

# CS & IT ENGINEERING



## Computer Network

### Transport Layer

**Lecture No. - 03**



**By - Abhishek Sir**





# Recap of Previous Lecture



Topic

UDP ✓

Topic

TCP





# Topics to be Covered



Topic

TCP Header

Topic

TCP Sequence Number

Topic

TCP ACK Number

# ABOUT ME



Hello, I'm **Abhishek**

- GATE CS AIR - 96
- M.Tech (CS) - IIT Kharagpur
- 12 years of GATE CS teaching experience

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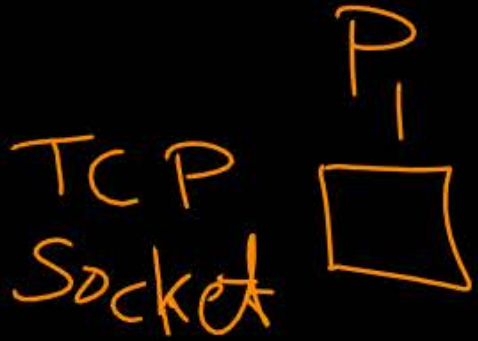




## Topic : TCP



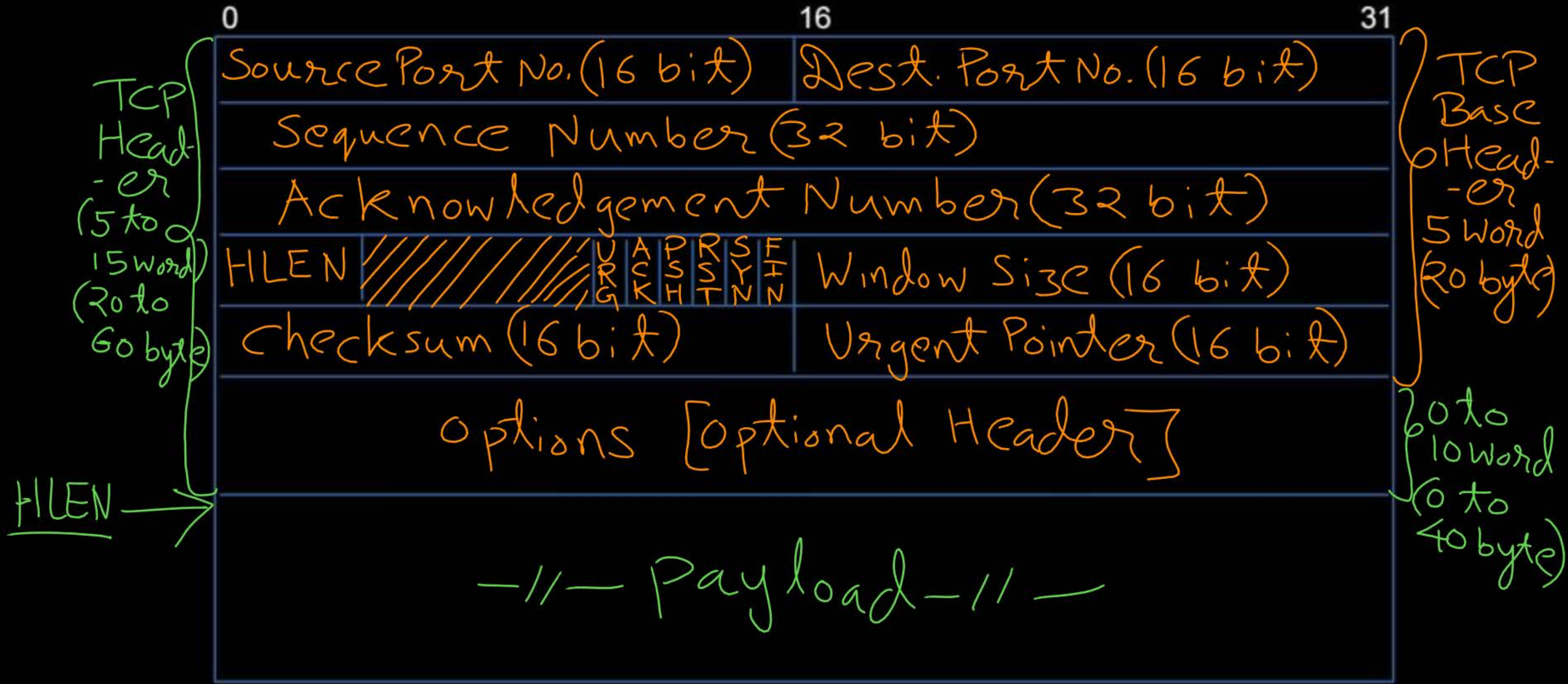
- TCP : Transmission Control Protocol
- Provide 'Connection-oriented' and 'Reliable' services  
[In-order delivery of messages]
- Full-duplex and point-to-point logical connection







