DECBit: Ramakrishnan & Jain [Ramakrishnan90a]

CSci551: Computer Networks
SP2006 Thursday Section
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Key ideas

- binary feedback… looking at congestion feedback from the network
  - vs. TCP that just uses loss as a signal of congestion
- terms
  - power and efficience
  - Explicit Congestion Notification
  - throughput vs. load with knee in curve
- academic treatment of subject
  - carefully breaks down problem into

Components of a Congestion Control System

- router:
  - detection mechanism
  - feedback sending mechanism
- user
  - feedback receiving mechanism
  - decision policy
    - decision frequency?
    - filtering?
  - response

Options

- Congestion avoidance vs. congestion control
  - which is TCP? DecBit?
- Feedback mechanisms:
  - packet loss
  - source quench packet
  - CI-bit (or DECBit): congestion indication

Metrics

- Fairness
- Power
- Efficiency

Fairness (partly covered in TCP overview)

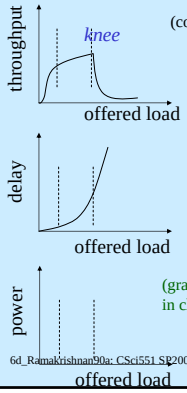
- tries to evenly split bandwidth between all flows
  - $f := (\Sigma x_i)^2 / (n \Sigma x_i^2)$ where $x_i := A_i / D$
  - A := allocation, D := demand
- good? bad? why hard?
  - (will talk about with the Demers paper)

Power and Efficiency

(partly covered in TCP overview)

- power = throughput$^{\alpha}$ / response time
  - why?
  - good throughput => bad response time (and vice versa); need to optimize for both
- shows trade-off beween throughput and response time
- efficiency?
  - defined as power / power-at-knee

Power and Load



(covered in TCP overview)

(graphed in class)

- throughput and delay change due to load
  - want to optimize *power*

$$power := \frac{(throughput)^{\alpha}}{delay}$$

(From [Ramakrishnan90a])

Measuring Congestion

- Measuring congestion
  - either *utilization* > T_u or *queue len* > T_l
    - use queue length, averaged over *regeneration period*
  - should use T_{low} and T_{high} (high and low watermarks) to provide hysteresis
  - why?
    - want to reduce oscillation

Measuring Queue Size

- Measuring queue size
  - need to consider *average*, not *instantaneous.* why?
    - xxx
  - option: exponential weighted moving average of queue size: (used by RED, not R&J)
    - $q_{avg}' := \alpha\ q_{avg} + (1\text{-}\alpha)\ q_{inst}$
  - choice: average over *regeneration cycles*
    - why? xxx

Policies

- decision frequency
  - adjust once per window (wait one RTT after adjustment for next adjustment)
- Use of info
  - keep history or not? no
- "signal filtering"
  - how many congestion bits => congestion? 50%
- increase/decrease algs
  - => AIMD: Additive Increase/Multiplicative Decrease

Other questions/observations?

- relationship between this and Internet protocols?
  - IETF did put ECN in the Internet
  - concepts come up may times (power, faireness, etc.)
- AIMD: both in Ramakrisnan and Jacobson's work
- slow start: first in [Jacboson88a]
- congestion:
  - loss indicate busy link… how does this work if we change paths for each packet
    - the network works hard to keep all pkts for a single flow on the same path