Analysis and Modification of Queue Mechanism of Sensor Nodes to Reduce Congestion

Nidhi Patel[1]
Department of Electronics and Communication Engineering
V.V.P. Engineering College
Rajkot, India
nidhipatel065@gmail.com

Sneha Pandya[2]
Department of Electronics and Communication Engineering
V.V.P. Engineering College
Rajkot, India
Sneha4680@gmail.com

***Abstract*— as the usage of network goes increasing day by day; to manage network traffic becomes a very difficult task. It is important to avoid high packet drop rates in the router. Congestion is one of the major problems in the present networks. To solve the congestion problem, proposed a number of queue management algorithms. Active Queue Management (AQM) is one mechanism which provides better control over congestion. This paper recently used load based AQM technique that provide better performance in terms of Queue size, packet loss rate, link utilization, throughput and queue occupancy time. The performance of the proposed work will be examined and evaluated with NS-2.34 simulator.**

***Index Terms*— Active Queue Management (AQM), Random Early Detection (RED), Congestion control, DropTail**

I. INTRODUCTION

Congestion control is one of the problems at the network routers and it affects the performance of TCP. Congestion in a network may occur when the link bandwidth exceeds the capacity of resource. Results of congestion include a high delay, link underutilized and degrade throughput and the response time tends to infinity [2].

To avoid the congestion problems two approaches are defined. The Droptail is one type of congestion control mechanism which drop the packet when buffer is full. Droptail queue suffer the problem of global synchronization [3]. The second is Active Queue Management (AQM), a proactive mechanism to achieve high bandwidth utilization with low queuing delay.

AQM is used to overcome the congestion at router where the packets are dropped probabilistically before buffers are full. The congestion is occurs when buffers overflow. AQM is a pro-active approach, and is highly uses for the Internet router. The main objectives of AQM are to achieve increase throughput and reduce average queuing delay in the network.

Random Early Detection, or RED, is an Active Queue Management algorithm is uses a mechanism of congestion without the queue become overflows [11]. RED overcome the problem of global synchronization and control average Queue length [9].

There are several other AQM mechanism based on RED have been proposed like Adaptive RED(ARED), Dynamic RED(DRED), Exponential RED, Refined Adaptive RED(Re-ARED), non-linear RED, Yellow, BLUE. These Schemes aim to improve some or all of the following features: fairness, network utilization, packet loss, and adaptability of different characteristics of traffic [2].

The rest of this paper is organized as follows. Section 2, gives an overview of the Queue management. Section 3, presents our literature survey on various RED algorithms. Section 4, include the proposed method. Section 5, gives the result of this proposed method. We come to the conclusion in the sixth section.

II. OVERVIEW OF QUEUE MANAGEMENT

Queue management schemes can broadly be divided into groups based on the use of instantaneous queue size like Droptail and use of average queue size and threshold value like RED.

1) Drop Tail

Droptail (DT) is the first and simple method for controlling the queue length at routers. In this queuing mechanism, set a maximum threshold at the end of each queue at the router which stores all incoming packets until the maximum queue length is empty. Once the queue becomes full packets start dropping packet as shown in fig 1.

The DT mechanism drop packets only when the buffer is full, which increase packet dropping rate and increase delay. When all links slowly down and also their transmission rate at the same time decrease these causes Global Synchronization. The DT technique also suffers from the lock-out problem where the queue is control by some insensitive connection.

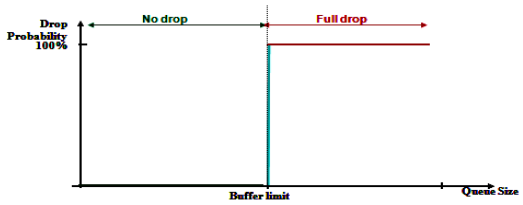

Figure1. Drop functions of Drop Tail

2) RED

Random Early Detection (RED) is a most widely used technique for congestion avoidance. It also overcomes the drawback of droptail like global synchronization by randomly choosing packets to be dropped before queue becomes full [8]. RED drops packet probabilistically by using four parameters such as average queue size (avg), minimum threshold (TH_{min}), maximum threshold (TH_{max}) and maximum probability (P). Then we have the following conditions [3] as shown in the figure 2.

a) If avg < $TH_{min,}$ then no packet drop and marks occure.
b) If avg > $TH_{max,}$ then all the packets are marked.
c) If TH_{min} < avg < TH_{max} then the packets are randomly marked with a certain probability whose values varies from zero to maxP.

