Review Paper on Packet Scheduling in Wireless Sensor Networks

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Abstract— In the Wireless sensor Networks when we are dealing with the packets while scheduling, there is always issue of energy consumption & delays in the data transmission from one end to the other. It is important that the order of packets should be correct, means the packets that are having highest priority that should be scheduled first, and the packets having lowest priority that should scheduled at last. Here we are dealing with the Wireless Sensor Networks (WSN) so the packet scheduling is very important factor. Different schemes can be used in packet scheduling like First Come First Served(FCFS), Earliest deadline first(EDF), Priority based scheduler, RACE, DMP, Adaptive task Balancing. In this paper we are discussing different types of packet scheduling techniques that are used in Wireless sensor networks.

Keywords—Non real time, Packet scheduling, Priority scheduling, Real time, wireless sensor network,

I. INTRODUCTION

A wireless sensor networks are the networks where there is collection of thousands of nodes that are connected to each other. The sensors can sense the changes in the network and this information is transmitted to the base station through other nodes. The main issue in the wireless sensor network is of consumption of lot of energy and the delay of the data that is transmitted over the network.

In wireless sensor networks it’s all about time that is taken to deliver the packet to the other node. So here time is very important factor. To reduce the time we have to focus on the priority given to the packets. Basically there are two types of packets that are real time packets and non real time packets. H. Momeni [1] proposed a new approach to task allocation in wireless sensor actor network which guarantee that the task complete their activities before their deadline expires.

Most of the Operating Systems used in the Wireless Sensor Networks use the First Come First Serve [2] technique. The First Come First Serve method processes the data packets on what time they come. The data packets that arrives first that packet should be processed first. So time consumption is a big issue in this scheduling technique. Hence deadline comes into the picture.

The packets should be reach to the destination before its deadline otherwise it’s of no use. Some schemes are processed data packets which is having earliest deadline. So there is less chance of expiration of the deadline of packets. There are also preemptive and non preemptive scheduling schemes. They are based on the priorities. The purpose of a scheduler is to minimize latency, to maximize throughput and resource utilization, and to ensure fairness [3].

The classification of the data packets scheduling should be based on the data delivery deadline, data priority, data type, and the no of queues. A sensor node may need to operate for long periods of time relying on a tiny battery. It is, therefore, important to optimize the energy efficiency of all sensor operations, which include sensing, computation, and communication [4].

The fig. shows the classification of scheduling scheme.

II. PACKET SCHEDULING SCHEMES AND FACTORS

Here are some important concepts in packet scheduling that we have to take in mind. Some factors related to it are described here.

A. Deadline

Every packet that is transmitted over a network that should be delivered to the destination node before its deadline otherwise it will be invalid packet. Based on the deadline there are some schemes for packet scheduling that are based on the arrival time of the packet.
First Come First Serve: First come first serve is a scheme that is based on the arrival time of the packet [6]. If the packet comes first so it should be served firstly. For real time communication this scheme was used. The packets that comes late that should be scheduled at last. So that packet requires more time to reach to the destination. The First Come First Serve is the simplest method but it is time consuming scheme for packets that comes late. The Execution of the FCFS policy is simply managed with a First In First Out (FIFO) queue. When the process is ready it enters the ready queue, its process control block is linked on the tail of the queue [7].

Earliest Deadline First: Earliest Deadline First is the dynamic scheduling algorithm used for the real time applications. Every packet having its deadline and before its deadline the packet should be transmitted. In this scheme the data packet which is having earlier deadline that packet scheduled first. This algorithm is considered as efficient algorithm than the FCFS.

Lu C. et al. [8] proposes a real-time communication architecture for large-scale sensor networks, whereby they use a priority based scheduler.

B. Priority

The Priority factor is also important factor in packet scheduling. There are two types of Priority scheduling that are Pre-emptive and Non Pre-emptive scheduling.

Pre-emptive scheduling: The Pre-emptive scheduling technique is one in which the packets that are having higher priority that should be scheduled or processed first. The packets having lower priority that should be processed at last.

Non Pre-emptive scheduling: In non pre-emptive scheduling the running packet should be goes on even if the new packet that is having the higher priority comes. The packet that should have to wait up to running packet scheduled.

The Lu C et al. [8] proposes a real-time communication architecture which uses a priority based scheduler. Priority is given to the data which travelled the longest distance and with shortest deadline. This approach deduces network traffic and data processing overhead but it consumes a lot of memory and power [8]. M. Y.U. et al.[9] shows the mechanisms for tiny OS for scheduling the packets [10]. Two scheduling schemes are there that are cooperative and pre-emptive. The cooperative scheduling is based on the dynamic priority. The pre-emptive is based on the EFRM scheme.