# Topic : TCP Segment Structure





## Topic : TCP Segment Structure



=> Source port number : 16-bits ✓

=> Destination port number : 16-bits ✓

=> Sequence Number : 32-bits ✓

=> Acknowledgment Number : 32-bits ✓





## Topic : Sequence Number



=> TCP is byte-stream protocol (Stream-oriented protocol) ✓

=> Every byte in 'service data unit' is identified uniquely  
[with 32-bit sequence number]

=> Unique sequence number is assigned to each byte

Sequence Number in TCP Segment ← First Byte Sequence Number of Payload



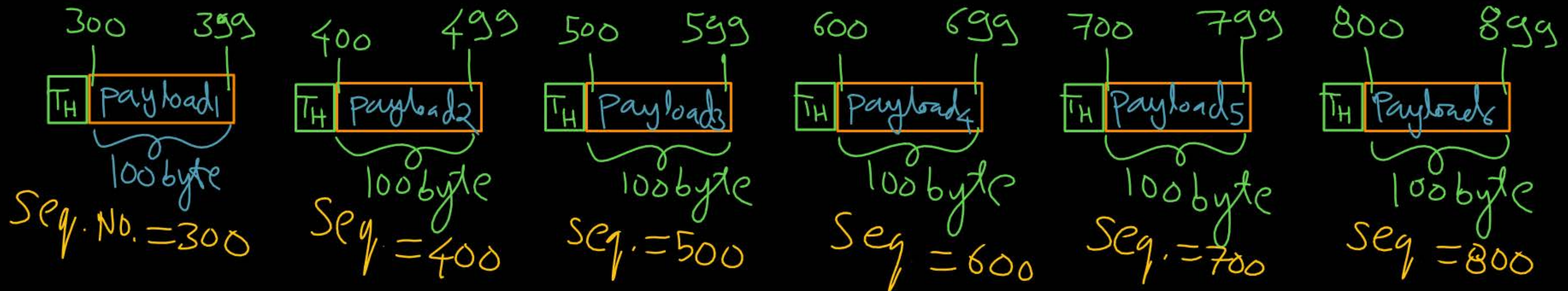
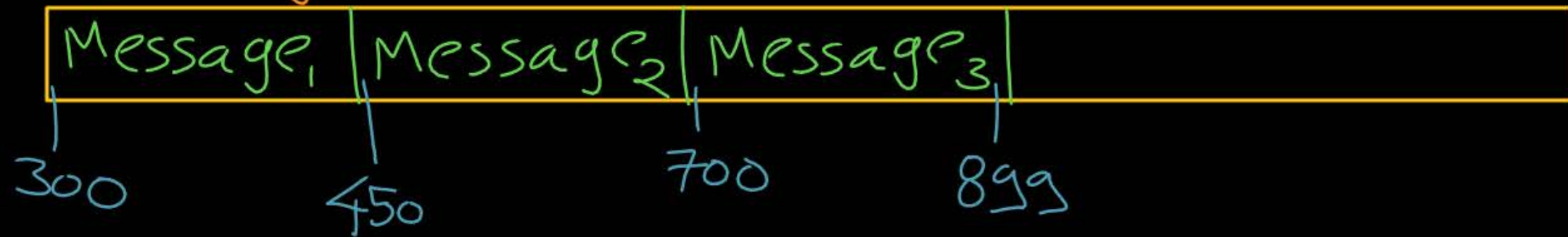
(P<sub>1</sub>)

