



SNS COLLEGE OF TECHNOLOGY

Coimbatore-35

An Autonomous Institution



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19ECT301-COMMUNICATION NETWORKS III YEAR/ V SEMESTER

UNIT 3- TRANSPORT LAYER & APPLICATION LAYER

TOPIC – CONGESTION CONTROL

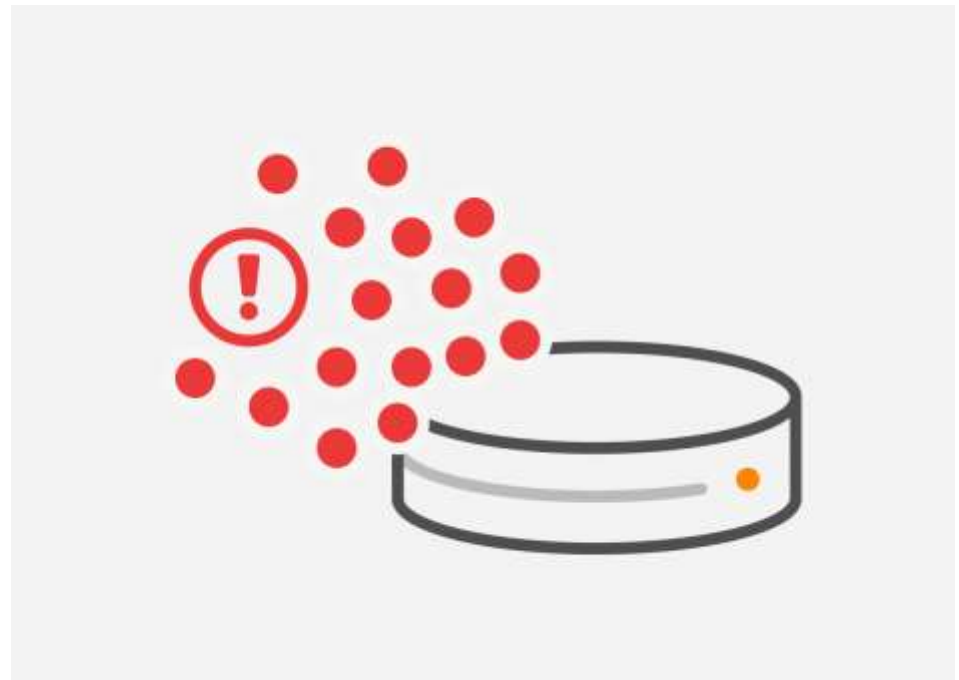


CONGESTION IN NETWORK-



Congestion refers to a network state where-

The message traffic becomes so heavy that it slows down the network response time.





CONGESTION IN NETWORK-



- ❑ Congestion is an important issue that can arise in Packet Switched Network.
- ❑ Congestion leads to the loss of packets in transit.
- ❑ So, it is necessary to control the congestion in network.
- ❑ It is not possible to completely avoid the congestion.



CONGESTION CONTROL



Congestion control refers to techniques and mechanisms that can-

- ❑ Either prevent congestion before it happens
- ❑ Or remove congestion after it has happened



TCP CONGESTION CONTROL



- ❖ TCP reacts to congestion by reducing the **sender window size**.

The **size of the sender window** is determined by the following two factors-

- Receiver window size
- Congestion window size



1. RECEIVER WINDOW SIZE



- ❑ Sender should not send data greater than receiver window size.
- ❑ Otherwise, it leads to dropping the TCP segments which causes TCP Retransmission.
- ❑ So, sender should always send data less than or equal to receiver window size.
- ❑ Receiver dictates its window size to the sender through TCP Header.



CONGESTION WINDOW



- ❑ Sender should **not send data greater than congestion window size.**
- ❑ Otherwise, it leads to dropping the TCP segments which causes TCP Retransmission.
- ❑ So, sender should always send data less than or equal to congestion window size.



