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# **DEPARTMENT OF INFORMATION TECHNOLOGY**

## **19CSB302 – COMPUTER NETWORKS**

III YEAR V SEM

### **UNIT 3 – TRANSPORT LAYER**

**TOPIC 16 – Transport Layer Services**

*connection-oriented protocol; it creates a connection between two TCPs to send data. In addition, it implements flow control and error control mechanisms at the*

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*discussed in this section:*

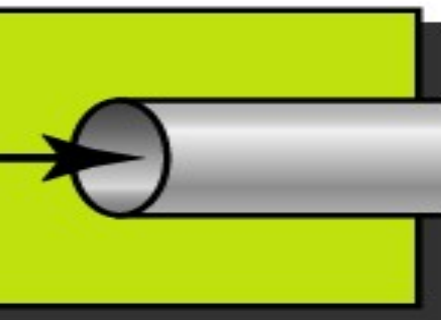
**es TCP**

**gment**

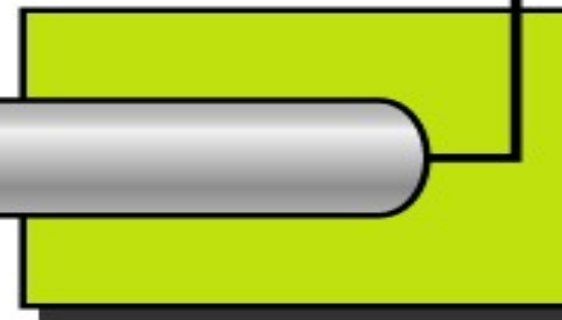
**ection Flow**

<i>Protocol</i>	<i>Description</i>
Echo	Echoes a received datagram back to the sender
Discard	Discards any datagram that is received
Users	Active users
Daytime	Returns the date and the time
Quote	Returns a quote of the day
Chargen	Returns a string of characters
FTP, Data	File Transfer Protocol (data connection)
FTP, Control	File Transfer Protocol (control connection)
TELNET	Terminal Network
SMTP	Simple Mail Transfer Protocol
DNS	Domain Name Server
BOOTP	Bootstrap Protocol
Finger	Finger
HTTP	Hypertext Transfer Protocol

