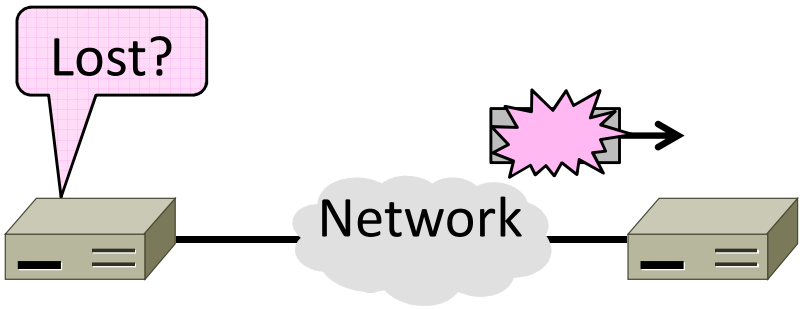
Introduction to Computer Networks

Retransmission Timeouts (§6.5.9)

David Wetherall (djw@uw.edu)
Professor of Computer Science & Engineering
UNIVERSITY of WASHINGTON

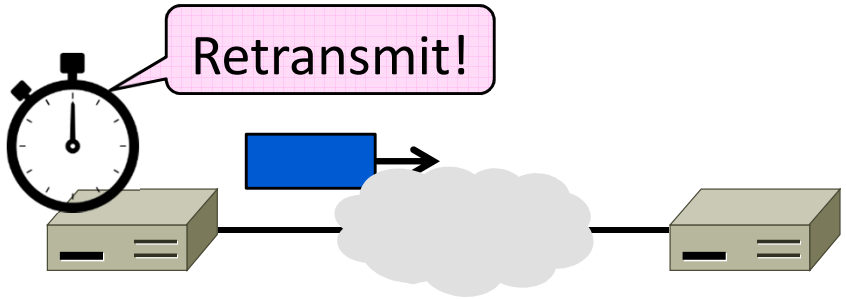
Topic

- How to set the timeout for sending a retransmission
  - Adapting to the network path



Retransmissions

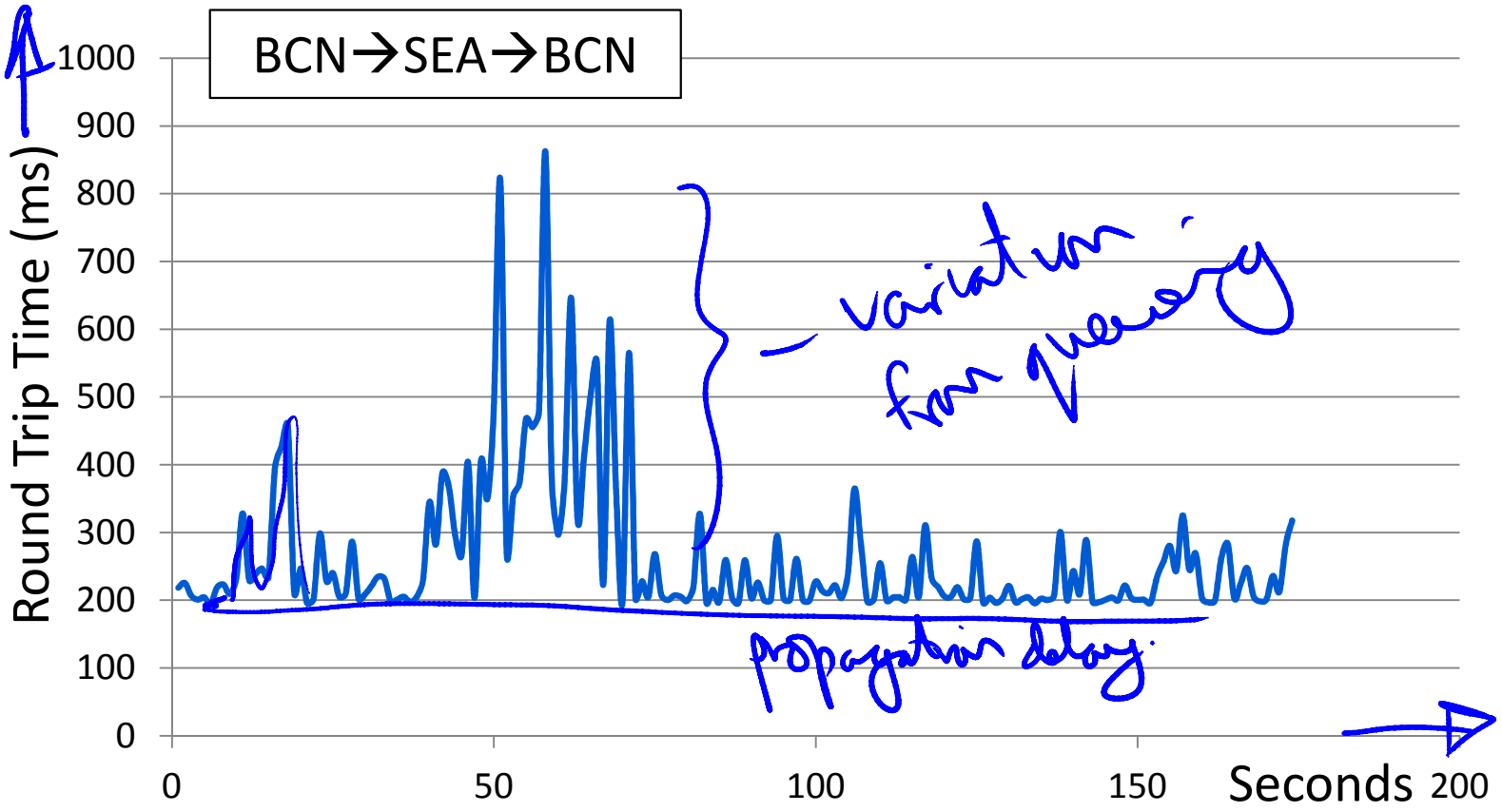
- With sliding window, the strategy for detecting loss is the timeout
  - Set timer when a segment is sent
  - Cancel timer when ack is received
  - If timer fires, retransmit data as lost



