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Minimizing Congestion in Neuro Fuzzy System

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Abstract: This paper presents a Fuzzy and Neural based congestion control in Diff-Services network. Congestion control in a dynamic environment remains a critical and high priority issue. Diff-Services is a new architecture for the time – sensitive voice and video application. The RED (Random Early Detection) algorithm is used for controlling congestion in Diff-Services. RED is one of the AQM (Active Queue Management) algorithms. RED (Random Early deduction) and its variants are one of these alternatives to provide QoS (Quality of Service) in Diff-Services networks. RED also defines some maximum threshold and minimum threshold in each class of router queue. The proposed fuzzy and neural based approach for congestion control allows us to reduce the PDP (Packet drop probability) in Diff-Services network when the AQL (Average Queue Length) of buffer exceeds the minimum Q.

Key Words: Fuzzy, Neural Networks, RED (Random Early Detection)

I. INTRODUCTION

Diff-Services network was proposed to deliver QoS in IP networks. Recently AQM mechanisms e.g. RED has been proposed within the framework of the Diff-Services architecture to preferentially drop packets. RED algorithm can mark a packet either by dropping it or by setting a bit in the packet's header.[2],[4].In this paper, we use fuzzy logic technique to develop a new AQM scheme, FEM (Fuzzy Explicit Marking) implemented within Diff-Services framework to provide congestion control. The proposal is to control the congestion using fuzzy rule set and refining these rule set with the help of neural network module, for this congestion control technique called Random Early Detection for Diff-Services is used. The RED implementation for Diff-Services defines different thresholds for each class. RED simply sets some minimum and maximum dropping thresholds in the router queues. In this work, system is expected to be simplified to take appropriate actions to handle the latest network conditions. So when the average queue length is greater than the maximum threshold then I will again update my rules in the rule-base of fuzzy logic module.

II. DIFF-SERVICES ARCHITECTURE

In our proposed work we are dealing with congestion control in Differentiated Services network. Diff-Services is a computer networking architecture that specifies a simple, scalable and coarse-grained mechanism for classifying, managing network traffic and providing Quality of Service (QoS) guarantees on modern IP networks.,[5]. DiffServ can, be used to provide low-latency, guaranteed service (GS) to critical network traffic such as voice or video while providing simple best-effort traffic guarantees to non-critical services such as web traffic or file transfers .

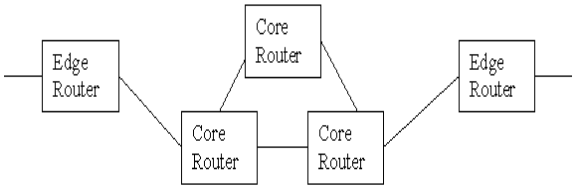

Figure 1: Diff-Services Architecture

Edge Router:

A. Per flow traffic management
B. Marks packet as in-profile or out-profile

Core Router:

C. Per class traffic management
D. Buffering, scheduling and control based on marking at edge.
E. Preference is given to in-profile packets
F. Assured forwarding

Diff-Services operate on the principle of traffic classification, where each data packet is placed into a limited number of traffic classes. Each router on the network is configured to differentiate traffic based on its class. Each traffic class can be managed differently, ensuring preferential treatment for higher-priority traffic on the network.The approach taken by DiffServ is to classify individual micro flows at the edge routers in the network, into one of the many classes and then apply a per-class service in the core of the network. When a packet enters a DS domain, it experiences classification and traffic conditioning actions and it is assigned a value called Differentiated Services Code-Point (DSCP). Each DS node must use the DSCP to select the PHB which is to be experienced by each packet it forwards. New technologies are emerging that requires real-time data streaming and therefore will make use of the DS field. An example is Voice over IP (VoIP) that is used for interactive data voice exchange.

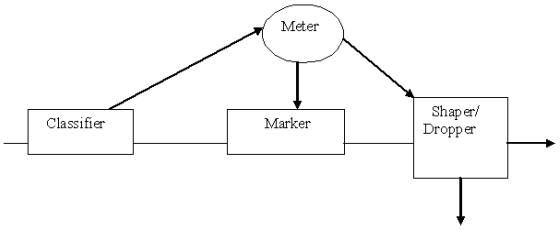

Figure 2: Classification of packets in Diff-Services Network

DiffServ is a computer networking architecture that specifies a simple, scalable and coarse-grained mechanism for classifying, managing network traffic and providing Quality of Service (QoS) guarantees on modern IP networks. DiffServ can, for example, be used to provide low-latency, guaranteed service (GS) to critical network traffic such as voice or video. DiffServ operates on the principle of traffic classification, where each data packet is placed into a limited number of traffic classes,[7],[8]. DiffServ operates on the principle of traffic classification, where each data packet is placed into a limited number of traffic classes.

III. ADVANTAGES OF DIFFSERV

Advantage of DiffServ is that all the policing and classifying is done at the boundaries between DiffServ clouds. This means that in the core of the Internet, routers can get on with doing the job of routing, and not care about the complexities of collecting payment or enforcing agreements. That is, DiffServ requires no advance setup, no reservation, and no time-consuming end-to-end negotiation for each flow, as with integrated services. This leads DS to be relatively easy to implement.

IV. METHODOLOGY

The implementation goes in the two modules.

A. Fuzzy Inference module
B. Neural network Adaptive Module

Both these modules when combined will be called as Neuro-fuzzy system.

In proposed technique, first of all Fuzzy logic fuzzifies the average queue length and calculates packet drop probability through the inference engine which works on rules defined in rule-base. Finally the calculated fuzzified packet drop probability is defuzzified by the defuzzifier of fuzzy logic Module. This defuzzified packet drop probability is used as parameter to decide whether packet will be enqued or early dropped.

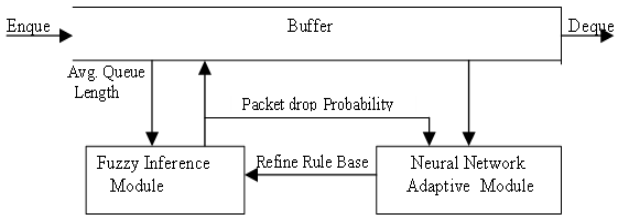

Figure 3: The basic approach used for the implementation

Neural network adaptive module is used to refine the rule-base of fuzzy logic to help Inference engine to take action according to the current network condition. For this we are using Neural Network model with feedback connection. BPN (Back Propagation Network) learning algorithm is used to update the network weights and bias. The module is trained through fuzzily calculated PDP and error signal as input. This module gives the PDP as output which is further used to refine the rules in the rule base. This was the situation when AQL> minimum Q and AQL < maximum Q. when AQL>maximum q then the packet is either late dropped or marked if ECN bit is used. But in my work when AQL>maximum q then I again update my rules in the rule base of fuzzy logic module.

V. CONCLUSION

This paper presents a Fuzzy and Neural based congestion control in Diff-Services network. Congestion control in a dynamic environment remains a critical and high priority issue. Diff-Services is a new architecture for the time – sensitive voice and video application. The RED (Random Early Detection) algorithm is used for controlling congestion in Diff-Services. RED is one of the AQM (Active Queue Management) algorithm. RED (Random Early deduction) and its variants are one of these alternatives to provide QoS (Quality of Service) in Diff-Services networks. RED also defines some maximum threshold and minimum threshold in each class of router queue. The proposed fuzzy and neural based approach for congestion control allows us to reduce the PDP (Packet drop probability) in Diff-Services network when the AQL (Average Queue Length) of buffer exceeds the minimum Q. In this paper when AQL> maximum Q then again rules are updated in fuzzy logic module.

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