Name : Chi-Ping, Lai and Cheng-Yuan, Tang

Title: Active Queue Management for Web Traffic

Huafan University Computer Center
Department of Information Management, Huafan University

No. 1, Hua Fan Road, Shih Ting Hsiang, Taipei Hsien, Taiwan 223, ROC

Chi-Ping, Lai **cplai@huafan.hfu.edu.tw** **02-26632102#3322**
Cheng-Yuan, Tang **cytang@huafan.hfu.edu.tw** **02-26632102#4357**

name of the contact author: Cheng-Yuan, Tang

Keywords: Congestion Control, Active queue management, Web Traffic.

Abstract

World Wide Web (WWW) has a rapid evolution in the Internet. Measurement studies have shown that the majority of Internet connections are Web browsing. On the other hand, Internet suffers from the congestion problems because the numbers of the Internet users and traffic demand grow explosively. In this paper, we will introduce a congestion control mechanisms for Web traffic. The modified RED will be proposed.

Active Queue Management for Web Traffic

Chi-Ping, Lai and Cheng-Yuan, Tang

Huafan University Computer Center
Department of Information Management, Huafan University

cplai@huafan.hfu.edu.tw, cytang@huafan.hfu.edu.tw

Abstract

World Wide Web (WWW) has a rapid evolution in the Internet. Measurement studies have shown that the majority of Internet connections are Web browsing. On the other hand, Internet suffers from the congestion problems because the numbers of the Internet users and traffic demand grow explosively. In this paper, we will introduce a congestion control mechanisms for Web traffic. The modified RED will be proposed.

Keywords: Congestion Control, Active queue management, Web Traffic.

2

1. Introduction

Congestion control for IP networks has been a problem for many years. The problem of congestion collapse has prompted the study of end-to-end congestion control algorithms in the late 80's. The essence of this congestion control scheme is that TCP keeps increasing the sending rate of packets as long as no packets are lost. In response to that, TCP decreases the sending rate. Thus the sending rate is changed according to the level of congestion perceived in the network. Usually, packets are dropped because the congestion occurs in the network. While congestion occurs, in router queue management, the packets are dropped from queue. Recently, the queue management technique, Random Early Discard (RED) [1], is popular. RED is an active queue management. Active queue management refers to the practice of manipulating the queue at an outbound interface in a router to bias the performance of flows. The goals of active queue management are to 1) reduce the average length of queues in routers and thereby decrease the end-to-end delay experienced by packets; and 2) ensure that network resources are used more efficiently by reducing the packet loss that occurs when queues overflow. However, the complexity of setting RED parameters seems to be no advantage to RED deployment on links carrying only Web traffic [2]. World Wide Web (WWW) has a rapid evolution in the Internet.

3

Measurement studies have shown that the majority of Internet connections are Web browsing [2]. In this paper, we will introduce an active queue management for Web traffic. RED will be modified to be suitable to web traffic.

2. Related works

In RED, packets are randomly dropped before the buffer is completely full, and the drop probability increases with the average queue size. By dropping packets before a router's queue fills, the TCP connections sharing the queue will reduce their sending rates and ensure the queue does not overflow. RED has the potential to overcome some of the problems such as synchronization of TCP flows and correlation of the drop events (multiple packets being dropped in sequence) within a TCP flow. However, RED configuration has been a problem. It can induce traffic disruption if not properly configured. Moreover, the complexity of setting RED parameters seems to be no advantage to RED deployment on links carrying only Web traffic [tuning web].

Many studies have been concerned with changing RED at the routers [3, 4] so as to make it fairer. The approach taken in [4] is to identify the misbehaving users at a RED gateway and subject them to different treatment using the help of scheduling mechanisms. But, the problem of identification of misbehaving users is not properly

4

set-up. FRED [3] suggests changes to the RED algorithm to ensure fairnes. The approach proposed is to maintain minimum and maximum limits on the packets that allow can have in the buffer. Flows, which consistently violate the maximum limits, are marked. But it has been seen that FRED frequently fails to achieve fair share for the flows in many cases.

