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REVIEW ON CONGESTION CONTROL IN WIRELESS SENSOR NETWORK

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Abstract: The sensor nodes of a WSN sense the physical phenomena and transmit the information to base stations. Under normal load condition the data traffic in the network is light. When an event occurs, the load becomes heavy and the data traffic also increases. This might lead to congestion. The algorithm provides an efficient way to prevent the packet loss at each node. This results in congestion management in the sensor networks. Through monitoring and controlling the scheduling rate the flow control and congestion control are managed. Different types of data generated in heterogeneous wireless sensor networks have different priorities. Data flow is forwarded in multiple paths to the sink node this happens in multipath wireless sensor network. Each sensor node route is own data as well as the data generated from other senor nodes. The parent node of each sensor node allocates the bandwidth based on the source traffic priority and transit traffic priority of the data from heterogeneous applications in the child nodes. Congestion is detected based on the packet service ratio. whole approach of this presented work is depended on source traffic and transit traffic

Keywords: Congestion technique; Congestion Control; WSN;

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INTRODUCTION

From the sink to the sensor nodes usually is a one-to-many multicast. The upstream traffic from sensor nodes to the sink is a many - to- one communication. Due to the convergent nature of upstream traffic, congestion more probably appears in the upstream direction. Congestion control is achieved by distributing the network bandwidth across multiple end -to- end connections.

Two types of congestion could occur in WSNs they are node-level congestion and link-level congestion. The node-level congestion that is common in conventional networks. It is caused by buffer overflow in the node and can result in packet loss, and increased queuing delay.

Two general approaches to control congestion they are network resource management and traffic control. Network resource management tries to increase network resource to mitigate congestion when it occurs. In wireless network, power control and multiple radio interfaces can be used to increase bandwidth and weaken congestion. This approach, it is necessary to guarantee precise and exact network resource adjustment in order to avoid over- provided resource or under-provided resource.

There are two general methods for traffic control in WSNs:

a. The end-to-end control: The end-to-end control can impose exact rate adjustment at each source node and simplify the design at intermediate nodes, it results in slow response and relies highly on the round-trip time (RTT).

b. The hop-by-hop congestion control: The hop-by-hop congestion control has faster response. It is usually difficult to adjust the packet-forwarding rate at intermediate nodes mainly because packet forwarding rate is dependent on MAC protocol and could be variable. [3]

WSN consist of heterogeneous traffic the problem of congestion lies in this, to tackle this problem heterogeneous traffic will devided into different classes and sends them to appropriate queue. Each queue is assigned with a priority. The multi path multi hop heterogeneous network model considered in the work. In case of multipath routing, each node divides its total traffic into multiple traffic flows and those flows pass through multiple downstream nodes. This will achieved by dividing bandwidth of parent nodes to child nodes

The growing advancements in computer and network technologies have envisioned wireless sensor network (WSN) as a monitoring platform with minimal human intervention in all types of applications such as patient healthcare, environmental and habitat monitoring, military applications and so on. As sensing becomes indispensable in all area of monitoring, WSN is forced to collect large amount of data continuously. The volume of collected data also increases with the size of the network. For a largesized WSN with hundreds of sensors utilising direct transmission to deliver the collected data from each of the sensor to few gateways, this may lead to overloading the few gateways beyond their storage and communication capabilities. Thus, the sensors have to wait for long times to transmit their data to the gateways. One of the solutions to reduce the sensors waiting time is to increase the number of gateways aggregating the data from sensors, there by executing parallel transmission sessions. However, the deployment and maintenance costs seem to be increased slightly with the increase in the number of gateways.

II. TECHNIQUES FOR CONGESTION CONTROL

Congestion control is a method used for monitoring the process of regulating the total amount of data entering the network to keep traffic levels at an acceptable value. It concerns controlling traffic entry into a network, so as to avoid congestive collapse by attempting to avoid oversubscription of any of the processing or link capabilities of the intermediate nodes and networks and taking resource reducing steps, such as reducing the rate of sending packets. Congestion control has to consider network capacity and application requirements. A number of schemes were proposed to address these challenges:

A. Local Cross Layer Congestion Control

This method [2] is based on buffer occupancy. Input to buffer is of two types: a) Generated packets and b) Relay packets. A sensor node has 2 duties a) Source duty and b) Router duty. During source duty, the sensing unit of the node senses the event and generates packets to be transmitted. A node as a part of router duty receives packets from its neighbors to be forwarded to sink. It has two measures:

a) It explicitly controls the rate of generated packets in source duty.

b) It regulates the congestion in router duty based on current

load on node.