CONGESTION WINDOW



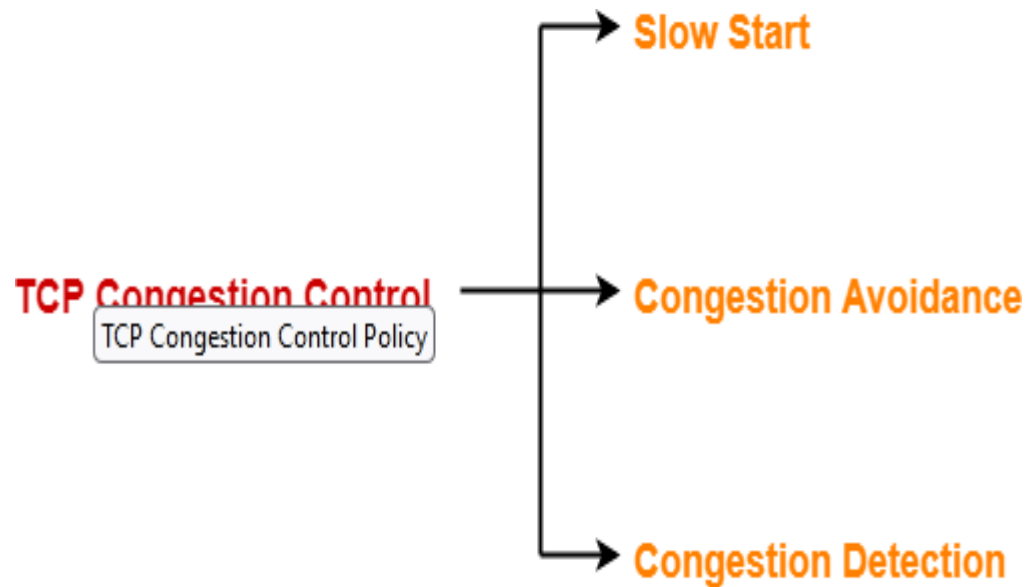
□ Sender window size = Minimum
(Receiver window size, Congestion
window size)



TCP CONGESTION POLICY



TCP's general policy for handling congestion consists of following **three phases-**





