Variety of TCP1—Tahoe

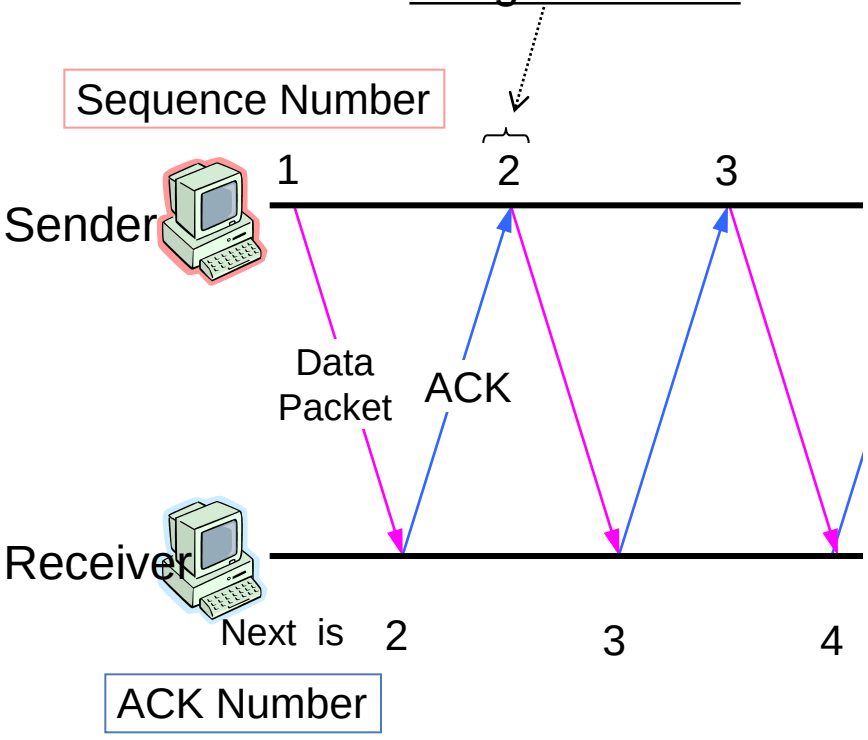
Practice 1

Information and Communications Technology
Internet Engineering

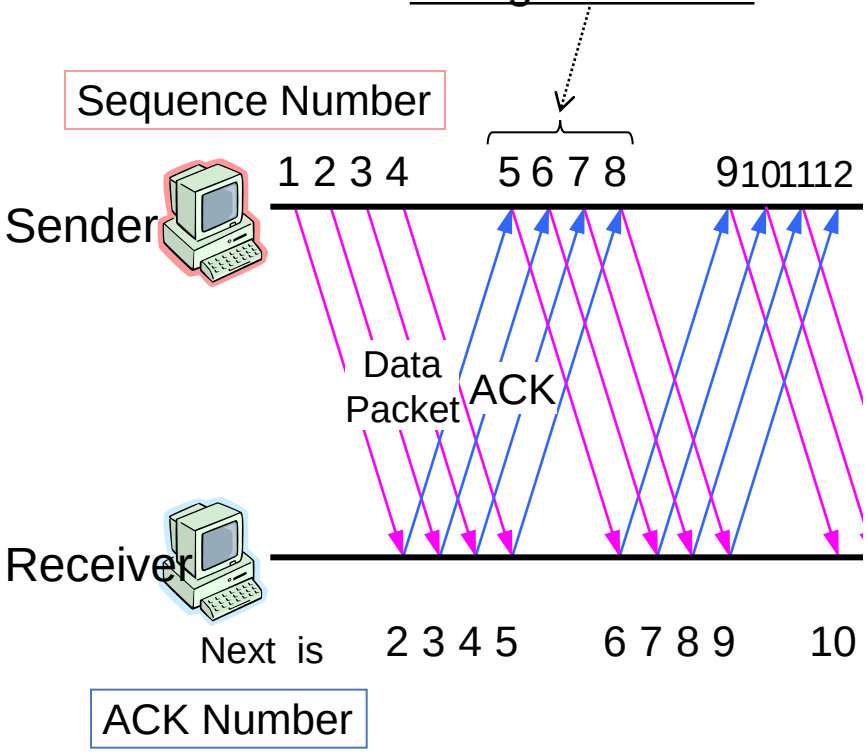
Window Control

- Adjust rate by change Window Size

- Window Size = 1segment case



- Window Size = 4 segment case

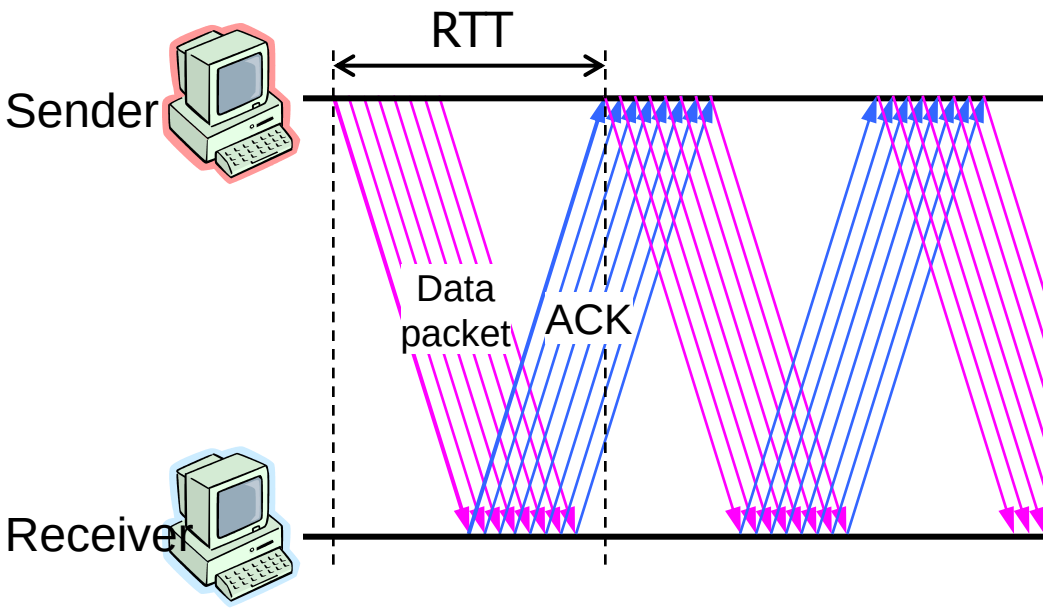


Window Size Control

- Rule 1
  - Window size is the smaller of value of Window Size which calculated by sender (Congestion Window Size) and buffer size of receiver (maximum window size)
    - Transmission Window = min(Congestion Window Size, Maximum Window Size)
- Rule 2
  - Congestion Window increase until network congestion occur
    - Network state is unknown when start sending data, Window Size chose a low value and increase rapidly by time
    - If the Window Size is large enough, it increase little by little
  - If congestion occur, it decrease immediately

TCP — The change of Window size

- Round Window Size (rwnd) = 8 segment
  - Ideally Case



RTT: Round Trip Time

Theoretical maximum throughput [Mbps]

