Improved Congestion Control using Modified Red Algorithm over Manet

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***Abstract* - Manet a mobile ad hoc network is network without any fixed infrastructure [1]. In mobile ad hoc network mobile nodes are freely moved anytime, anywhere without infrastructure that means they are self systematize. In this type network nodes behave as nodes as well as router. Due to mobility and no fixed infrastructure there are various problems arise among them congestion is the major problem in Manet. Congestion is situation where transmitted packets to the network are much more than holding capacity of network. The RED (Random Early detection) is congestion control algorithm [1][2] which is active queue management technique that can avoid congestion. RED is powerful then other traditional algorithms but RED has challenges such as high packet drop ratio, degradation of throughput and frequent link failure. This paper presents the Modified Red algorithm over Manet. Modified Red algorithm is better as it lowers the packet drop at high load and increases the throughput and takes care of underutilized resources. Modified Red with ECN (Explicit Congestion Notification) can be better in performance than red without ECN. So I am trying to modified red with ECN.**

***Keywords* - Modified Random Early Detection (MRED), Random Early Detection (RED), Active Queue Management (AQM), DECbit , Drop tail.**

1. Introduction

Manet is stand for "mobile ad hoc network" [1][2][8]. All we know is mobile ad hoc network is network of any mobile nodes that are connected to all other network nodes wirelessly. That's why no any fixed infrastructure or topology required by this network. Due to this many problems arise like less topological control, security, congestion control, packet loss, degradation of network performance, unnecessary repeated use of network resources etc. Among this all congestion is major problem in manet. Congestion can explained as network situation where increase packet drops, decrease network throughput, high end to end delay due to exceed arriving packets in a network than handling capacity of network. There are various mechanisms that are used in congestion control. To main techniques are active queue management and passive queue management. In active queue management situation of congested network can be detected early as it can possible. And drop packets according to packet dropping probability. In passive queue management packets allow enter into queue till buffer or queue will full. As soon as queue becomes full this technique drops all packets without any probability from the queue. Routing protocols helps to find route. There are reactive, pro-active and hybrid three types routing protocols available in manet. All are different in their nature of working. Pro-active routing protocols are table-driven, "DSDV "distance sequenced destination vector is pro-active routing algorithm. Re-active routing protocols are on demand protocol. AODV ad hoc on demand routing protocol is re-active routing protocol. Hybrid routing protocols are zonal wise used these two algorithm, ZRP is hybrid routing protocol. Up to this point we know that manet has no any router. Nodes are behave as nodes like source, destination or intermediate node as well as they all have to do work as router. Because of no any router in these network nodes have to take care of listen and broadcast packets for making communication with other nodes. But for broadcast packets to other nodes and in mobile ad hoc network nodes are mobile so they all have to have knowledge of other nodes identification numbers and location of them. So for this purpose nodes maintain routing table that can help them to recognize and get required necessary information for communication. However both of two techniques active queue and passive queue management uses different but efficient algorithms. Active queue management is more powerful and successfully drop disadvantage of passive queue management. Active queue management uses RED algorithm for avoiding congestion. RED can be named as "random early detection", "random early discard", "random early drops". This algorithm detects congestion early and reduce packet drop and increase network throughput. RED algorithm notified sources that congestion occurred in a network you should react against this otherwise drop will be happen. This algorithm periodically calculates average queue size and detects congestion early so that name is random early detection. Drop tail algorithm on other hand uses FIFO policy and allows packet to enter in a queue till queue becomes full. As soon as queue become full algorithm drop packets. Due to this global synchronization problem occur.

RED is better than all other traditional approach in performance metrics but it is analyzed that red with ECN is more powerful than red without ECN. ECN stand for "Explicit congestion notification". It marks packets that have high probability rather than drop them. So it is efficient than red without ECN because red sometimes drops packets more than drop-tail which is not desirable for a network. So I used Modified RED algorithm with ECN mechanism. Modified RED with ECN is

better than other algorithms in sense of packets drop, end-to-end delays and network performance. I used here modified red instead of traditional red because modified red is extend version of red that can calculate dropping probability of packets in accordance of network load. It divides dropping probability of packet in three equal section and indentifies them as light, medium and high load network and calculate probability of these different type of network load. So that network congestion can be detected early and packet drop is more specific. That can help reduce packet drops and high network throughput.

