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Intelligent Traffic Management Service Using Fuzzy Logic Controller in High Speed Networks

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ABSTRACT

Network traffic management is a core area of research that is of great importance in the field of communication. This paper proposes a new scheme for controlling router side traffic in networks by updating source sending rate according to its IQ size. A new fuzzy controller is to be modelled to implement the proposed system. Simulation results and comparisons has verified the effectiveness and showed that our proposed scheme can achieve better performances than the existing protocols.
Keywords : Traffic Management, Fuzzy Logic Controller, IQ size, BDP, XCP, RCP, XCP

I. INTRODUCTION

Network traffic management can prevent a network from severe congestion and degradation in throughput-delay performance. Congestion in a network may occur when the load on the network is greater than the capacity of the network. Congestion control is 'adapting speed of transmission to match available end-to-end network capacity'. In order to make use of the bandwidth those high-speed networks offers, we need to have a proper and efficient mechanism to control congestion in these nodes. There are mainly two classes of approaches: implicit congestion control and explicit congestion control. Historically, TCP (Transmission Control Protocol) is a widely deployed congestion control protocol that tackles the Internet traffic. It has the important feature that the network is treated as a black box and the source adjusts its window size based on packet loss signal.

However, as an implicit control protocol, TCP encounters various performance problems (e.g., utilization, fairness and stability) when the Internet BDP (Bandwidth-Delay Product) continues to increase. Explicit congestion control protocols has been proposed to signal network traffic level more precisely by using multiple bits. these protocols have their controllers reside in routers and directly feed link information back to sources so that the link bandwidth could be efficiently utilized with good scalability and stability in high BDP networks.

II. METHODS AND MATERIAL

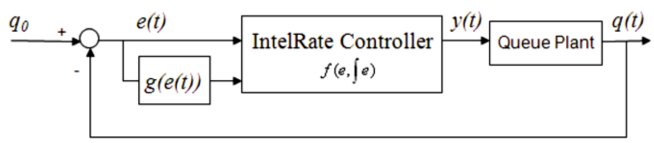
EXISTING SYSTEM:

The algorithm begins in the slowstart state. In this state, the congestion window size is doubled for every window of packets acknowledged. Upon the first congestion indication, the congestion window size is cut in half and the session enters into the exponential congestion control state.
In this state, the congestion window size is increased for each new acknowledgement received. The

algorithm reduces the window size when congestion is detected.

PROPOSED SYSTEM

To achieve the new proposed system, our new scheme pays attention to the following methodologies as well as the merits of the existing protocols. Firstly, in order to keep the implementation simple, like TCP, the new controller treats the network as a black box in the sense that queue size is the only parameter it relies on to adjust the source sending rate. Secondly, the controller retains the merits of the existing rate controllers such as XCP and RCP. XCP feeds back the required increment or decrement of the sending rate, while RCP directly signals sources with the admissible sending rate according to which sources pace their throughput Thirdly, we rely on the fuzzy logic theory to design our controller to form a traffic management procedure.



Intel rate closed loop control system

Intel-rate Controller Design:

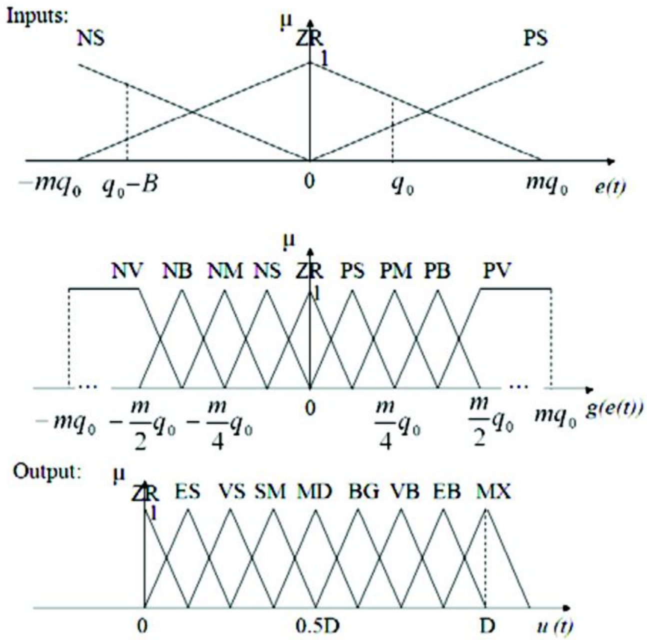
The queue deviation e(t)= q0-q(t) is one of the two inputs of the controller.In order to remove the steady state error, we choose the integration of e(t) as the other input of the controller,i.e. g (e (t)) =$\int e(t)\,dt$
The aggregate output is y (t)=$\Sigma ui(t{-}Ti)$ .Under heavy traffic situations, the IntelRate controller would compute an allowed sending rate u(t) for flow i according to the current IQSize so that q(t) can be stabilized around q0. In our design, IQSize q(t) is the only parameter each router needs to measure in order to complete the closed-loop control.

