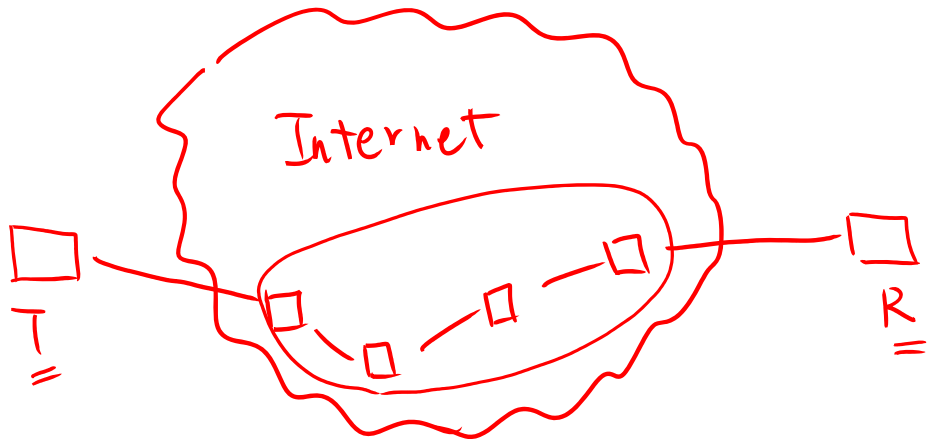
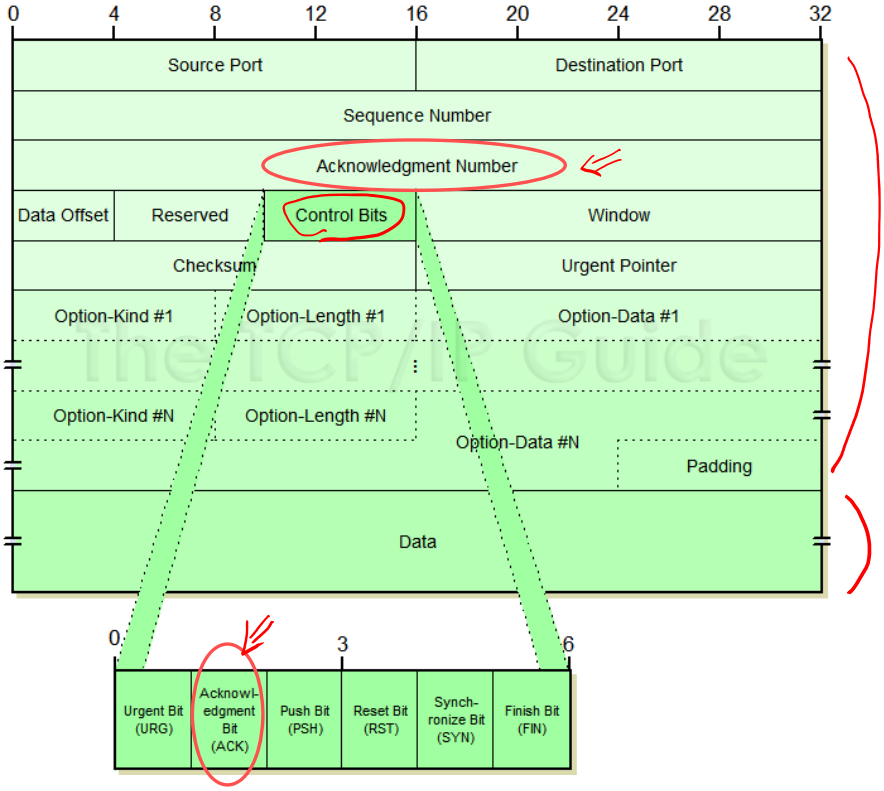
Topic 6: Transport Layer

Transmission Control Protocol (TCP)

to provide connection-oriented reliable byte-stream end-to-end service over IP.



