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HOP REACTION IN CONGESTION CONTROL OF COMPUTER NETWORKS

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ABSTRACT

We can't imagine without computer network in this modern civilization. But in the network, congestion plays an important role in degrading the performance of the network. So it is important to detect and control the congestion to improve the performance of the computer network. There exists a different factor for congestion. One of the main important factors is buffer overflow or managing the buffer to hold the packets by hop or router from the source. There may have different techniques in this respect. This paper only gives some idea of how to allow the packets for receiving and giving the warning message by hop or router to avoid the congestion for passing the packets to the outgoing line smoothly. Actually based on the measured value how the router adapts the data rate for transmission to control the congestion is expressed in this paper.

Keywords: packet buffering, congestion detection, congestion control, controlling threshold

1. INTRODUCTION:

When too many packets are present in the subnet, performance degrades. This situation is called Congestion. In the present world more and more research is taking place to increase the speed, connectivity, reliability, scalability etc. of computer networks. When too many traffics intend to pass from a network to another network, the main factor is to decide how to pass this data efficiently, otherwise it may exceeds the capacity of a network creating a degradation of performance or slow or useless. With the growing number of network users and concurrent transmission of packets the network may be congested.

2. PRINCIPLES OF CONGESTION CONTROL:

Open loop control decides when to accept new traffic, when to discard packets and which ones and to make schedule decisions at various points in the network. All of these have in common the fact that they make decisions without regard to the current state of the network. Whereas **close loop** solutions are based on the concept of a feedback loop. This approach has three parts when applied to congestion control:

1. Monitor the system to detect when and where congestion occurs.
2. Pass this information to places where action can be taken.
3. Adjust system operation to correct the problem.

3. CONGESTION CONTROL:

Congestion control has to do with making sure the subnet is able to carry the offered traffic. It is a global issue, involving the behavior of all the hosts, all the routers, the store and forwarding processing within the routers and all the other factors that tend to diminish the carrying capacity of the subnet. Congestion control is of three types: 1. Proactive, 2. Reactive and 3.Hybrid. Proactive control mechanism makes the reservations of network resources such as bandwidth and buffers. So performance is always available to the user. So it is Reservation-Oriented congestion control. Reactive control first detects the congestion and then makes necessary actions to remove the problem of congestion. Hybrid scheme can combine aspects of both approaches.

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Choke packet sending mechanism is an example of reactive congestion control. In this approach the router sends a **choke packet** bac to the source host, giving it the destination found in the packet. When the source host get the choke packet then it reduces the traffic and ignores another choke packets coming from the same destination for a fixed amount of time and if after that time gets another choke packet it again reduce the flow. Again after a fixed interval if it doesn't get any choke packet it increases the flow. At high speed or over long distances, sending a choke packet to the source is not a good idea and that's why **hop-by-hop** choke packet mechanism is very efficient. In this mechanism the congested router first detects the congestion and then sends the choke packet to the adjacent router. The adjacent router then sends that choke packet to the router directed to the source and also sends less data to the router from which it has received the choke packet. In this way only one choke packet is received to the source and source controls the flow.

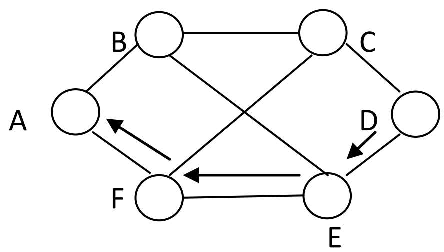

Fig-1 choke packet to the source
Congestion is noticed at D
A Choke packet is sent to A
The flow is reduced at A
The flow is reduced at D

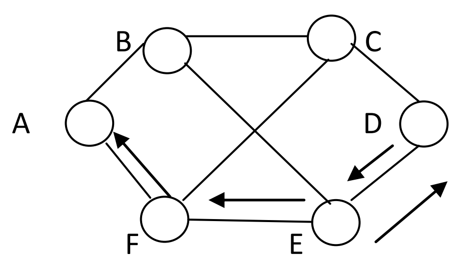

Fig-2 hop-by-hop choke packet
Congestion is noticed at D
A Choke packet is sent to A
The flow is reduced at E
The flow is reduced at D

In [2], by queue length measurement congestion is detected. Here it has been shown the hop-by-hop flow control technique. In [3], here congestion is controlled by hop-by-hop mechanism. Here service rate is calculated and numbers of nodes have been considered. Available link capacity should be measured.

