International Journal of scientific research and management (IJSRM)
||Volume||3||Issue||1||Pages|| 2000-2003 ||2015||
Website: www.ijsrm.in ISSN (e): 2321-3418

Survey on Mobile Ad hoc Network Performance Using Upper Threshold RED

Jai Mungi, Prof. Aishwarya Mishra

Computer Technology & Application
IES Institute of Technology & Management, Bhopal.

Computer Technology & Application
IES Institute of Technology & Management, Bhopal

jaimungai14@gmail.com

ABSTACT
Random Early Detection [RED] algorithm achieves high throughput, packet delivery and low average delay by stabilizing the average queue size through mapping the congestion into packet drop probability and detection and avoidance of incipient congestion. In most cases RED performance is sensitive to its parameter setting. In this paper proposed algorithm has introduce the new threshold parameter (U_{th}) to reduce sensitivity of RED on its parameter setting, so that its performance will improve. Goal of this paper is propose a new mechanism to achieve high throughput and low end to end delay in congested network.

1. INTRODUCTION

A mobile ad hoc network (MANET) [1] is a wireless network model without the need of central base stations. MANETs can be applied in natural catastrophes, medical emergencies and military applications and conduct geographic exploration. Mobile and wireless devices belonging to a MANET are usually called mobile nodes. These nodes are being characterized by high mobility, limited storage, low power, and limited transmission range. Mobile nodes communicate through bi-directional radio links and data transmission is a key challenge. MANET communication events are called sessions. The two communicating nodes, namely the source node and the destination node comprise a session pair (or source, destination pair). A mobile can directly communicate with other nodes if any such a link exists within their radio transmission range. If the distance between a session pair is too large to establish direct contact, then the data will sent via intermediate nodes which connect the two parties. At least one valid routing path must be established before the source node of a session pair can send data to its destination node. MANET routing protocols can be categorized into three categories, namely table-driven routing, source-initiated on demand routing, and hybrid routing. Well known source-initiated on demand routing protocols include AODV [2] and DSR. These protocols are based on the strategy of only find valid routes once they are needed by the source node. This procedure is known as route discovery. Route discovery involves the route request phase (RREQ) and the route reply phase (RREP). These protocols all construct a single-path route between a source node and a destination node. Backup routing protocols are usually designed to provide data salvation capabilities for the previously mentioned protocols, and they are classified as a special type of single-path routing protocols. A multipath routing protocol usually establishes several valid paths for a session pair during a successful protocol run. A backup routing protocol mainly establishes one valid primary path together with several other alternative paths during a successful protocol run.

2. RANDOM EARLY DETECTION

Floyds and Jacobson presented a mechanism called Random Early Detection (RED) [3] in 1993. The idea of this mechanism is that the router will detect incipient congestion by regular monitoring of the average queue

length. If incipient congestion is being detected, router will select the source terminal to inform about the incipient congestion. So the source terminal can be reduced the data transmission rate before the queue overflow, and it will try to reduce the network congestion. RED [4][5] algorithm congestion detection consists of two steps: in first step this mechanism calculate the average queue length, and in the second step it calculate the packet drop probability. Packet drop probability is used to decide whether to drop the packet or not, packet drop is takes as the signal of congestion.

A. Calculation of Average Queue Length

RED algorithm average queue length (Avg), calculation is done by using the following formula:

$$Avg = (1-W_q) * Avg + q * W_q \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

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

B. Calculation of Packets Drop Probability

RED algorithm calculates packet drop probability by using two thresholds Min_{th} and Max_{th}, to detect the incipient congestion. Whenever the packet reaches the router, it calculates the average queue length (Avg) immediately and then it determines the packet drop probability based on Avg , Min_{th} and Max_{th}. When avg is greater than $Max_{th,}$ all packets are discarded, and the packet loss rate is 1. When Avg is between Min_{th} and Max_{th}, we have the following Packet Drop Probability (PDP) formula:

$$P_b = Max_p * (Avg-Min_{th}) / (Max_{th}-Min_{th}) \ldots. (2)$$

$$P = P_b / (1 - count * P_b) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

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

3. RELATED WORKS

Several solutions have been proposed in the literature for the Queue Management in Mobile Ad hoc Networks (MANET's). Some of them are as follows:

K. Dinesh Kumar et al presented a mechanism called predictive queue management strategy PAQMAN [7], this mechanism reduces Packet loss, Increases packet transmission efficiency.

Zhenyu et al presented a mechanism with dynamic reference queue threshold named ARTAQM [8], which offers stable and flexible queue length which reduces packet loss and increases link utilization.

Guan-Yi Su et al presented a mechanism called MRED [9], it is modified from RED; this algorithm provides higher transmission throughput and avoid the sensitivity of RED performance to the parameter setting. Progressive Random Early Detection (PRED) algorithm improved by the progressive adjustment method is proposed.

Torres Rob et al presented an innovative TCP [10] flow control method. This algorithm combines RED with TCP window adjustment for improving the network performance. The result of the algorithm shows that during fully utilizing the network resource this scheme achieves increased network stability with desired latency and packet dropping rate.

