REDUCING PACKET LOSS USING MDRED TECHNIQUE IN ACTIVE QUEUE MANAGEMENT

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Abstract- Mobile Ad hoc network [MANET] is consists of mobile nodes without any fixed infrastructure, communicating through wireless medium. In MANET, Congestion occurs in any intermediary nodes when data packets pass through source to destination and they acquire high packet loss and long delay, which cause the performance degradations of a network. Congestion can be controlled by Active Queue Management [AQM] like Random Early Detection [RED]. Random Early Detection (RED) is a network congestion control algorithm which detects incipient congestion according to current length of average queue. It detects congestion only after a packet has been dropped. In the recent, high speed networks, it is important to have some mechanisms that keep throughput high and average queue sizes low without packet loss and it would be undesirable to have large queue because it would significantly increase the average delay in the network.

I. INTRODUCTION

Mobile Ad hoc Network (MANET) is self-organizing network of mobile devices without any fixed infrastructure. Dynamic topology provides a great facility for ad hoc networks, Such as easy installation and mobility without loss of connection. In such facility packet dropping is a serious challenging for quality performance of ad hoc network. Dynamic nature of MANET with limited resources, which varies with time such as battery power, storage space, bandwidth constraint makes QoS provisioning, a challenging problem. Congestion within the network happens when the aggregated demands exceed available resources, and packet loss rate becomes serious drawback. In these increasing network resources is unable to address the congestion problem. Various congestion control methods have been proposed to solve this issue.

Packet loss rate is especially high during times of heavy congestion, when a large number of connections compete for limited network bandwidth. Due to an exponential increase in network traffic, many congestion control mechanisms have been proposed, including the deployment of explicit congestion notification (ECN), along with active queue management (AQM) techniques. RED algorithm can solve the full queue problem by predicting the network congestion situation in advance. Before the queue size exceeds the capacity of the queue buffer, RED algorithm performs a precautionary measure to regulate the queue size in the queue buffer of the gateway. It drops the arriving packet occasionally and randomly before the full queue problem is encountered, so the problem of lock-out and global synchronization can be solved simultaneously.

RED detects congestion only after a packet has been dropped by router in the transmission. In the recent, high speed networks, it is important to have some mechanisms that keep throughput high but average queue sizes low without packet loss. To minimize packet loss it would be undesirable to have large queue because it would significantly increase the average delay in the network.

II. RANDOM EARLY DETECTION

Floyds et al proposed Random Early Detection (RED) in 1993. The basic idea of this mechanism was to detect incipient congestion by monitoring the average queue length. Once the incipient congestion is detected, router selects the source terminal to notify about congestion. On reception of signal source terminal reduces the data transmission rate, to avoid queue overflow, and try to alleviate the network congestion. RED algorithm consists of two steps: the first step is to calculate the average queue length, and the second step calculates the packet drop probability. Packet drop probability to decides whether to drop the packet or not, packet drop is treated as the signal of congestion.

A. Calculation of the Average Queue Length
RED calculates the average queue length (Avg_q), by using the following formula:
$Avg_q = (1-W_q) * Avg_q + q * W_q$ ………… (1)

Here, W_q represents the weighted value, and q represents the actual queue length in the sampling moments.

B. Calculation of the Packets Drop Probability
RED has two thresholds Min_{th} and Max_{th}, which are related with queue length. When the packet reaches the router, RED calculates the average of the queue length Avg_q immediately. Then it determines the packet drop probability based on Avg_q , Min_{th} and Max_{th} . When avg_q is greater than $Max_{th,}$ all packets are discarded, and the packet loss rate is 1. When Avg_q is between Min_{th} and Max_{th}, we have the following Packet Drop Probability (PDP) formula:

$P_b = Max_p * (Avg_q\text{-}Min_{th}) / (Max_{th}\text{-}Min_{th})$…. (2)
$P = P_b /(1–count* P_b)$ ………………………..(3)

Packet drop probability is used to decide whether to drop the packet or not, packet drop is treated as the signal of congestion.

III. MODIFIED RANDOM EARLY DETECTION (MDRED)

Proposed mechanism is based on virtually dividing the queue between minimum threshold (Min_{th}) and maximum threshold (Max_{th}) into smaller subparts and calculation of packet drop probability will be based on the position of average queue size (Avg) into smaller subparts.

