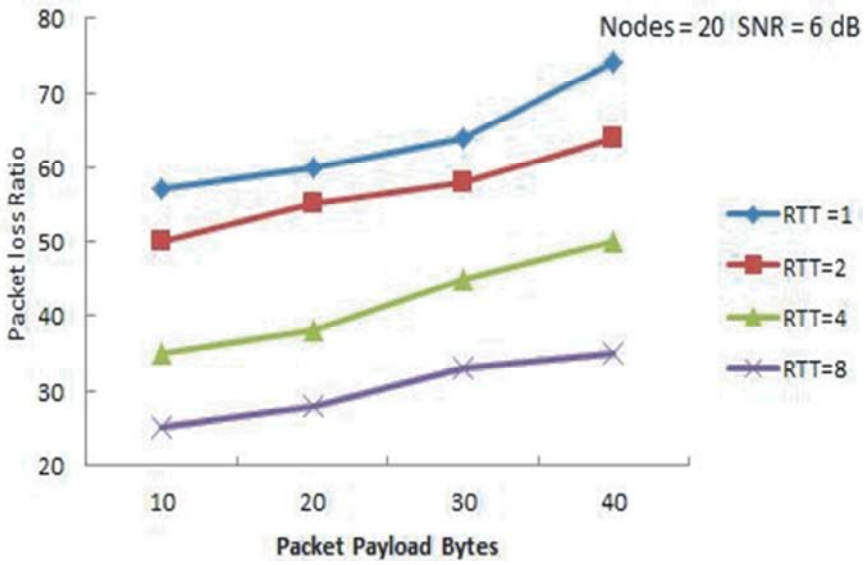

Fig. 2. Average Delay with different number of Retransmissions

Conclusion and Future Work: WSNs have got much more attraction of scholars in various disciplines. The key and important aim of using Wireless sensor network is its wide coverage of valuable applications as sensors have capability of interaction with the environments by accomplishing essential parameters. In this paper we have studied the comparison of QoS parameters reliability and delay in Wireless sensor Network. To provide both reliable and on time communication is the most challenging issue in such networks which requires more research work and new protocols, techniques or standard should be developed to solve this problem. Our future work will focus on providing real time and reliable communication in wireless sensor network. Furthermore we also aim to consider the energy with our future work as it is also an important parameter and has much concern with the above mentioned both parameters.

Conflict of Interest: The authors declare no conflict of interest

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