Congestion Control

Congestion Control and QoS

- Congestion control and QoS are closely bonded.
- Congestion Control-try to avoid traffic.
- QoS- create appropriate environment to maintain flow of data.

Traffic Descriptors

- **Average Data Rate:**

Amt of data/time

Indicates average bandwidth needed

- **Peak Data Rate:**

Defines max data rate(speed) of traffic

Traffic Descriptors

- **Maximum Burst Size:**

Max length of time the traffic is generated at peak rate

- **Effective Bandwidth:**

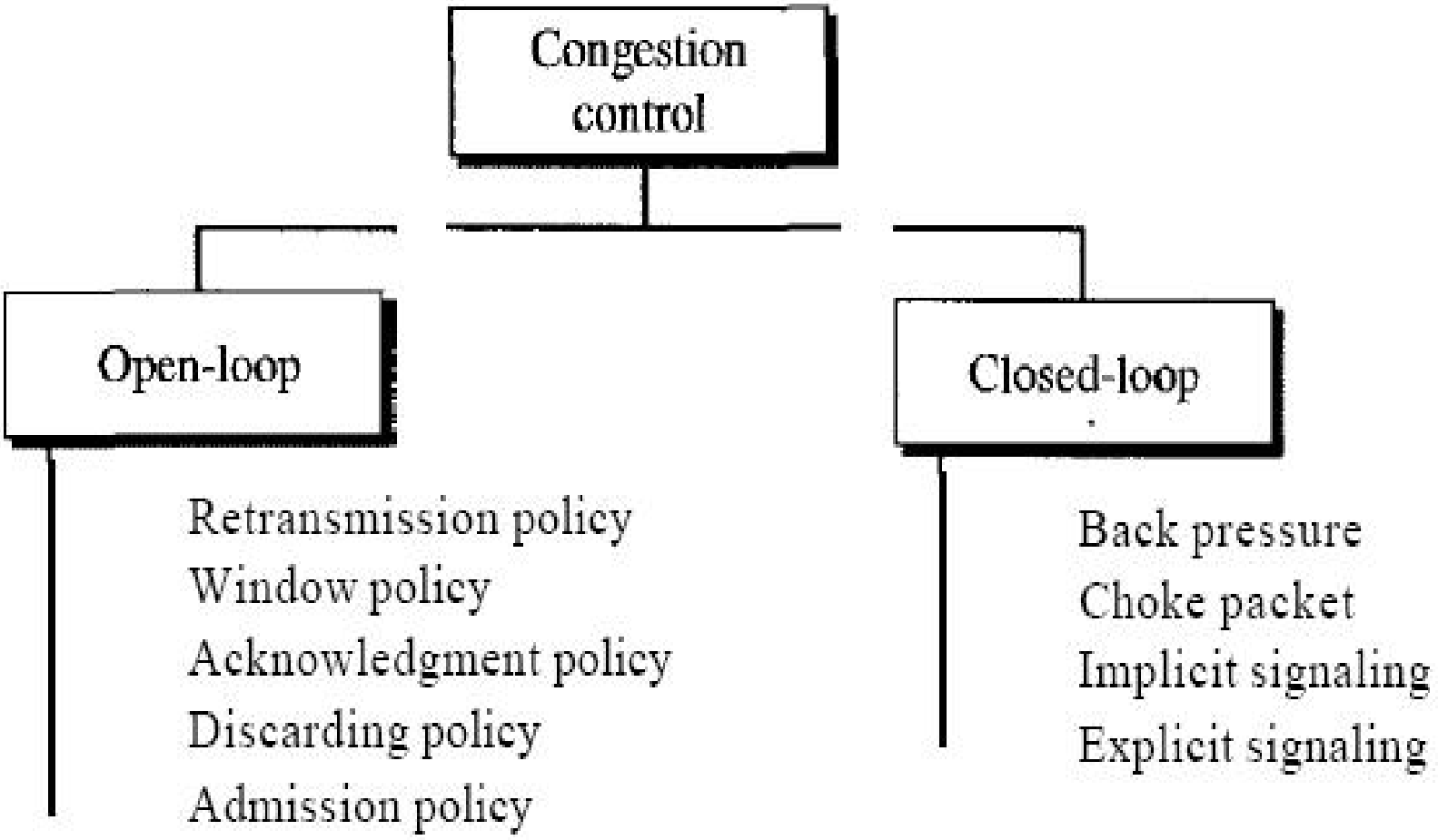
B/W that network needs to allocate for flow of traffic

Congestion

- **Congestion:** packets sent to network greater than the capacity of network.

- **Congestion Control:** techniques or mechanism that either prevent congestion or remove congestion

Congestion Control Categories



Open-Loop Congestion Control

- Here policies are applied to prevent congestion before it happens

1. **Retransmission Policy:**

- Sometimes unavoidable
- Sender feels sent packet is lost: initiates retransmission.
- May increase network congestion.
- Retransmission policy and timers to be designed to increase efficiency and avoid congestion

Open-Loop Congestion Control

2. Window Policy:

- Type of window at sender side and receiver side.
- Selective Repeat window better than Go-Back-N

3. Acknowledgment Policy:

- ACK policy of receiver may also affect congestion

Open-Loop Congestion Control

- Rx does not acknowledging every packet may slow down sender.
- Rx may send NAK for only lost packets.
- Rx may decide to acknowledge N frames together.
- ACKs are part of load on network.

Open-Loop Congestion Control

4. Discarding Policy:

- A good discarding policy of routers may prevent congestion.