For the best-effort traffic in the current Internet uses conformant end-to-end congestion control (i.e., TCP). We need additional mechanisms at routers to protect the Internet from “misbehaving” flows that don’t use conformant end-to-end congestion control. RED with Preferential Dropping, RED_PD [5], preferentially control and drop the high-bandwidth flows to improve the performance of the rest of the traffic. It use a light-weight mechanism combining the simplicity of FIFO with some of the protection of full max-min fair techniques. RED-PD achieves this by keeping state for the high-bandwidth flows only. It is called partial flow state. However, RED_PD addresses only best-effort traffic, and does not consider traffic protected by QoS mechanisms such as Differentiated services.

3. RED for Web Traffic

Most of the flows for web browsing are short-term and small. While a packet is dropped, usually the performance of web browsing is poor. We assume that the TCP

5

for Web traffic will send several packets once. If one of those packets is lost, all these packets will be retransmitted by TCP. In fact, the dropping of a packet in a flow for Web browsing will cause the poor performance of this flow [2]. So, if one of packets of a flow for web browsing is dropped at a router buffer, other packets in this buffer may be retransmitted by TCP. Current RED only drops the arriving packets and only drops one packet once. However, other packets of this flow in the buffer will be retransmitted and should be dropped by active queue management.

The advantage of this approach is that we can reduce the size of buffer more quickly than RED and then the arriving packets of web traffic will not be dropped. The average queue length is small than RED. The performance of more flows for web browsing is improved. We do not decrease the performance of the flow too much, which the packets are dropped, because these packets will be always retransmitted. Another advantage is that we can notify the source end to reduce the sending rate as early as possible because the packets in buffer are dropped. The algorithm is shown in figure 1.

//Saved Variables:
//AVG: average queue size;
//Q_time : start of the queue idle time;
//count : packets since last marked packet;

```
Initialization:
        AVG=0;
        count=-1;

for each packet arrival
{
        calculate the new average queue size AVG:
          {
                if    the queue is nonempty
                        AVG=(1-w_q)*AVG+w_q*q;
                else
                        m=f(time-q_time);
                        AVG=(1-1-w_q)^m*AVG;
          }
        If    MIN_th <AVG<MAX_th
         {
                Increment count
                calculate probability    Pa :
                  {
                        Pb=max_p(AVG- MIN_th) / (MIN_th -MAX_th)
                        Pa=Pb/(1-count*Pb) ;
                  }
                with probability = > :
                    {
                        mark the arriving packet
                                and the packets in buffer which is the same flow;
                        count=0;
                    }
          }
        else if    MAX_th < AVG
            {
                mark the arriving packet
                            and the packets in buffer which is the same flow;
                count=0;
              }
when queue becomes empty
        q_time=time;

} //end of for loop
```

Figure 1: Modified RED algorithm.

7

4. Conclusions

We modify RED algorithm to improve the performance of web traffic. This approach may reduce the size of buffer more quickly than RED. The performance of more flows for web browsing is improved and we do not decrease the performance of the flow too much, which the packets are dropped. In next step, we will test our algorithm by experiment.

Reference:

[1] S. Floyd and V. Jacobson, "Random Early Detection Gateways for Congestion Avoidance," *IEEE/ACM Trans. Net.*, vol. 1, no. 4, Aug. 1993, pp. 397–413.

[2] *Mikkel Christiansen, Kevin Jeffay, David Ott, F. Donelson Smith*, "Tuning RED for Web Traffic," *IEEE/ACM Trans. Net.*, vol. 1, no. 4, April. 2com.

[3] D. Lin and R. Morris. Dynamics of random early detection. In Proc. ACM SIGComm Symp., Cannes, France, September 1997.

[4] S. Floyd and K. Fall. Router Mechanisms to Support End-to-End Congestion Control, February 1997.

[5] Ratul Mahajan and Sally Floyd, "Controlling High Bandwidth Flows at the Congested Router," b c AT&T Center for Internet Research at ICSI (ACIRI) ,TR-01-001, April 2001.

8