**Review on Congestion Avoidance Schemes in MANETS**

Niharika Khurana¹ Pinki Tanwar²

¹Student ²Assistant Professor

1,2Department of Computer Science & Engineering

1,2JMIT, RADAUR

**Abstract**—A mobile ad hoc network (MANET) is an infrastructure-less & self-configuring network of mobile devices. Congestion is the main factor in determining the quality of network. Congestion occurs when too much traffic is there in the network causes long delay, bandwidth degradation & overhead. So many mechanisms have been proposed to control the congestion in the network. Main aim of this paper is to study and analyse the various congestion control mechanisms by using various network parameters and to measure various performance matrices.

**Key words:** Mobile Ad hoc network, congestion controls mechanisms, flow control mechanism, FIFO scheme, Flow proportional Queuing

I. INTRODUCTION

Network based congestion avoidance involves managing queues in the network is an integral part of any network.

Network congestion occurs when a node is carrying too much data that its quality of service impaired. The network performance degrades when the number of packets increases beyond the limit which can be handled by the network resources, and this position is called congestion. Congestion basically means blockage or overcrowding due to overloading. It is similar to traffic jam caused by various cars on a narrow road.

It is a situation in Communication Networks in which too many packets are present in a part of the subnet, due to which performance degrade. Congestion in a network may occur when the load on the network (i.e. the number of packets sent to the network) is greater than the capacity of the network (i.e. the number of packets a network can handle.)

Network protocols which use hostile retransmissions to reimburse for packet loss tend to keep systems in a state of congestion in network, even after the primary load has been reduced to a certain level which would not normally have induce network congestion. Thus, networks using these routing protocols can show two stable states under the same level of load. The stable state with low network throughput is recognized as congestive breakdown. Congestion is the main factor in determining the quality of network. Congestion occurs when too much traffic is there in the network causes long delay, bandwidth degradation & overhead. So many mechanisms have been proposed to control the congestion in the network.

A. Congestion Control:

Two styles of control, proactive (Open Loop) and reactive (Closed Loop) control are presented. It is shown that congestion control must happen at several different time scales.

Fig. 1: types of Congestion Control Methods

B. Need for Congestion Control in Networks:

Congestion is a severe problem in current reservation less networks. However, in networks the available bandwidths and switching speeds will be several orders of magnitude larger.

C. Congestion Control in MANETs:

A mobile ad-hoc network (MANET) is composed of self-configuring mobile nodes without any infrastructure. The main goal of MANETs is to extend mobility into the realm of mobile, autonomous, and wireless domains. Congestion is situation in network when too much traffic is offered which leads to Packet losses, Bandwidth degradation, wasting of time (i.e. long delay), and High network overhead. So, many routing protocols have been proposed to reduce the congestion in mobile ad-hoc network.

The main objective of congestion control is to reduce the buffer overflow and delay caused by network congestion and hence enables the network to perform well. In wired networks, congestion control is done at the transport layer and is mainly designed separately from the functions of other layers. However, such congestion control schemes do not apply directly to ad hoc network, which includes special challenges like limited wireless bandwidth, route failures and power constraints due to limited buffer size and node mobility. This means that as more number of packets is being sent, congestion in network should result in high packet loss rate, loss of energy and bandwidth, retransmission of lost packets and re-routing instability. However, delays and packet losses need not necessarily be caused by congestion, but these can be misunderstanding as congestion losses.

In ad-hoc network every device or node is a router as well as end host. Congestion control is the prime problem in ad-hoc networks. Congestion control is connected to controlling incoming traffic to a telecommunication...
network. To avoid congestive collapse or link capabilities of the intermediate nodes or devices, networks and to reduce the rate of sending packets congestion control is used widely.

II. CONGESTION CONTROL MECHANISMS
A. Flow-Control Mechanism:
Flow control mechanism is a way to prevent sender form overflowing the buffers of the receiver.

B. Network Congestion Control:
This mechanism is similar to end-to-end flow control but it reduces congestion in the network, not the receiver.

C. Network-Based Congestion Avoidance:
It detects the congestion before occur and slow down the senders before queues become full.

D. Resource Allocation:
It involves the use of physical resources for a specific time period. This technique is difficult but eliminates network congestion by blocking traffic that is in excess of capacity.

III. TECHNIQUES FOR CONGESTION CONTROL
A. Bit Vector Flow Count Mechanism:
Prerna et al. [14] proposed how node's buffer space gives brunt to the in-flight packets in ad hoc network by taking mobility. The network condition has been pretended with a restricted size of users. Performance has been calculated on several parameters such as varying queue length and number of dropped packets. He explained a simple flow counting algorithm in this paper. His paper conclude a design which is set of congestion control algorithm in mobile network and implementation is done through simulation on various network parameters such as number of sender increased and varying queue length. His result presents the performance of mechanism and how congestion control mechanism performs when we enhance the number of source and usages [15].

B. Adaptive Congestion Protocol:
Marios Lestas et al., [2] develop an Adaptive Congestion Protocol (ACP) which is revealed to satisfy all the design necessities and thus outperform earlier proposals. Extensive simulations specify that the protocol is capable to guide the network to a stable equilibrium which is characterized by max-min fairness, small queue size, high utilization, and no observable packet drops. In accumulation, it is found to be scalable with changing bandwidth, number of users and delays utilizing the network. To preserve stability it implements at each link a new estimation algorithm which estimates the numeral of flows utilizes the link. It uses the same representation to create phase portraits which express that the ACP protocol is constant for all delays.

