Explicit Congestion Control With Buffer Management For Multihop Adhoc Networks

S. Anbukaruppusamy[1], K.Batri[2]

Department of Electronics and Communication Engineering, Shree Venkateshwara Hi-Tech engineering College, Gobi, Erode, Tamilnadu,India
Department of Electronics and Communication Engineering, PSNA College of Engineering and Technology, Dindugal, Tamilnadu,India
Email: anbuksamy@gmail.com, krishnan.batri@gmail.com

ABSTRACT: Wireless multi-hop adhoc network, a group of mobile devices or nodes form an infrastructure-less wireless network. Packets are relayed over multiple hops from source to destination via wireless links. The attractive characteristics of wireless ad hoc networks are ease of deployment, no wired installation, maintenance cost, and flexibility of mobility. In a number of environments, there is a role for the wireless multi-hop ad hoc networks as an alternative to a wired LAN. Some example include building with large open areas, such as manufacturing plants, stock exchange trading floors, and warehouses; historical buildings with insufficient twisted pair and where drilling holes for new wiring is prohibited; and small offices where installation and maintenance of wired LANs is not economical. In all of these cases, a wireless multi-hop ad hoc network provides an effective and more attractive alternative. In this work we developed an algorithm named Explicit Congestion Control Protocol with Buffer Management (ECCPBM) for Multi-Hop Wireless Networks which controls the congestion in the wireless network and fairly allocates the network resources among the communication flows and also minimizes the delay of packet sending between the source and destination.

[S. Anbukaruppusamy, K. Batri. **Explicit Congestion Control With Buffer Management For Multihop Adhoc Networks.** *Life Sci J* 2013;10(2):1699-1703].(ISSN:1097-8135).http://www.lifesciencesite.com. 239

Keywords: Multi-hop, Packets, Twisted pair, Buffer Management, mobility

1. LITERATURE REVIEW

Kun Tan, et al. [1] explains in details about the Explicit Wireless Congestion Control Protocol, EWCCP algorithm. It tells that as RED /ECN provides 1-bit information about the congestion state, so TCP becomes prone to be unstable and also network resources cannot be fairly allocated to the communication flows. And due to the slow start nature of TCP it increases the sending rate of data packets until packet drop occurs. As a result congestion created in the network. To overcome this problem EWCCP had been implemented. The EWCCP sender maintains a congestion window and controls the maximum number of packets to be sent before receiving an acknowledgement. The data packets of the EWCCP contain two types of header. One is End to End Congestion Header which is being controlled by the end to end system and updates it. The second one is Link Congestion header which is controlled by the EWCCP routers and updated by it. The packets from the TCP layer when comes to EWCCP layer, it is checked before it is send to the network. As a result less congestion will take place in the network and packet drop probability will also decrease. As a result the throughput will increase.

Z. Fu, et al. [2], "The impact of multihop wireless channel on TCP throughput and loss",2003. This paper tells that in IEEE802.11, before each packet transmission there is a control handshake of RTS/CTS messages. Hearing the handshake the nodes defers from transmission till the subsequent DATA/ACK transmission are completed. Another failure in transmission of control and data packets are due to the hidden node problem. In this hidden node problem some nodes are not in the transmission range of some nodes. So they don't know each other and started transmission in the network together. But these packets collide in the network causing loss of data packets and also congestion occurs. Due to this the throughput of the network gets affected causing the performance of TCP to degrade.

S. Xu, et al. [3] "Does the IEEE 802.11 MAC protocol work well in multi-hop wireless ad hoc networks?" Jun. 2001. This paper tells that there are two types of networks i.e. Wired/Fixed network and Wireless networks. In a fixed network there is no problem of sending the packets from the source to the destination. This sending of the packets is controlled by the TCP (Transmission Control Protocol). In wireless there is no fixed path of sending the packets. Each and every nodes has its own transmission range. The nodes can move in and out of the transmission ranges. In this we can't use the fixed links. In this wireless network also TCP is used because TCP can adjust to any network conditions and also it performs the congestion control.