2. Existing Algorithms

As we know there are two types of queue management mechanisms: Active queue and Passive queue management. And there are various algorithms that are use these techniques. I explained here two main algorithms that are necessary and required to understand this document. And they are Drop tail and RED algorithm.

2.1 Passive queue management

Passive queue management technique uses drop-tail algorithm. This algorithm uses FIFO policy. That means it allows packet enter into one end called front end and out from the other hand called rear end. This algorithm allows packets to enter into front end till queue will become full.

PROBLEM: As soon as queue becomes full it drops packets from the rear end. So simultaneously more than two nodes shrink their windows at their own side and it reduces transmission of further packets. As soon as queue is available the all nodes want to transfer data packets simultaneously transmit packets. This causes global synchronization problem.

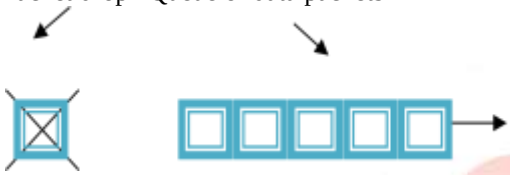


Figure: Queue in drop tail algorithm [2]

2.2 Active queue management.

As we know active queue management red algorithm which is congestion avoidance based algorithm. Main objectives of RED were shrink packet loss ratio and high queuing wait, managing high connective utilization, and remove biases opposed to rush sources [1]. Ism of RED is it can distinguish congestion early as it can, and acknowledge user about condition of network and prevent packet loss due to buffer or network resources overflows. For this purpose, RED calculates weighted average queue and detect congestion according comparison of predefined minimum and maximum value.

Red predefines minimum and maximum thresholds. As soon as packet arrives average queue size is calculated and then it compares it with both thresholds. If average queue size is less than minimum threshold then it can enter into queue. If average queue size is greater than maximum threshold then it drops packets randomly. But if average queue size is in between minimum and maximum threshold then it calculates dropping probability of packets. If dropping probability is less than it simply allows packet to enter into queue but if probability is high than it drop packet. However Red successfully solve global synchronization problem raised in tradition drop tail approach it have several disadvantages. The main disadvantage is RED depends on queue size as a measuring factor of network congestion [1, 3].

RED is also known as random early drop, random early discard. Active queue management [9] facilitate over the problems of Drop tail queues by setting congestion indication to end points before limited space is overfull [3]. RED is better than drop-tail, as it does not have a diagonal against well endowed traffic that uses limited division of the bandwidth.

Four criterions used by RED are:

- Buffer size
- Minimum threshold (min_threshold)
- Maximum threshold (max_threshod)
- Max Probability (P)

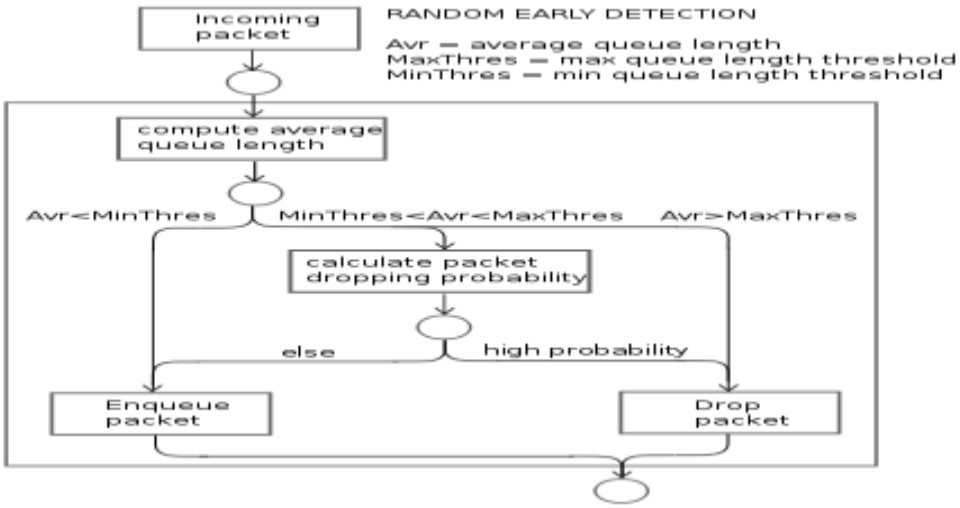


Figure: RED algorithm flow chart (www.google.com)