C. Multipath Rate Based Congestion Control Algorithm:
Soundararajan, S. et al., [6] gives a multipath rate based congestion control algorithm. Its algorithm has estimation for rate and rate control mechanisms such that the traffic rate is familiar based on the estimated rate. The estimated rate can be acquired from the middle nodes by the destination node which forward this information to the source. Simulation outcomes show that the planned rate control algorithm outperforms the existing congestion control methods in terms of packet delivery ratio & throughput.

D. Single Queue Start-Time Fair Queuing Method:
Addisu Eshete et al. [5] present S-SFQ which is a single queue design and implementation of the known Start-time Fair Queueing (SFQ). This collective queue orders packets based on timestamps rather than order of arrivals of packets. Through simulation, it illustrates the performance gains of S-SFQ over other existing single-queue schemes such as FIFO & RED in terms of flow fairness and link utilization. When senders apply end to-end (e2e) congestion control, S-SFQ can quite estimated the fairness of both simple and weighted, of per flow queues. In addition, it explains in detail the undesirable effect of packet loss synchronization problem as in aggregated queues. The character of aggregate queue based router method may easily and single-handedly remove by this problem. Loss synchronization may face during overloaded drops when the buffer becomes full (FIFO) or firm (upper) buffer thresholds are exceeded (RED).

E. Predictive Congestion Control Routing Protocol:
S. Subburam et al. [7] defines the predictive congestion control routing protocol for wireless Ad-hoc networks (WANET) called as PCCAODV. Unlike existing AODV, predictive congestion key of a node as the ratio of current queue occupancy over total queue size. Based on congestion key, PCCAODV uses the upstream nodes and downstream nodes of a congested node and starts route finding process Bi-directionally (in both direction) to find alternate non congested path for transmitting data between them. Suppose that this process finds more non congested multipath than before and decides a best single path for transmitting the data. This protocol is implemented and simulated by using Ns-2 simulator. Performance comparisons of the planned PCCAODV protocol against AODV is offered and shown that the PCCAODV algorithm performs well.

F. Effective Congestion Avoidance Scheme:
Dr.Ramachandra.V.Pujeri, et al. [10] planned to develop the Effective Congestion Avoidance Scheme which consists of following three main steps i.e. congestion monitoring, effective routing establishment and congestion less based routing. The congestion position is measured in congestion monitoring. In routing establishment, it proposes the contention metric in the particular channel in terms of queue length, overall congestion standard, packet dropping ratio and packet loss rate in order to monitor the congestion position. Based on the congestion standard, the congestion less routing is established to decrease the packet loss, high overhead in the network and long delay. By general simulation, the planned scheme shows better throughput, low end-to-end delay, packet delivery ratio, and overhead than the previous schemes.

G. Dynamic Congestion Detection and Control Routing:
T. Senthilkumaran et al. [12] presents a technique for dynamic congestion detection and control routing (DCDR) in mobile ad hoc networks (MANETs) based on the estimation of the average queue length. By using the
average queue length, a node finds the present congestion status and sends a warning signal to its neighbours. The neighbour then tries to find a congestion-free alternative path (other than before) to the destination. This dynamic congestion mechanism supporting congestion control in ad hoc networks ensures the reliable intercommunication within the MANETs. According to simulation results by using NS-2 simulator, the DCDR showed improved performance than the EDOCR, EDAODV AODV and EDCSAODV routing protocols.

H. Energy Efficient and Cooperative Congestion Control Protocol:

Md. Imran Chowdhury, et al, November 2012, [3] presents an energy efficient and cooperative congestion control protocol to control the congestion in mobile ad hoc networks (MANETs). The proposed scheme overcomes the disadvantages of existing multicast congestion control protocols which depend on individual receivers to detect congestion and adjust their receiving rates. In the first phase of the proposed protocol, it builds a cooperative multicast tree rooted at the source, by including the nodes with higher residual energy towards the receivers. In the second phase of the proposed protocol, it proposes an admission control scheme in which a cooperative multicast flow is admitted or rejected depending upon on the output queue size. In the third phase of the proposed protocol, it proposes a scheme which tests whether the relay node has the potential path to the required destination, if not then choose the another node which has the second highest remaining energy as a new relay node.

IV. COMPARISON OF VARIOUS MECHANISMS

This table shows the comparison of various mechanisms for congestion control in MANETS. It describes the various techniques for it and their advantages.

<table>
<thead>
<tr>
<th>S.NO</th>
<th>Based on</th>
<th>Comparison with</th>
<th>Advantages</th>
</tr>
</thead>
</table>
| 1.   | Flow based mechanism, FIFO Queue scheme | AODV,D SR DSR performs better | - Reduced queuing delay  
- Proper bandwidth utilization  
- Fewer packet drop |
| 2.   | Active flow count, Performance analysis of various protocols | AODV, DSR, AOMDV | - AOMDV gives less packet loss rate |
| 3.   | S-SFQ FIFO scheme used | AODV, AOMDV, DSR DSR performs better | - Low packet drop rate  
- Fairness is achieved  
- Bandwidth utilization |
| 4.   | SFQ Using single Queue, flow buffer | RED, FIFO | - Improves loss synchronization on problem |

Table 1: Comparison of various mechanisms

V. CONCLUSION

After studying the various congestion control mechanisms, performance of various protocols have been concluded based on various performance metrics. DSR protocol gives better performance using bit vector flow counts & AOMDV gives less packet loss rate in active flow counts mechanism. In start -time fair queuing using single queue based on FIFO scheme DSR performs better. Packet drop rate is low at large queue length in S-SFQ scheme. It also improves loss synchronization problem. In mobility based congestion control scheme, there is less overhead and less end-to-end delay in the network.

REFERENCES