1. TCP ACK

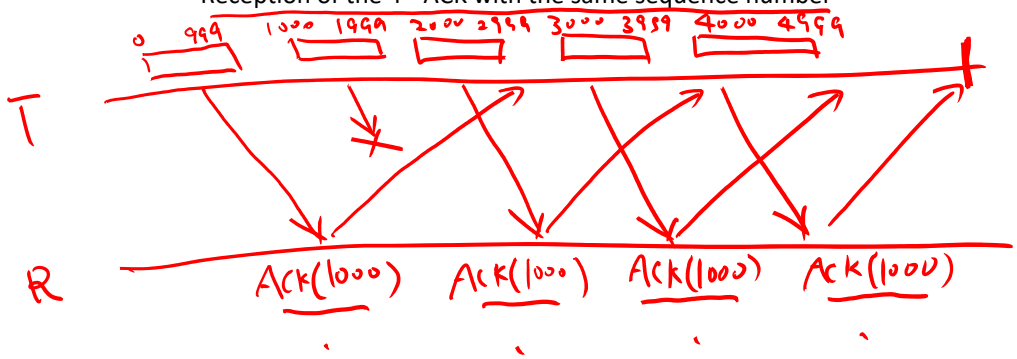


byte-stream

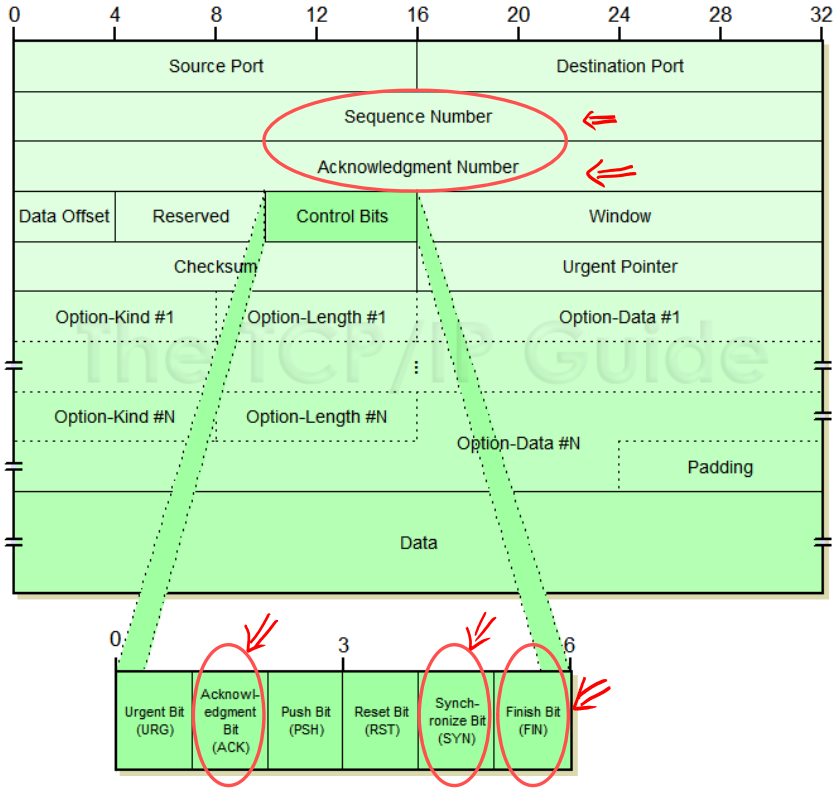
- TCP ACK
  - Acknowledgment Number: index of the next byte which the receiver expects to receive, NOT index of the next datagram to be received
    - This is because TCP segments may have variable lengths and retransmitted TCP segment can include more data than the original
  - TCP ACK is cumulative

2. TCP Error Control

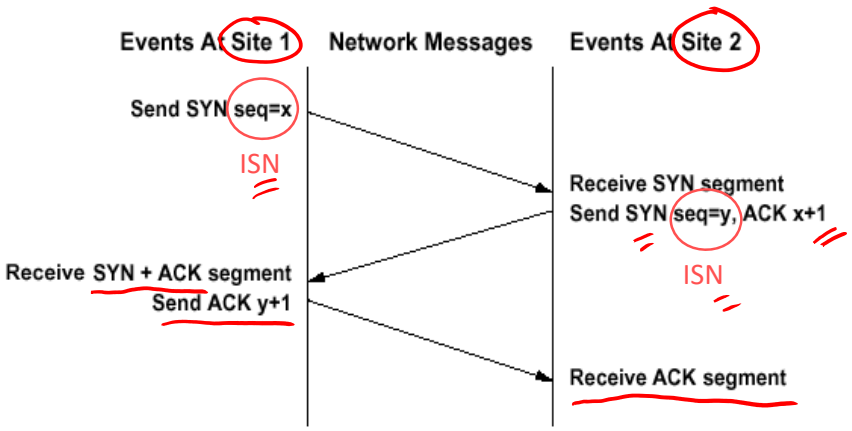
- TCP Error Control
  - Special version of Selective Repeat ARQ
    - ACKs only
    - No NAKs
    - Retransmit upon
      - Retransmission Timeout (RTO)
      - Reception of the 4th ACK with the same sequence number



