Review on Enhanced Multi-Queue Packet Schedular Scheme for Wireless Sensor Network

Shital L. Bansod, Sonal Honale

Abstract— Wireless sensor network (WSN) applications heavily rely on information being transmitted in a timely manner. In such sensor networks, packet scheduling plays a vital role in reducing end-to-end data transmission delays. Developing packet scheduling algorithms in wireless sensor networks can efficiently enhance delivery of packets through wireless links. Packet scheduling can guarantee quality of service and improve transmission rate in wireless sensor networks. It is the process used to select which packet to be serviced or which to be dropped based on the priority such as real time packet and non-real time packet. This paper deals with various packet scheduling algorithms. Wireless sensor network has a different packet scheduling strategy and each has their own advantage and disadvantage. This paper brings a survey on algorithm which provides priority based scheduling and its application.

Index Terms— Wireless Sensor Network, Packet scheduling scheme, Non-preemptive priority scheduling, Preemptive pocket scheduling scheme, Real-time, Non-Real-time.

I. INTRODUCTION

Wireless sensor networks is an vast area of research and has many design issues like data aggregation from source node to base station and routing protocols which deals with data transmission, data packet scheduling, sensor energy consumption. Based on above criteria we talk about important concept, Data packet delivery based on priority and fairness with minimum latency. In this paper we will be dealing mainly with packet scheduling based on priority. According to the application, real-time data packet should be given higher priority and non-real-time data packet should be given less priority. Packet scheduling is a process defined as decision making to select or drop the packet. Dropping of packet will depends on some the characteristics of network such as packet size, bandwidth, packet arrival rate, deadline of packet. Scheduler is used to schedule the packets. Schedulers will have hard time to handle when all packets coming in with high packet rate, when bandwidth is too low and packet size is large. The scheduler will make decision to select the packets based on various algorithms. It is by default that not all packets may reach the base station or destination. Some of the packets may be dropped along the way with respect to the above previously mentioned effect of network characteristics. So the algorithms have been selected for the survey based on various factors like priority, preemptive, non-preemptive, deadline, packet type and number of queues. Various Packet scheduling algorithms are applied mainly to guarantee packet data quality of service and transmission rate in wireless sensor networks [1].

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Ms. Shital L. Bansod, Wireless Communication and Computing, ABHA college of engineering, Nagpur, India.
Prof. Sonal Honale, Wireless Communication and Computing, ABHA college of engineering, Nagpur, India.

II. LITERATURE REVIEW

Scheduling data packets at sensor nodes are important to prioritize applications of wireless sensor nodes. Scheduling data packets as real-time and non-real time at wireless sensor nodes decreases the processing over-head, reduces the end-to-end data transmission delay and saves energy consumptions of packets [9]. Data sensed as real time application are given high priority than non-real time data. There exist wide range of study and research on scheduling the sleep-wake times of sensor nodes have been performed [1]–[18], but only a small number of studies subsist in the literature on the packet scheduling of sensor nodes that schedule the dealing out of data packets presented at a sensor node and also reduces energy consumptions[19]–[22]. But, most commonly used task scheduling algorithm in wireless sensor networks is First Come First Served (FCFS) scheduler algorithm in which the progression of data packets takes place based on arrival time and thus it takes more amount of time to be delivered to a appropriate base station (BS). However, to be clearer, the sensed data should reach the base station within exact time period or before the expiration of a deadline. In addition to that, real-time emergency data should be delivered to base station with the minimum possible end-to-end delay. Hence, the intermediate nodes call for changing the delivery order of data packets in their ready queue based on their significance such as real or non-real time data packet and delivery deadline of packet. But First Come First serve algorithm is inefficient with regard to end-to-end delay and sensors energy consumptions. In existing wireless sensor networks task scheduling algorithms do not accept traffic dynamics since intermediate nodes need data order delivery change in their ready queue based on priorities and delivery deadlines. Management of bandwidth is also important and necessary to avoid network congestion and poor performance. Packet scheduling technique maximizes bandwidth utilization. The Scheduler for packet scheduling ensures that packets are transmitted from the queue buffer. There are wide ranges of scheduling techniques which include random scheduling, round robin scheduling, priority scheduling and weighted fair queuing scheduling. It emphasizes rules in link-bandwidth sharing. Wireless sensor networks use fair queuing scheduling algorithms for a share of link capacity to guarantee multiple packet flow [5]. The buffer helps the queuing system, where data packets are stored until transmission takes place. In fair queuing scheduling technique it accounts for data packet sizes thereby ensures that each flow has equal chance in transmitting equal amount of data in network. Weighted fair queuing is one of the fair queuing scheduling techniques used in packet scheduling that allows different scheduling priorities to statistically multiplexed data flows here. So weighting is achieved through multiplication of packet size considered by fair queuing algorithms with weight inverse for a related queue. Packet scheduling algorithm