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ess

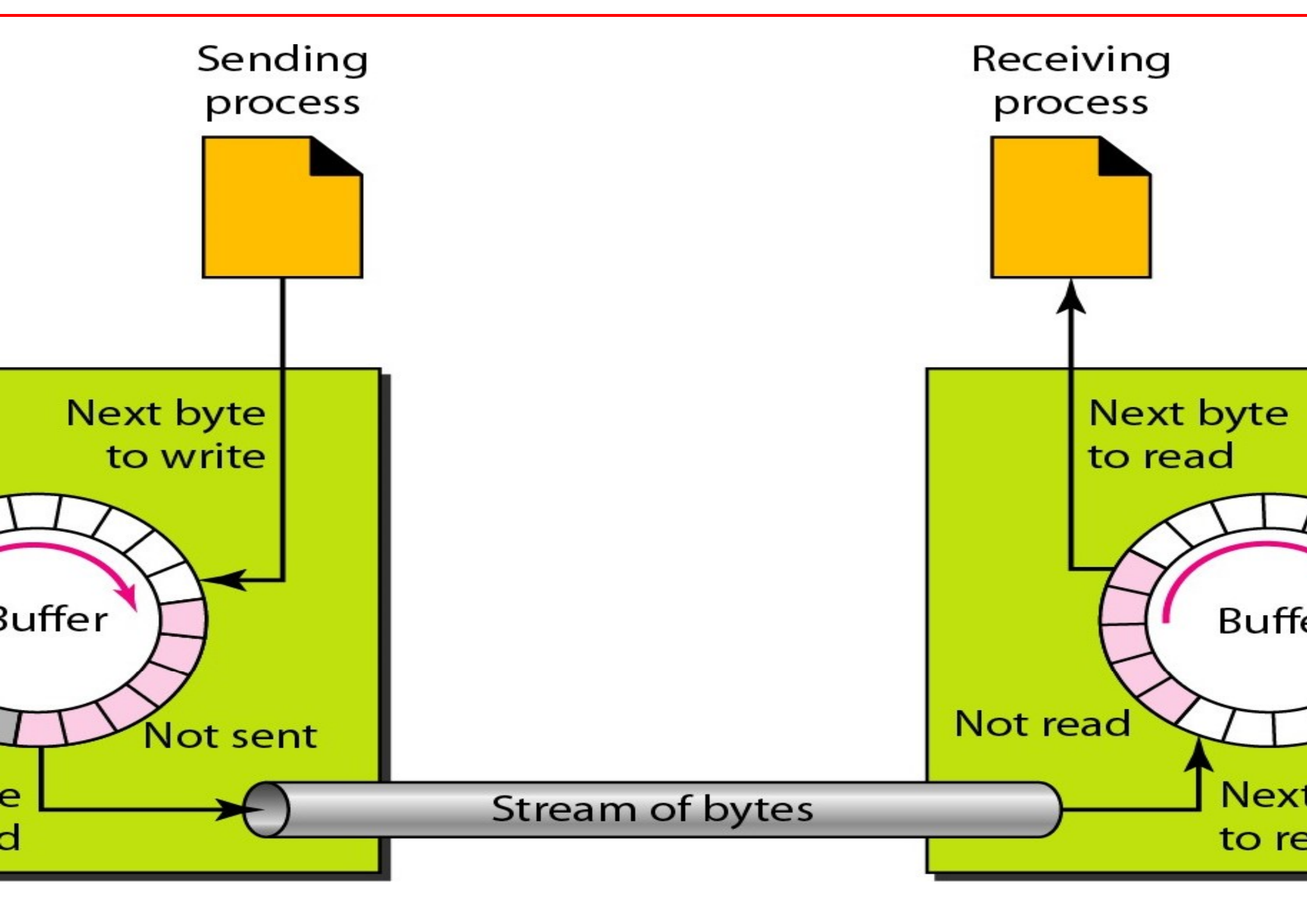


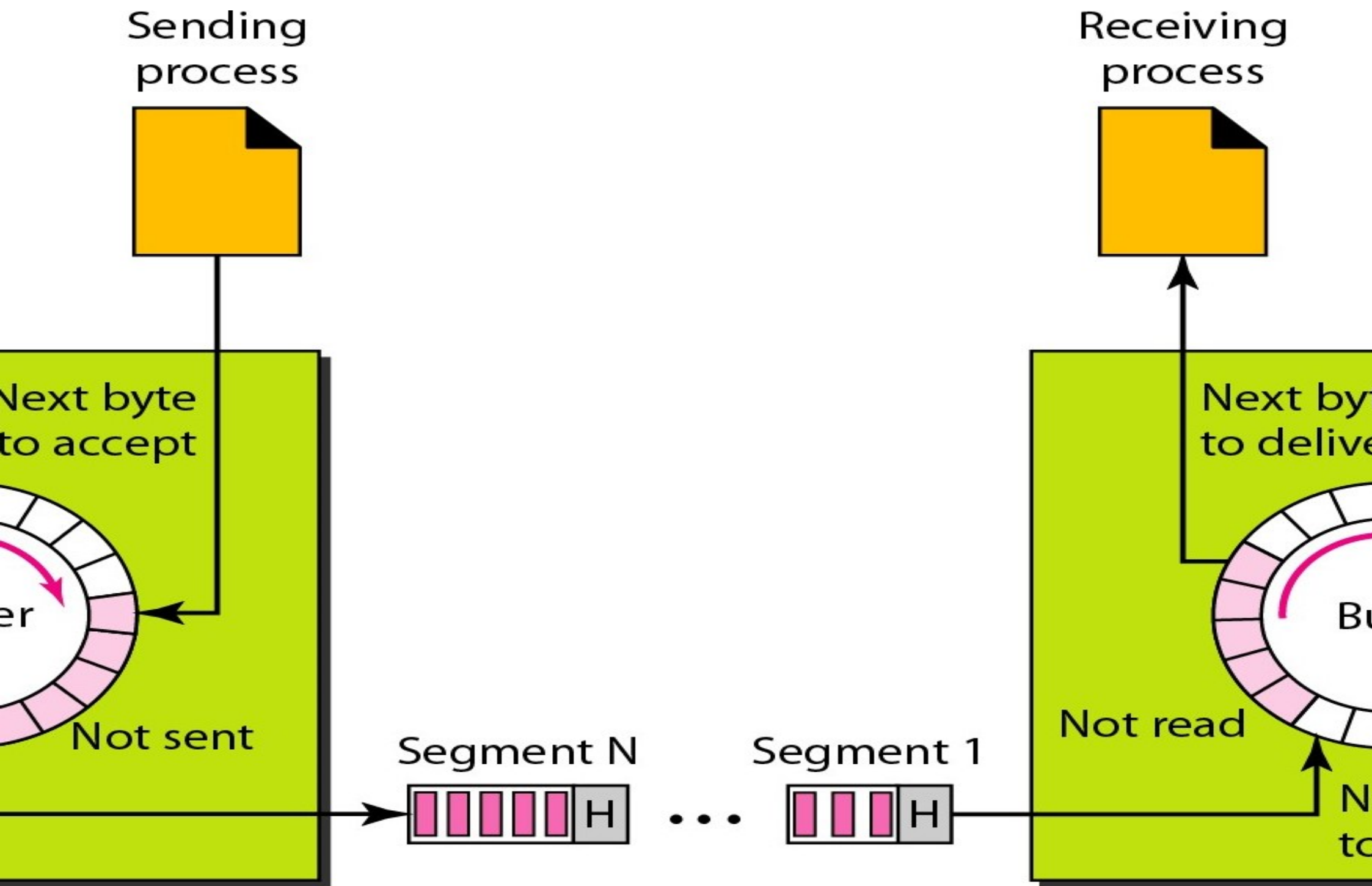
Stream of bytes



Receiv  
proc







**Bytes of data being transferred in a connection are numbered by TCP. The numbering starts with a randomly generated number.**

*ing shows the sequence number for*

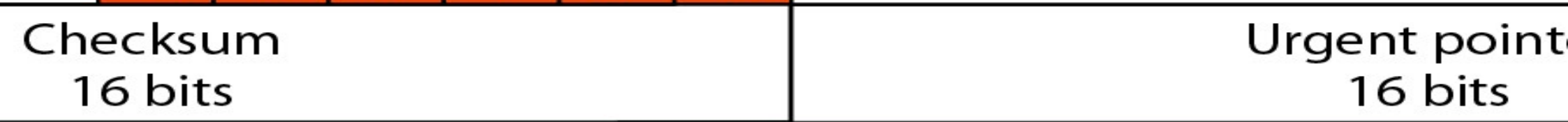
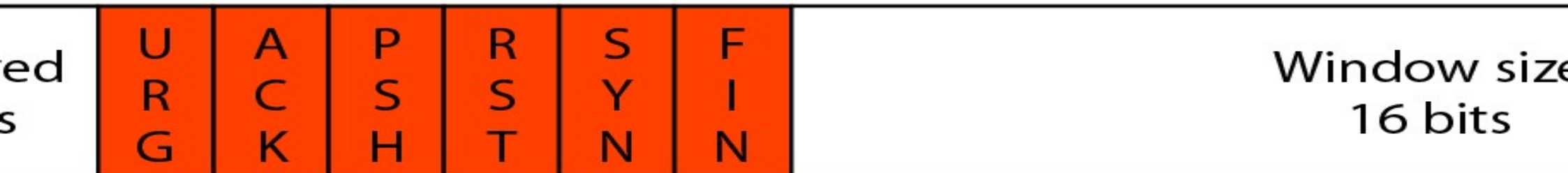
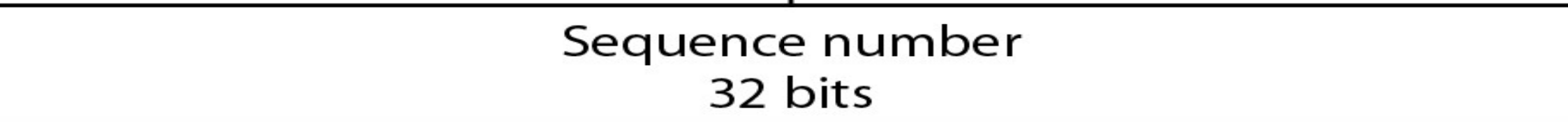
- ➔ **Sequence Number: 10,001 (range: 10,000-10,001)**
- ➔ **Sequence Number: 11,001 (range: 11,000-11,001)**
- ➔ **Sequence Number: 12,001 (range: 12,000-12,001)**
- ➔ **Sequence Number: 13,001 (range: 13,000-13,001)**
- ➔ **Sequence Number: 14,001 (range: 14,000-14,001)**