3. Proposed work

As we know from above discussion that RED is convenient than other techniques and algorithms but it suffers from various problems like**:** high packet drop ratio, degradation of throughput and frequent link failure.

My proposed work presents the Modified Red algorithm with ECN over Manet. Modified Red algorithm is better as it lowers the packet drop at high load and increases the throughput and takes care of underutilized resources. Modified Red with ECN (Explicit Congestion Notification) can be better in performance than red without ECN. So I am trying to modified red with ECN.

One major drawback of RED is that the queue size varies with the level of congestion. This also implies an unpredictable queuing delay from RED, which has negative impacts on the network design.

To overcome this problem TRED algorithm is used. Solution presents minimal settlement to RED called "three sections random early detection (TRED) based RED ".

This algorithm divide packet dropping probability into tree equal parts and distinguishes network load as light, medium, high load. According to this, it calculates dropping probability: when to discard packets. In light load it takes cares of resources underutilization reduces or tries to adjust it with high load network where more resources are required. In medium load condition it is not required extra efforts as it is good to use old formula. In high load it decreases delays.

Due to above advantage it can balancing the performance. TRED scheme does not use explicit congestion notification (congestion window) and it is efficient to use ECN. So I used TRED scheme with ECN window.

Problem: this algorithm proves best among all other algorithm of this category but the only problem is: The nodes who want to use it must be ECN capable.