Implementing Intelrate controller using fuzzy logic theory

Since e(t) is bounded by the physical size of a queue, we have the boundaries according to the limits q0–B≤e(t)≤ q0.

The absolute values of both the upper and lower limits of g(e(t)) set to mq0.

The output u(t)=$\sum_{j=1}^{k} c_j s_j \,/\, \sum_{j=1}^{k} s_j$



Controlling Procedure

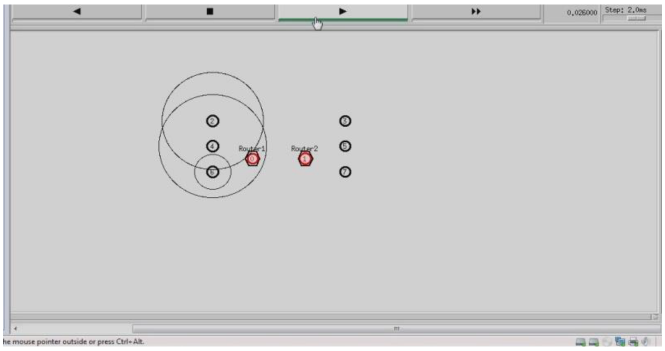
Upon the arrival of a packet, the router extracts *Req_rate* from the congestion header of the packet.
1)Sample IQSize q(t) and update e(t) and g(e(t)).
2)Compute the output u(t) and compare it with *Req_rate*.

a) If u(t) < *Req_rate*, it means that the link does not have enough bandwidth to accommodate the requested amount of sending rate. The *Req_rate* field in the congestion header is then updated by u(t).
b) Otherwise the *Req_rate* field remains unchanged.

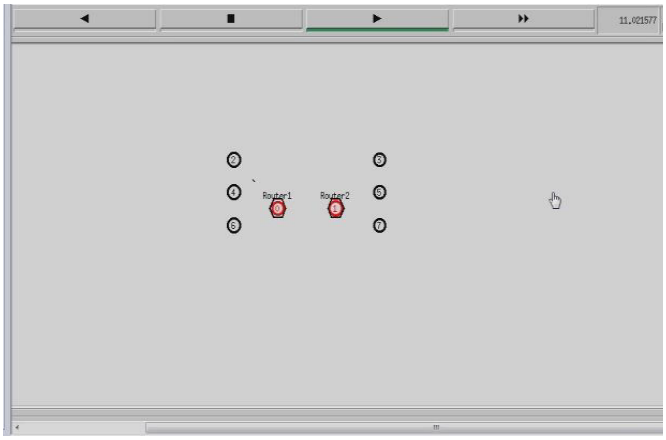
3) If an operation cycle d is over, update the crisp output u(t) and the output edge value of D.

