Congestion Control in Cable Network Transmission using Novel RED Algorithm

Prasant Kumar Dash, N. K. Barpanda, Madhumita Panda

Abstract: ***Congestion is an important issue in cable network where transmitted packets to the network are much more than holding capacity of network. Each network needs the maximum number of successful packets to reach the destination with less number of packet losses and low time delay with better fairness. There are several congestion control algorithms which have been studied to keep the network stable. They employ various techniques from which the buffer or queue management used by the router is one significant issue to control congestion. The Active Queue Management algorithms like RED controls the queue size by dropping or marking the packets before buffer becomes full . In this paper a new algorithm has been proposed and the results are compared with existing RED algorithm using network simulator (NS-2) in a responsive environment of the cable network.***

Keywords: Congestion control, AQM,RED,NOVEL RED, Queue based

I. INTRODUCTION

Congestion refers to the state when a link bandwidth exceeds the capacity of the network. We know that any network can perform reasonably well with light load. The problem arises when they are used heavily in higher load conditions. In simple language, we can say that congestion refers to the loss of network performance when a network is heavily loaded. The congestion problems leads to degradation in throughput ,large packet loss rate. At very high traffic, even the performance collapses entirely and almost no packets are delivered to the destination.

To increase the performance of the network, it is required to control the congestion in the link. The Internet is a packet switched network where data routes from source to destination computer by routers. Routers have queues to store packets in their buffers for some time when the network is busy, rather than just reject them. As the resources of the routers are limited ,the size of these queues are also restricted. In high speed network, we need to develop mechanisms to keep throughput high however average queue size should be slow. For that queue management technique utilized by the routers is one in of the significant issue in the congestion control study. Queue management algorithms are of three types : active, passive and proactive .This paper presents a new Active Queue Management algorithm called Novel RED which controls the constraints of minimum threshold and maximum threshold of queue and produce better outcome than existing RED.

Revised Manuscript Received on August 05, 2019.

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The rest of the paper is organized as follows: Section 2 gives the related works. The proposed scheme Novel RED algorithm is discussed briefly in section 3, whereas section 4 shows the simulation set up and result analysis of the proposed algorithm and its comparison with the existing RED. Finally, Section 5 concludes the paper with some future scope of research work.

II. RELATED WORKS

In this section some similar related works done on active queue management has been presented.In [1] an improved version of RED algorithm named ERED (Enhanced RED) is proposed. Simulations are done using NS2 simulator, comparing packet numbers and packet loss numbers under different congestion condition. Results showed that the packet loss and link utilization of ERED are better than RED. Shubhangi Rastogi et al. [2] has done the comparison of different queuing mechanism in Dumb-bell Technology. The simulation results show that Non Linear Random Early Detection has superior quality than others. In the paper[3]several active queue management algorithms are discussed and their performances are compared on the basis of NS-2 simulations. The authors in[4] have proposed a new algorithm called Enhanced Random Early Detection (ENRED) by improving some parameters of RED that works to provide better congestion control over the network .Simulations are done with ns2. Results show that the proposed algorithm achieves better queue size than RED and decreases the delay and losses. In the paper [5] an exhaustive survey is made on the AQM techniques that are proposed and the merits and short falls is presented.

III. PROPOSED ALGORITHM

RED also known as Random Early Detection or Random Early Discard or Random Early Drop is an AQM algorithm that provides method for congestion avoidance (RED) [6] which has been recommended by the IETF as the default AQM scheme for routers of next generation networks (NGN) [7, 8].

The proposed AQM algorithm is called as Novel RED to deal with the marking or dropping probability factor. Like other AQM methods, the packets are dropped in the router. But here, the objective is to control the dropping packets through the probability factor p_a and p_b, so that network performs better.

The value of $\boldsymbol{p_a}$ and $\boldsymbol{p_b}$ of existing RED algorithm is

now calculated according to the following equation:

$$p_b \leftarrow max_p * \frac{(max_{th} + min_{th}) * avg_q^2 - (max_{th} - min_{th}) * min_{th}^2}{max_{th}^2 - min_{th}^2} \quad (1)$$

$$p_a \leftarrow \frac{p_b}{1-(count * p_b)} \quad (2)$$

where,

p_a : Current packet marking probability,

p_b : Packet marking probability which varies from 0 to $\mathbf{max_p}$.