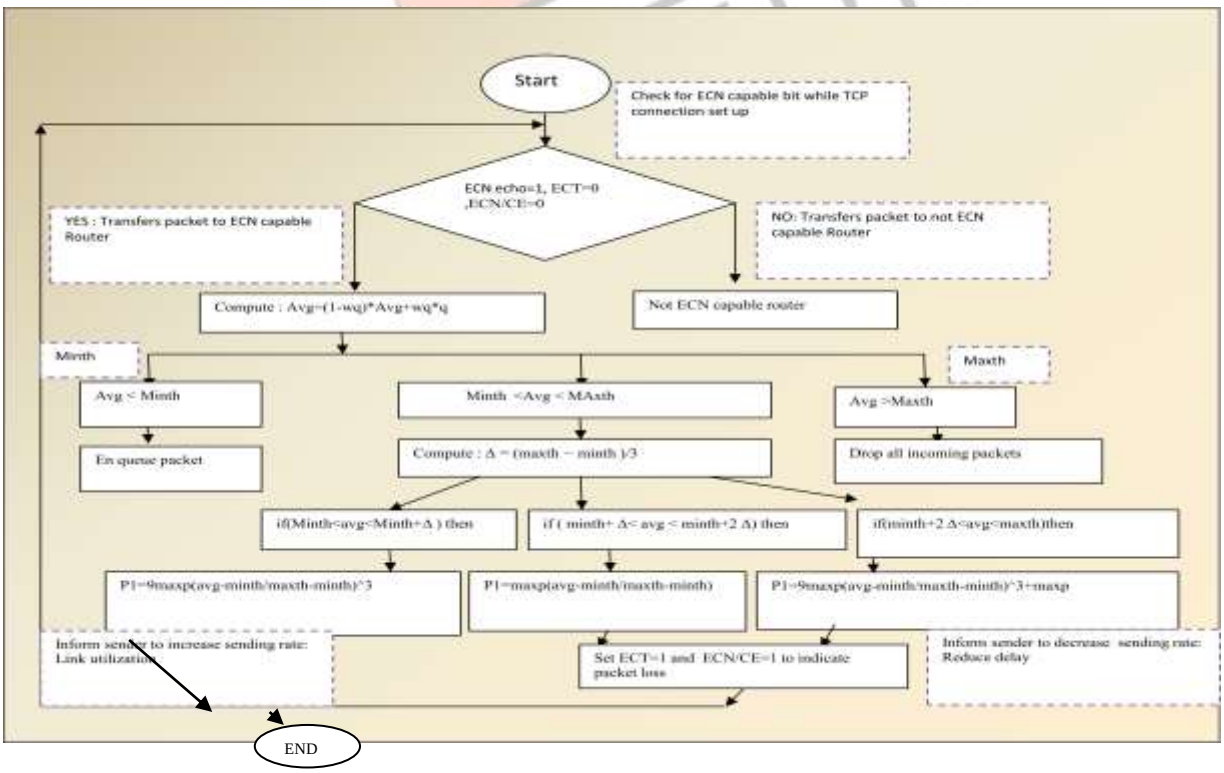


Figure: Flowchart of proposed algorithm

4. Simulation

Network simulator is software or hardware that predicates the performance of a network without a real network being there. NS2 is a required simulation tool used in networks. It is compatible with a number of algorithms which are used routing and queuing. It can arrange or distribute packet traffic according to internet and calculate a variety of different criterion. I used ns2.34 and ubuntu 14.04 LTS for practically proving my work. Performance metrics I used for this are: Listed below:

Throughput

- "Total number of packets delivered over the total simulation time.

Goodput

- "The Goodput is a ratio between delivered amount of information, and the total delivery time"

Packet drop/ Packet loss:

- Packet lost = Number of packet send – Number of packet received.\

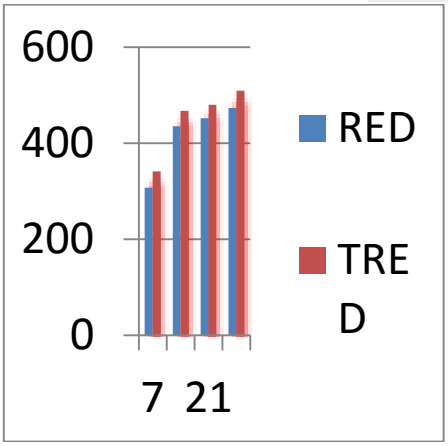
4.1 Simulation result

Table: simulation scenario and throughput comparision , Pdr Comparison

Parameters	Values
Terrain Area	500 X 500
Protocol	DSDV
Traffic	cbr
Numbers of node	7 ,14 , 21 ,28
Packet size	100 bytes
Queue_size	50

Node	RED	TRED with ECN
7	307	341
14	435	467
21	452	480
28	473	509

Node	RED	TRED with ECN
7	0.9967	0.9911
14	0.9978	0.9917
21	0.9965	0.9941
28	0.9951	0.9969



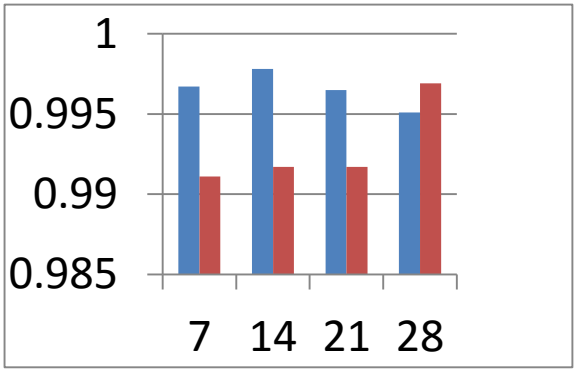


Figure: Throughput Comparison Figure: Packet drop ratio Comparison

Conclusion:

From the whole discussion I am concluded that active queue management is nice choice than passive. And red is good among all other but it sometimes worse than drop-tail in sense of packet dropping. So I used modified version of red, TRED which calculates and drops packets according to different dropping probability in different load like light, medium, heavy load. So it can control dropping packets and underutilized resources in high and low load respectively. I modified this TRED with ECN because working with ECN is more beneficial than without ECN. ECN uses marking rather than dropping. It provides us end-end notification. Result shows that TRED with ECN proves itself practically and improves congestion control in sense of drop packets further improves performance of network. ECN does not work with ECN incapable nodes.

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