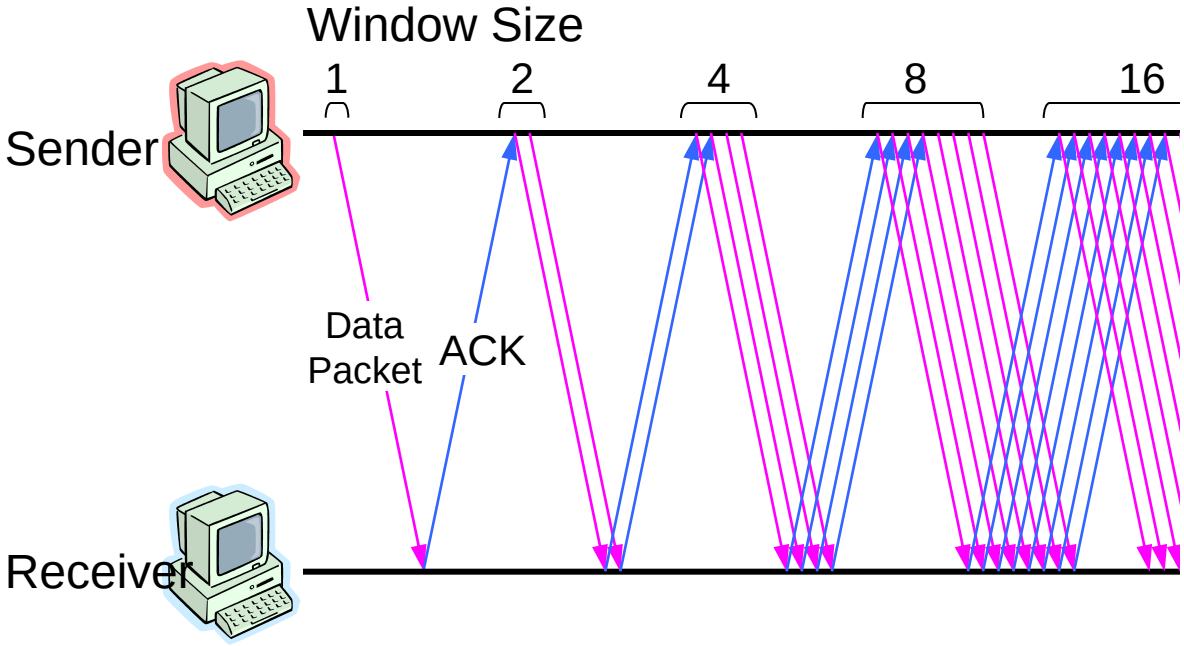
$$\frac{\text{rwnd [bytes]}}{\text{RTT [s]}}$$

※ byte = 8 bits

  - Actuality
    - Adjust transmission rate by change window size
      - Slow Start phase
      - Congestion Avoidance Phase

