

Computer Networks

History of TCP Congestion Control (§6.5.10)



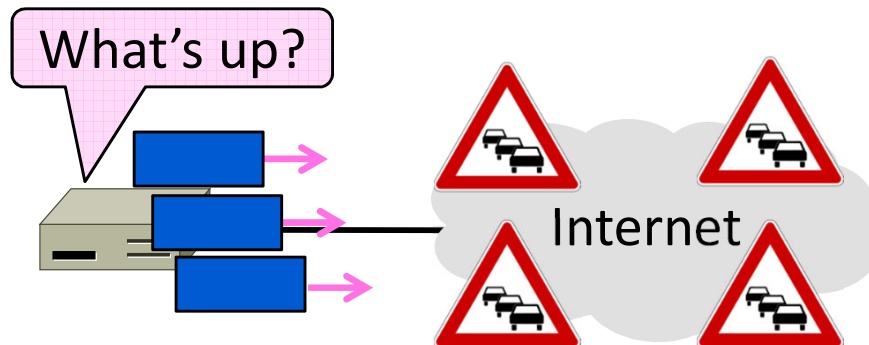
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Topic

- The story of TCP congestion control
 - Collapse, control, and diversification

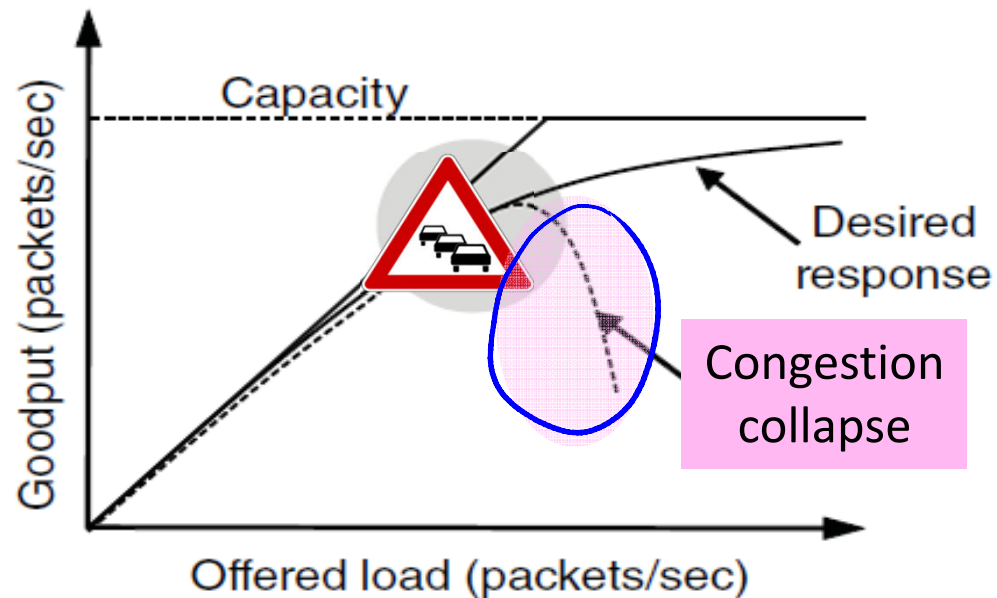


Congestion Collapse in the 1980s

- Early TCP used a fixed size sliding window (e.g., 8 packets)
 - Initially fine for reliability
- But something strange happened as the ARPANET grew
 - Links stayed busy but transfer rates fell by orders of magnitude!