**Value in the sequence number field of a segment defines the number of the first data byte contained in that segment.**

**value of the acknowledgment field  
segment defines  
the number of the next byte a par  
expects to receive.**

**The acknowledgment number is  
cumulative.**



Window pointer is valid  
Acknowledgment is valid  
Request for push

RST: Reset the connection  
SYN: Synchronize sequence number  
FIN: Terminate the connection

ACK

PSH

RST

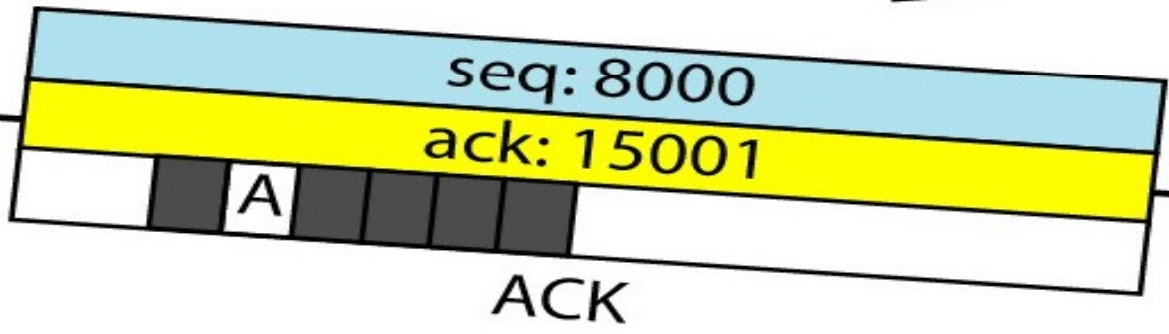
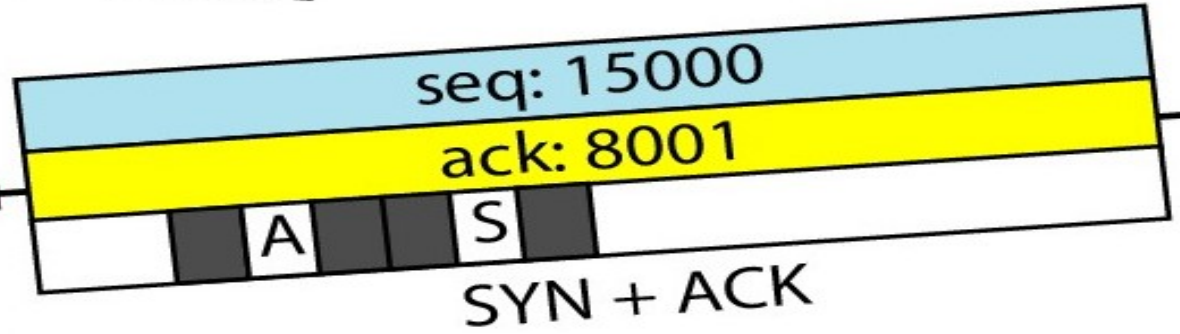
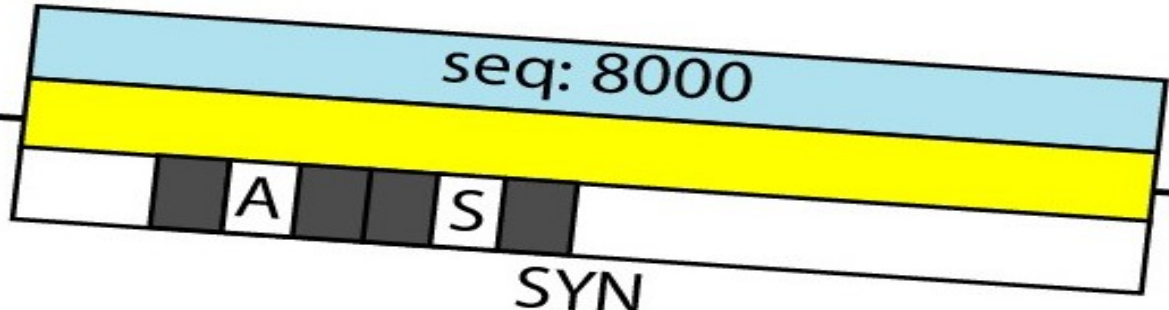
SYN

## Figure 23.3 Description of flags in the control field

<i>Description</i>
The value of the urgent pointer field is valid.
The value of the acknowledgment field is valid.
Push the data.
Reset the connection.
Synchronize sequence numbers during connection.
Terminate the connection.