–Slow Start Phase–

- Sending a large amount data from start→Network will congest rapidly

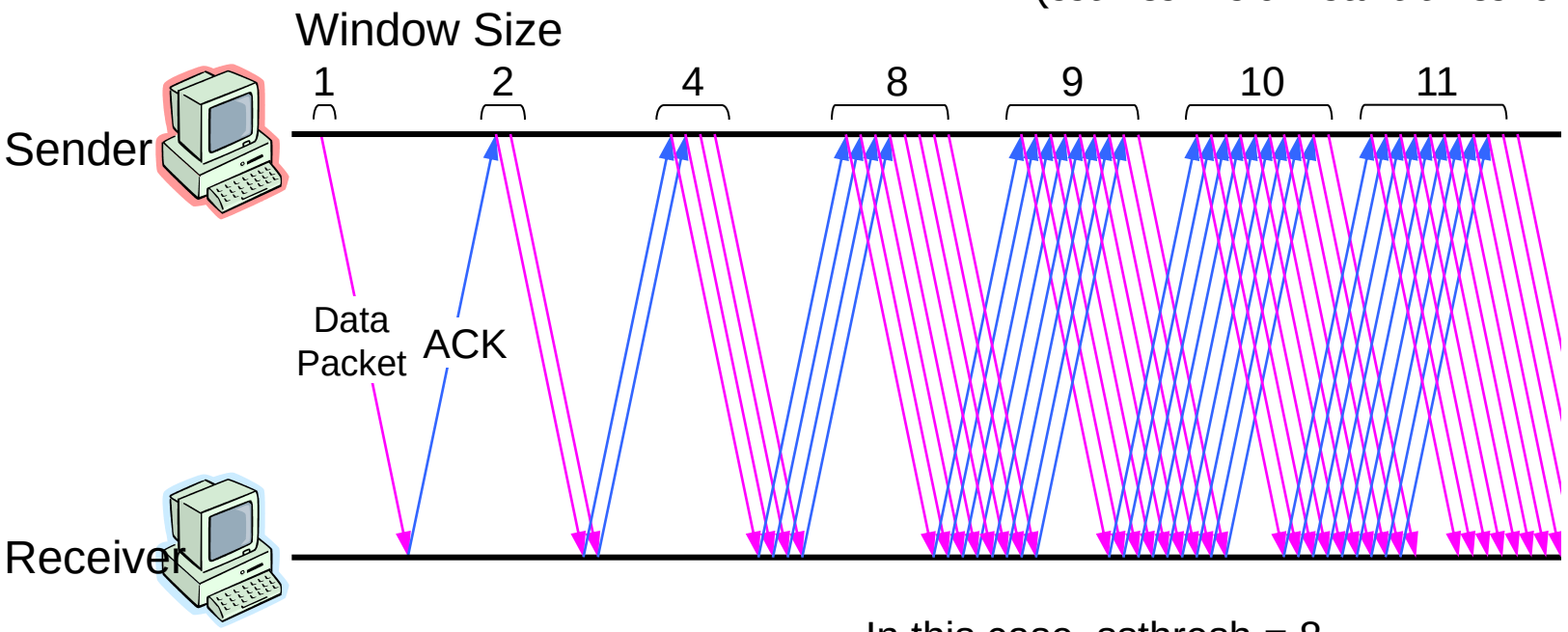


However, window size will increase rapidly by exponent function
