Current Research Topics

-Sigcomm Sessions
  -QoS
  -Network analysis & security
  -Multicast
  -giga/tera bit routers /fast classification
  -web performance
  -TCP
  -Diff Serv.
  -Routing
  -Network Topology

BEST-EFFORT VERSUS RESERVATIONS

A simple comparative Analysis

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PROCEEDINGS OF ACM SIGCOMM’ 98
MOTIVATION
- Current Internet
  - single class of best-effort service
  - no guarantees about if/when packets are delivered
- Best-effort service not suitable for real-time applications
  - audio, video, soft real-time …
-Solution: Integrated Services
  - Applications reserve bandwidth
  - Network admits flows, enforces reservations...

KEY QUESTIONS
- Are reservations really necessary?
- Are we better off with an over-provisioned BE network?
* Arguments for reservations
  - Applications needing higher quality benefit
* Arguments against reservations
  - Network must operate at low utilization levels for low blocking probability
  - Low util => over-provisioned BE network is ok
  - Soft real-time applications are adaptive
GOAL OF NETWORK DESIGN

- A network should be designed to meet user needs
- Each user gets a utility $u$ based on network bandwidth, delay, jitter
- Design the network to maximize total utility ($\Sigma ui$) => provide maximum satisfaction to users

\[ \sum_{i} u_{i} \]

\[ \Rightarrow \text{provide maximum satisfaction to users} \]

**FIXED LOAD MODEL**

Assume

- Single link of capacity $C$
- $K$ identical flows, $b/w b = C/k$
- Utility fn $\pi(0)=0, \pi(\infty)=1$
- Maximize $v(k)=$

- Elastic applications $\sum_{i} \pi_{i} = k \cdot \pi(C/k)$
  - $v(k)$ increases as $k \rightarrow \infty$
  - $\Rightarrow$ admit $\infty$ flows to maximize $v$
  - $\Rightarrow$ use B/E network

- Rigid applications
  - $v(k)$ drops to 0 beyond a certain $k$
  - admit no more than $k_{\text{max}}$ flows
  - $\Rightarrow$ use reservation
VARIABLE LOAD MODEL
- Number of flows is taken from a probability distribution
  \[ V = \sum_{k=1}^{\infty} P(k) \cdot k \cdot \pi(C/k) \]
- Reservations =>
  \[ v = \sum_{k=1}^{\infty} P(k) \cdot k \cdot \pi(C/k) + \sum_{k=\text{max}+1}^{\infty} P(k) \cdot \text{max} \pi(C/\text{max}) \]
- Question: How much extra b/w do you need for BE network to match the performance of resv?
  - trade b/w for complexity
- P(k): - exponential
  - Poisson
  - Algebraic (heavy tailed)

Results
- BE v/s rigid v/s adaptive application
- Fixed model: substantial difference between BE & resv-capable network
  - adaptive applications change the picture
    - less compelling case for reservations
- Poisson: equal costs except at highest prices
- Exponential: small difference
- Algebraic: Resv is better IF complexity is small
  - B/W is expensive -?
  - B/W is cheap -?