3. Establishing/Terminating a TCP Connection

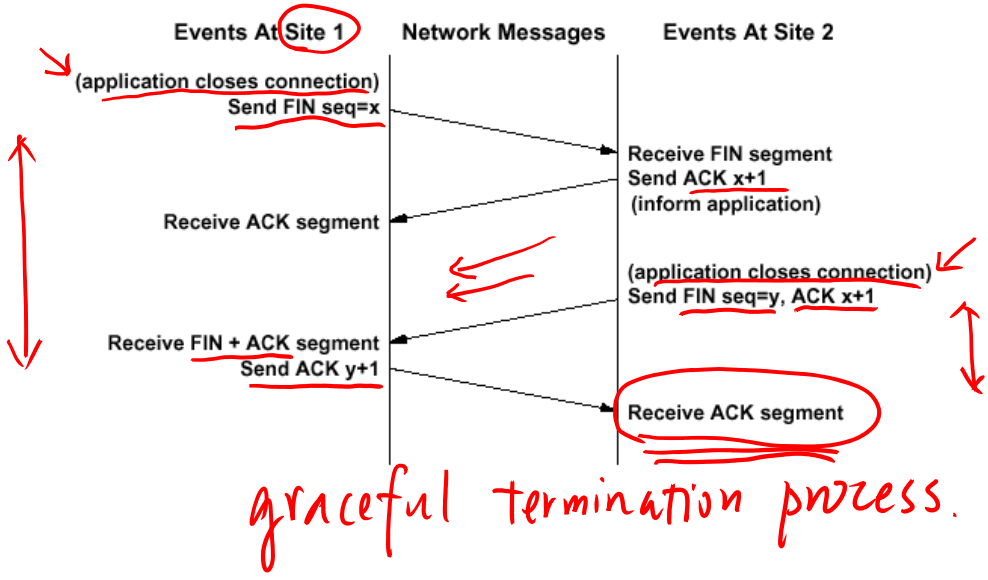


- TCP uses three-way handshake to establish a connection



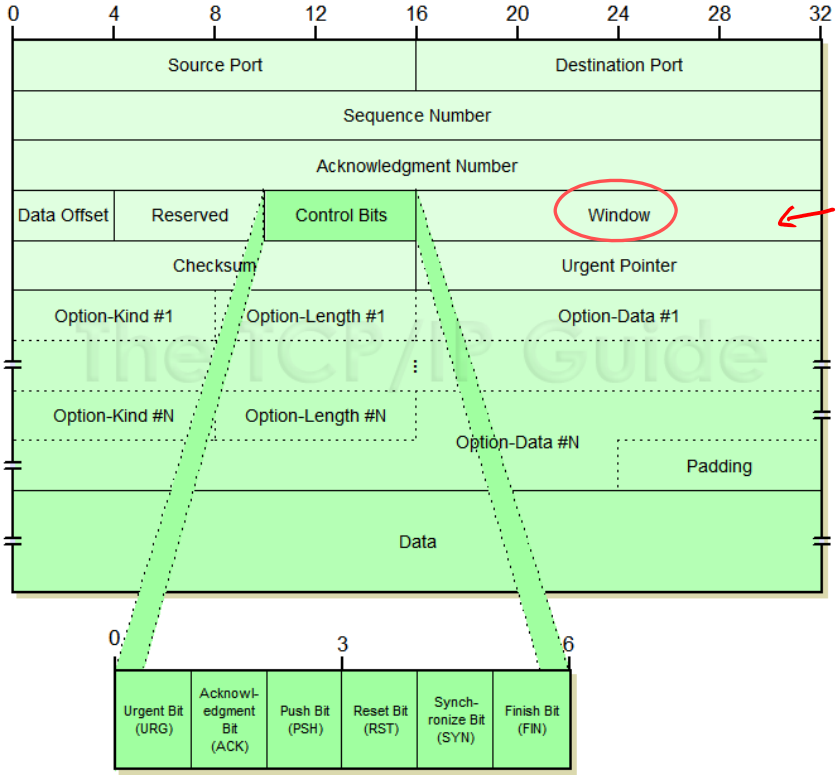
ISN: Initial Sequence Number (a byte index)

- TCP uses modified three-way handshake to terminate a connection



graceful termination process.

4. TCP Flow Control



- TCP flow control prevents the sender from overwhelming the receiver with too much data
  - Receiver advertises the available buffer space (rwnd)
  - Sender makes sure that the amount of outstanding data (swnd) is less than the receiver-advertised buffer space
    - swnd ≤ rwnd