Congestion Collapse (2)

- Queues became full, retransmissions clogged the network, and goodput fell





Van Jacobson (1950—)

- Widely credited with saving the Internet from congestion collapse in the late 80s
 - Introduced congestion control principles
 - Practical solutions (TCP Tahoe/Reno)
- Much other pioneering work:
 - Tools like traceroute, tcpdump, pathchar
 - IP header compression, multicast tools



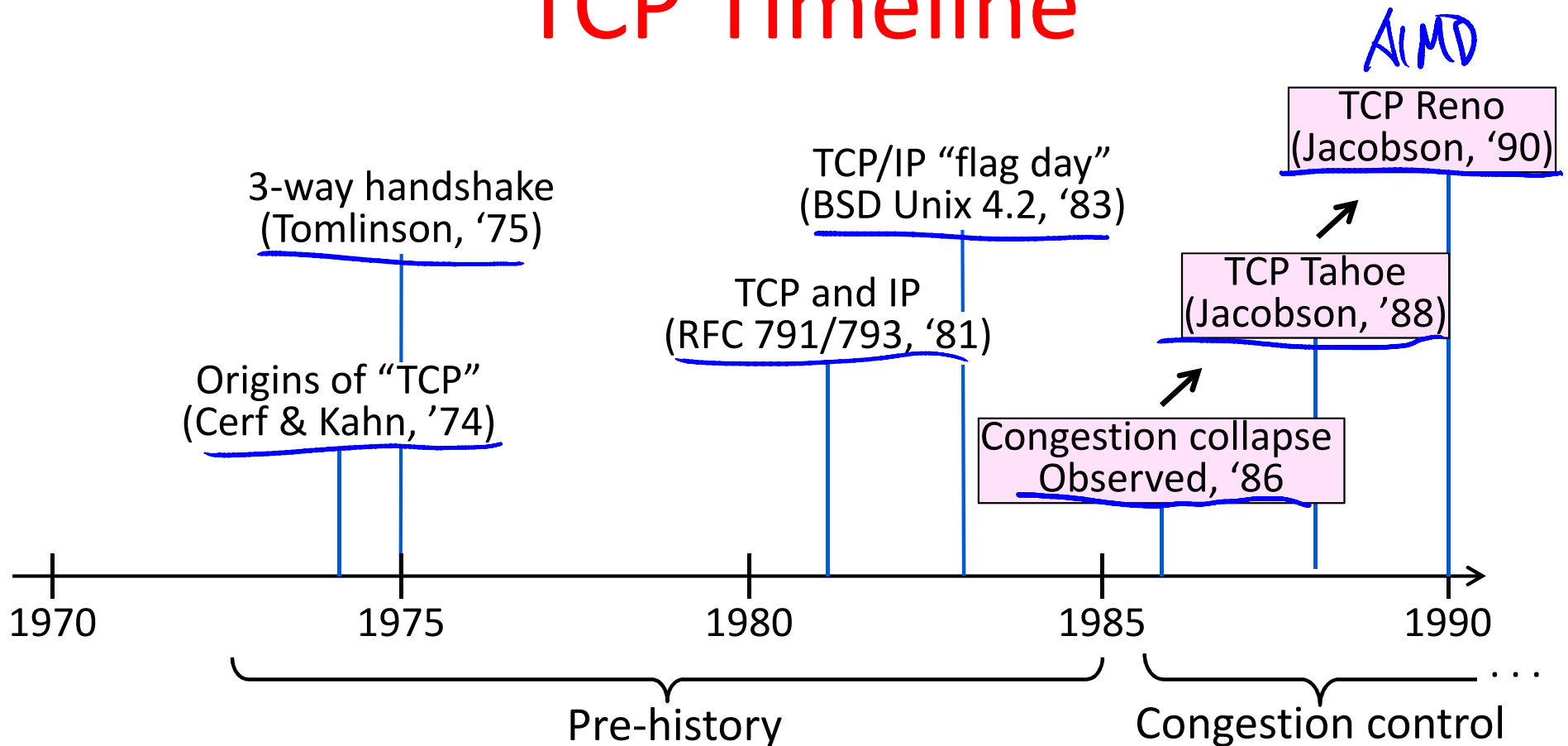
TCP Tahoe/Reno

- Avoid congestion collapse without changing routers (or even receivers)
-  Idea is to fix timeouts and introduce a congestion window (cwnd) over the sliding window to limit queues/loss
-  TCP Tahoe/Reno implements AIMD by adapting cwnd using packet loss as the network feedback signal