→How to cope this problem？

–Congestion Avoidance Phase–

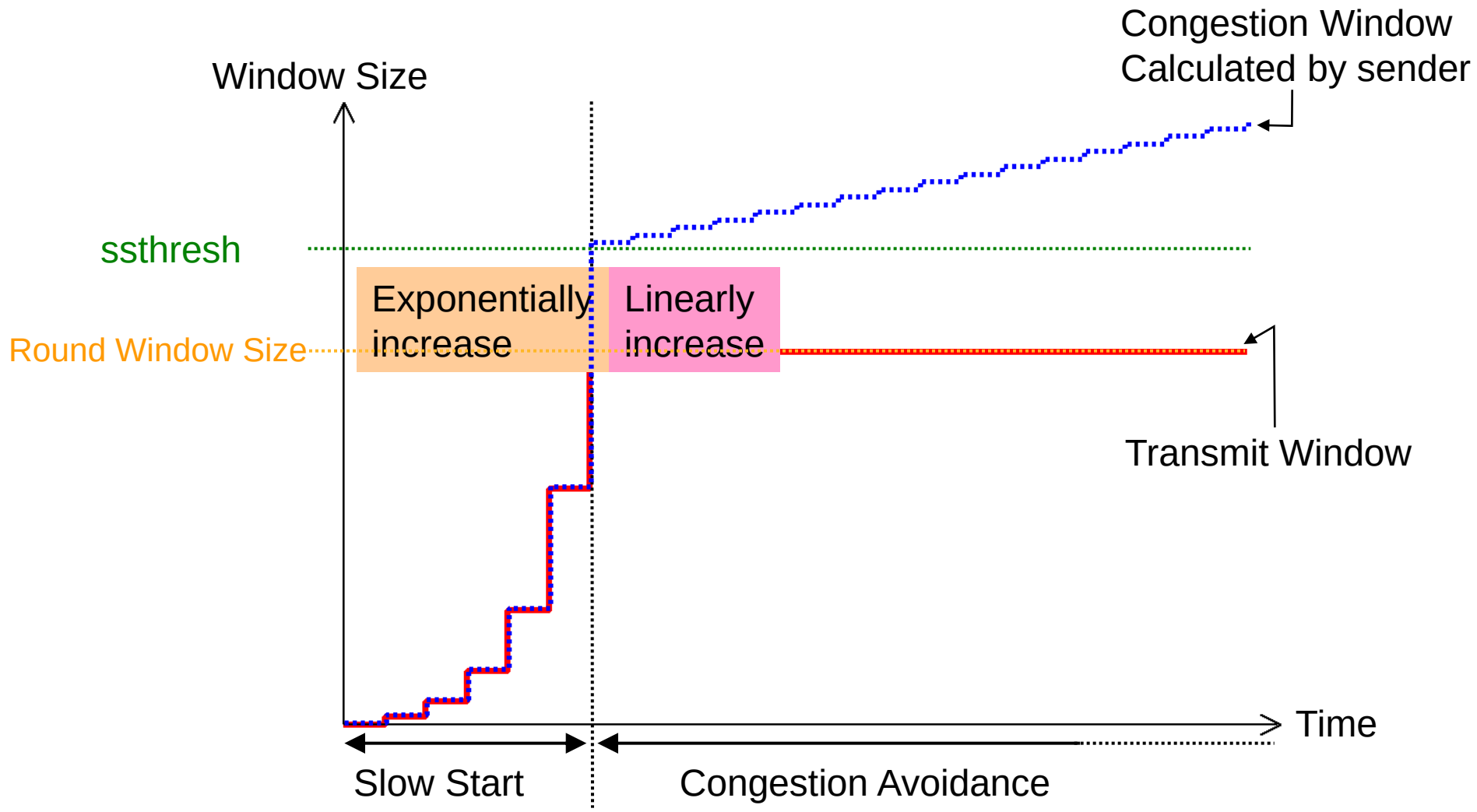
- If congestion window is bigger than a value…