B. Adaptive Duty Cycle based Congestion Control

Adaptive Duty Cycle based Congestion Control (ADCC) [2] is energy efficient and lightweight congestion control scheme, with duty cycle adjustment for wireless sensor networks. It uses combined mechanism of resource control scheme and traffic control scheme. ADCC periodically calculates the required service time using incoming packet information of child nodes and infers there is congestion or not based on calculated service time. If the congestion degree is below a certain threshold, this scheme adjusts its own duty cycle to reduce congestion. On the other hand if the congestion degree is above threshold, it notifies child nodes of congestion so that transmission rates of child nodes can be adjusted.

C. Receiver Assisted Congestion Control

In Receiver Assisted Congestion Control (RACC) method [3] sender performs loss based control and receiver performs delay based control. Receiver maintains 2 timers, one for recording the packet interarrival time and other for measuring RTT. Sender uses this information from receiver to adjust the congestion window. The receiver can estimate the rate the sender should adapt to make best use of measured bandwidth based on packet interarrival timer. The RTT timer at receiver times the arrival of the next packet and detect packet drop if timeout occurs. Since receiver detects packet drop earlier than sender, it can send ACK to inform sender thereby reducing the waiting time of sender to retransmit a lost packet.

D. CAF: Congestion Avoidance and Fairness.

CAF [2] is a congestion avoidance algorithm which uses the topology information to control congestion. It detects congestion based on the buffer occupancy. In CAF every node calculates its *Characteristic Ratio (CR),* which is defined as the ratio of the number of downstream nodes to the number of upstream node. If the CR value is less than one that means there are more upstream nodes than downstream nodes. It uses this information to adjust the rate

of its upstream nodes by sending the congestion notification.

E. LWBM: Light Weight Buffer Management

LWBM [2] strives to avoid explicit rate signaling between the sensors. In LWBM, every node piggybacks it buffer status to the neighbor nodes. This way, the buffer status of all the nodes is propagated to their neighbor. A node will send data only when the buffer of the receiver node is not full. This way, it adapts the forwarding rate of sensor nodes to near-optimal without causing congestion. It gives how to implement buffer based congestion in different MAC schemes particularly in CSMA with implicit ACK.

III. DESIGN GUIDELINES FOR CONGESTION CONTROL IN WIRELESS SENSOR NETWORK

An effective congestion control scheme contains three major functions: *Congestion Detection, Congestion Notification* and *Rate Adjustment* [1].

A. Congestion Detection **:** In order to control congestion, first we have to find the place which is congested. In traditional networks congestion is detected using end-to-end timeout mechanism or by redundant acknowledgement. In WSNs, to detect the congestion more proactive mechanism like buffer occupancy, channel load and packet service time can be used.

B. Congestion Notification **:** Once congestion has been detected the sensor node has to propagate that information to the sink or to the upstream neighbor of the node. The information can be a single bit or it can be rich information like allowable data rate and congestion degree etc. Another issue is how to send the congestion notification. There are two ways of doing this:

Implicit congestion notification and *explicit congestion notification.*

In implicit congestion notification, congestion information is piggybacked in the packet header so no need to send a separate control packet. In explicit congestion notification a separate control packet is sent to notify the source.

C. Rate Adjustment **:** After receiving congestion notification, source will adjust its sending rate. The new sending rate depends on the type of information provided in congestion notification. For example if single CN bit is set, AIMD (Additive Increase Multiple decrease) scheme or its variant can be used or if more information is provided the source can adjust its rate to some exact value.

IV. CONCLUSION

In this paper we have presented techniques congestion control which minimize congestion in the network and various guidelines for congestion control in wireless sensor network.

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