6.033 Computer System Engineering

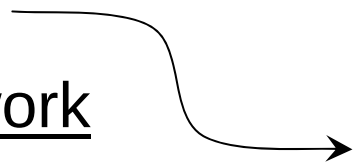
Spring 2009

Congestion Control

E2E

Network

Link



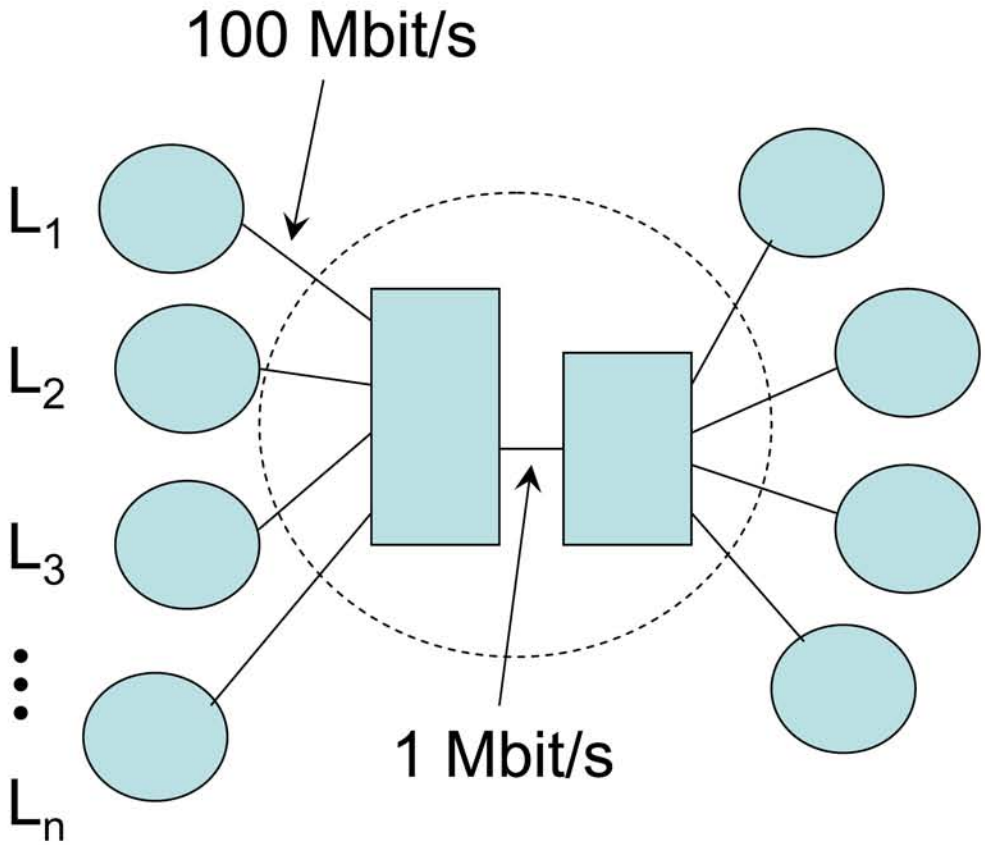
Reliability

Timers

Sliding window

Flow control

Sharing



Problem

$$\sum_{i=1}^{N} L_i \leq C$$

→ Scalable — large nets, large N

→ N varies

L_i ”

→ Resource far from ctrl.

Cross-layer

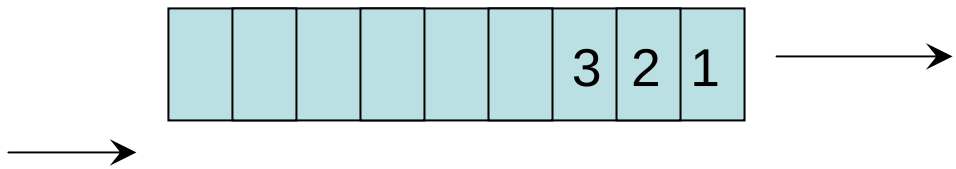
Plan: Sender i sends @ rate r_i.