TCP Socket  
i) Sending Window ✓  
ii) Receiving Window

Message<sub>1</sub> → 150 byte  
Message<sub>2</sub> → 250 byte  
Message<sub>3</sub> → 200 byte



Sending Window (P<sub>1</sub>)



#Q. In TCP, a unique sequence number is assigned to each :

[GATE-2004]

☒ (A) byte

☐ (B) word

☐ (C) segment

☐ (D) message

Ans: A





## Topic : Acknowledgment Number

=> TCP acknowledgment are always piggy-backed

=> TCP uses cumulative acknowledgment

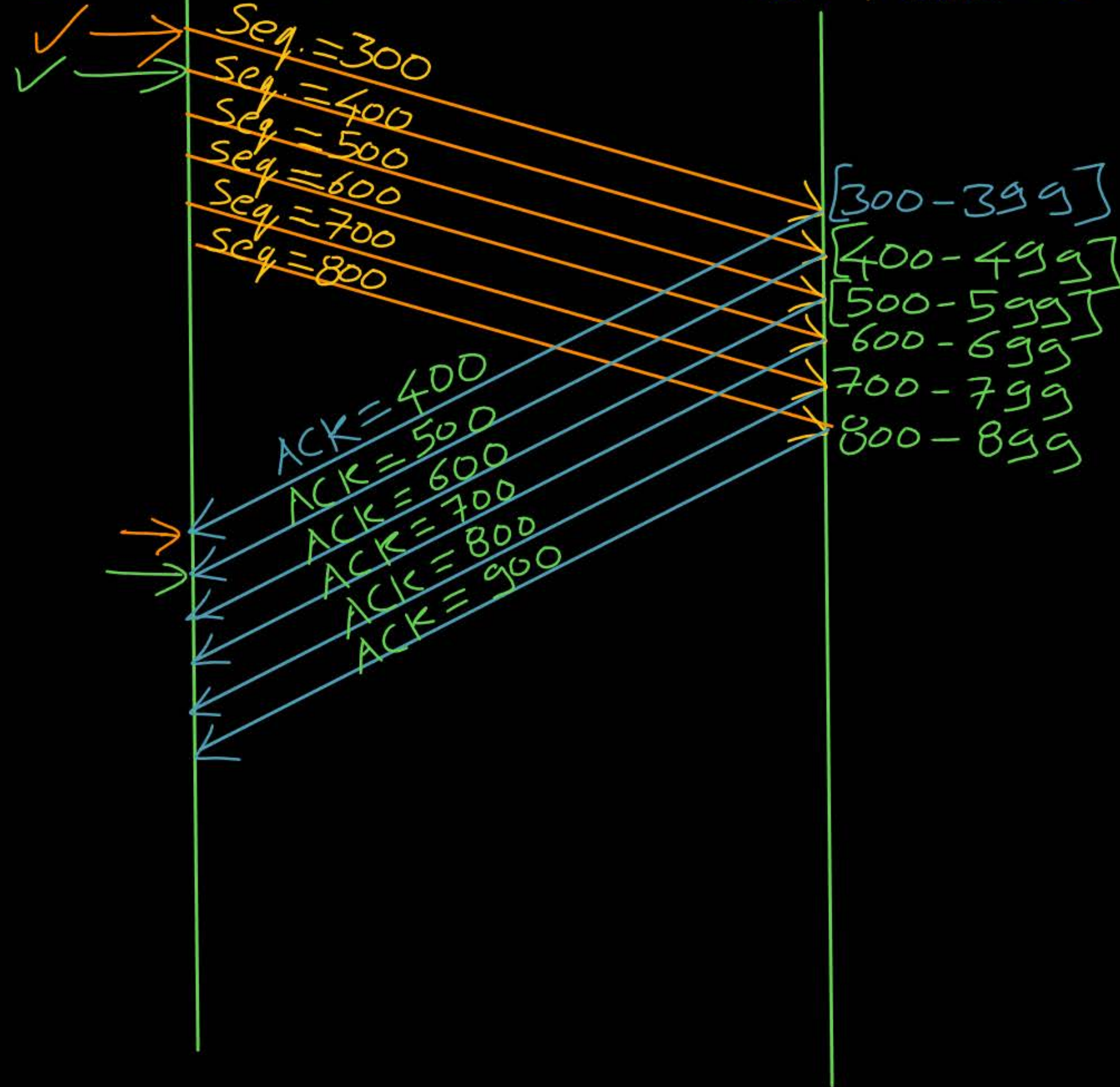
=> if ACK flag is on  
then TCP segment carry acknowledgment number  
else :  
Acknowledgment number is garbage value

