CONGESTION FREE ROUTING IN WIRELESS SENSOR NETWORKS BY IMPLEMENTAITON OF CROSS LAYER APPROACH

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Abstract: Wireless Sensor Networks (WSNs) is a collection of wireless mobile nodes dynamically forming a temporary network without the use of any existing network infrastructure or centralized administration. Wireless Sensor Networks have the attributes such as wireless connection, continuously changing topology, distributed operation and easy of deployment. Each node operates not only as an end system, but also as a router to forward packets. Routing in Sensor Networks has been a challenging task ever since the wireless networks came into existence. The major reason for this is continue changes in network topology because of high degree of node mobility. A number of protocols have been developed to accomplish this task. Sensor is extensively used in military and civilian applications. In the paper, we address the routing problem in multi cast routing protocols for ad hoc networks. We have introduced the concept of congestion free routing in WSNs based on cross layer implementation.

Keywords: WSNs, AODV, cross layer design, packet loss, and packet received.

I. INTRODUCTION

A sensor network is composed of a large number of sensor nodes that are densely deployed either inside the phenomenon. They enabled the development of low cost, low-power that are small in size and communicate unlettered in short distances. Sensor nodes are fitted with an onboard sensor network & is influenced by many factors including fault tolerance, scalability, production costs, operating environment, sensor network topology, hardware constraints, transmission media, and power consumption. A sensor node is made up of four basic components:

1. Sensing unit
2. Processing unit
3. Transceiver unit

3. Power unit.

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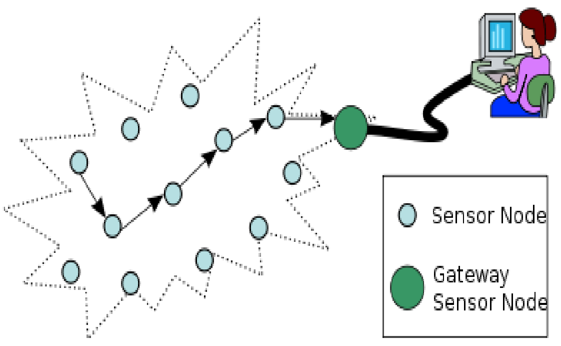

Figure 1: Typical multi-hop wireless sensor network architecture

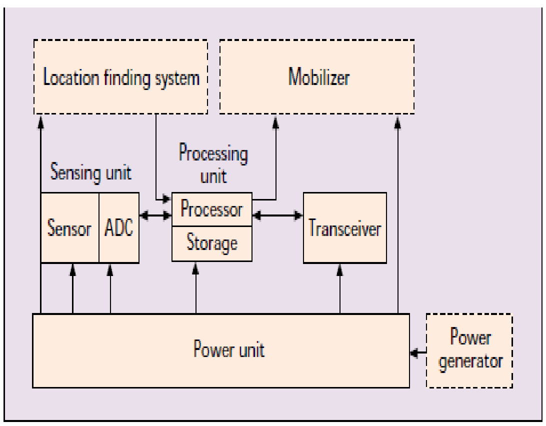

Figure 2. The components of a sensor node.

They may also have additional application-dependent components such as a location finding system, power generator and mobilize. Multiple sensor nodes deployed in a common neighbourhood to sense an event and subsequently transmit sensed information to a remote processing unit or base station, has been the recent focus of research. Tiny sensor nodes, which consist of sensing, data processing, and communicating components, leverage the idea of sensor networks based on collaborative effort of a large number of nodes. The sensor nodes are usually scattered in a sensor field. Each of these scattered sensor nodes has the capabilities to collect data and route data back to the sink. The sink may communicate with the task manager node via Internet or satellite.

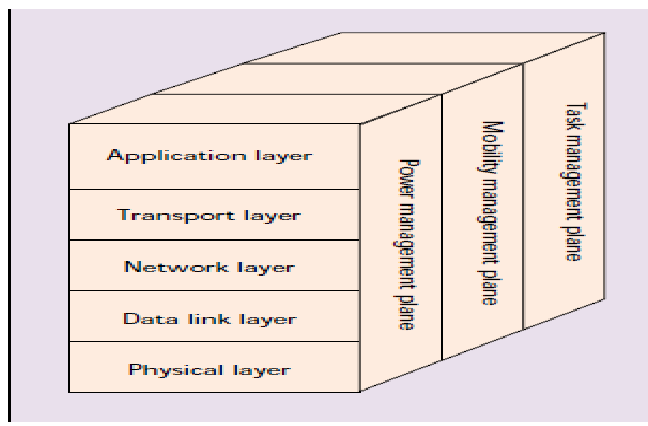

Figure 3. The sensor networks protocol stack.