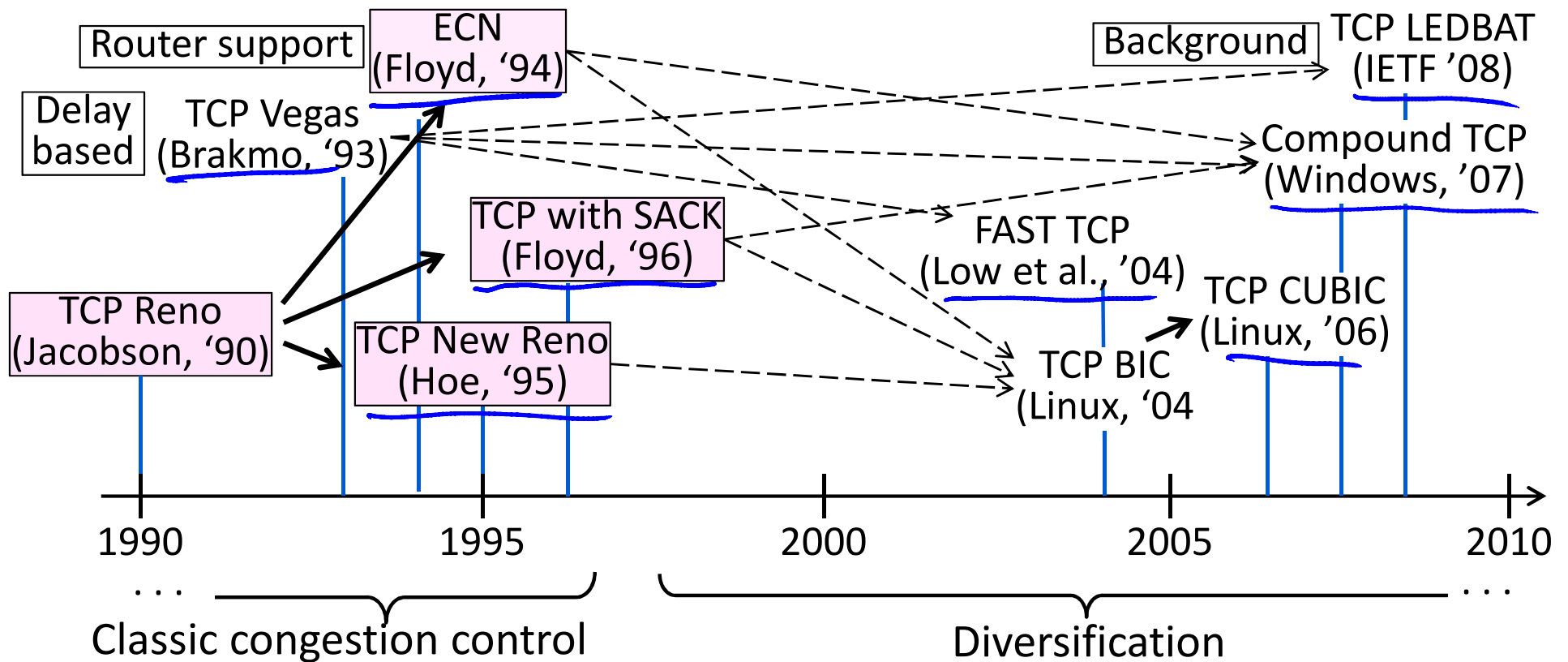
TCP Tahoe/Reno (2)

- TCP behaviors we will study:
 - ➔ ACK clocking
 - ✓ Adaptive timeout (mean and variance)
 - ➔ Slow-start
 - ➔ Fast Retransmission
 - ➔ Fast Recovery
- Together, they implement AIMD

TCP Timeline



TCP Timeline (2)



END

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