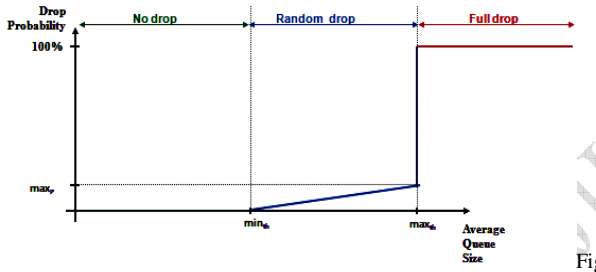

Figure2. Drop functions of RED

III. REVIEW OF LITERATURE

In this we will discuss about the research work of different authors, to avoid the congestion in network how they use of Active Queue Mechanism (AQM) strategies, in which packets are dropped before queue get full.

In [2] this paper proposed a three-section RED (TRED) which is based on nonlinear RED. The bandwidth is underutilized when traffic load is low and the delay is large when traffic load is high. These are the major drawback of RED. To overcome this problem, this paper introduce a three-section random early detection(TRED) in which the average queue length between two threshold divided into three equal section to differentiate the performance of delay and throughput between light, moderate and high traffic loads.

This paper compare the performance of TRED with RED using NS2 simulation, TRED achieve better congestion control and improving bandwidth utilization. Further optimization in TRED's with Explicit Congestion Notification (ECN) because a lot of research has proved that AQM with ECN perform more efficiently.

In [4] this paper analyzed the network performance improvement by using RED or Droptail. The RED routing is more effective congestion control mechanism based on router performance. This paper concludes following result from simulation. First, RED algorithm perform better when the load is dynamic. If the average queue length exceeds the maximum threshold than router discard the packet and it efficiently control the average queue length. Second, RED overcomes the problem of TCP's global synchronization by drop packet with uniform random variables. Third, RED algorithm reduce transmission delay without reducing the throughput. Above mentioned result shows that RED routing performs better than the Droptail routing.

In [5] this paper proposes an algorithm called as LAL Random Early Detection (LALRED), which is based on the learning-automata-like mechanism. The primary objective of LALRED is to improve the performance of congestion avoidance by lowering the average queue size and packet loss rate at queue.

The performance of LALRED obtained using NS2, over the RED. First, reduce the number of packets drop at the gateway using LALRED compare to RED. Second, the dropping probability of LALRED at the gateway is proportional to the average queue size. Third, average throughput of LALRED is less than RED but the average queue size and the number of packets drop at any instant of time as less compared to normal RED. This paper suggests some ideas for further optimization of LALRED. First, how the LALRED perform in different network like MANET in which the nodes are mobile. Second, LALRED or modified LALRED is used for congestion avoidance in wireless network. Third, how LALRED perform in the network when large number of nodes needs to improve.

In [11] this paper focus on Multicasting network using PIM-DM (Protocol Independent Multicast-Dense Mode) with two queuing algorithms Drop Tail and Random Early Detection (RED). This paper analyses and contrasts Drop Tail and RED for queue management based on drop out data packets in network. PIM-DM is a multicast routing protocol. It uses unicast routing information base to flood multicast datagrams to all multicast routers connected in the network. PIM-PD uses RPF (Reverse path Forwarding) to prevent looping of multicast datagrams while flooding. This paper increase the performance of RED to be better queuing algorithm for the networking topology compared to Drop tail.

IV. PROPOSED METHOD

From this literature survey summarized the limitation of RED. RED is aware to the traffic load and creates difficulties in setting of parameters. One major drawback of RED is that the Queue length varies with the level of congestion. RED algorithm drops all incoming packets

when average queue length exceeds the maximum threshold, so it does not utilize the queue fully. When traffic load is low, the bandwidth is underutilized. When the traffic load is high, the delay is increased.

Objective of this paper is to overcome the drawback of RED is to increase the throughput at a low traffic and decrease the delay at a high traffic. Developing modified RED algorithm to overcome the drawback of RED mechanism. Simulating and implementing this new approach for improving the network resource utilization and avoiding packet loss in NS-2. To overcome the drawback one method use is Explicit Congestion Notification (ECN) which notify sender before the queue become full, it avoid the large packet drop and increase the throughput.

The modified algorithm is shown in the flow chart to overcome the limitation of Existing RED as shown in figure 3 and figure 4.