(ssthresh: slow start threshold)



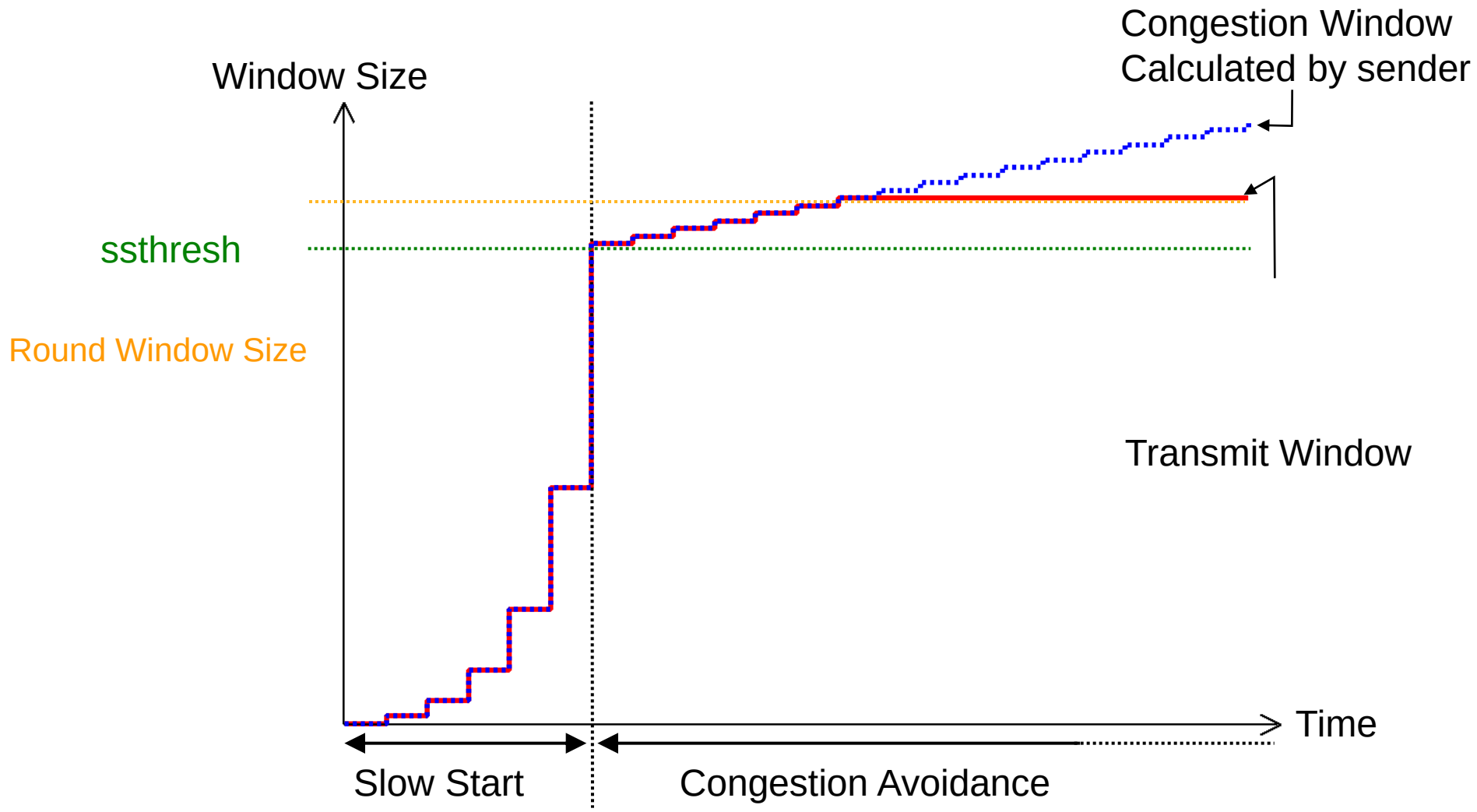
Window Size increase linearly

Change of Window Size



Rule 1: Transmit Window Size = min(Congestion Window Size, Round Window Size)

Change of Window Size



Rule 1: Transmit Window Size = min(Congestion Window Size, Round Window Size)

Network Congestion Case

- Receive three duplicate ACK
- Time Out

→ Packet was drop (determine)