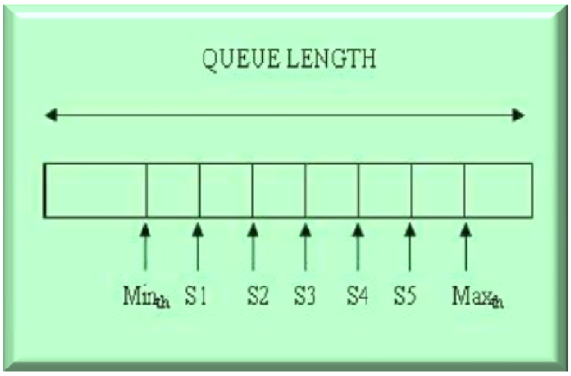

Figure 1: Queue length

Multiple values are applied between minimum threshold (Min_{th}) and maximum threshold (Max_{th}) in this case S1, S2, S3, S4, S5, five values are applied and it is divided into six smaller subparts.

A. Calculation of the Average Queue Length
MDRED calculates the average queue length (Avg), by using the following formula:
$Avg = (1-W_q) * Avg + q * W_q$ ……………… (1)
Here, W_q represents the weighted value, and q represents the actual queue length in the sampling moments.

B. Calculation of the Packets Drop Probability
MDRED has two thresholds Min_{th} and Max_{th} and other value S1, S2, S3, S4, S5 which are related with queue length. When the packet reaches the router, it calculates the average of the queue length Avg immediately. Then it determines the packet drop probability based on Avg , Min_{th} and Max_{th} and S1, S2, S3, S4, S5 .

If average queue size lies between minimum threshold and maximum threshold then Calculate Packet Drop Probability

If (Min_{th} < Avg < S1) {
$P_b = Max_p * (Avg_q\text{-}Min_{th}) / (Max_{th}\text{-}Min_{th})$ }
Else if (S1<= Avg < S2) {
$P_b = Max_p * (Avg_q\text{-}S1) / (Max_{th}\text{-}Min_{th})$ }
Else if (S2 <= Avg < S3) {
$P_b = Max_p * (Avg_q\text{-}S2) / (Max_{th}\text{-}Min_{th})$ }
Else if (S3 <= Avg < S4) {
$P_b = Max_p * (Avg_q\text{-}S3) / (Max_{th}\text{-}Min_{th})$ }
Else if (S4 <= Avg < S5) {
$P_b = Max_p * (Avg_q\text{-}S4) / (Max_{th}\text{-}Min_{th})$ }
Else if (S5 <= Avg < Max_{th}) {
$P_b = Max_p * (Avg_q\text{-}S5) / (Max_{th}\text{-}Min_{th})$ }
$P=P_b / (1 –count* P_b)$
}
If average queue size is greater than Maximum threshold (Max_{th}) then
If (Max_{th} < Queue_length) {
$Max_{th} = Max_{th}$ + packet_size
$P = Max_p$ }

Packet drop probability is used to decide whether to drop the packet or not, packet drop is treated as the signal of congestion.

IV. SIMULATION AND RESULTS

A. Throughput
Network throughput is the average rate of successful message delivery over a communication channel. This data may be delivered over a physical or logical link, or pass through a certain network node. The throughput is usually measured in bits per second (bit/s or bps), and sometimes in data packets per second or data packets per time slot.

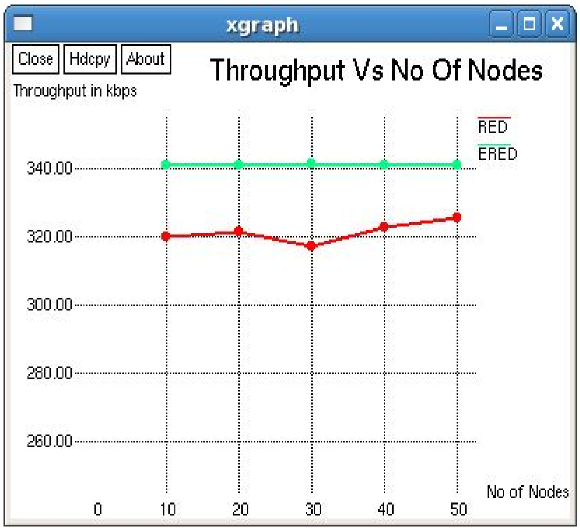

Figure 2: Throughput comparison xgraph

No. of nodes	RED	MDRED
10	320.03	341.07
20	321.5	340.99
30	317.27	341.60
40	322.77	341.0
50	325.62	340.9

