CSE 434 - 3/21/06

1st day (class) after Spring Break.

TCP - overview & congestion control.
- End-to-End Protocol
- Windowing?
- Issues
- pipelining

IP

Finite capacity buffers can get full quickly.
Routers queues can get filled up.

Will cause more congestion in the network.
Rush hours
6-9 am
3-7 pm

Characteristic traffic
- bursty

Consequence
- delay (commute time)

Finite capacity (bandwidth)
Road

Solution
Long term: build bigger highway (with e.g.)
Short term:
- stagger the time at which people get off work
- car pooling (reduce volume of traffic)
- rate control at entrance (on-ramp)

\[ \text{average commute time decreases} \]
- control yourself when you get onto highways
- delay at on-ramp self-regulation.
highway - shared resource
so is Internet.

How to make resource allocation
"fair"?

Remember in Internet
no centralized controller
every sender working independently
What kind of "fairness" Internet provides?

How can it be achieved?

Fairness — "if there is B bandwidth available and there are n flows then each should get B/n bandwidth.

"TCP was not designed for companies to make money."

Since one the Internet philosophy is to keep "core" simple — the core does not provide any feedback to end system.
So the end-systems have to guess how much b/w is available. If bottleneck b/w

bad

if something bad happens reduce window size

increase in RTT

loss of pks.

if something good happens increase the window size

decrease in RTT

no losses.

Issue: how much to increase? How much to decrease?

- where to start?
Start "Slow" - small window size

How to quickly ramp up the search rate + available b/ps?

Exponential increase in window size.

"Slow" start.

Linear increase

Threshold (estimate of available bottleneck s/ps)
"bad" events: timeout = more seriously
"negative ack" duplicate ack
triplicate

Read sec. 3.5, 3.6, 6.3.7