1. Slow Start Phase

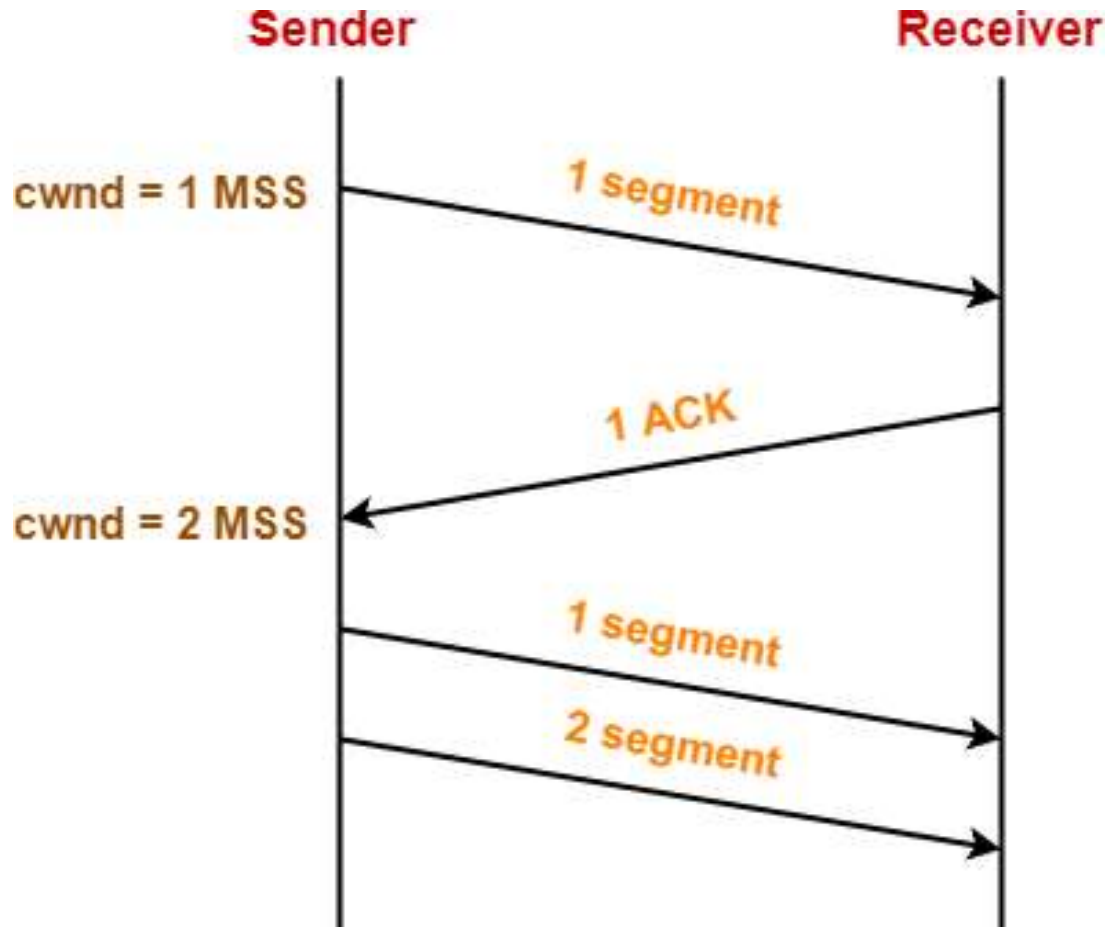


- ❑ Initially, sender sets congestion window size = Maximum Segment Size (1 MSS).
- ❑ After receiving each acknowledgment, sender increases the congestion window size by 1 MSS.
- ❑ In this phase, the size of congestion window increases exponentially.

