Q) On a TCP connection, the current congestion window size is Congestion Window = 4 KB. The window size advertised by the receiver is Advertise Window = 6 KB. The last byte sent by the sender is LastByteSent = 10240 and the last byte acknowledged by the receiver is LastByteAcked = 8192. The current window size at the sender is

(A) 2048 bytes

(B) **4096 bytes**

(C) 6144 bytes

(D) 8192 bytes

Solution :

Congestion Window: It is the factor which tells how much maximum byte can be sent through the network in TCP connection. It is dynamic in TCP.

Receiver Advertised Window: It is the factor which tells what is the maximum capacity of the receiver to receive the data in bytes.

Total amount of maximum bytes that can be sent by the receiver at any time is called receiver window size.

At any time the receiver can send a minimum of Congestion Window and Receiver Advertised Window.

Thus current window size=min(congestion window ,receiver advertised window)

=min(4KB,6KB)

=4KB

=4*1024 bytes=4096bytes

But this is a confusing question. In my opinion 4KB will be for the first time.

After that Receiver Window Size will be = buffered data(unacknowledged) + min(congestion window ,receiver advertised window)

= Unacknowledged data= (10240-8192)bytes=2048 bytes.

= (4096+2048) bytes=6144 bytes

Q)Let the size of the congestion window of a TCP connection be 32 KB when a timeout occurs. The round trip time of the connection is 100 msec and the maximum segment size used is 2 KB. The time taken (in msec) by the TCP connection to get back to the 32 KB congestion window is _____.

(A) 1100 to 1300

(B) 800 to 1000

(C) 1400 to 1600

(D) 1500 to 1700

Solution :

Current size of congestion window in terms of number of segments
= (Size in Bytes)/(Maximum Segment Size)
= 32KB / 2KB
= 16 MSS

When timeout occurs, in TCP's Slow Start algorithm, threshold is reduced to half which is 16KB or 8MSS. Also, slow start phase begins where the congestion window is increased twice.
So from 1MSS to 8 MSS window size will grow exponentially.
Congestion window becomes 2MSS after one RTT and becomes 4MSS after 2 RTTs and 8MSS after 3 RTTs. At 8MSS, threshold is reached and congestion avoidance phase begins. In congestion avoidance phase, window is increased linearly. So to cover from 8MSS to 16MSS, it needs 8 RTTs

Together, 11RTTs are needed (3 in slow start phase and 8 in congestion avoidance phase).

Q. The growth of congestion window takes place-

A. Infinitely
B. Up to Threshold
C. Up to the size of receiver's window
D. Up to timeout

Q)Consider the effect of using slow start on a line with a 10 msec RTT and no congestion. The receiver window is 24 KB and the maximum segment size is 2 KB. How long does it take before the first full window can be sent?

Solution-

Given-

- Receiver window size = 24 KB
- Maximum Segment Size = 2 KB
- RTT = 10 msec

Receiver Window Size-

Receiver window size in terms of MSS

= Receiver window size / Size of 1 MSS

= 24 KB / 2 KB

= 12 MSS

Slow Start Threshold-

Slow start Threshold

= Receiver window size / 2

= 12 MSS / 2

= 6 MSS

Slow Start Phase-

- Window size at the start of 1st transmission = 1 MSS
- Window size at the start of 2nd transmission = 2 MSS
- Window size at the start of 3rd transmission = 4 MSS
- Window size at the start of 4th transmission = 6 MSS

Since the threshold is reached, it marks the end of the slow start phase.

Now, the congestion avoidance phase begins.

Congestion Avoidance Phase-

- Window size at the start of 5th transmission = 7 MSS
- Window size at the start of 6th transmission = 8 MSS
- Window size at the start of 7th transmission = 9 MSS
- Window size at the start of 8th transmission = 10 MSS
- Window size at the start of 9th transmission = 11 MSS
- Window size at the start of 10th transmission = 12 MSS

From here,

- Window size at the end of 9th transmission or at the start of 10th transmission is 12 MSS.
- Thus, 9 RTT's will be taken before the first full window can be sent.

