Transmission Power Optimization for Congestion Control using RED algorithm in MANET

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Abstract **-** Each network device has buffer for storing incoming packet if packet is not instantly transferred, store packets if buffer space is available and drop packets if buffer space is exhausted. Mobile ad hoc Network (MANET) devices also using buffer space for same purpose as other network devices. MANET has its own routing protocols which can compromised with frequent route exchange, dynamic topology, bandwidth constraint and multi hop routing. Efficiently managing buffer in devices is new area for research is called Active Queue Management. AQM manages queue according to queue policy for accepting incoming packets and forwarding received packets. To work in with congestion control there is a RED queuing technique. A Red queue work where number of data packet need to be hold and then process in the FIFO and required manner. In this paper our work is performed towards the congestion control protocol over the AODV, DSR and DYMO protocol using RED algorithm. RED uses a mechanism early detection of packet drop without waiting to queue overflow, this mechanism inform the sender to reduce the packet transmission rate and also inform the receiver to not to send excessive acknowledgement packets. It can reduce considerable amounts of delay time if network length is more and sender and receiver are at sufficient distance and increase the throughput.

Keywords- *MANET, AODV, DSR, DYMO, Random Early Detection, Throughput , Avg. QUEUE length, Packet Drop Ratio.*

I. INTRODUCTION

Mobile ad hoc network (MANET) is self-organizing network formed by mobile devices which does not relay in any fixed infrastructure. MANET nodes can be personal devices like laptop, mobile phones and personal digital assistance (PDA's). Nodes in MANET can move freely within transmission range of network for communication take place and nodes which are outside the transmission range of network cannot take part in communication [1]. Devices in MANET can communicate directly if both source and destination devices are in direct transmission range. Devices which is not in direct transmission range can communicate with the help of intermediate node which works as router for forwarding packets, it means that devices in MANET not only works as end system but also as router for forwarding route request, reply packets and data packets which helps in communication. MANET reduces the cost and time of network setup and administration. This can have many application especially including military and emergency services [2]. The dynamic nature of MANET with limited resources that can vary with Time such as battery power, storage space bandwidth makes QoS provisioning, a challenging problem. Due to congestion the packets have to be deleted and also reduce the performance of the network. To finding the congestion free shortest path is a main issue in MANET [3]. Congestion leads to packet losses and bandwidth degradation and waste time and energy on congestion recover. The particular dropped packets might already have travelled a long way in the network and thus consumed significant resources. When the routing protocols in MANET are not alert about the blocking, it results in the following issues [4]:

Long delay: These holds up the procedure of detect the congestion. When the congestion is more exact, it is better to select an alternating new path. But the existing on- demand routing protocol delays the route searching process.

High overhead: More processing and communication at- tempts are required for new route detection. If the multi- path routing is utilized, it needs additional effort for upholding the multi-paths regardless of the existence of alternate route.

Packet Losses: The congestion control technique attempts to minimize the excess load in the network by either reducing the sending rate at the sender side or by drop- ping the packets at the intermediate nodes or by executing both the procedure. This cause improved packet loss rate or lowest throughput.

Congestion defines as when packets across the networks greater than the capacity of the networks and therefore, network become congested [5]. Mainly congestion occurs when number of nodes shared same resources. Congestion is a reason of packet dropped, high end to end delay etc. So, congestion control is a difficult problem in mobile ad-hoc network. Many approaches or algorithms have been proposed for congestion control in MANET.

Main function of any congestion control mechanism is to balance the traffic to increase throughput of the network. Also it is achievable to maximize nodes transmit, packets delivery ratio, less energy spending and decrease traffic congestion, decrease end to end delay and network performance can be improved[2,6].

Each network device manages buffer space for storing incoming data packets and routing information, if the packet in not instantaneously transferred then it is stored in buffer space available in the device, managing such buffer is called Active Queue management (AQM) [7-9]. AQM has ability to improve the bottleneck link. One bottleneck link in communication path can reduce the performance of whole

network. Managing queue in network devices is critical task because different types of devices exists in network with varying parameters such as different computing power, different battery lifetime and available buffer space in each device is different, thus managing of such devices not only required the knowledge of how communication takes place but also should have the knowledge of each devices in communication path. In communication packet may traversed many nodes from source to destination and each node process the packet and forward to next node in path if it is not destination, each nodes process and forward packet until it reaches to the destination [8].