S. Floyd, et al. [4], "Random early detection gateways for congestion avoidance," Aug. 1993. This paper tells that Random Early Detection (RED) is used with the TCP for the flow control in the networks. What it does id that first of all the sender will start sending the packets to the network. If the network queue buffer overflows then the packets are being dropped and a feedback is send back to the sender about the congestion information. As a result the sender will adjust the sending rate by slowing the sending rate.

2. PROPOSED WORK

2.1Explicit Congestion Control Protocol with Buffer Management (ECCPBM)

ECCPBM, Explicit Congestion Control Protocol with Buffer Management is an algorithm which notifies the congestion explicitly similar to RED/ECN and it maintains the buffer at each node. When there is a congestion identified, packets are not dropped; instead they are buffered at a particular node and are sent once the route is clear.

"Congestion Control in multi-hop wireless networks" is done using the ECCPBM algorithm. In this algorithm the main thing is that it uses the feedback which is controlled by the ECCPBM sender and routers. The ECCPBM routers will check whether the network is congested or not. It acts on TCP so the packets which are being send from TCP layer to ECCPBM layer are regulated by the ECCPBM. After checking only the packets can be allowed to be sent by the ECCPBM window.

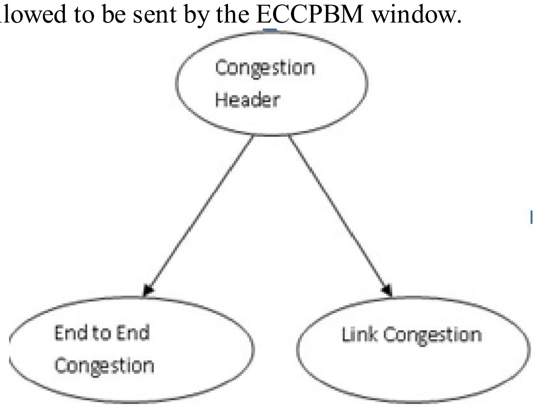

Figure 1.1 Types of Congestion Header

2.2 Classification of Congestion header

2.2.1 End-to-End Congestion Header

This Congestion Header is taken care of by the ECCPBM Sender and ECCPBM receiver at both the ends. Whatever the congestion information will be gathered at the two ends will be put in the feedback field and will be send to the sender back. It will get the awareness of the congestion in the network.

2.2.2 Link Congestion Header

This Congestion Header is taken care of the ECCPBM routers. When the packets are sent from the sender it starts checking whether these are congestion in the network or not. If then the feedback field will be updated and also the congestion information about the link will be put by the routers. When the packets will reach the receiver then the receiver will know about the condition of the network and accordingly it will send the positive feedback and negative feedback to the sender.

The neighboring queue table contains the following information

- Source ID
- Destination ID
- Type of packets
- Sequence number of the packets
- Size of the packets

In ECCPBM explicit signaling is used to make coordination between the neighbors. It periodically broadcasts the average queue information and this broadcast is confined within one hop.

The signaling protocol is as follows

- When the node sends a data packet along a downstream link, it fills the average queue size of that link in the piggyback field of the link congestion header
- When a signaling interval is passed broadcast packets is generated and sends.
- When receiving a broadcast or a data packet with link congestion header, a node updates their neighbor queue table with information contained.

3. FLOW CHART

ECCPBM is a congestion control protocol designed for static multi-hop wireless networks. It is implemented over TCP as a thin layer between IP and TCP. The packets from TCP layer cannot be directly send. Those packets are checked by ECCPBM window and if it is allowed then only the packets are passed. The ECCPBM algorithm works as follows