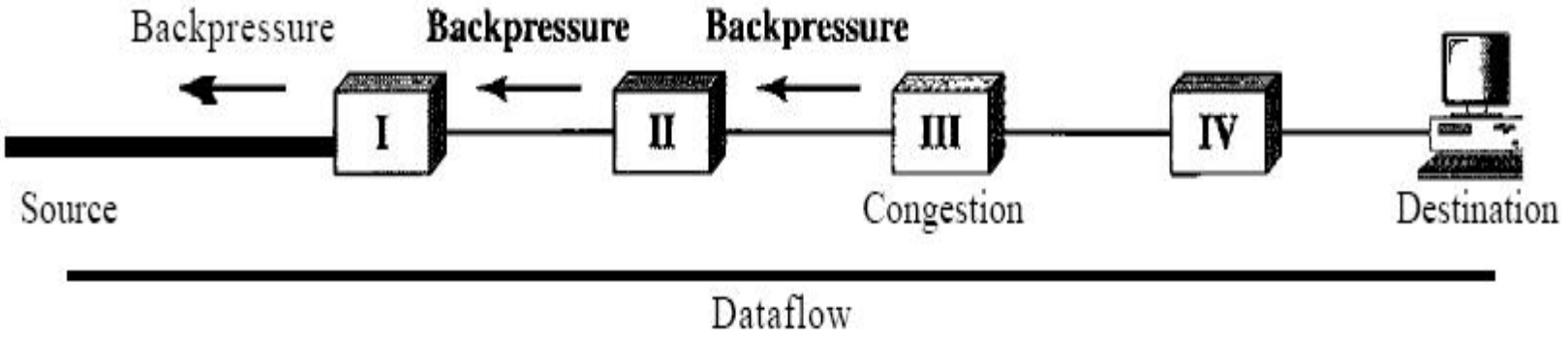
5. Admission Policy:

- Can also prevent congestion in virtual network circuits.
- Router can deny establishing virtual connection if there is congestion or possibility of congestion over the network.

Close-Loop Congestion Control

- Close loop congestion control will try to reduce congestion after it happens.

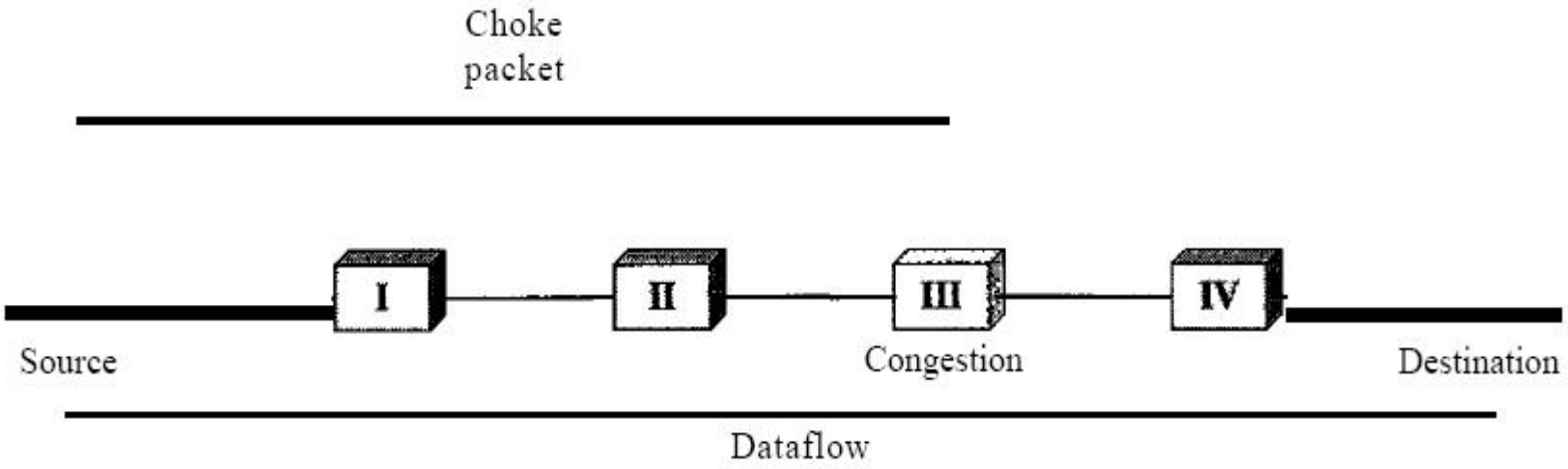
1. **Backpressure**



Close-Loop Congestion Control

2. Choke Packet

- Choke packet directly from congested node to source- ICMP message



Close-Loop Congestion Control

3. Implicit Signaling

- No communication between congested node or nodes and source.
- Source guesses congestion in the network from other symptoms
- Example: Packet sent by source but no ACK.
- Delay in ACK
- NAK

Close-Loop Congestion Control

4. Explicit Signaling

- Node that experiences explicitly sends signal to source or destination.

- Choke packet separate packet is sent.

- Explicit signaling: congestion related signal is included in data packet.

Close-Loop Congestion Control

- **Backward Signaling**

- Bit set in packet moving in direction opposite to the congestion.

- Bit warns source about congestion signaling it to slow down.

Close-Loop Congestion Control

- **Forward Signaling**

- Bit set in packet moving in direction of congestion.

- Bit warns destination about congestion.

- Rx can thus slow down ACK to alleviate congestion