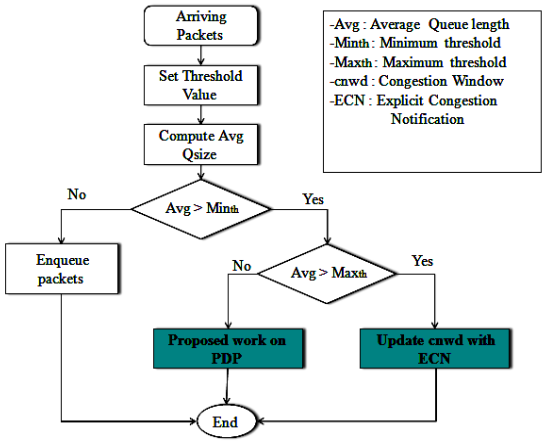

Figure3. The flow chart for Modified RED

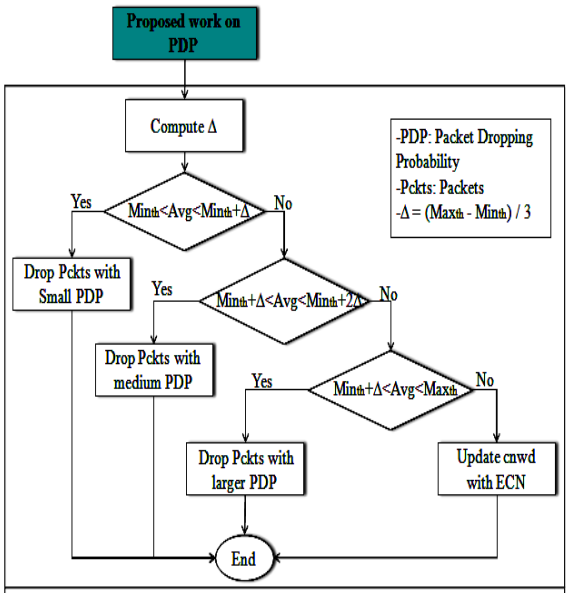

Figure4. The flow chart for Modified RED based on PDP

V. RESULT ANALYSIS

Comparison of RED Queue mechanism with Modified RED based on various parameters like throughput, Goodput and End-to-end delay. This research work is shown the modification in existing RED which gives greater throughput and reduce end-to- end delay.

The parameter for the RED queue which is predefined for set their thresholds and it is set into the tcl file. For this simulation, RED uses queue length is 50, minimum threshold is about at 4, maximum threshold at 15, maximum dropping probability is 0.1 and the weighting factor is 0.001.

The simulation result shows the comparison of existing RED and Modified RED mechanism in terms of Goodput as shown in figure 5. The simulation result clearly shows that the goodput of Modified RED is greater than the existing RED.

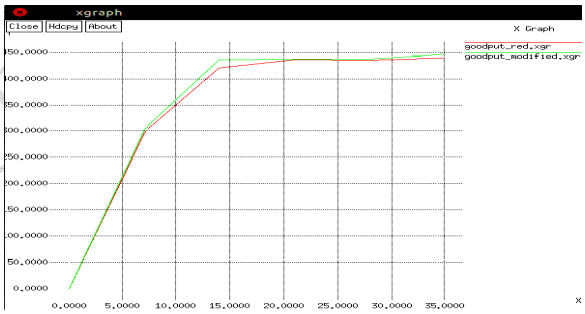

Figure5. Analysis of Goodput Vs Number of Nodes

The simulation result shows the comparison of existing RED and Modified RED mechanism in terms of Throughput as shown in figure 6. The proposed algorithm shows that the result of modified RED is better than the existing RED.

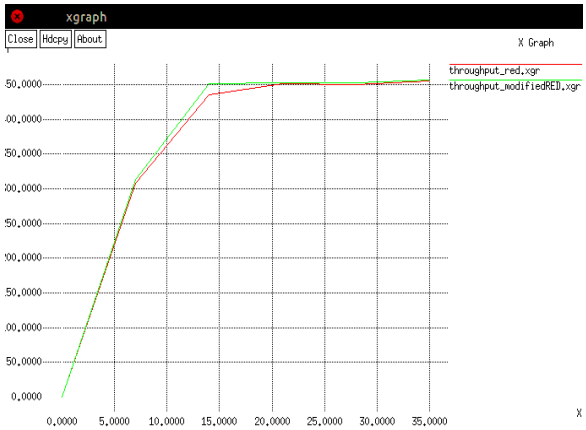

Figure6. Analysis of Throughput Vs Number of Nodes

The simulation result shows the comparison of existing RED and Modified RED mechanism in terms of End-to-end Delay as shown in figure 7. End-to-end delay refers to the time taken for a packet to be transmitted across a network from source to destination. When the traffic is high or the number of nodes is increases then the Delay will decreases from this proposed method.

Figure7. Analysis of End-to end Delay Vs Number of Nodes

VI. CONCLUSIONS

This paper solves the drawback of Existing RED; here in propose work Modified uses ECN which notify sender before the queue become full by marking the packet. From this method, it solve the major drawback of RED is the average queue size exceeds the maximum threshold then all incoming packets are dropped. Modified RED is combined with ECN which gives better result in terms of throughput and delay.

Instead of existing RED, the Modified RED has used nonlinear packet dropping probability to differentiate the traffic load. When the traffic is low then Modified RED uses lower packet dropping probability compare to existing RED which maximizes the use of link utilization and when traffic is high then Modified RED uses the higher packet dropping probability compare to the existing RED which minimizes the delay.

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