Table 1: Throughput comparison table

B. Packet Delivery Ratio

Packet delivery ratio is the ratio of the number of delivered data packet to the destination. Mobile wireless Ad hoc networks use packet delivery ratio (PDR) as a metric to select the best route, transmission rate or power. PDR is normally estimated either by counting the number of received hello/data messages in a small period of time, i.e., less than 1 second, or by taking the history of PDR into account.

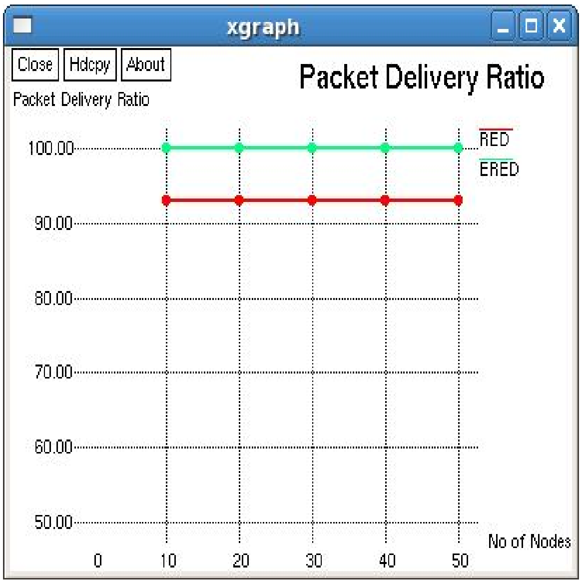

Figure 3: Packet Delivery Ratio comparison xgraph

From the figure 3, it is confirmed that both line of packet delivery ratio is straight lines which shows that packet delivery ratio is consistent in each case of using different no of nodes configuration from 10 nodes to 50 nodes. From figure 3 it is shown that Random Early Detection, having Packet Delivery Ratio (PDR) consistent around 92 and proposed mechanism having PDR consistent around 100.

C. Comparison of Packet transmitted v/s Packet received

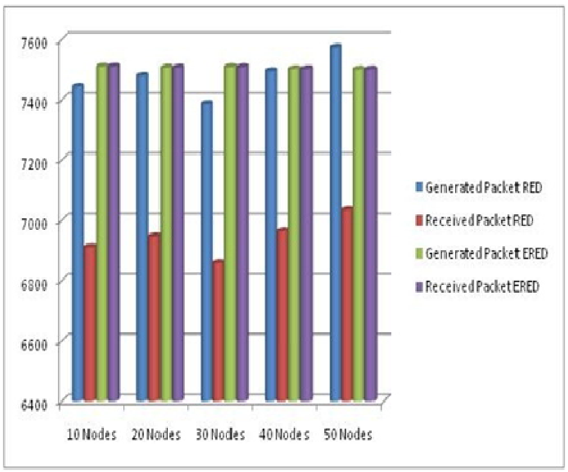

Figure 4: Packet transmitted v/s packet delivered comparison graph

Figure 4 having the comparison of both the Random Early Detection (RED) and proposed mechanism in term of packet transmitted and packet delivered at the destination.

This graph shows that RED having the lots of packet drop thus there difference in packet transmitted and packet delivered, but in proposed mechanism there is no difference in packet transmitted and packet received thus there is no packet drop.

CONCLUSION

This paper proposed a new queue management algorithm based on a completely different control methodology. Without having to rely on some assumptions, new methodology allows the system to completely previous adjustment so as to decide on the trend of new adjustment. Compared to the standard RED, this proposed technique clearly demonstrates its superior performance. It is very likely the same methodology can be easily applied to the adjustment of other critical parameters in the system, for example, the max_{th} and/or min_{th}. Packet Delivery Ratio and Throughput are employed as the performance indicator for merit judgment of the proposed technique.

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