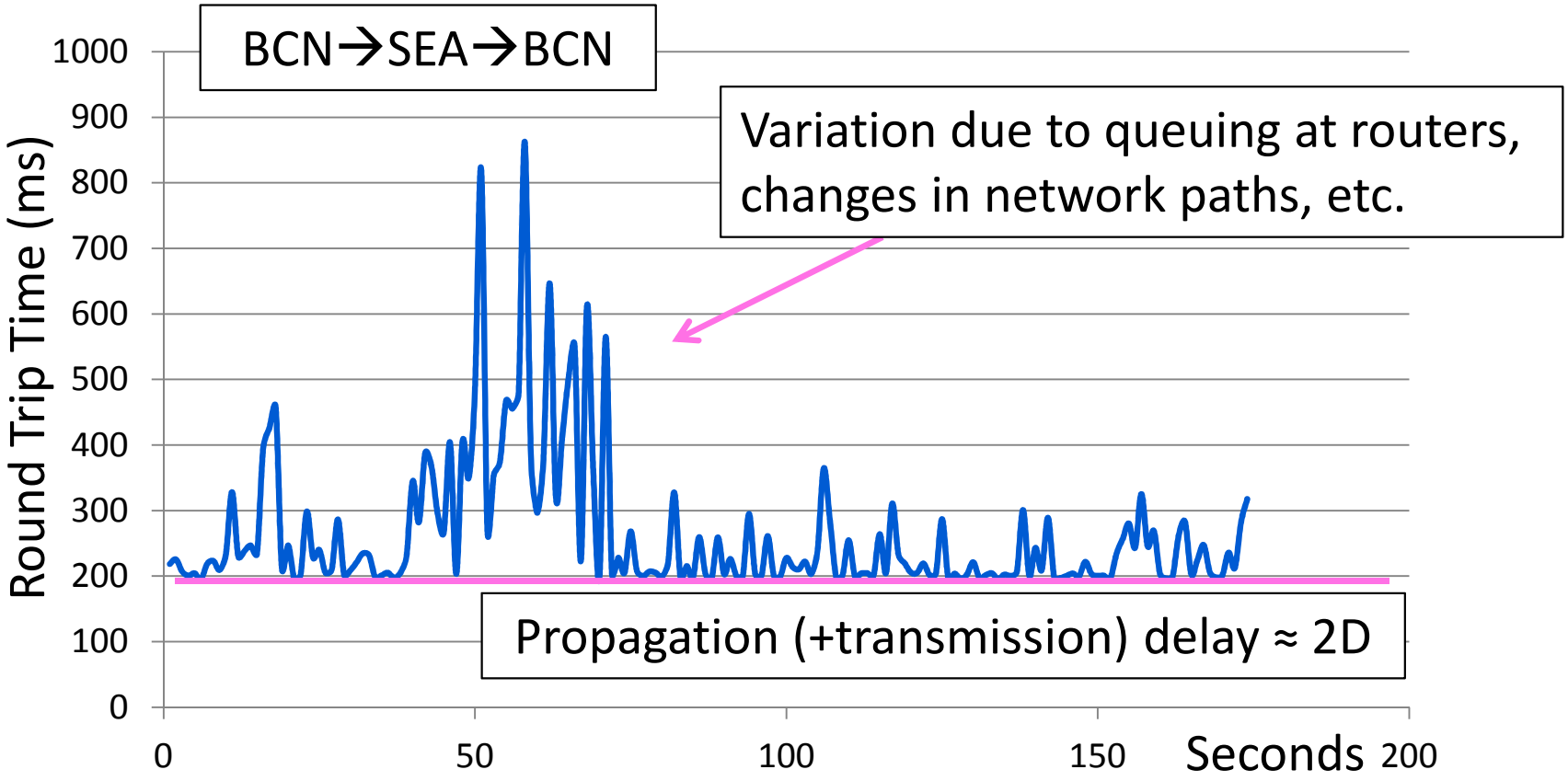
Timeout Problem

- Timeout should be "just right"
  - Too long wastes network capacity
  - Too short leads to spurious resends
  - But what is "just right"?
