Design Issues for the Future Internet: [Shenker95a]

CSci551: Computer Networks
SP2006 Thursday Section
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Key ideas

- should the Internet have best-effort only or something more (like intserve)
- looks at application requirements
- uses utility
  - idea: what benefit does some QoS provide
  - both per application and for the net as a whole

What's the Real Goal of the Network?

- Do we really need Integrated Services?
- Is best effort OK?
- Do we need something in-between?
- How do we even study this question?

Utility and Efficacy

- Does the network make users *happy*?
- Define *U(j)* be the utility delivered to the *j*th user
  - map network performance to user happiness
  - ex: higher bandwidth or lowered delay is better, up to a point where you don't care
- Goal of network is to maximize *V*

$$V = \sum_{\forall j} U(j)$$

Overprovisioning vs. Int-Serve

- what: network does best-effort, but with lots of headroom
- network cost:
  - bandwidth: more
  - others: no per-flow costs
  - existing routers
- application cost:
  - application just tries, but needs to be prepared to figure out what does and doesn't work
  - net: send pkts
  - edges: much more
  - easy for net to add new services (but apps are hard)

- what: network provide guarantees
- network cost:
  - bandwidth: maybe 100% utilization
  - others: must monitor flows, more complicateed routers
  - must change all routers
- application costs
  - app needs to explicitly requests
  - net: need specification of jitter/bandwidth/loss
  - edges: not much
  - maybe harder to add new apps in net (but apps are easier?)

Overprovisioning vs. Int-serve

- alternatives?
  - XXX
- market?
  - XXX

Other Considerations

- Will two networks (one best-effort, one guaranteed) win?
  - no—better to share bandwidth
  - (this is a basic result from queueing theory)
- Service models must meet application requirements
  - Otherwise, none of these arguments holds
  - need a generic way for apps to say what they want

Admission control

- idea: only let people in if you can handle it
  - at connect setup, make decision
- Admission control: allow a new connection?
  - users must know what they want (ahead of time!)
  - routers must get that information
    - requires *signaling:* call setup and tear-down messages
  - Internet standard: RSVP
- is it a good idea? not in best effort net, assume that the ends will cope with whatever they get; but in intserve want to be able to insure guarantees

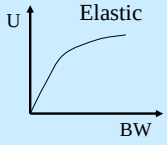
Defining Overload

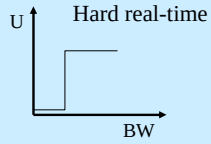
- Shenker: overload is if removing a flow increases V
- depends on shape of U(*j*)

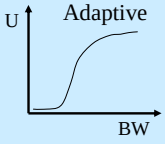
⇒ by this definition, best effort *cannot* be overloaded since more users just split bandwidth

- (but most users probably wouldn't agree :-)

Utility curve shapes







If convex near origin, then need admission control

Other questions/observations?

- about utility functions:
  - how to standardize across apps
- lots of apps today have users pick different bitrates: sort of an aggregate utility function with multiple bumps