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Integrity and Delay Differentiated Routing (IDDR) in Wireless Sensor Networks

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ABSTRACT: There is different Quality of Service (QoS) for applications running in same wireless sensor network (WSN). Low delay and high data integrity are two main basic requirements. But both of the requirements cannot be satisfied simultaneously. We have proposed IDDR, which is multi-path dynamic routing algorithm. This algorithm resolves the conflict. The IDDR assigns weight to each packet with different requirement for QoS and the packets are then routed to the sink. Fidelity and also end-to-end delay for delay sensitive applications are reduced

KEYWORDS: Wireless Sensor Network, shortest path, delay sensitive, data integrity, drop ratio

I. INTRODUCTION

We use wireless sensor networks to sense physical world. WSN will be very important for the next generation networks. The applications running over WSNS have different complexities. WSN should support various types of applications on the same platform. Different applications require different type of QOS requirements. For example, in fire monitoring application the fire alarm should be reported as soon as possible to the sink sensor node. Likewise in other applications all the packets need to be sent to the sink sensor node irrespective of the time when they arrive. That is delay can be expected but all the packets should reach the sink node. For instance, in habitat monitoring application delay is allowed for the packet arrival but most of the packets must reach the sink node.

There are two basic requirements in WSN. They are low delay and then high data integrity. These are called delay sensitive application and high-integrity applications, respectively. Both of these requirements are easily classified in light load networks. But in heavily loaded networks congestion will be there which leads to end-to-end delay.

The main objective of study in my project is to improve the fidelity for high integrity applications and the end-to-end delay need to be decreased for delay sensitive applications. These two requirements should be fulfilled when the network is congested. From the idle path and the under loaded path buffer space are found so that excessive packets are cached easily.

II. RELATED WORK

In [1] authors present TOSSIM. It is a simulator program for tinyOS. It mainly captures the network behaviour in the presence of thousands of nodes at high fidelity. Though it is simple and efficient, TOSSIM can capture wide range of network interactions. The author has used probabilistic bit error model. In [3], CEDAR has been proposed by the authors. They have proposed a routing algorithm with QOS in Adhoc networks. The three main components are as follows:(a)self organised routing (b)propagation of link static in core through increase/decrease waves(c)only locally available states are required. A real time communication algorithm is proposed in [5] which is event based. It connects autonomous components in distributed control systems. Their analysis is on achieving real time guarantees in mobile Adhoc wireless sensor networks. SPEED is proposed in [9] which is real time communication protocol. Three types of communication services have been found(a)real time unicast (b)real time multicast (c)real time anycast. It is stateless algorithm which has been proved to be highly efficient and scalable. The protocol proves to be scalable for nodes in sensor networks which have scarce resources.

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III. PROPOSED ALGORITHM

We propose a new mechanism which allows the packets with delay sensitivity to be sent along the shortest path. And the packets with high data integrity to avoid possible dropping. Hence in the same network two different QoS requirements are satisfied. Our algorithm is called IDDR (Integrity and Delay Differentiated Routing in WSN) which is a multipath dynamic routing algorithm.

First we find idle or the under-loaded paths. And secondly we cache the packets efficiently for subsequent transmissions. A mechanism called Implicit Hop-by-Hop Rate Control is designed to cache the packets for delay sensitive applications. Higher priority has been assigned to delay sensitive packets. IDDR inherently avoids the conflict between high integrity and low delay: the high-integrity packets are cached on the under loaded paths along which packets will suffer a large end-to-end delay because of more hops, and the delay-sensitive packets travel along shorter paths to approach the sink as soon as possible