Congestion window size = Congestion window size + Maximum segment size

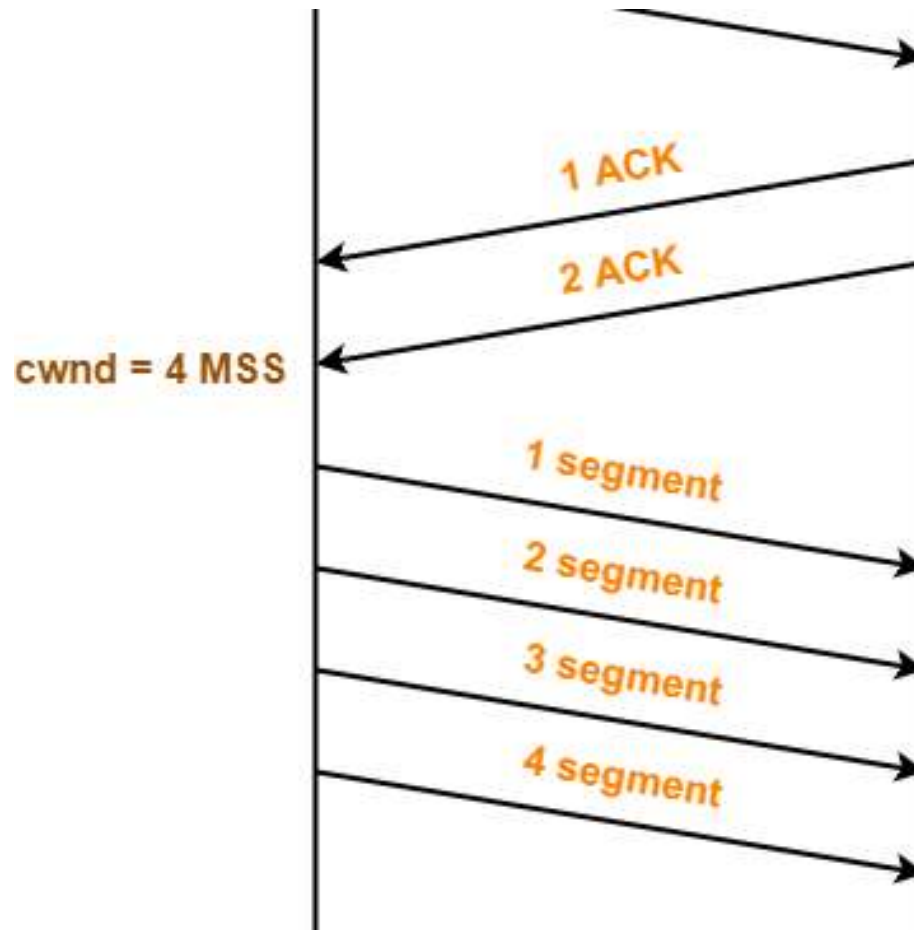


1. Slow Start Phase



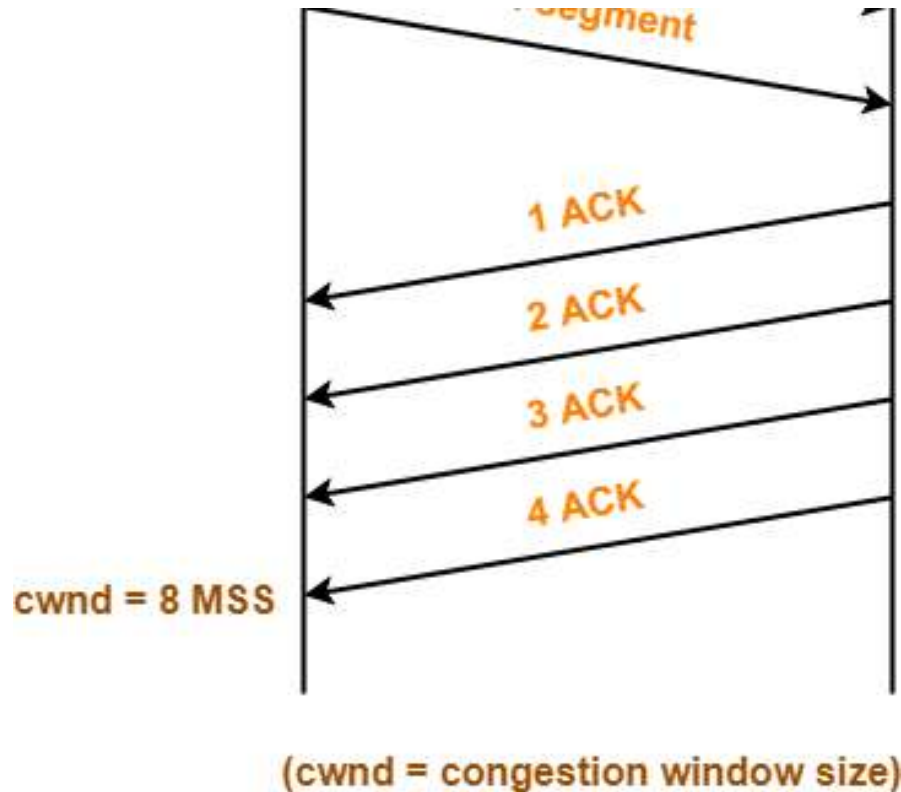


1. Slow Start Phase



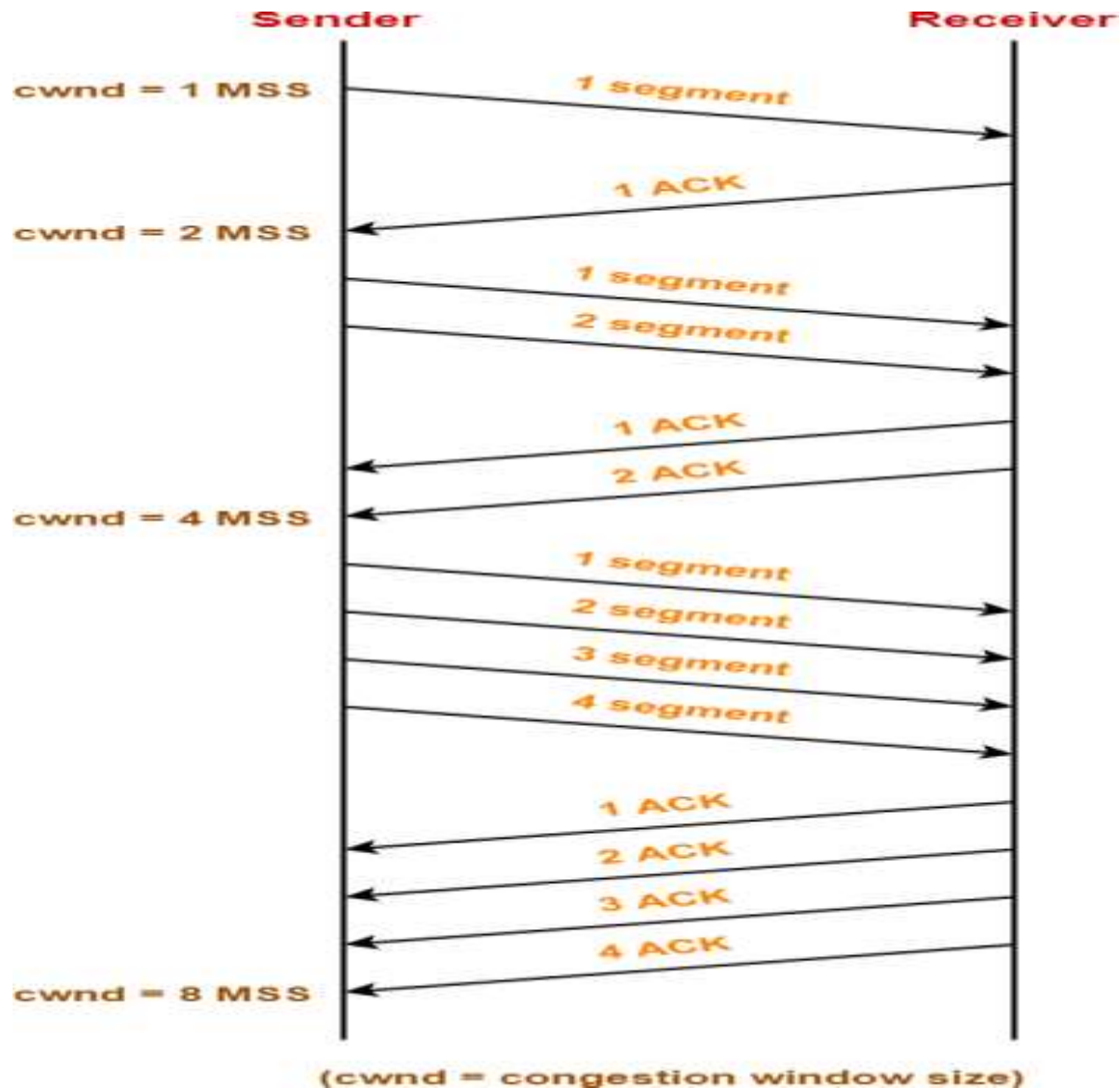


1. Slow Start Phase





1. Slow Start Phase





1. Slow Start Phase



- ❑ After 1 round trip time, congestion window size = $(2)^1 = 2$ MSS
- ❑ After 2 round trip time, congestion window size = $(2)^2 = 4$ MSS
- ❑ After 3 round trip time, congestion window size = $(2)^3 = 8$ MSS and so on.



1. Slow Start Phase



This phase continues until the congestion window size reaches the **slow start threshold**.