Random early Detection seeks to prevent the router's queue from becoming fully used by randomly dropping packets, and send signals to the sender to slow down before the queue is entirely full. RED also performs tail drop, but does so in a more gradual way. Once the queue hits a certain average length, packets en-queued have a configurable chance of being marked (which may mean dropped). This chance increases linearly up to a point called the max average queue length, although the queue might get bigger [9].

In this problem is when a queue is filled the router start to discard all extra packets thus dropping the tail of mechanism. The loss of packets causes the sender to enter slow start which decreases the throughput and thus increases its congestion window [10].

This paper is organized as follows: Existing work described in section II, further proposed work is described in section III, result analysis is described in section IV and finally conclusion and future work is described in section V.

II. RELATED WORK

In this recently published paper [1], a new algorithm called Effective Queue Management has been proposed that solves the backgrounds in all the existing queue management techniques. Its efficiency over the existing AQM algorithms is verified using the comparison graphs. The proposed scheme is very simple, robust, very low in computational complexity, easily configurable, and autonomous to a single router hence very easy to deploy. In paper [2], the Random Early Detection (RED) gateways technique is proposed to avoid congestion in packet-switched networks. RED is a first generation Active Queue Management (AQM) technique. RED suffers from some severe limitations. The nodes' queue size is not a good method and indicator of the severity of the network congestion, and congestion warning levels issued might be too burst and great, leading to excessive and unnecessary packet loss rate. RED is liable to times of high loss rate followed by link underutilization. In [3] researchers proposed the ACO based multipath congestion control technique with varying the queue according to load in dynamic network. The AOMDV is also balance the load by providing alternative path but not proficient at every condition. The AOMDV is provides the multiple path for data sending. In [4] author proposed an algorithm that combines the idea of Ant Colony Optimization (ACO) with Optimized Link State Routing (OLSR) protocol to identify multiple stable paths between source and destination node. A new route repair and congestion avoidance mechanism is proposed in [5] which was termed as IOAS-AODV. This algorithm selects a limited set of nodes in order to find a new alternate route based on battery status, queue length, quadrant position, and forwarding region. A statistical RED is proposed in [6] that combine RED with ECN which reduces packet loss, which is drop to notify sender to reduce packet sending rate. ECN marks packets instead of drop to send notification this mechanism reduce packet loss. The proposed algorithm will reduce packet delay about to 20% and throughput will increase up to 10%. In [7] QoS performance of AOMDV protocol was improved and is called Enhanced AOMDV (EAOMDV) on the basis of queue length, which enhances the routing capability of AOMDV protocol. In this technique the queue length has handled the data and network performance has improved. The performance of both the protocol has been measured on the basis of performance metrics and packet loss. In paper [8], Random Early Detection (RED) algorithm is applied to maintain Coordinator queue for gaining high throughput as the lowest possible delay and data packet dropped. The simulation results show the performance of RED enabled network parameters are better. This analysis will be a convenient direction for the further development of ZigBee network. A novel approach based on design of experiments is proposed in [9] to study the performance measures related to several AQM schemes viz., random early detection (RED), random exponential marking, modified RED, adaptive RED, stabilized RED, three-section RED, and AQM with random dropping. The impact of several input factors on the performance measures viz., throughput, queuing delay, loss-rate is investigated by using the factorial design where it is used to find the interaction of input factors.

III. OPTIMIZED CONGESTION CONTROL

Network congestion deteriorates the quality of service in the Transmission Control Protocol (TCP) network model. A number of congestion control algorithms have been proposed to achieve the high link utilization with minimum queue latency. Queue management is a very active research area in real time networking traffic so as to meet the demands of real time internet based applications. An AQM algorithm called Random Early Detection (RED) strategy has recently been proposed to manage the queue proactively. It is more fair that other existing algorithms because it does not possess a bias against busty traffic. RED uses four parameters according to which queue is managed i.e. Queue length, Minimum threshold, Max threshold and max probability. Queue length is maximum size of buffer in which packets are stored. Min threshold is the value where the first notification is sent if queue length is crossed the min threshold then packets are forwarded without any packet drop. Max threshold is the value where incoming packets are dropped if queue crosses the max threshold value. In this paper a comparative analysis of different routing algorithm i.e. AODV, DSR and DYMO are performed with varying transmission range using RED AQM algorithm. Aim of this study is to analyze the End to End Delay, Average Jitter, Packet drop and Average Throughput

by the AODV, DSR and DYMO routing protocols using RED AQM algorithm. The simulations have been performed by using QualNet 5.0.2 simulator.