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technique and active queue management service improves network Quality of Service. Furthermore, most existing packet scheduling algorithms of wireless sensor networks are neither dynamic nor suitable for wide range of applications since these schedulers are predetermined and not dynamic but static, and cannot be changed immediately to response for change in the application requirements or environments [24]. For example, in a lot of real-time applications, a real-time priority scheduler cannot be changed dynamically at some point in the function and it is statically used in wireless sensor network applications

III. ANALYSIS ON PACKET SCHEDULING

The In this section, we present existing packet or task scheduling schemes by classifying them based on several factors as is illustrated in Figure 1.

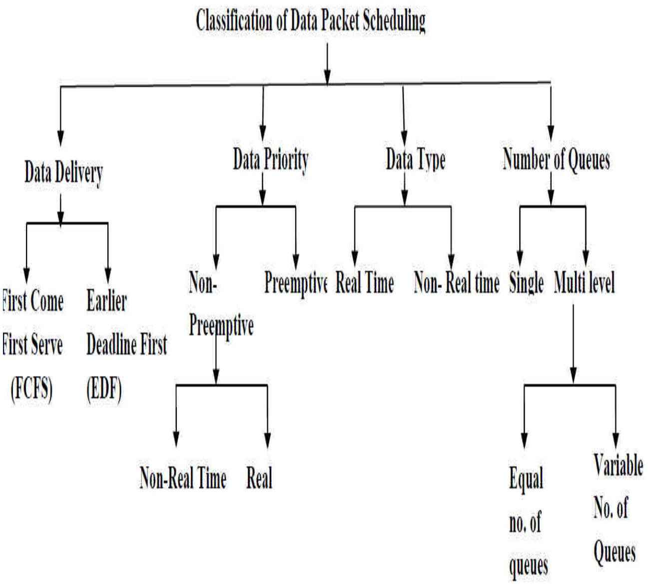

Fig.1 Classification of Packet Scheduling Algorithm.

Packet scheduling schemes can be classified based on various factors such as deadline, priority, types of packets and number of queues. Here in this analysis we will discuss all these factors.

A. Factor: Deadline

Packet scheduling schemes can be classified based on the deadline of arrival of data packets to the base station (BS), which are as follows.

First Come First Served (FCFS): Most existing WSN applications use First Come First Served (FCFS) schedulers that process data in the order of their arrival times at the ready queue. In FCFS, data that arrive late at the intermediate nodes of the network from the distant leaf nodes require a lot of time to be delivered to base station (BS) but data from nearby neighboring nodes take less time to be processed at the intermediate nodes. In FCFS, many data packets arrive late and thus, experience long waiting times.

Earliest Deadline First (EDF): Whenever a number of data packets are available at the ready queue and each packet has a deadline within which it should be sent to BS, the data packet which has the earliest deadline is sent first. This algorithm is considered to be efficient in terms of average packet waiting time and end-to-end delay.

B. Factor: Priority

Packet scheduling schemes can be classified based on the priority of data packets that are sensed at different sensor nodes.

***Non-preemptive*:** In non-preemptive priority packet scheduling, when a packet t1 starts execution, task t1 carries on even if a higher priority packet t2 than the currently running packet t1 arrives at the ready queue. Thus t2 has to wait in the ready queue until the execution of t1 is complete.