- Easy to set on a LAN (Link)
  - Short, fixed, predictable RTT
- Hard on the Internet (Transport)
  - Wide range, variable RTT

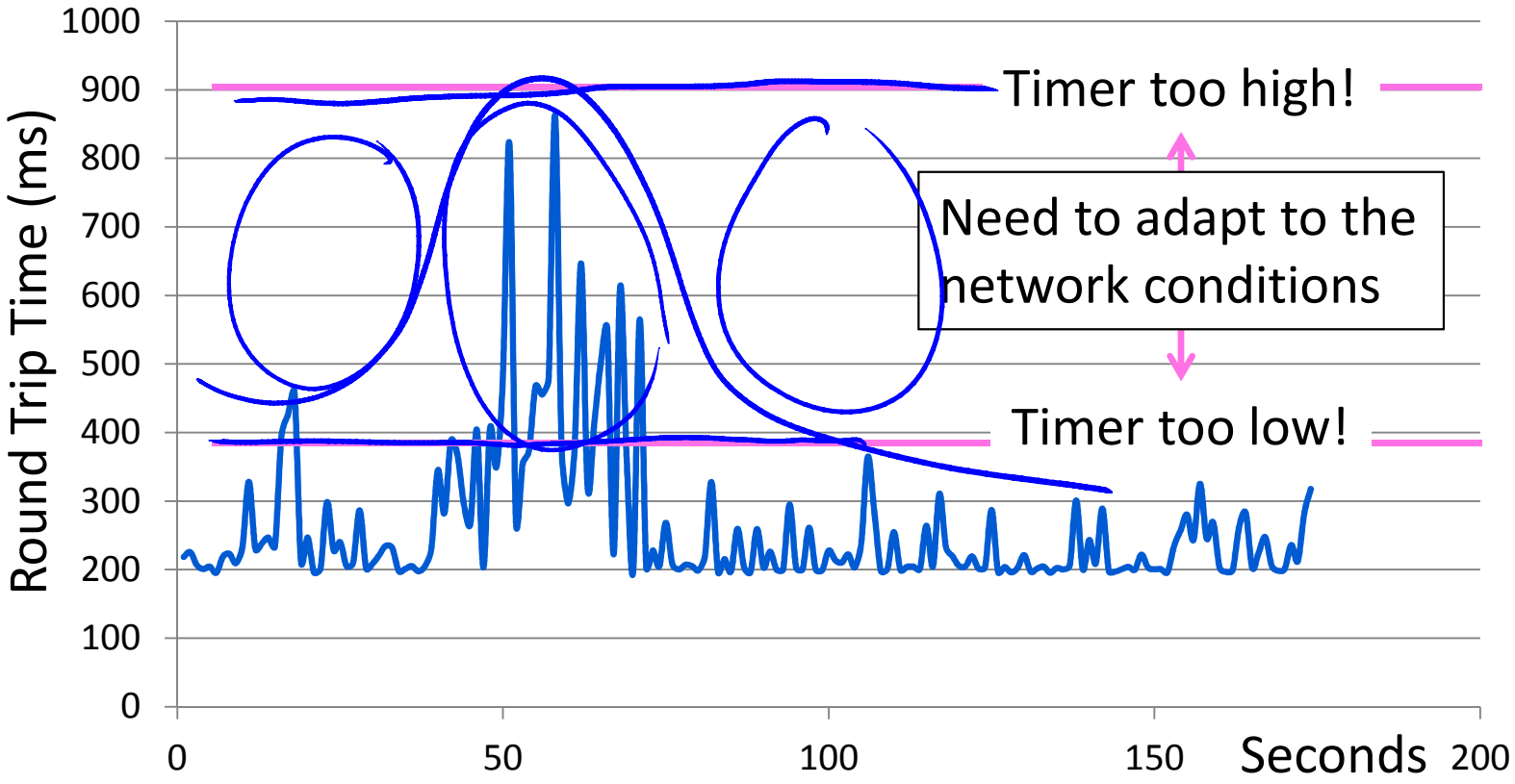
Example of RTTs



Example of RTTs (2)