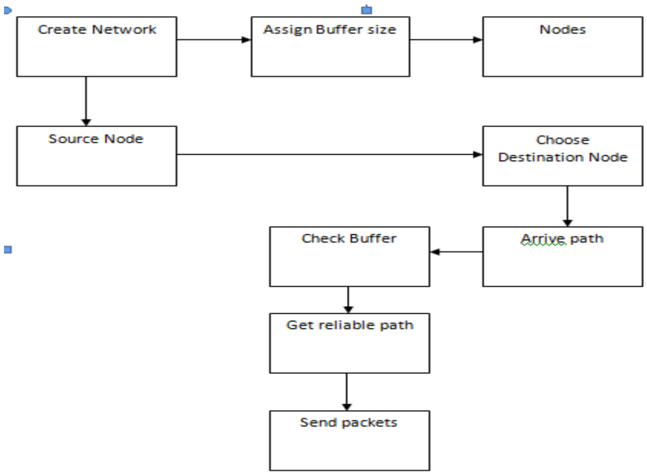

Fig 3 Architecture of the Proposed System

As shown in the figure 3, first we create a network with the required number of nodes. Mesh network is created. For each node the buffer size is assigned. Next select a source node and the destination node. The destination node is always called as sink here. From the source node to the sink i.e the destination node select the reliable path. Then for this reliable we check the buffer size. If the buffer is free then packets can be sent through the selected path. If the buffer is not free then select another path from the path list from source to sink

IV. PSEUDO CODE

We have used the Dijkstra's algorithm to find the shortest path for the delay sensitive applications. The pseudo code is as follows:

Step 1: djkstra (Graph, source)
Step 2: create vertex set Q
Step 3: for each vertex v in graph:
Step 4: dist[v] ← INFINITY
Step 5: prev[v]←UNDEFINED
Step 6: add v to Q
Step 7: dist [source]←0
Step 8: while Q is not empty:
Step 9: u←vertex in Q with min dist[u]
Step 10: remove u from Q
Step 11: for each neighbor v of u:

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Step 12: alt←dist[u] + length (u, v)
Step 13: if alt < dist[v]
Step 14: dist[v] ←alt
Step 15: prev[v]←u
Step 16: return dist [ ], prev [ ]

V. EXPERIMENT RESULTS

We compare the performance of IDDR with MintRoute. This has been taken from [13]. The results shows smaller drop ratio in IDDR than MintRoute.

Fig (5) and fig (6) shows the drop ratio of two apps in IDDR and MintRoute respectively. In fig (5), we can see the drop ratio is smaller. The app1 has smaller drop ratio. This is because if the load difference of shorter and longer path is large then in app1 the packets choose longer path since it has smaller queue length. And congestion is severe in the shortest path. App2 has higher drop ratio

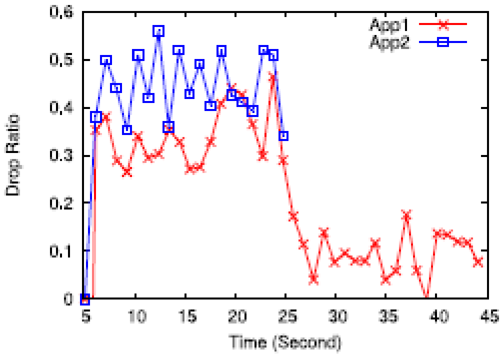

Fig 5. Drop ratio of each application under IDDR

. While in fig (6), it shows the MintRoute has the same drop ratio for both app1 and app2. This is because the packets are not differentiated and hence all the packets choose the shortest path no matter whether it is congested or not

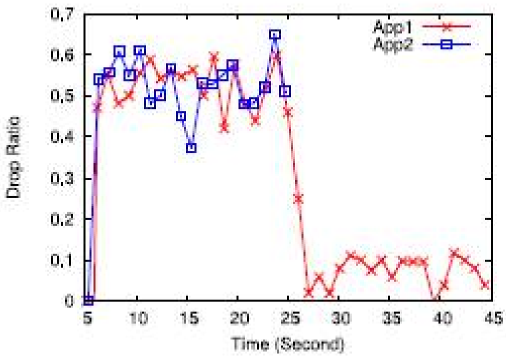

Fig 6. Drop ratio of each application under MintRoute

VI. CONCLUSION AND FUTURE WORK

In this thesis, we have proposed IDDR which is a dynamic multipath routing algorithm. This is based on the concept of potential in physics. We satisfy two different QoS requirement over the same WSN simultaneously. The QoS are high data integrity and low end-to-end delay. Our algorithm is proved stable and it significantly decreases the end-to-end delay in delay sensitive applications and improves the throughput of high-integrity applications. It does not require global information which means only local information of the network topology is required. And it has low communication overhead. The algorithm can be tried to implement with networks other than mesh network. The paper can be enhanced for audio and video files.

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