CONGESTION CONTROL

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BASIC CONGESTION CONTROL TECHNIQUES

- BACK PRESSURE:- This technique is similar in effect to backpressure in fluids flowing down a pipe. The network tells the source to restrict the flow of packets. The properties of this technique can be summarized as follows:-
  1) Telling the transmitter to control / reduce the flow of packets.
  2) Reduces the sliding window size
  3) It creates a kind of ripple flow in the connection from the source to the destination .
  4) It can have a very disastrous effect if not used properly. Eg:- North East American Power Grid Failure . It must be ensured that the pressure is not propagated throughout the network.

- CHOKE PACKETS:- In this technique of congestion control whenever there is congestion on a node it generates a special packet called quench packet indicating congestion on that node. This packet it sent to the source node. The source node regulates is flow of traffic until it receiving the quench packets .

- IMPLICIT SIGNALING:- Whenever there is congestion in the network then either the packet transmission time increases or the packets get discarded. If the end nodes can somehow detect the increased delays or packet loss then it has implicit evidence of network congestion. If all sources can detect the congestion and reduce the packet control , then the network congestion will be relieved.

- EXPLICIT SIGNALING:- This approach depends on using the network capacity as much as possible and alerting the end systems whenever the congestion in the network increases. The techniques are:-

  a) Backward Signal :- This technique notifies the source that congestion control should be activated in the opposite direction of the received notification. The notification can be in the form of modified bits in the header of the packets sent.

  b) Forward Signal :- It notifies the user that congestion control has to be applied in the same direction as the received notification. The information is transmitted again in the form of modified bits in the packet.

  Explicit Congestion signaling can be categorized as :-
  c) Credit Based:- This scheme is based on providing an explicit credit to a source over a logical connection. The credit indicates how many packets a source may transmit.When that credit is exhausted the source may waits for additional credit before sending any more packets.

  d) Rate Based :- This is based on assigning a maximum data rate to a node at which it can transmit data. To control congestion , any node along the path of the connection may reduce the data rate limit.

TRAFFIC MANAGEMENT :- It includes more duties than Congestion Control . When a node is saturated it may discard packets based various criteria but fairness has to be maintained:-

Fairness:- Always the last incoming packet may be discarded first . This way low bit rate applications will always fail. Another method can be to maintain separate buffers for all incoming connections discarding the buffers which overflow.

Quality of Service:- QOS can be application specific for example.-
Video-Delay sensitive but loss insensitive .
File Transfer-Loss sensitive but Delay insensitive .
Interactive Graphics/Games-Delay sensitive , Loss sensitive.

FRAME RELAY CONGESTION CONTROL Objectives of the Frame Relay Congestion Control are :-
1)Minimizing frame discard.
2)Maintain Quality of Service.
3)Minimize monopolization of one-end User.
4)Create minimal traffic overhead.

5)Limit spread of congestion to other parts of network.

Traffic Rate Management:-
To prevent random discarding of frames during a congested network , every source is assigned a fixed data rate upto which it is allowed to transmit data on the network. This rate is known as the Committed Information Rate (CIR). Any data arriving at a rate greater than CIR is vulnerable to being discarded. During heavy congestion the network may not be able to provide CIR to all users.

In the traffic rate management , 2 more terms are defined :-
a)Committed Burst Size (Bc)-This is the maximum amount of data the network agrees to transfer ,under normal conditions.
b)Excess Burst Size (Be)-The maximum amount of data in excess of Bc that the network attempts to transfer without discard although this much data is not committed.

The time measurement interval T, Committed Information Rate(CIR) , Excess Burst Rate (Bc)are related by :-
Tc = Bc/CIR.

ATM Traffic Management :-

ATM traffic management is difficult because of its high speed and small cell size. Also because of the very small cell size: *Time of Propagation ¿ Time of transmission.*

Example:-
One Cell Size : 53 bytes
Date Rate : 150 Mbps.
Time for transmission = (53*8)/(150*10^6) = 2.83 microsec.

For transmitting over a distance of 1000 km .
Time of propagation = (1000 * 10^3)/(2 * 10^8) = 0.005 sec = 5 msec.
(Time of Propagation/Time of Transmission):(5 * 10^-3/2.8 * 10^-6)= 2 * 10^3.

Because of these problems the Flow Control is not possible in ATM networks. So normal congestion control techniques are employed and mostly the applications atthe boundary of the spectrums are penalized.

Delay Variation in ATM networks :-

Cell delays are introduced due various reasons. In a packet-switching network delays can be introduced due to the queuing effect of the packets at the individual nodes. In ATM network delay variations are negligible because:-
1) Minimum overhead in the ATM protocol.
2) ATM switches have minimum processing time.

Cell delays are introduced at the *User Network Interface* due to the effect of 3 different layers of the ATM network. ATM adaptation layer encapsulates each 48 byte packet in a 53 byte cell. These are then transmitted to the physical layer. Delay are introduced in this interleaving process if 2 cells from different connections arrive at ATM layer at overlapping times since one cell will have to be delayed by the amount of the overlap time.