Example of RTTs (3)



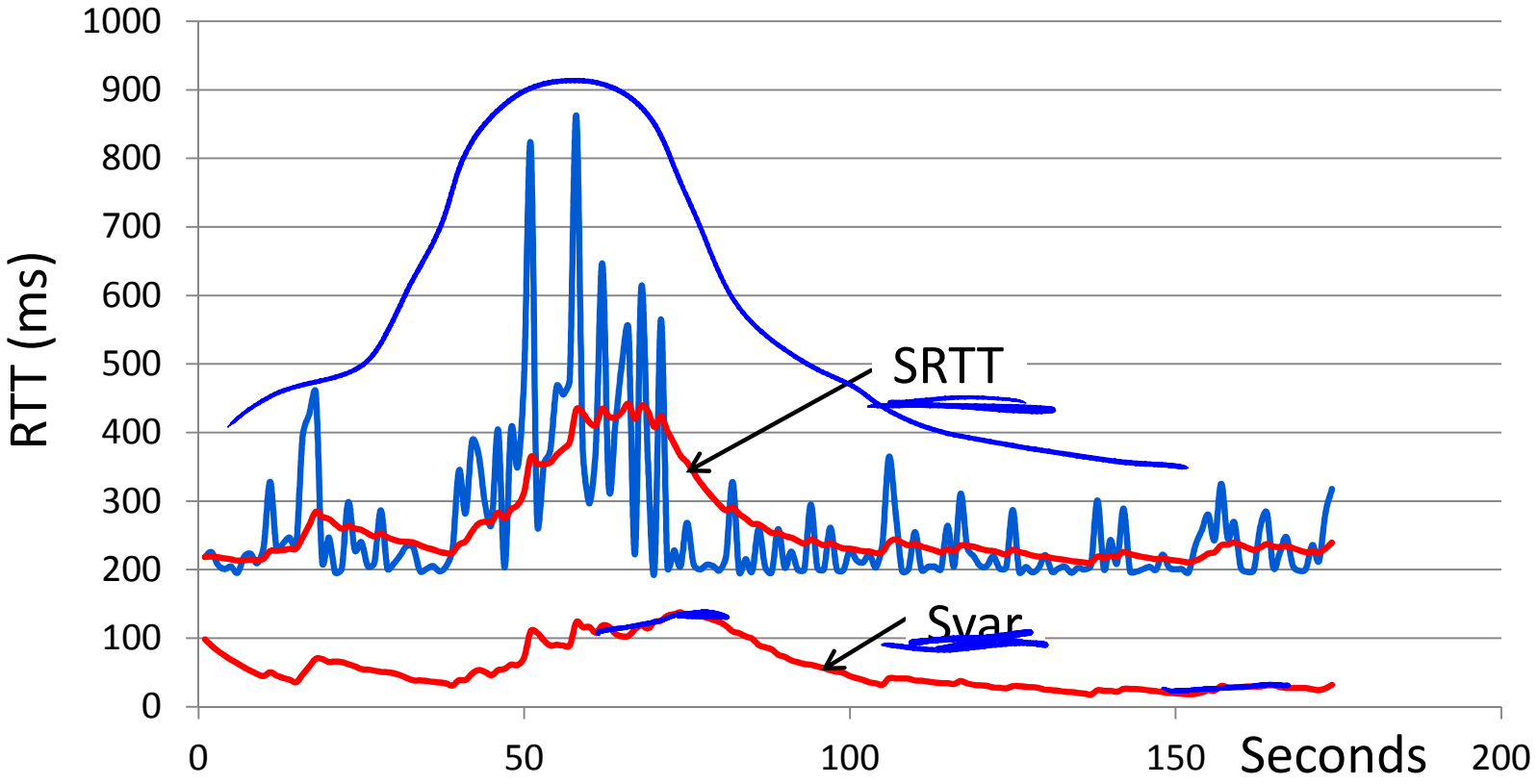
Adaptive Timeout

- Keep smoothed estimates of the RTT (1) and variance in RTT (2)
  - Update estimates with a moving average