The design of the sensor network is influenced by many factors, including fault tolerance, scalability, production costs, operating environment, sensor network topology, hardware constraints, transmission media, and power consumption. In wireless sensor networks, the number of sensor nodes has direct relation to the cost of total wireless sensor networks and at the same time the problem is closely connected to wireless sensor networks performance such as robust, fault-tolerance and furthermore it is considered at first as wireless sensor networks are designed the sensor deployments are simulated and the efficient coverage area ratios of corresponding deployments are computed. The simulated results are the same. That is the efficient coverage area ratio decreases with increasing number of sensor nodes. The sensor deployments in the form of equilateral triangle as a rule are better than those in the form of square. The efficient coverage area ratio of the former is up to above 90% inversely that of the latter is below 90%. [1]

Further, the problem regarding congestion in WSNs arises due to error in transmission protocol that allows all nods to flood data at similar time. Thus, in this paper we proposed a routing technique that can efficiently transmit data with causing any congestion. This has been carried out by implementation of cross layer design.

II. PROBLEM DEFINITION

The problem definition in wireless sensor networks can be classified on basis of following research gaps that have been obtained on analysis of previous literature. These are as follows:

- A location information of free sensor nodes can be avoided and it can further simplify the routing protocol.(Energy Efficient Routing Protocol for Wireless Sensor Networks with Node and Sink Mobility)
- Cross layer service mechanism can be architecture based and can include complete system design. (Service Discovery in Wireless Sensor Networks: Protocols & Classifications)
- QOS routing can further include Multicasting in WSN and support of multipath routing (solution of associated out of order deliver problem). It can also include additional metrics like SIR.(signal to interference ratio). (QoS Routing Performance in Multihop, Multimedia, Wireless Networks)
- In WSN Markov process framework can be used to guide the development of communication solutions & event detection delay distributions. (Cross-Layer Analysis of the End-to-End Delay Distribution in Wireless Sensor Networks)

• The average retention time for histogram can be decreased as it is about half the period of timeout. Timeout policy has a better behaviour in terms of bandwidth, but it lacks an upper bound for the added delay. (Cross-layer Design of Congestion Control and Power Control in Fast-Fading Wireless Networks).

From the above explained research gaps, our main objective is to eradicate the congestion formed in WSNs by implementation of cross layer design and analyze the working structure of network by comparing it with previous work.

III. CONGESTION FREE ROUTING IN WSNs BY IMPLEMENTAITON OF CROSS LAYER DESIGN

Cross Layer formation is the process of forming virtual layer between two layers that are actually communicating via third layer present in between them. Thus, cross layer provides a direct virtual link between the two layers where another process of data verification, group relaying can be executed to carry on effective transmission. Our work also includes the similar methodology; in our work we have formed two cross layers. One between physical layer and network layer and another between transport and data link layer. The group number are included in header of packets at data link layer and particular destination id decided at the cross layer formed between it and transport layer. The routing decision is taken at cross layer formed between physical and network layer based upon shortest distance and number of packets to be transmitted. The working of our routing algorithm can be explained as follows:

1. Perform RREQs and RREPs and maintain table.
2. Select source and destination node and generate group number for source.
3. to participate in transmission, node joins the group and leaves on transmission.
4. No transmission will be allowed if group number is not generated.
5Perform the above steps depending upon the number of packets and data to be transmitted.
6. The group number will be generated only by the node actually transmitting at particular instance of time.

The performance of this can be shown with the help of following snap shots from the animator.