Threshold

= Maximum number of TCP segments that receiver window can accommodate / 2

= (Receiver window size / Maximum Segment Size) / 2



2. Congestion Avoidance Phase-



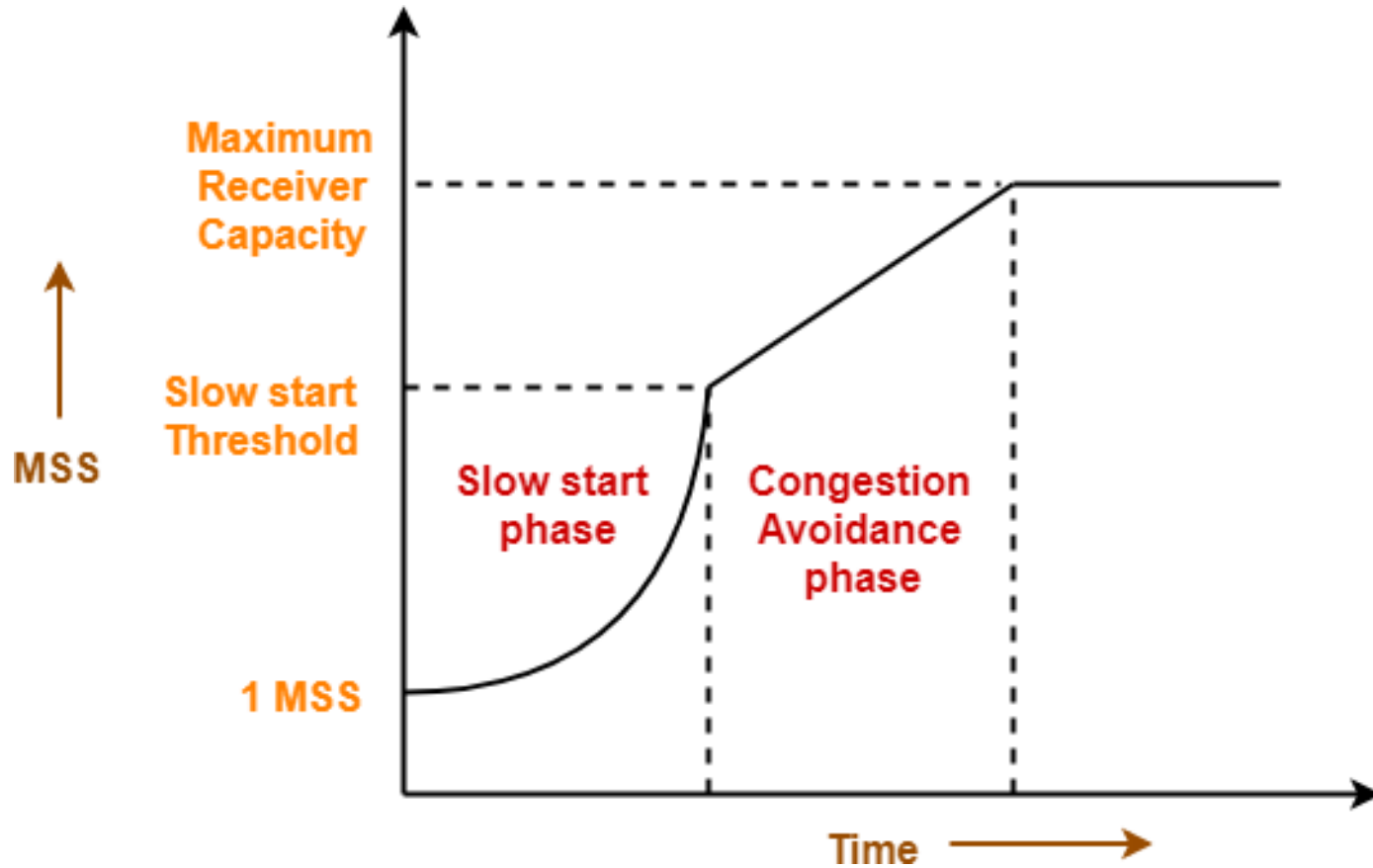
After reaching the threshold,

- Sender increases the congestion window size linearly to avoid the congestion.
- On receiving each acknowledgement, sender increments the congestion window size by 1.

Congestion window size = Congestion window size + 1



2. Congestion Avoidance Phase-





3. Congestion Detection Phase-



Case-01: Detection On Time Out-

- ❑ Time out Timer expires before receiving the acknowledgement for a segment.
- ❑ This case suggests the stronger possibility of congestion in the network.
- ❑ There are chances that a segment has been dropped in the network.



3. Congestion Detection Phase-



Reaction-

In this case, sender reacts by-

- Setting the slow start threshold to half of the current congestion window size.
- Decreasing the congestion window size to 1 MSS.
- Resuming the slow start phase.



3. Congestion Detection Phase-



Case-02: Detection On Receiving 3 Duplicate Acknowledgements-

- Sender receives 3 duplicate acknowledgements for a segment.
- This case suggests the weaker possibility of congestion in the network.
- There are chances that a segment has been dropped but few segments sent later may have reached.



3. Congestion Detection Phase-



Reaction-

In this case, sender reacts by-

- Setting the slow start threshold to half of the current congestion window size.

- Decreasing the congestion window size to slow start threshold.

- Resuming the congestion avoidance phase.



Animation Video of TCP congestion Control





ASSESSMENT



- 1. What is the message format in Transport layer ?**
- 2. List the Congestion control mechanism in TCP**
- 3. Mention the applications of TCP**



THANK YOU