IV. RESULT ANALYSIS

The simulation has been carried out using following parameters as described in Table I.

Table I: Parameters Considered for Simulation

Parameter	Value
Number of Node	40
Total Simulation Time	600s
Terrain	1500M m X 1500 m
Movement Model	Random way point
Routing Protocol	AODV, DSR
Send Packets	8000
Packet Size	512kb
Interface transmit Speed	10 Mbps
Transmission Range(dbm)	5, 10,15,20,25,30,35,40
Number of traffic connection	25
Queues	RED

Figure 1 shows the throughput graph of routing algorithm i.e. AODV, DSR and DYMO using RED queue with varying transmission range.

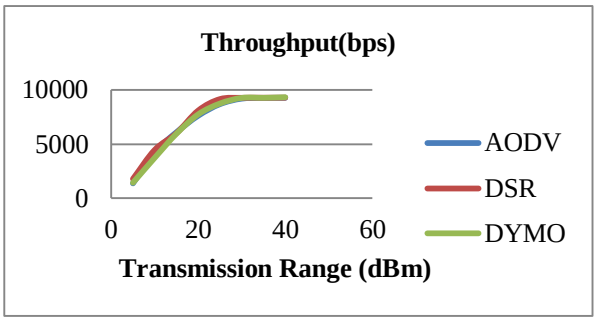

Figure 1: Throughput Comparison between AODV, DSR and DYMO using RED algorithm

Figure 2 shows the average jitter graph of routing algorithm i.e. AODV, DSR and DYMO using RED queue with varying transmission range.

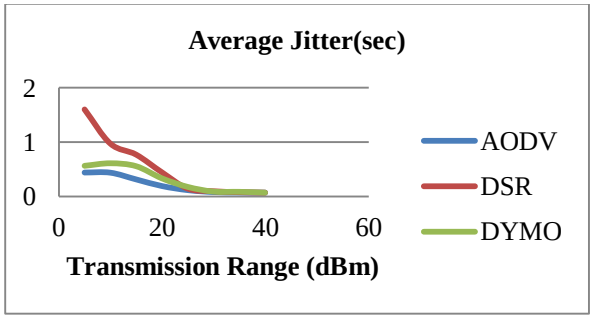

Figure 2: Throughput Comparison between AODV, DSR and DYMO using RED algorithm

Figure 3 shows the average end to end delay graph of routing algorithm i.e. AODV, DSR and DYMO using RED queue with varying transmission range.

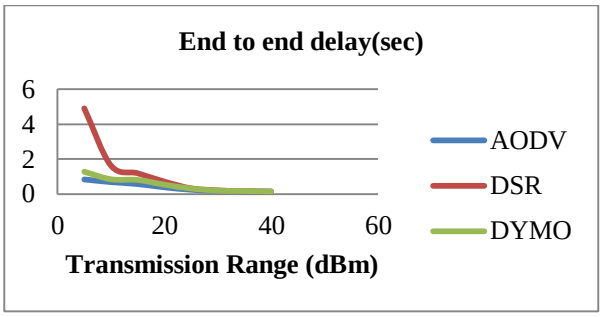

Figure 3: Throughput Comparison between AODV, DSR and DYMO using RED algorithm

Figure 4 shows the received packet graph of routing algorithm i.e. AODV, DSR and DYMO using RED queue with varying transmission range.