Preemptive: In preemptive priority packet scheduling, higher priority packets are processed first and can preempt lower priority packets by saving the context of lower priority packets if they are already running.

C. Factor: Packet Type

Packet scheduling schemes can be classified based on the types of data packets, which are as follows.

Real-time packet scheduling: Packets at sensor nodes should be scheduled based on their types and priorities. Real-time data packets are considered as the highest priority packets among all data packets in the ready queue. Hence, they are processed with the highest priority and delivered to the BS with a minimum possible end-to-end delay.

***Non-real-time packet scheduling*:** Non-real time packets have lower priority than real-time tasks. They are hence delivered to BS either using first come first serve or shortest job first basis when no real-time packet exists at the ready queue of a sensor node. These packets can be intuitively preempted by real-time packets. Though packet scheduling mechanisms of Tiny OS are simple and are used extensively in sensor nodes, they cannot be applied to all applications: due to the long execution time of certain data packets, real-time packets might be placed into starvation. Moreover, the data queue can be filled up very quickly if local data packets are more frequent that causes the discard of real-time packets from other nodes.

D. Factor: Number of Queue

Packet scheduling schemes can also be classified based on the number of levels in the ready queue of a sensor node. These are as follows.

Single Queue: Each sensor node has a single ready queue. All types of data packets enter the ready queue and are scheduled based on different criteria: type, priority, size, etc. Single queue scheduling has a high starvation rate.

Multi-level Queue: Each node has two or more queues. Data packets are placed into the different queues according to their priorities and types. Thus, scheduling has two phases: (i) allocating tasks among different queues, (ii) scheduling packets in each queue. The number of queues at a node depends on the level of the node in the network. For instance, a node at the lowest level or a leaf node has a minimum number of queues whilst a node at the upper level has more queues to reduce end-to-end data transmission delay and balance network energy consumptions.

IV. ENHANCED MULTI-QUEUE PACKET SCHEDULAR SCHEME

It proposes Enhanced multi-queue packet scheduler (EMP) scheme. In the proposed scheme, each node, except those at the last level of the virtual hierarchy in the zone based topology of WSN, has three levels of priority queues. of

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Real-time packets are placed into the highest-priority queue and can preempt data packets in other queues. Non-real-time packets are placed into two other queues based on certain threshold of their estimated processing time. Leaf nodes have two queues for real-time and non-real-time data since they do not receive data from other packets and thus, reduce end-to-end delay Multi-Level-Queue scheduler scheme which use different number of queue according to location of node in the network for non-real time data packets sensed from remote location since they do not get data from other nodes and thus, decrease end-to- end delay.

V. CONCLUSION

In this paper, we propose Enhanced multi-queue packet scheduler for wireless sensor network. This scheme can minimizes end-to-end data transmission delay & average packet waiting time .In Proposed scheme Enhanced Multi-queue (EMP) packet scheduler scheme for Wireless Sensor Networks (WSNs) we can use three-level of priority queues to schedule data packets based on their types and priorities. It can ensure minimum end-to-end data transmission for the highest priority data while exhibiting acceptable fairness towards lowest-priority data. Enhanced multi-queue packet scheduler scheme reduces processing overhead and save bandwidth. We could also consider removing tasks with expired deadline from the medium. We would prevent dead lock from occurrence the EMP scheme.

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Ms. Shital L. Bansod, received has received the B.E (2010) degree in Electronics and Telecommunication Engineering from Sant Gadge Baba Amravati University, Maharashtra, India and pursuing Master of Engineering in wireless Communication and Computing from ABHA College of engineering, Nagpur, Rashtrasant Tukadoji Maharaj Nagpur University, India Her research interests include wireless sensor networks, mobile communication..

Prof .Sonal Honale, has received M.Tech Computer Science and Engineering in (2013) from Tulsidas Gaikwad Patil College of Engineering, Nagpur, Rashtrasant Tukadoji Maharaj Nagpur University, India with a strong interest in Information and technology field

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