Acknowledgment Number  $\leftarrow$  Last Byte Sequence Number of Payload + 1



TCP sender

TCP Receiver



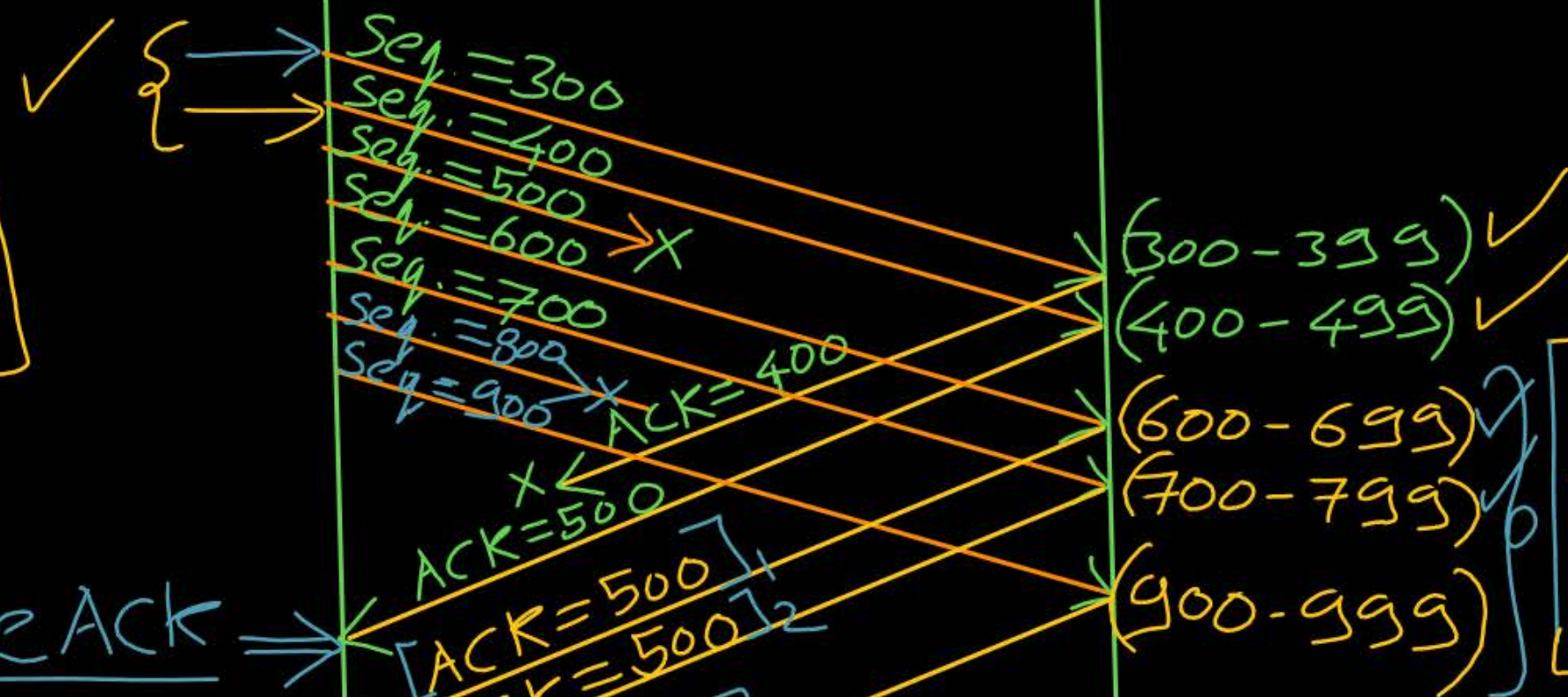




ACK<sub>4</sub>  
ACK=800  
Optional Header  
SA=(900-999)