Chandni M Patel [11] has suggested that Random Early Detection (RED) is one of the most prominent congestion avoidance schemes in the Internet routers. To overcome the limitations, this research propose an algorithm, with laser changes to the overall RED algorithm which provides effective solution to avoid congestion collapse of network services by introducing new threshold Uth (Upper Threshold). Simulation results show that our new URED algorithm gives better performance than RED and Adaptive RED.

4. NETWORK PERFORMANCE PARAMETERS IN MANET

The following metrics are used in varying scenarios to calculate performance of network

1) Throughput – Throughput or network throughput is the average rate of successful message delivery over a communication channel.

2) End-End Delay - The packet end-to-end delay is the time of generation of a packet by the source up to the destination reception. So this is the time that a packet takes to go across the network.

3) Packet delivery rate - The total number of data packets received divided by the total number of data packets originated.

4) Data Dropped – This is the difference between total number of packet transmitted by transmitter and total number of packet received by receiver at receiver end.

5. SOLUTION APPROACH

In our proposed algorithm, we have added an additional Threshold for better use of queue space, to enqueue more packets with less packet drops drop rate, when average queue size is greater than max_{th} but lesser than additional threshold named Upper threshold (Uth). As in RED and other enhanced RED algorithm Packet Drop probability increases linearly from 0 to max_p up to Max_{th}, If average queue size goes greater than max_{th} then P is set to 1 and all incoming packets are dropped. In order to reduce packet loss the queue buffer packet drop probability is calculated by another linear function when average queue size reaches between max_{th} threshold and Uth threshold.

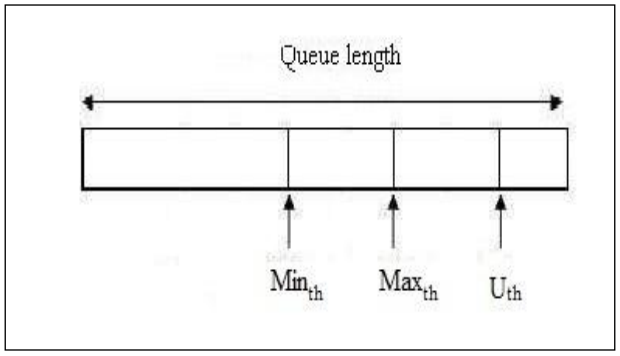

Figure 1: logical division of Queue length

Figure 1 shows logical division of queue length, in which queue length is logically divided by minimum and maximum threshold and applying one extra threshold after maximum threshold. After dividing queue length into smaller parts packet drop probability function is increasing between minimum threshold and maximum threshold from 0 to max_p and from maximum threshold to U_{Th} packet drop probability function is linearly increasing from max_p to 1.

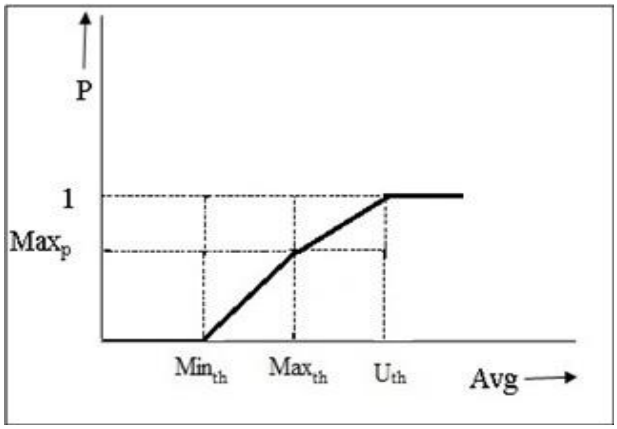

Figure 2: variation of packet drop probability

5.1 Algorithm for Upper Threshold RED

Step 1: If the average queue size of RED is less than min_{th}

Then P = 0 ;

Step 2: If the average queue size of RED is between min_{th} and max_{th} then
$P_b = (avg - min_{th}) / (max_{th} - min_{th})$;
$P = P_b$ *max_p;

Step3: If the average queue size of RED is between max_{th} and Uth, then
$P_b = (avg - max_{th}) / (max_{th} - min_{th})$;
$P = P_b$ *(1 - max_p);

if at any step (P > 1.0)
P = 1.0;
return P;
}

In above algorithm, whole process is divided into three steps if average queue size is less than minimum threshold then packet drop probability will set to 0 so that no packet drop will occur because there is no chance for congestion. In step 2 if average queue size is between minimum and maximum threshold packet drop will be decided based on calculated value of packet drop probability, if PDP is high packet drop will occur otherwise no packet drop will occur. In step 3 instead of dropping all the packets in RED, the proposed algorithm has applied one extra threshold and packet drop probability is being calculated by another function whose PDP values varied from max_p to 1.

6. CONCLUSION

RED queue management algorithm performance is better than other traditional queue management algorithm such as drop-tail, but its performance in most cases is sensitive to setting of queue parameters and packet drop probability function. Proposed algorithm has introduce the new threshold for reducing the parameter sensitivity of Random Early Detection and it will improve network performance

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