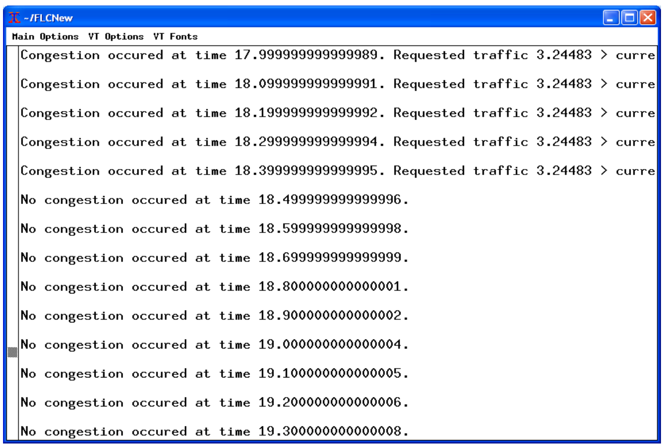
III. RESULTS AND DISCUSSION

Existing System

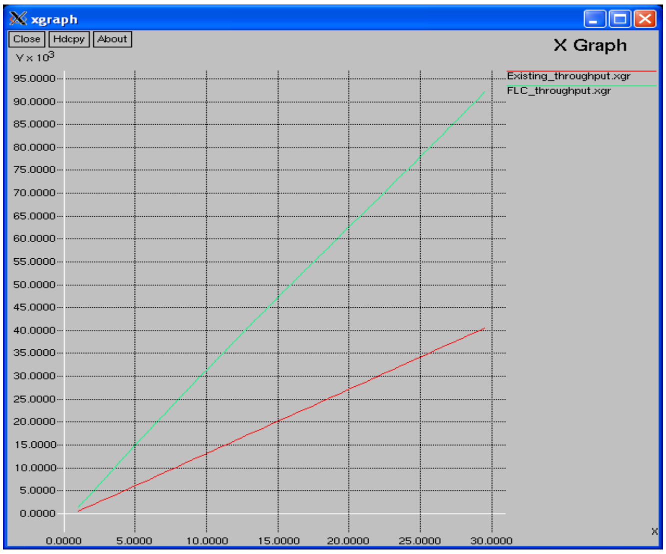


Proposed System

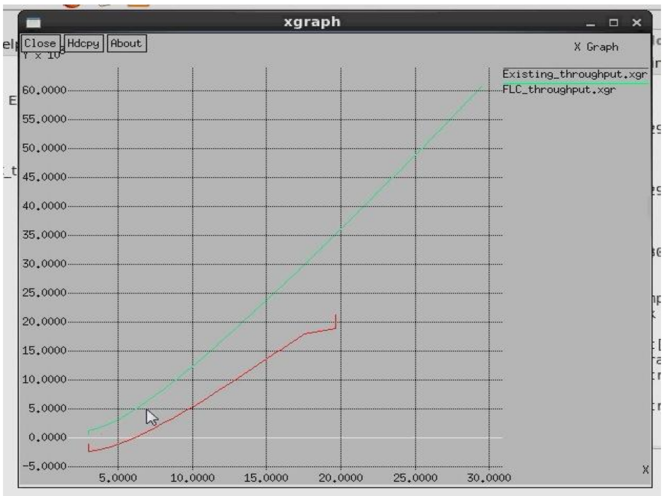




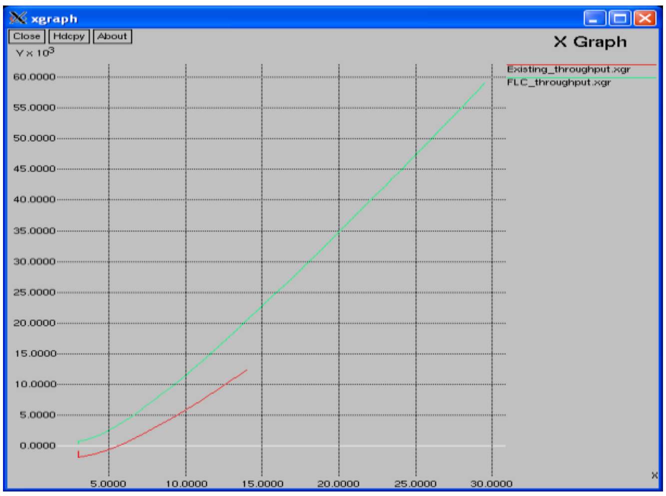
For Two Flows



For Three Flows



For Five Flows



Comparison Table

Throughput:

No.of flows	Existing system(kbps)	Proposed system(kbps)
Two	817.93	1327.96
Three	778.67	1302.48
Five	696.65	1292.03

Time taken for congestion occurrence

No.of flows	Existing system(ms)	Proposed system(ms)
Two	5.99	6.21
Three	3.64	3.98
Five	1.07	1.73

A novel traffic management scheme, called the IntelRate controller, has been proposed to manage the Internet congestion for different flows. The controller is designed by paying attention to the disadvantages as well as the advantages of the existing congestion control protocols.I n addition to the feature of the FLC being able to intelligently tackle the nonlinearity of the traffic control systems, the success of the IntelRate controller is also attributed to the careful design of the fuzzy logic elements.

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