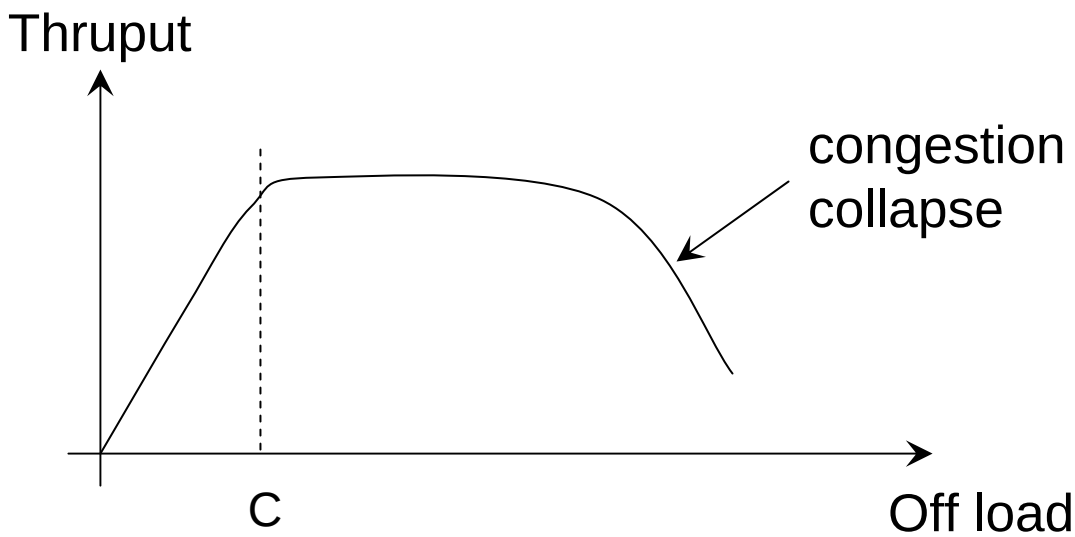
Too fast ➔ slow down

Too slow ➔ speed up

Buffering

- How much?
  - Too little? → DROP
  - Too much? → Potential for congestion collapse


3
2
1
rxmit 1


Thruput
congestion
collapse
C
Off load

Want: $\sum_{i=1}^{N} L_i \leq C$

→ No congestion collapse

→ Reasonable utiliz'n

→ Equitable allocation

$\sum L_i \leq C$:

< 1 RTTs → Buffering

1-100 RTTs →

> 100 RTTs

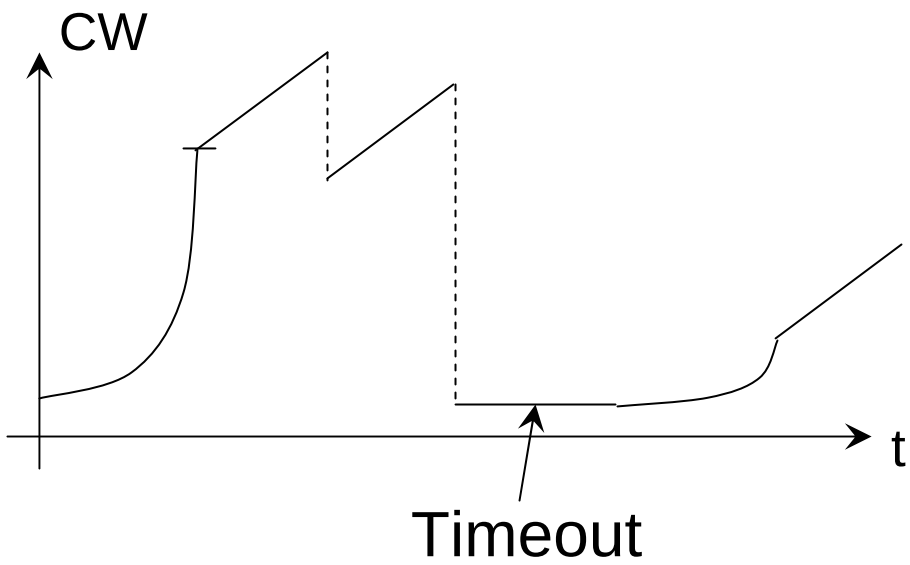
Solutions

- Some buffering → < 1 RTT
- Congestion ➔ feedback → DROP
- Get feedback ➔ adapt → change speed

Congestion Control

Self-pacing

- ACKs strobe data
- Packet drop $\longrightarrow$ cong. Window $\leftarrow \frac{\text{cong. Window}}{2}$


CW
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Timeout