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Network is congestion？

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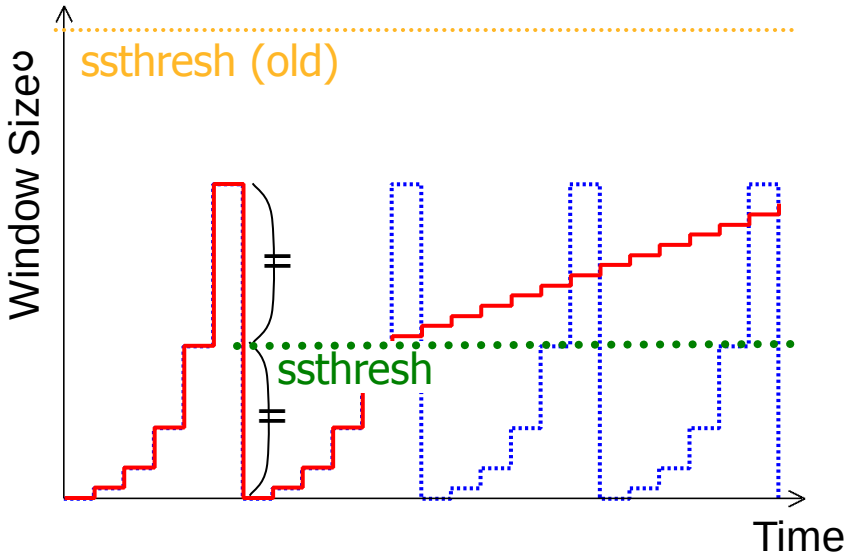
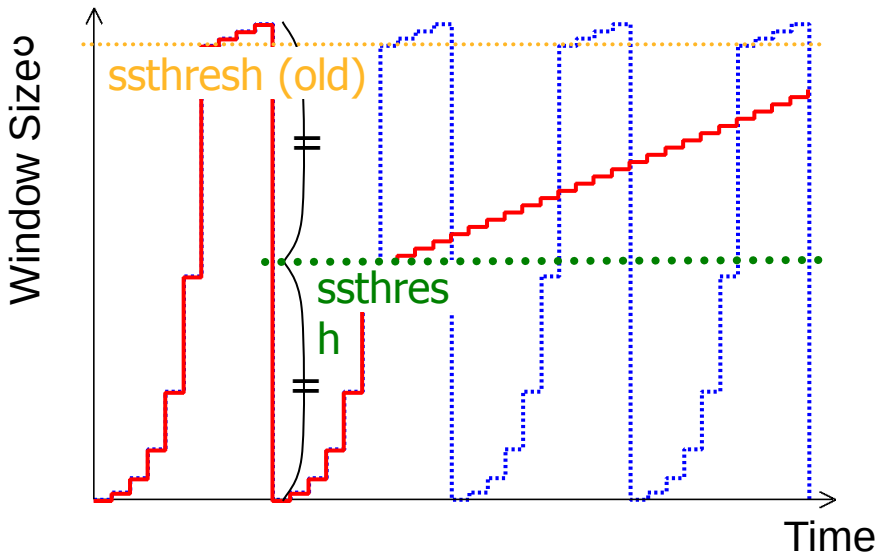