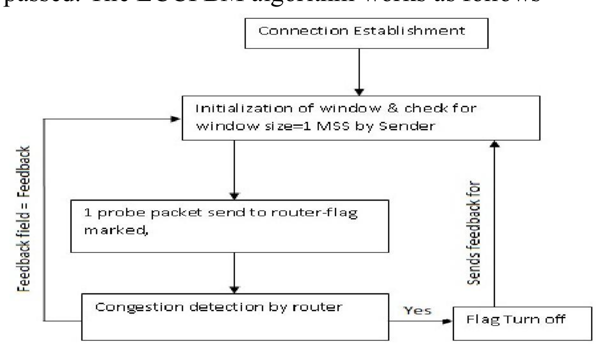

Figure 1.2 shows how ECCPBM works

4. Comparison of Wired and Wireless Networks Scenario

4.1 Scenario for Wired/Fixed Networks

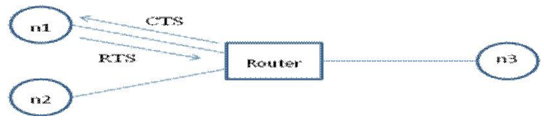

Figure 1.3.showing the exchange of RTS/CTS

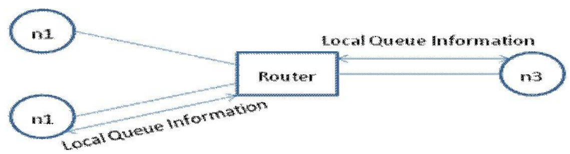

Figure 1.4.showing the getting local queue information

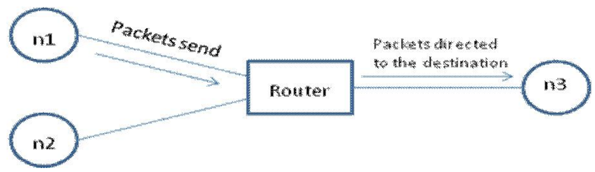

Figure 1.5.Showing the packet transmission

Figure 1.6. Shows the negative and positive feedback of to the destination

4.2 Scenario for Wireless networks

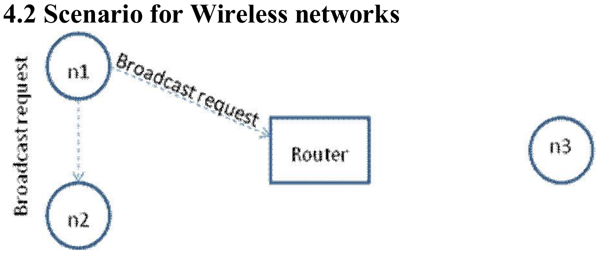

Figure 1.6. Source broadcast request to the next hop

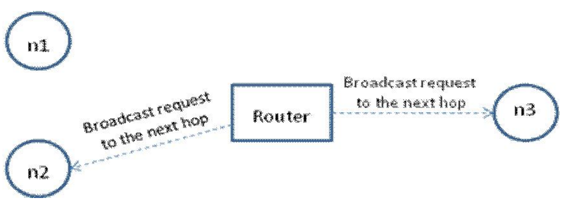

Figure 1.7.Router broadcast the information to the next hop

5. PERFORMANCE METRICES

Throughput: It is defined as total number of packets received by the destination**.** It is a measure of effectiveness of a routing protocol. Finally the main thing which matters is the number of packets delivered successfully.

Packet Delivery Ratio: The ratio between the number of packets received by the TCP sink at the final destination and the number of packets originated by the "Application Layer" sources. It measures the efficiency of the protocol.

Packets Lost: It is the measure of the number of packets dropped by the routers due to various reasons. The reasons considered for evaluation are collisions, time outs, looping and errors.

Average Delay: it is a metric which is very significant with multimedia and real-time traffic. It is very important for any application where data is processed online.

Packet delivery fraction: the ratio of the data packets delivered to the destination to those generates by the Constant Bit Rate (CBR) sources.

Average end to end delay of data packets: This includes all possible delays caused by buffering during route discovery latency, queuing at the interface queue, retransmission delays at the MAC, and the propagation and transfer times.