So,Time taken before the first full window is sent

= 9 RTT's

= 9 x 10 msec

= 90 msec

Q) Consider an instance of TCP's Additive Increase Multiplicative Decrease (AIMD) algorithm where the window size at the start of slow start phase is 2 MSS and the threshold at the start of first transmission is 8 MSS. Assume that a time out occurs during the fifth transmission. Find the congestion window size at the end of tenth transmission.

A. 8 MSS
B. 14 MSS
C. 7 MSS
D. 12 MSS

Solution-

Given-

- Window size at the start of slow start phase = 2 MSS
- Threshold at the start of first transmission = 8 MSS
- Time out occurs during 5th transmission

Slow Start Phase-

- Window size at the start of 1^{st} transmission = 2 MSS
- Window size at the start of 2^{nd} transmission = 4 MSS
- Window size at the start of 3^{rd} transmission = 8 MSS

Since the threshold is reached, so it marks the end of slow start phase.Now, congestion avoidance phase begins.

Congestion Avoidance Phase-

- Window size at the start of 4^{th} transmission = 9 MSS
- Window size at the start of 5^{th} transmission = 10 MSS

It is given that time out occurs during 5th transmission.

TCP reacts by-

- Setting the slow start threshold to half of the current congestion window size.
- Decreasing the congestion window size to 2 MSS (Given value is used).

- Resuming the slow start phase.

So now,

- Slow start threshold = 10 MSS / 2 = 5 MSS
- Congestion window size = 2 MSS

Slow Start Phase-

- Window size at the start of 6^{th} transmission = 2 MSS
- Window size at the start of 7^{th} transmission = 4 MSS
- Window size at the start of 8^{th} transmission = 5 MSS

Since the threshold is reached, so it marks the end of slow start phase.

Now, the congestion avoidance phase begins.

Congestion Avoidance Phase-

Window size at the start of 9^{th} transmission = 6 MSS

- Window size at the start of 10^{th} transmission = 7 MSS
- Window size at the start of 11^{th} transmission = 8 MSS

From here,

Window size at the end of 10^{th} transmission

= Window size at the start of 11^{th} transmission

= 8 MSS

Thus, Option (A) is correct.

Q)Suppose that the TCP congestion window is set to 18 KB and a time out occurs. How big will the window be if the next four transmission bursts are all successful? Assume that the MSS is 1 KB.

Solution-

Congestion Window Size-

Congestion window size in terms of MSS

= 18 KB / Size of 1 MSS

= 18 KB / 1 KB

= 18 MSS

Reaction Of TCP On Time Out-

TCP 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.

So now,

- Slow start threshold = 18 MSS / 2 = 9 MSS
- Congestion window size = 1 MSS

Slow Start Phase-

- Window size at the start of 1^{st} transmission = 1 MSS
- Window size at the start of 2^{nd} transmission = 2 MSS
- Window size at the start of 3^{rd} transmission = 4 MSS
- Window size at the start of 4^{th} transmission = 8 MSS
- Window size at the start of 5^{th} transmission = 9 MSS

Thus, after 4 successful transmissions, window size will be 9 MSS or 9 KB.

Q)On a TCP connection, current congestion window size is 4 KB. The window advertised by the receiver is 6 KB. The last byte sent by the sender is 10240 and the last byte acknowledged by the receiver is 8192.

Part-01:

The current window size at the sender is ____.

A. 2048 B
B. 4096 B
C. 6144 B
D. 8192 B

Part-02:

The amount of free space in the sender window is ____.

A. 2048 B
B. 4096 B
C. 6144 B
D. 8192 B

Solution-

Part-01:

Sender window size

= min (Congestion window size, Receiver window size)

= min(4KB , 6KB)

= 4 KB

= 4096 B

Thus, Option (B) is correct.

Part-02:

Given-

- Last byte acknowledged by the receiver = 8192
- Last byte sent by the sender = 10240

From here,

- It means bytes from 8193 to 10240 are still present in the sender's window.
- These bytes are waiting for their acknowledgement.
- Total bytes present in sender's window = 10240 – 8193 + 1 = 2048 bytes.

From here,

Amount of free space in sender's window currently

= 4096 bytes – 2048 bytes

= 2048 bytes

Q)In the slow start phase of the TCP congestion control algorithm, the size of the congestion window
(A) does not increase
(B) increases linearly
(C) increases quadratically
(D) increases exponentially

Answer: (D)