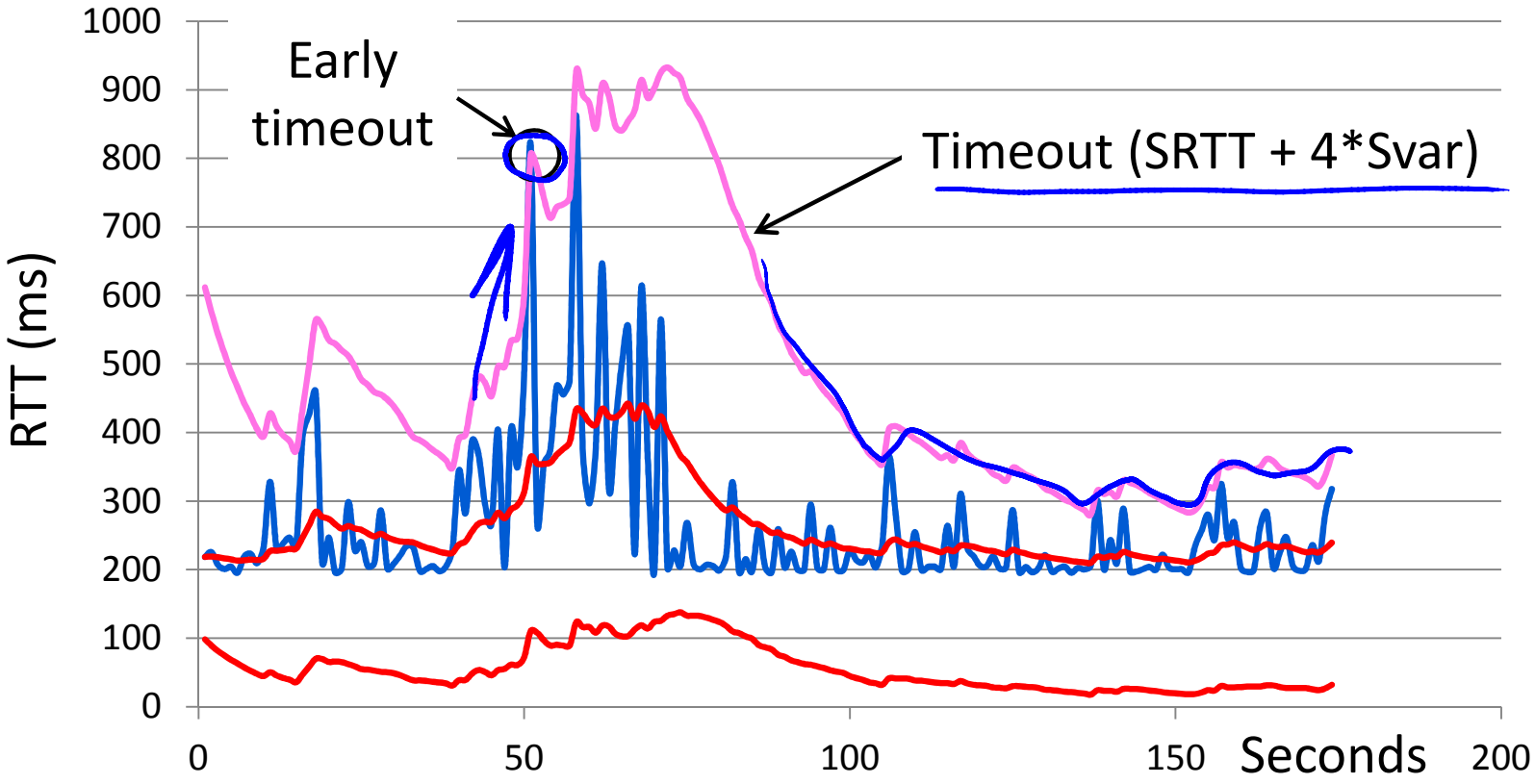
1. $SRTT_{N+1} = 0.9*SRTT_N + 0.1*RTT_{N+1}$
2. $Svar_{N+1} = 0.9*Svar_N + 0.1*|RTT_{N+1} - SRTT_{N+1}|$

- Set timeout to a multiple of estimates
  - To estimate the upper RTT in practice
  - TCP $Timeout_N = SRTT_N + 4*Svar_N$

Example of Adaptive Timeout



Example of Adaptive Timeout (2)



Adaptive Timeout (2)

- Simple to compute, does a good job of tracking actual RTT
  - Little “headroom” to lower
  - Yet very few early timeouts
- Turns out to be important for good performance and robustness

END