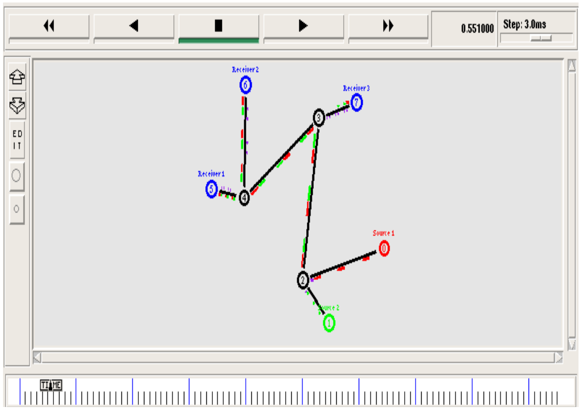

Fig. 2

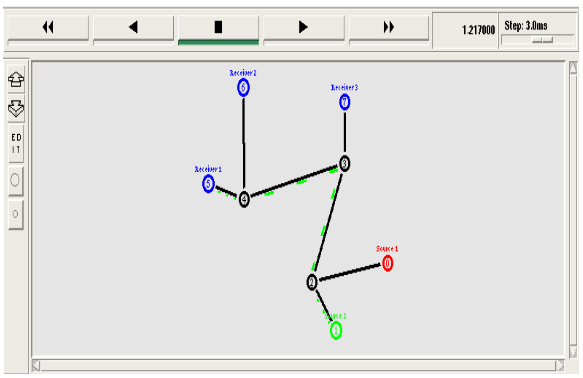

Fig. 3

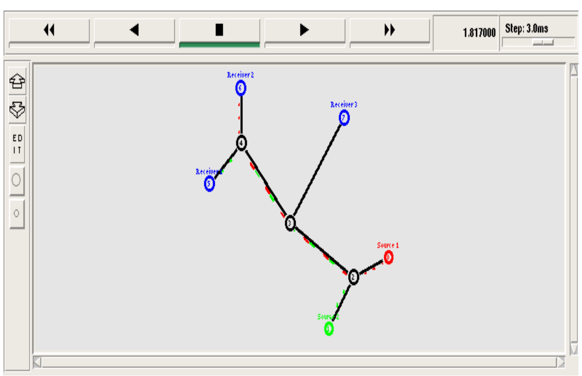

Fig. 4

A. *Performance Metrics*

The simulation has been carried out by us using NS-2. The area considered is 1500x1500. The various metrics considered by us are explained below:

- **Packet Lost:** The packet lost and received ratio is checked in the process transmission between the source and destination.
- **Buffer Size:** Buffer explains the pool strength that network can handle.
- **End to End delay:** this includes actual transmission delay during whole transmission between source and destination.

IV. SIMULATION RESULTS AND ANALYSIS

The simulations of the above technique are carried out using NS-2 simulation and the graphical result of the analysis is shown below:

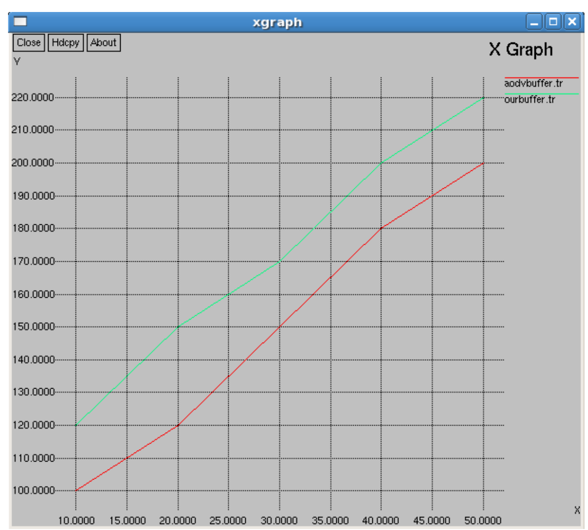

Fig. 5 Buffer Size (X: NODES, Y: BUFFER)

The above graph shows the relation between our and AODV's buffer size during process of transmission, on implantation of cross layer design.

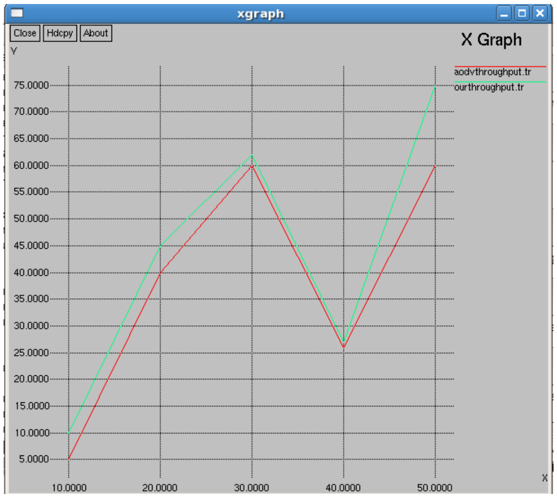

Fig. 6 Throughput Efficiency

The above graph shows the relation between our and AODV's throughput efficiency during process of transmission, on implantation of cross layer design.

V. CONCLUSION

In the paper, we proposed the cross layer design based group implementation to allow transmission to continue without occurrence of any congestion. This has been carried out by us on AODV as base routing protocol. The results have been obtained using NS-2 simulator. This technique can be further enhanced in future by considering more number of metrics comparison and further can be applied on other routing protocols and evaluation thus, can be done to choose the best out of all.

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