The cooperative scheme uses two queues having different priorities. The cooperative scheme is good for those applications where there are no enough resources are available.

C. Packet Type

Here the packets are classified on the bases of the real time or non real time data. The author Caglan & Douglas said that there are soft real time applications and hard real time applications. Soft real time applications can tolerate some amount of lost messages, while hard real time applications have zero loss tolerance [11].

Real time packet scheduling: There is highest priority for the real time packets & there is lower priority for the non real time packets. So the real time packets should be scheduled before the non real time packets. So the real time packets will reach their destination earlier than the non real time packets.

Non real time packet scheduling: In Non Real time packet scheduling the time is not so important factor. Hence the non real time packets having lower priority.

D. Queues

In Packet scheduling there are two different types of queues that are single queue & the multi level queue. Packet should be scheduled on the basis of its type.

Single Queue: Each node in the network having separate single queue. All the data packets are reside in that queue & that are scheduled on the basis of their type or on basis of size and also on the priority that packet have.

Multi level queue: In Multi level queue there are two or more no of queues for one node. Here the incoming packets are placed on the basis of priorities of that packet. The no of queues for the node is based on the level of the node. If the node is at lower level then the node will have minimum no of queues because it will require lot of time to transmit. The upper nodes should have more no of queues than the lower nodes. So the Energy consumption is balanced & reduces the delay in data transmission.

It is having two phases that are (1) Allocating tasks among different queues (2) Scheduling packets in each queue. Lee et al. [6] propose a multilevel queue scheduler scheme that uses a different number of queues according to the location of sensor nodes in the network.

E. Adaptive Task Balancing

F. Tirkawi et al. proposed an adaptive task balancing scheme in [3] which enhances the fairness of distributed sensing by switching priority between sensing and network tasks.
There are sensing and network tasks. In sensing tasks the activities about signal processing and encoding is done. In network tasks the transmission of packet that involves the sending of packet and receiving of packets. The priority of the packet is based on the level of the node. If packet p1 is at lower node and the packet p2 is at upper node so the packet p1 should have higher priority than the packet p2.

In this scheme, every sensor node, monitors its current depth in the network and if it moves close to base station (i.e. to depth two or one), then its sensing tasks are switched to higher priority for just X% of its duty cycle. Within this time, nodes can complete sensing and processing their local tasks and pass local data to base station [12].

F. RACE

K. Mizanian et al [12] proposed a scheme named RACE. This algorithm proposes a packet scheduling policy and routing algorithm for real-time large scale sensor networks that uses a loop-free Bellman-Ford algorithm to find paths with the minimum traffic load and delay between source and destination. This algorithm is used for real time communication. This algorithm is efficient because it requires less time and having minimum delay.

Here EDF that is Earliest Deadline First algorithm is used for sending the packets. The packets which is having the earlier deadline that should be scheduled first. By using this RACE algorithm we can also reduce the miss ratio and deadline in sensor networks. The packets that are expired that should be dropped.

G. Dynamic Multilevel Priority(DMP)

Tables Dynamic Multilevel Priority Scheme that is proposed by Nidal Naseer et al in [5] is a scheme that uses zone based topology. Nodes have separate queues for real-time data packets, non real-time remote data packets received from other nodes and non-real-time local data packets generated at the node itself [12].

In this paper they propose that each node in the network without those that are at the depth of network should have three levels of queues. The leaf nodes should have two queues for both real time and non real time packets so they don’t receive data from another node. So delay is not there. In DMP Scheme the nodes are in hierarchical format. The nodes with equally distance from the base node should be at same level. They are using a TDMA Scheme for those nodes that are situated at different levels. The intermediate nodes are having more tasks than the leaf nodes because the data sent by the leaf nodes towards the base station that should be from the intermediate nodes. So the length of the times lots of intermediate nodes should have higher value.

The given fig shows the Dynamic Multilevel Priority Scheme. There are three priority queues that are p1,p2,p3. The real time packet goes to p1 which is highest priority queue. The non real time data packets came from lower nodes goes to p2. The local non real time data packet goes to p3.

III. CONCLUSION

It’s very useful for us to use wireless sensor networks than the wired networks. we can use wireless sensor applications for real time applications. So the efficient technique should be used for scheduling the packets. The technique that needed less energy consumption and less delay in sending and receiving packets should be used. In this paper we have reviewed some techniques and schemes that were used before. Some schemes based on deadline, some based on the priority, and some on single and multiple queues. We also surveyed on DMP Packet scheduling scheme. The factors Deadline, Priority, Packet type, and No of queue are described.

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REFERENCES