6. SIMULATION RESULTS

Figure 2.1 Tcl program in execution

Figure 2.2 Nodes are in wireless and broadcasting information first before sending packets

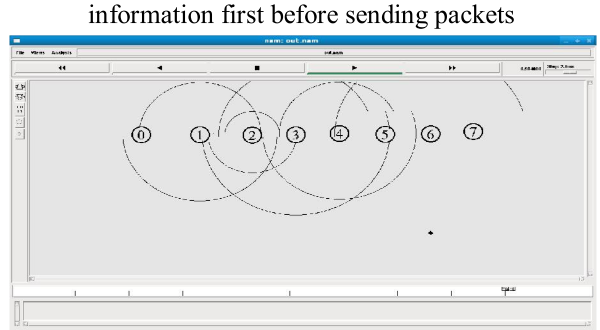

Figure 2.3 shows that congestion had occurred at node 6

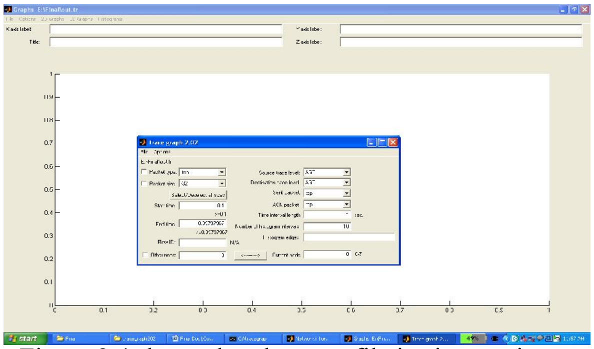

Figure 2.4 shows that the trace file is given as input

This graph shows that simulation time increases the throughput of the generating packets at the sending node also increases linearly due to TCP. Because in TCP slow start occurs which is that the sending nodes will greedily sends the data packets until the congestion occurs.

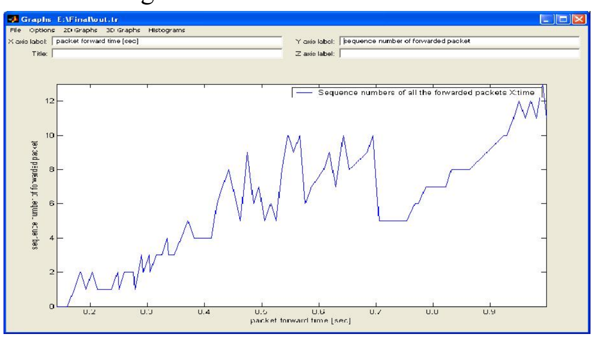

Figure 2.6 Graph showing packet forward vs seq. no. of forwarding packets

The graph depicts that as the packet forwarding time increases the sequence number of forwarding packet sometime increases and sometime decreases because of the unsuccessful delivery of the packets or delay delivery of the packets. As a result the acknowledgement is also delayed or lost.

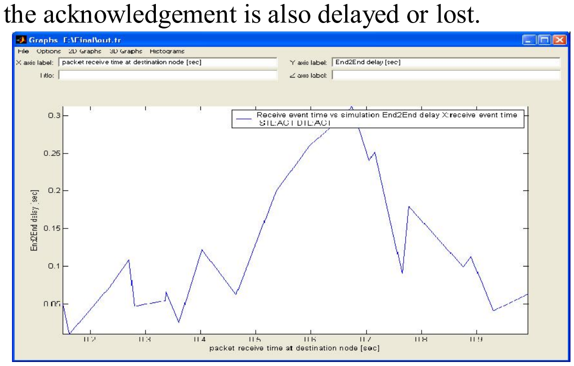

Figure 2.7 Graph showing packet received at destination vs End to End delay

This graph shows that as the packet receiving time at the destination increases the End to End delay also increases. At one time the congestion will take place. At that time the packets will be dropped and the End to End delay will decrease.

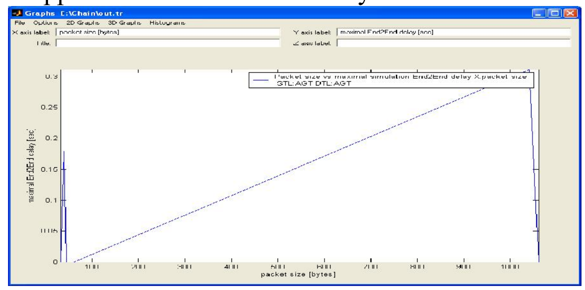

Figure 2.8 Graph showing Packet Size Vs Max End-to-End Delay

This graph shows that there is some jitter as a result the graph could not start from the origin. Then as the packet size increases End to End delay also increases due to the queue size of the receiving nodes. At one time the congestion will take place. Then at that time the packets will be dropped and as a result the End to End delay also decreases.