A: ACK flag  
S: SYN flag



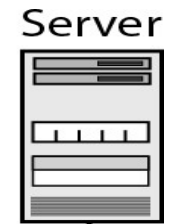
Time

**segment cannot carry data, but  
sumes one sequence number.**

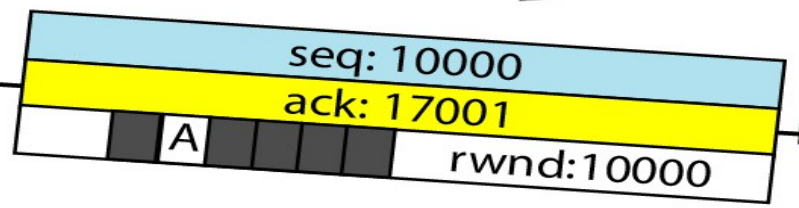
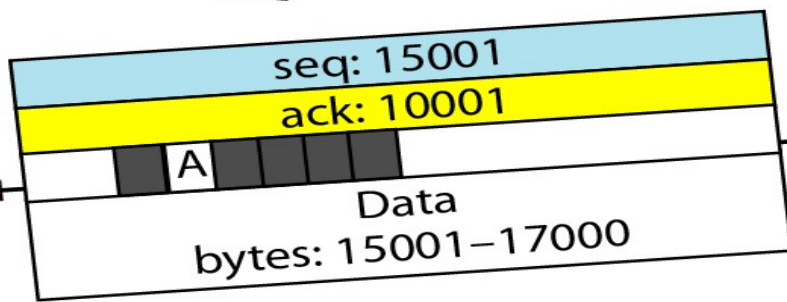
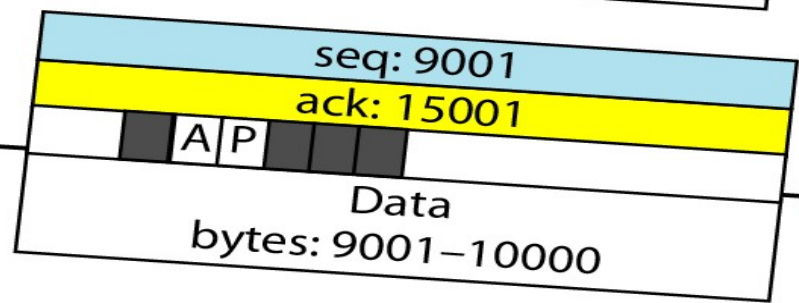
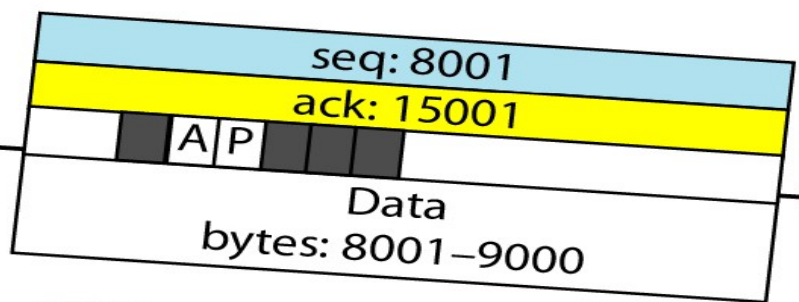
**SYN + ACK segment cannot carry data, but does consume one sequence number.**



**CK segment, if carrying no data,  
assumes no sequence number.**



A: ACK flag  
P: PSH flag

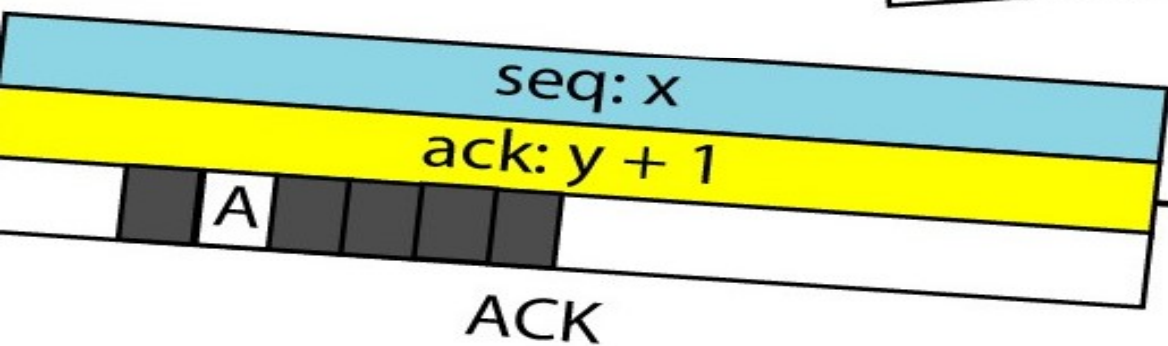
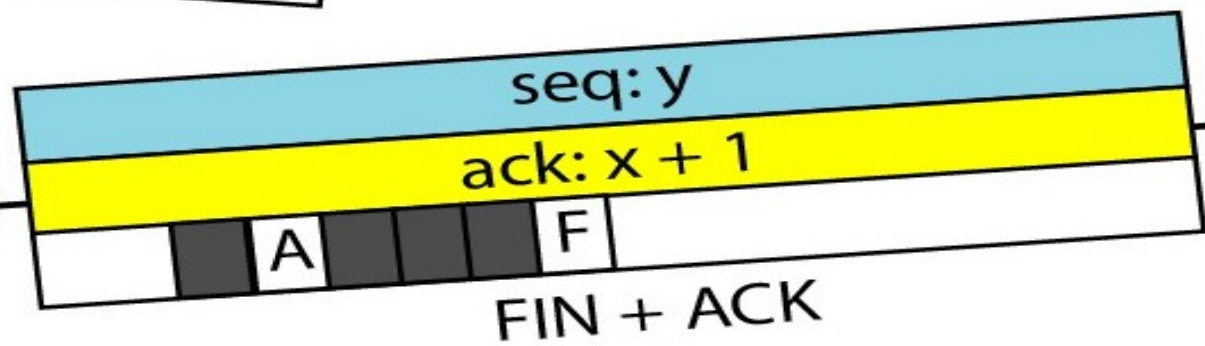
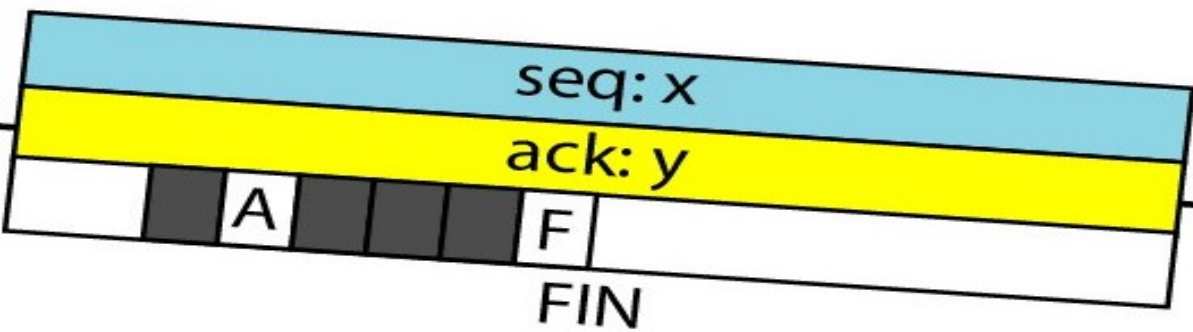