4. ALGORITHM OF CONGESTION DETECTION AND ALARMING:

Here Circular Queue has been used (for router) whose Front is denoted by F and Rear is denoted by R. A circular queue is an abstract data type that contains a collection of data which allows addition of data at the end of the queue(R) and removal of data at the beginning of the queue(F). Circular queues have a fixed size.

Maximum and minimum threshold value must be calculated. **I think the following calculation would be very effective.**

Minimum Threshold calculation:

if F<R
then the minimum threshold would be the lower bound of [{(Q-R)+F}*2/3]
if F>R
then the minimum threshold would be the lower bound of {(F-R)*2/3}

Maximum Threshold calculation:

if F<R
then the maximum threshold would be the upper bound of [{(Q-R)+F}*5/6] plus 1
if F>R
then the maximum threshold would be the upper bound of [{ (F-R)*5/6}] plus 1.

Flag is a variable for congestion notification
Queue length = Q
While
Packets are passing the network through the router
do
Set Flag=0;
if (F<R)
N= (Q-R)+F
/*N is the number of free spaces to receive N packets in the **queue***/

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else
N=F-R

if (P_A >minimum & P_A<maximum)
/* minimum is for minimum threshold and maximum is for maximum threshold and P_A is for number of packets arrive */
then
A packet will be sent to source to reduce transmission rate. /* Packet arrival rate is high. Congestion may occur. This is alarming*/

Flag=1 /*1 indicates Congestion*/
else if (P_A ≥maximum)
then Router will drop packet.
Packet arrival rate is much greater than packet service rate. Congestion will definitely occur within a while. /* So drop packet at least 1*/

Else
Packet arrival rate is ok that is smaller than packet service rate
No congestion
End if
End while

5. EXPLANATION:

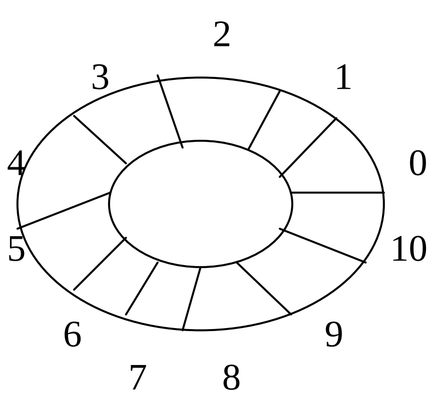

Fig-3 Circular queue

Say the value of Front is 3, the value of R is 7 and the value of Queue length is 11.
So the minimum threshold calculation like this;
{(Q-R)+F}*2/3={(11-7)+3}*2/3=7*2/3=4
So if the total number of packets is less than or equal to 4 then the router finds no congestion.

The maximum threshold will be:
Upper bound[{(Q-R)+F}*5/6]+1=[{(11-7)+F}*5/6]+1=6+1=7.
If the number of packets is less than 7 it will accept it but send the alarming packet of congestion. If the number of packets is greater than or equal to 7 it will send the alarming packet and also drop at least one packet from the queue.

6. CONCLUSION AND FUTURE WORK:

To control the computer network congestion is a very important researchable area. The proposed work helps in predicting congestion and passing data packet efficiently. It helps in reducing packet loss and transmission delay. Here queue will not be overflow. But in future I will try how to control the flows taken by the source. If a few packets arrive and the number of packets is just greater not too greater than the minimum threshold value then how **much increase in number of packets** should be taken by the source. In this case if the maximum threshold is very high relative to the minimum threshold that is the available space in the queue is very high then of course the router can take large number of packets.

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