IV. RESULTS AND DISCUSSIONS

In this section, the performance of proposed scheme has been evaluated and compared with well-known RED AQM using the network simulator NS2 (http://www.isi.edu/nsnam/ns/2004-05- 04) and all the graphs are plotted using gnuplot. The simulation shows that Novel RED gives better throughput, less number of packet drop and average inter packet delay than existing protocol RED in the cable network (DOCSSIS 3.0) with a constant number of flow.

The number of flow in both the sides (sender and receiver) is increased constantly to check the performance of network if congestion occurs or not and then we analyse the proposed scheme Novel RED with RED in terms of throughput, average end to end delay and packet delivery ratio. For simulating the experiment, we vary the number of flow from 20 to100, where link delay and bandwidth of all the links are constant. In case of throughput metric, the proposed scheme Novel RED performs better from RED as shown in Figure 1. Figure 2 shows the minimum average end to end delay in Novel RED with RED. Similarly, in packet delivery ratio, Novel RED obtained fewer ratios than RED as shown in Figure 3. In all the different types of network, constant number of flow has taken one important role for testing and analysing the new algorithm. From Figures 1, 2 and 3, it is clearly visible that our proposed algorithm outperforms RED algorithm in terms of throughput, Average end-to-end delay, and Packet Delivery ratio.

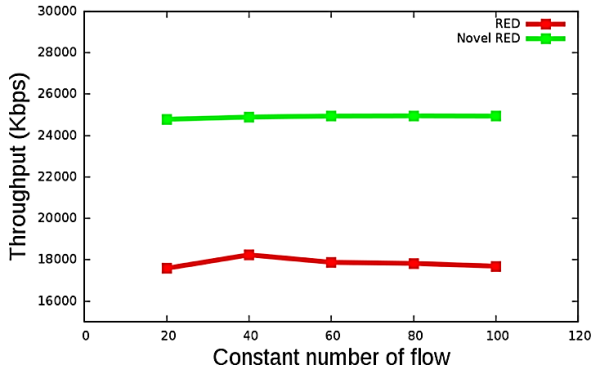

Figure 1: Constant number of flow vs Throughput

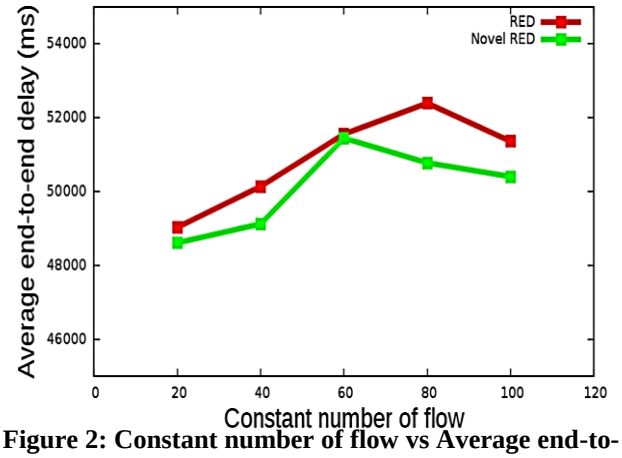

Figure 2: Constant number of flow vs Average end-to-end delay

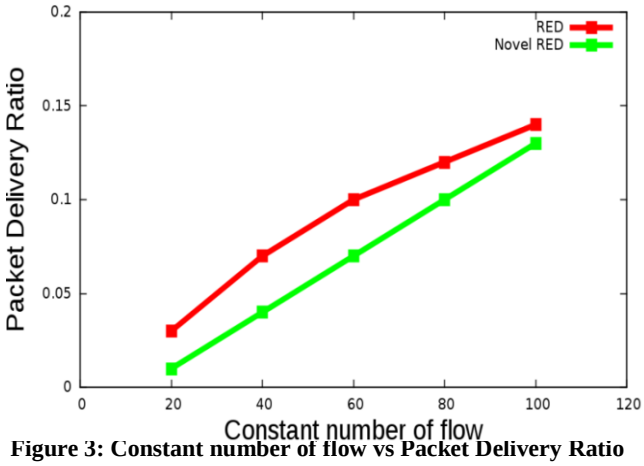

Figure 3: Constant number of flow vs Packet Delivery Ratio

V. CONCLUSION

The main objective of AQM scheme is high throughput, low delay, less number of packet drop, robust and stable. According to the goal of AQM, as seen ,the proposed algorithm Novel RED simulated under cable network produces better throughput, less number of packet drop ratio and also delay is minimum than RED in dynamic environment of the cable network. The proposed method may also be used to compare the congestion control of RED and Novel RED by varying the Link Capacity, Link Delay, and Fairness in cable network.

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