Time

Time

Server

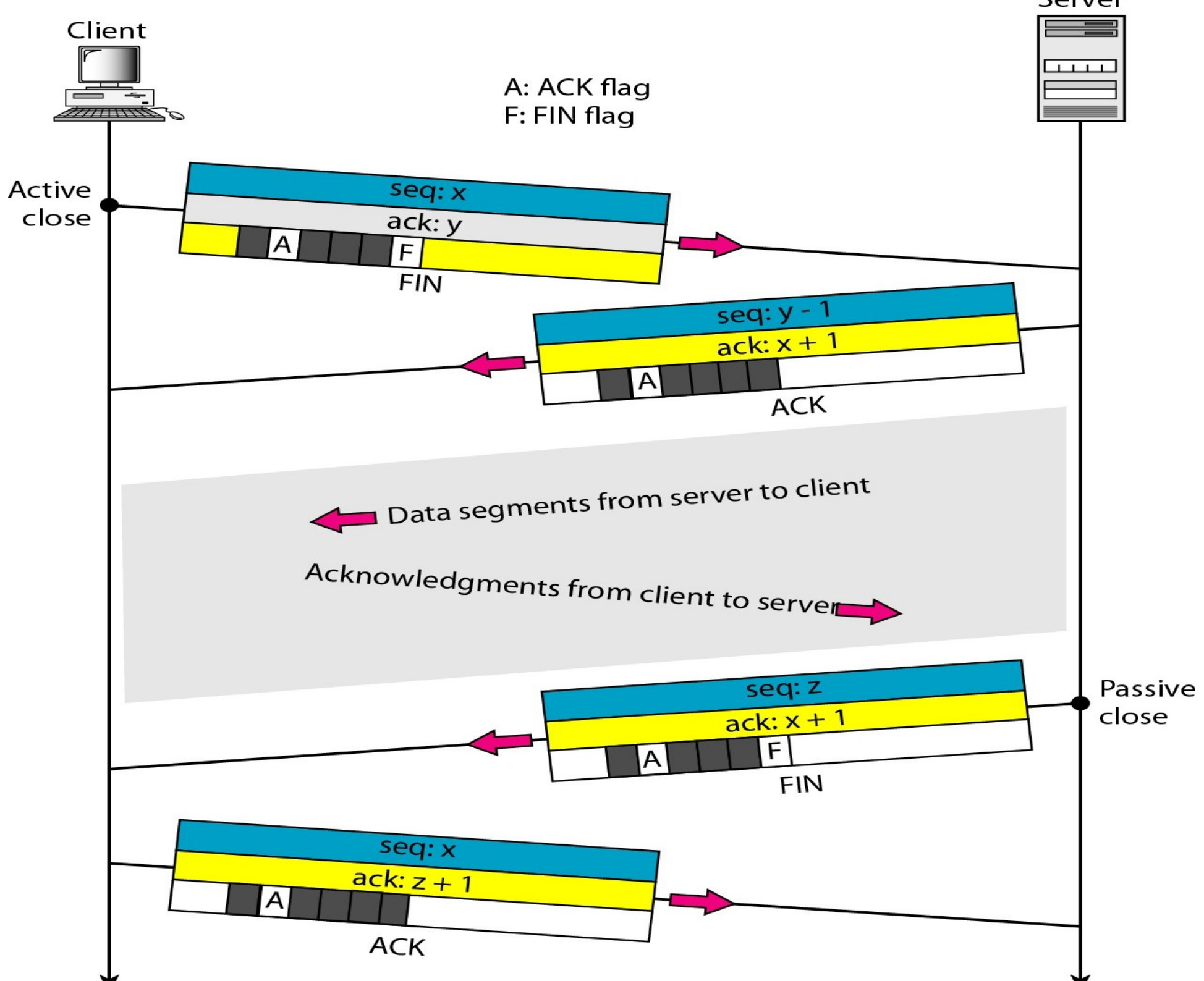
A: ACK flag  
F: FIN flag



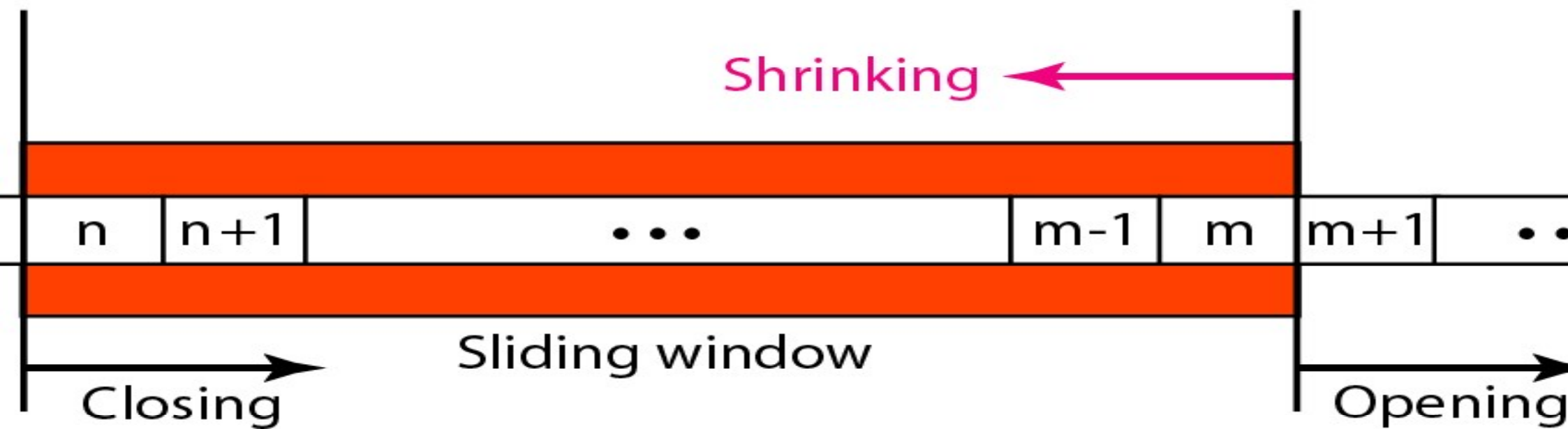
Time

**The FIN segment consumes one  
sequence number if it does  
not carry data.**

**FIN + ACK segment consumes  
sequence number if it  
does not carry data.**



Window size = minimum (rwnd, cwnd)



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**A sliding window is used to make  
transmission more efficient as well as  
control the flow of data so that the  
destination does not become  
overwhelmed with data.**

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**sliding windows are byte-orient**



*value of the receiver window (rwnd) for host B, has a buffer size of 5000 bytes received and unprocessed data?*

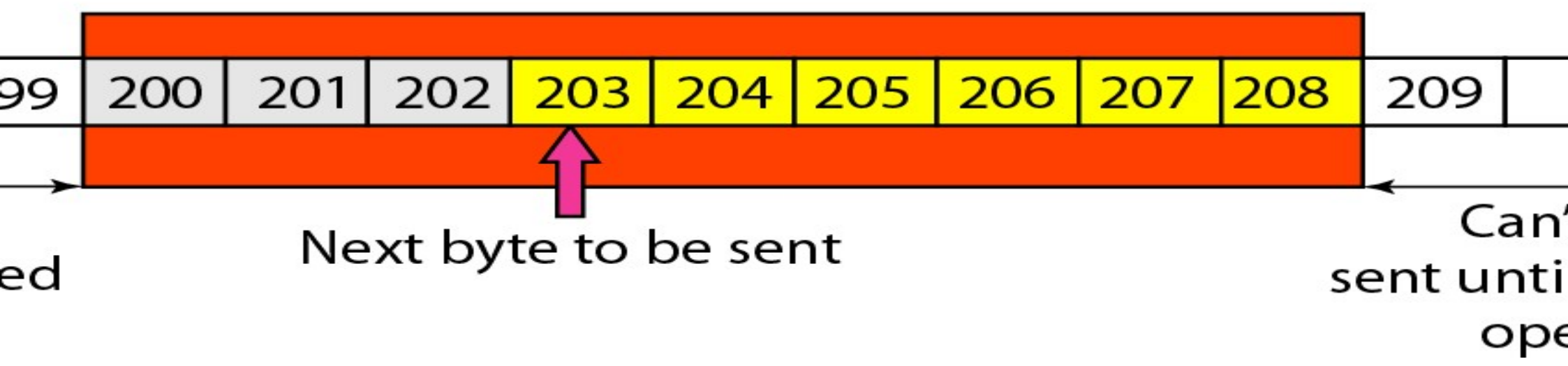
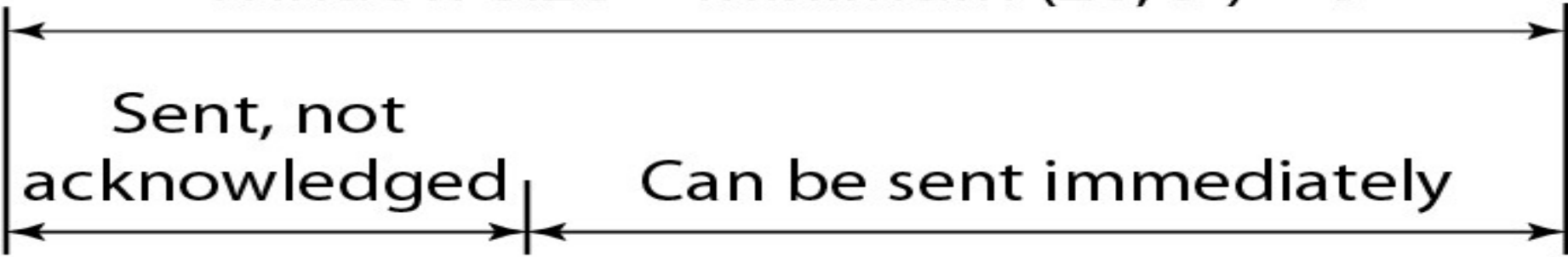
*if  $rwnd = 5000 - 1000 = 4000$ . Host B can receive 4000 bytes of data before overflowing its buffer. Host B sets this value in its next segment to A.*

*size of the window for host A if the value  
s and the value of cwnd is 3500 bytes?*

*the window is the smaller of rwnd and cwnd.*

3 shows an unrealistic example of a sliding window. The sender has sent bytes up to 202. We assume that the receiver has received this value is thousands of bytes). The receiver has sent an acknowledgment number of 200 with an rwnd of 200 (this value is thousands of bytes). The sender's current window is the minimum of rwnd and cwnd, which is 200. Bytes 200 to 202 are sent, but not acknowledged. Bytes 203 to 205 are sent without worrying about acknowledgment. Bytes 206 and above cannot be sent.

Window size = minimum (20, 9) = 9



points about TCP sliding windows:

of the window is the lesser of  $rwnd$  and  $cwnd$ .  
ce does not have to send a full window's worth

ow can be opened or closed by the receiver.  
uld not be shrunk.

ination can send an acknowledgment at any time,  
it does not result in a shrinking window.

iver can temporarily shut down the window;  
owever, can always send a segment of 1 byte.  
window is shut down.