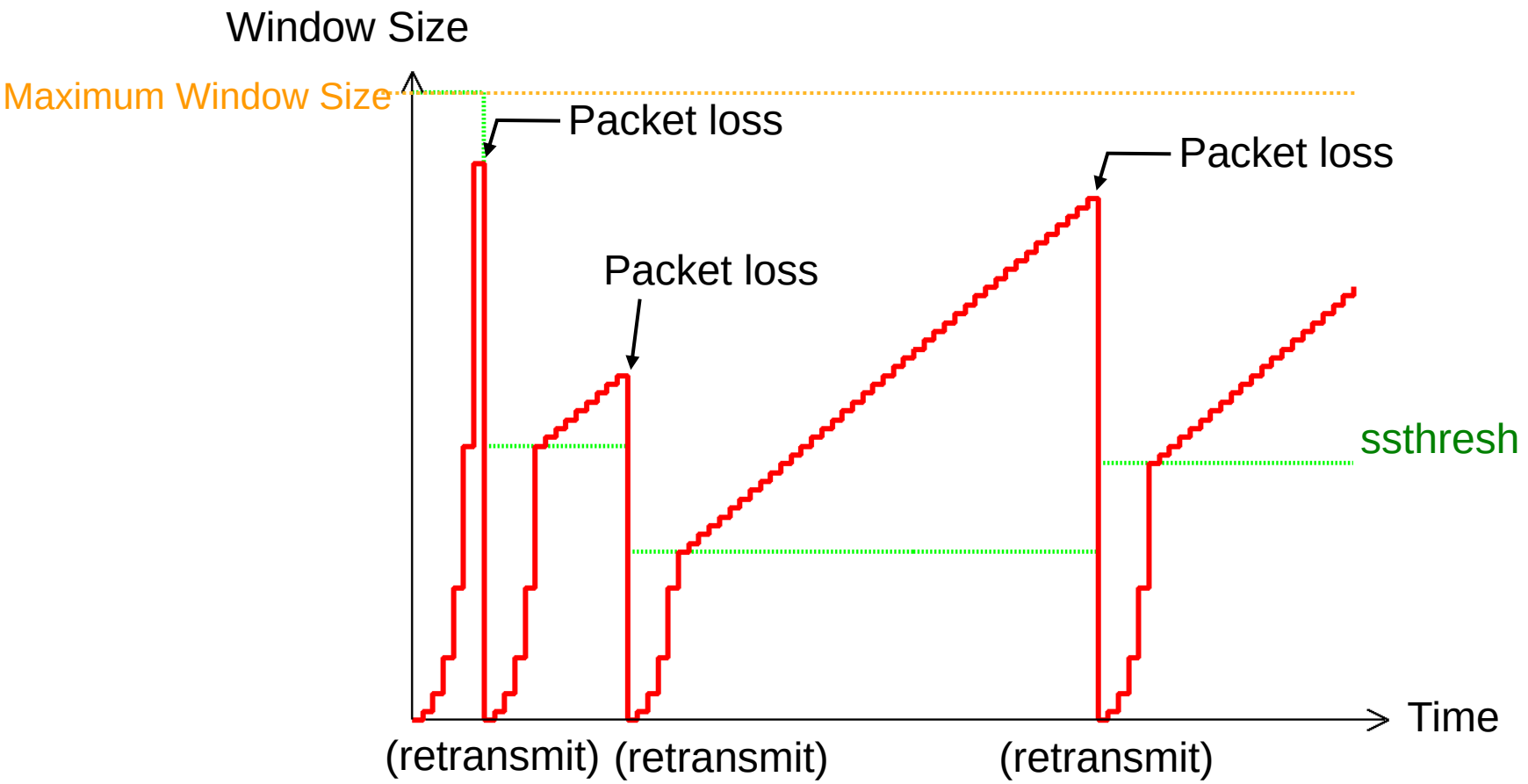
Congestion Window Size is decrease to 1→Slow Start Phase

Ssthresh is changed to a half of transmit Window





Summarize of TCP Window Control (Tahoe)



Experiment 2-1