TCP Sender

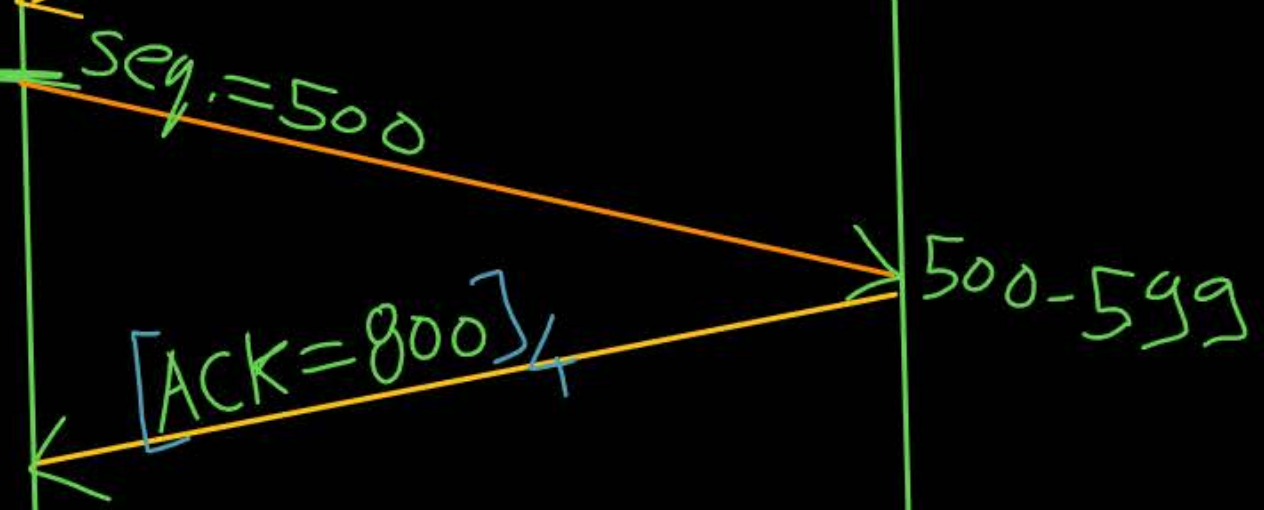
TCP Receiver



ACK<sub>1</sub>  
ACK=500  
Optional Header  
SA=[600-699]

ACK<sub>3</sub>  
ACK=500  
Optional Header  
SA=(600-799)  
(900-999)

T.O.(Re)



ACK<sub>2</sub>  
ACK=500  
Optional Header  
SA=[600-799]





## Topic : Acknowledgment Number



=> In TCP, provision for 'selective acknowledgment'

=> TCP keeps 'selective acknowledgment(s)' in optional header ✓

=> selective ACK is optional



#Q. Consider a TCP connection in a state where there are no outstanding ACKs. The sender sends two segments back to back. The sequence numbers of the first and second segments are 230 and 290 respectively. The first segment was lost, but the second segment was received correctly by the receiver. Let  $X$  be the amount of data carried in the first segment (in bytes), and  $Y$  be the ACK number sent by the receiver. The values of  $X$  and  $Y$  (in that order) are :

- (A) 60 and 290
- (B) 230 and 291
- (C) 60 and 231
- (D) 60 and 230

[GATE-2007]

IT-K  
H.W.



## 2 mins Summary



Topic

TCP Header ✓

Topic

TCP Sequence Number ✓

Topic

TCP ACK Number ✓





**THANK - YOU**