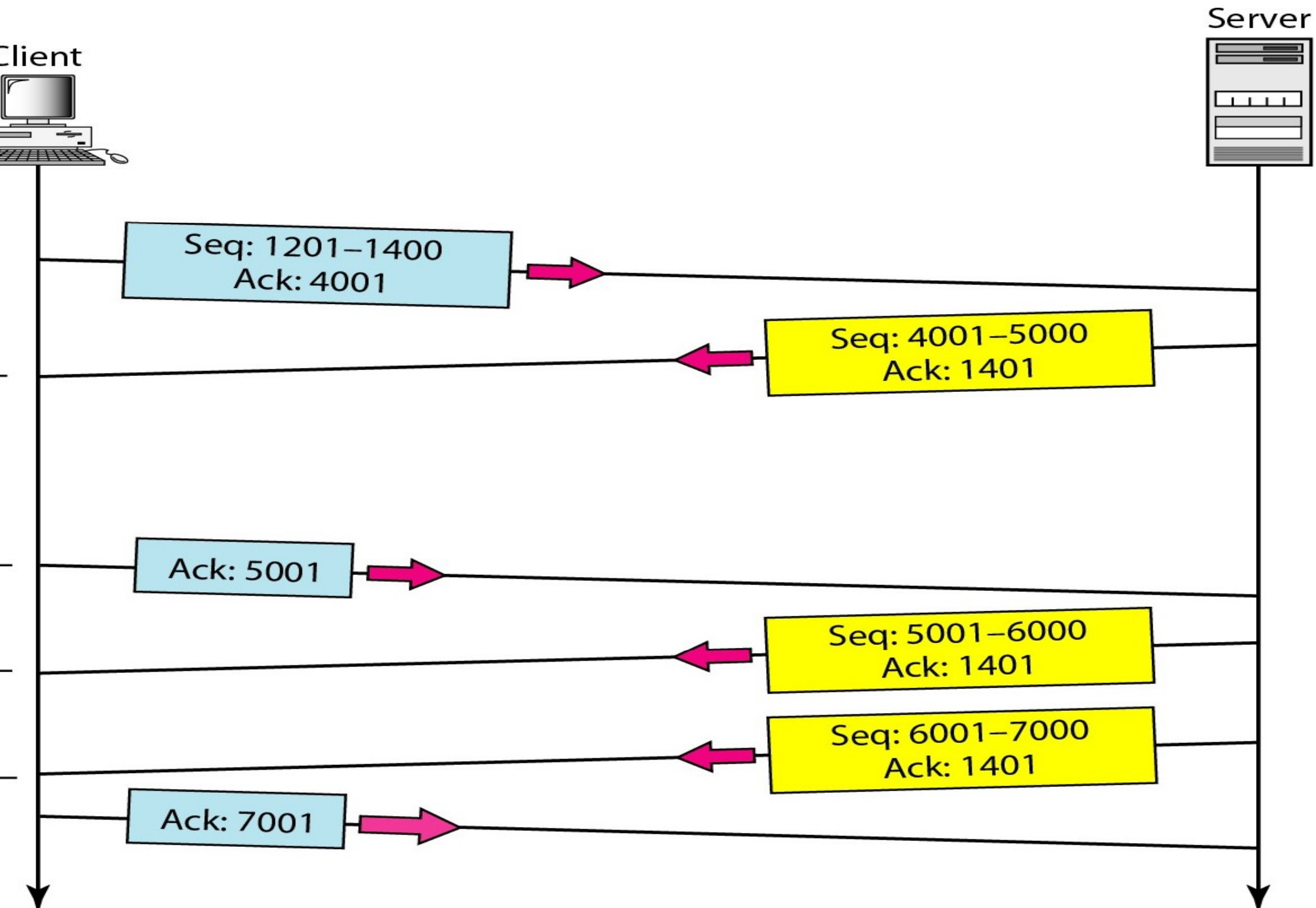
**ACK segments do not consume sequence numbers and are not acknowledged.**

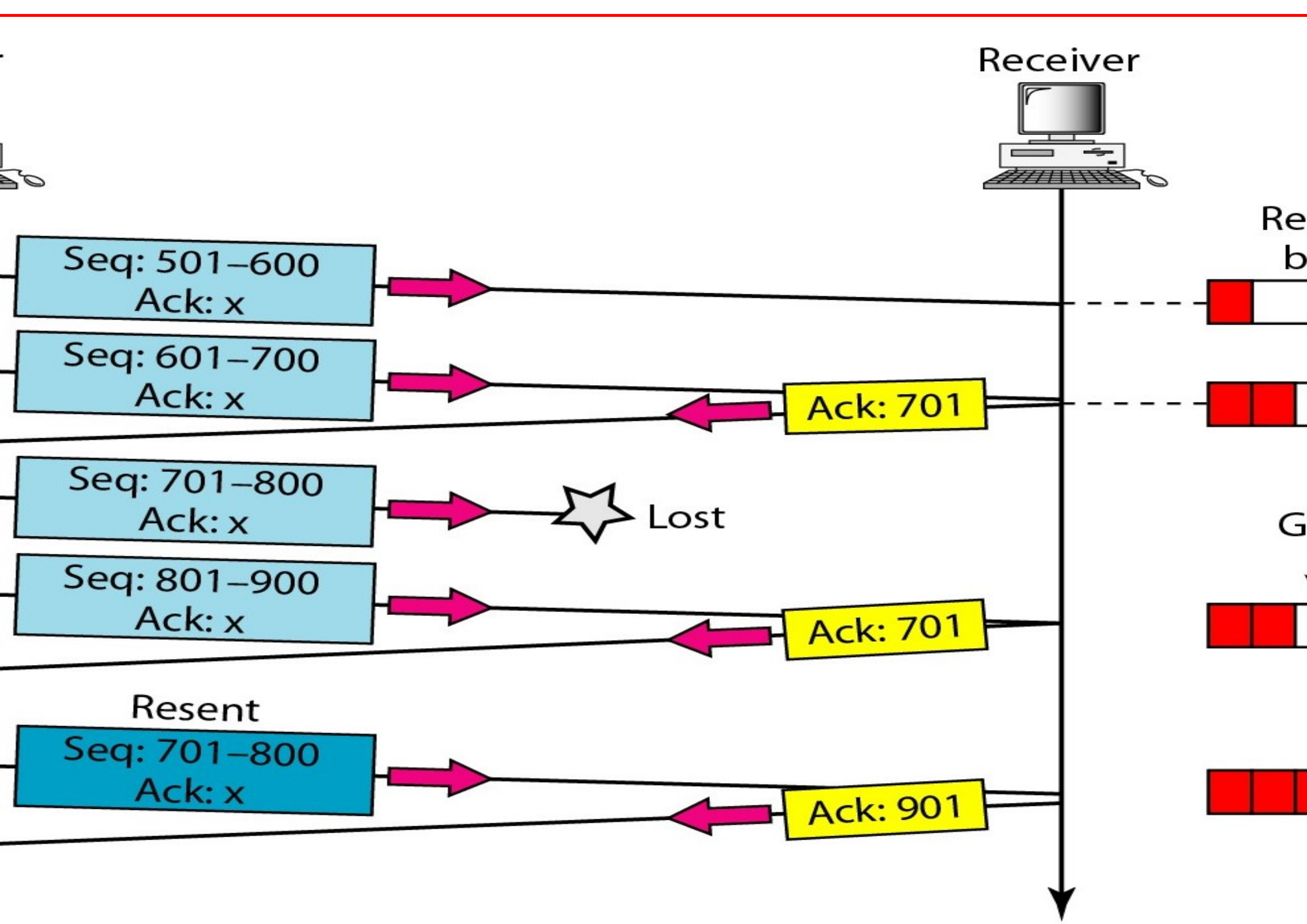
**Modern implementations, a retransmission timer expires or duplicate ACK segments have arrived.**