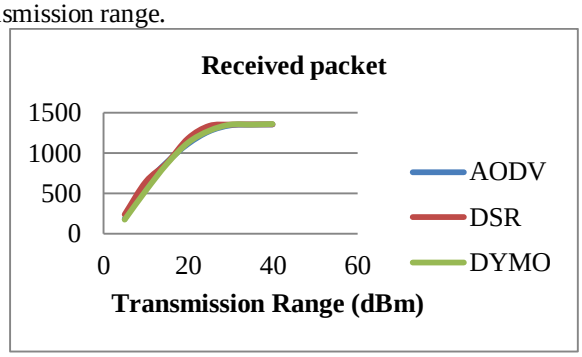

Figure 4: Received Packet Comparison between AODV, DSR and DYMO using RED algorithm

Figure 5 shows the average queue length comparison graph of routing algorithm i.e. AODV, DSR and DYMO using RED queue with varying transmission range.

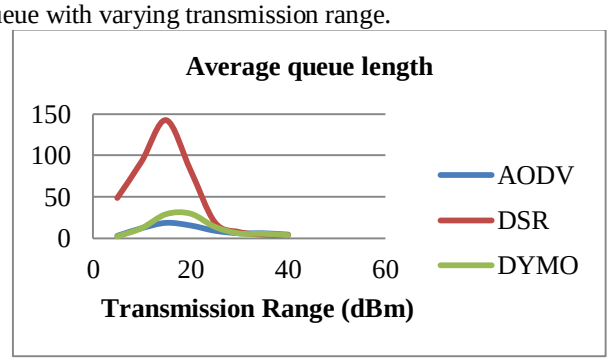

Figure 5: Average Queue Length Comparison between AODV, DSR and DYMO using RED algorithm

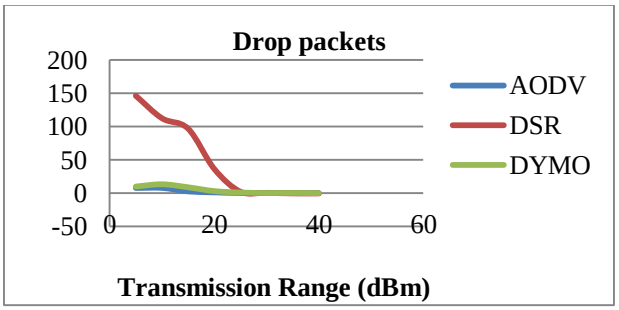

Figure 6: Drop Packets Comparison between AODV, DSR and DYMO using RED algorithm

Figure 6 shows the drop packets comparison graph of routing algorithm i.e. AODV, DSR and DYMO using RED queue with varying transmission range. Figure 7 shows the total dequeue comparison graph of routing algorithm i.e. AODV, DSR and DYMO using RED queue with varying transmission range.

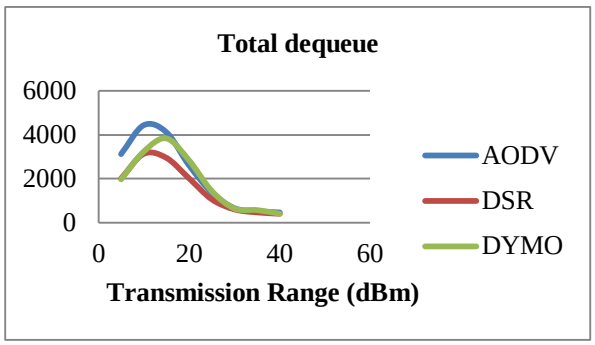

Figure 7: Total Dequeue Comparison between AODV, DSR and DYMO using RED algorithm

V. CONCLUSION

MANET is a network deals in communication and transmission of node between sources to sink. Each network device manages buffer space for storing incoming data packets and routing information, if the packet in not instantaneously transferred then it is stored in buffer space available in the device, managing such buffer is called Active Queue management (AQM).RED detect packet loss using before queue become full by dropping some packets before queue become full, this mechanism reduces packet loss which is drop after the queue become full. As RED achieved the best result in terms of the throughput. In this paper comparative analysis of the RED queue algorithms on the basis of various performance parameters (queue length, packet loss, throughput, drop packet and delay) measured with varying transmission range for a configured network using routing protocol i.e. AODV, DSR and DYMO. Different performance parameters for each algorithm of considered network configuration is shown in comparative graphs. As a conclusion AODV achieved the best result in terms of the throughput, end to end delay as well as drop packets. It is also seen that after 30 dBm transmission range throughput, end-to end delay and packet drop becomes constant. So, after 30 dBm transmission range RED gives optimal result.

VI. REFERENCES

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