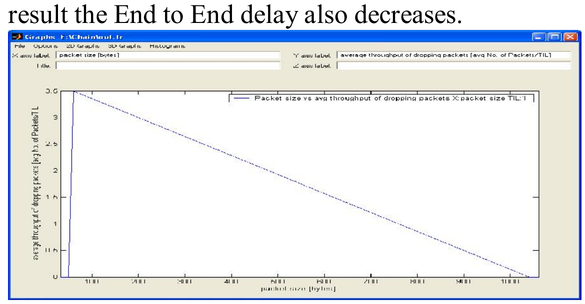

Figure 2.9 Graph showing Packet size Vs Average Throughput

This graph shows that as the packet size increase, the congestion will start in the networks. As a result the average throughput of dropping packets will decrease.

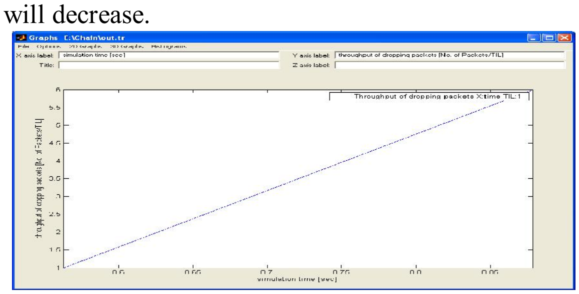

Figure 2.10 Graph showing Throughput of Dropping Packets Vs Simulation time

This graph tells that as the simulation time increases the throughput of the dropping packets also increases. All because of the slow start behavior of the TCP which greedily increases the sending rate of the data packets in the network.

7. CONCLUSION

ECCPBM is best congestion control protocol in multi-hop wireless networks. It is implemented over TCP. The function of TCP is to send the packets from one node to another. But this ECCPBM does not allow all the packets to be transmitted. When the packets from the TCP layer comes to the ECCPBM layer, then the ECCPBM protocol checks whether the packets can be send or not. If not then the packets can note be send out. That means the packets are controlled by ECCPBM. As a result the congestion in the network will decrease. Also it can be implemented as a thin layer between TCP and IP and provides enhanced congestion control.

REFERENCES

[1] Congestion Control in Multihop Wireless Networks Kun Tan, Member, IEEE, Feng Jiang, Qian Zhang, Senior Member, IEEE, and Xuemin (Sherman) Shen, Senior Member, IEEE, IEEE TRANSACTIONS ON VEHICULAR TECHNOLOGY, VOL. 56, NO. 2, MARCH 2007.

[2] Z. Fu, P. Zerfos, H. Luo, S. Lu, L. Zhang, and M. Gerla, "The impact of multihop wireless channel on TCP throughput and loss," in Proc. IEEE INFOCOM, 2003, pp. 1744–1753.

[3] S. Xu and T. Saadawi, "Does the IEEE 802.11 MAC protocol work well in multihop wireless ad hoc networks?" IEEE Commun. Mag., vol. 39, no. 6, pp. 130–137, Jun. 2001.

[4] S. Floyd and V. Jacobson, "Random early detection gateways for congestion avoidance," IEEE/ACM Trans. Netw., vol. 1, no. 4, pp. 397–413, Aug. 1993.

[5] Ferorelli R., Grieco L. A., Mascolo S., Piscitelli G., Camarda P., Live Internet measurements using Westwood+ TCP Congestion Control, IEEE Globecom 2002, Taipei,Taiwan, November 18-20, 2002.

[6] Grieco, L. A., and Mascolo, S., Westwood TCP and easy RED to improve Fairness in High Speed Networks, Proceedings of IFIP/IEEE Seventh International Workshop on Protocols For High-Speed Networks, PfHSN02, (Berlin, Germany, April, 2002).

[7] Haifa Touati, Ilhem Lengliz and Farouk Kamoun, "TCP Adaptive RTO to improve TCP performance in mobile ad hoc networks", The Sixth Annual Mediterranean Ad Hoc Networking Work Shop, Corfu, Greece, June 12-15, 2007.

21/5/2013