**transmission timer is set for an  
ACK segment.**

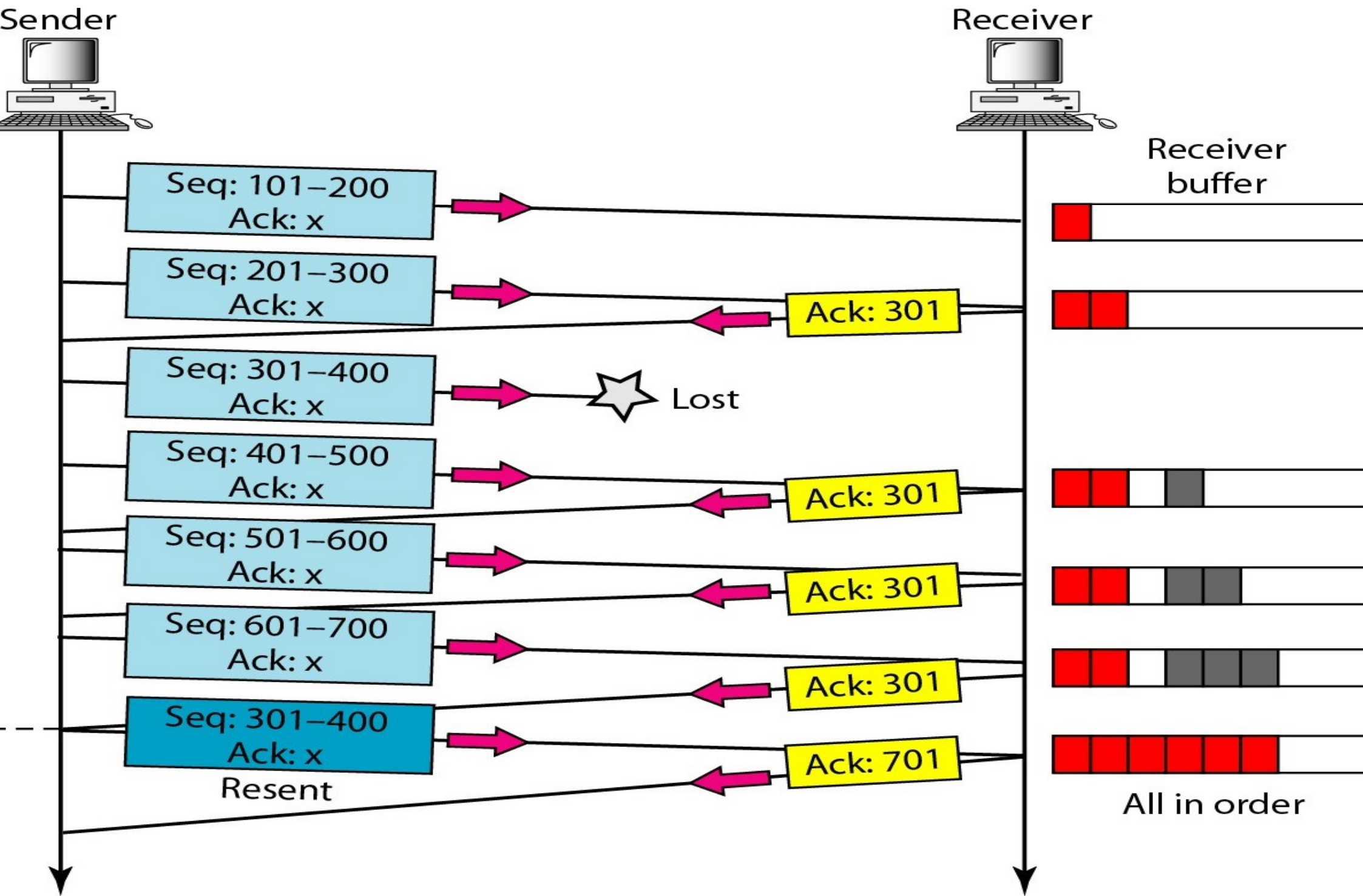


may arrive out of order and be temporarily buffered by the receiving TCP, but TCP guarantees that an in-order segment is delivered to the process.





**Receiver TCP delivers only ordered  
to the process.**



*Thank You*