Networks Research Lab (NetRL)

http://www.NetRL.cs.ucy.ac.cy
Estimating effective number of users at a bottlenecked link

- Many CC protocols recently proposed for high speed networks
  - require estimates of number of users utilizing each link in network to maintain stability in presence of delays

- propose novel estimation algorithm based on online parameter identification techniques
  - shown through analysis and simulations to converge to effective number of users utilizing each link
  - does not require maintenance of per flow states within network or per packet processing
  - outperforms previous proposals based on point wise division in time
  - estimation scheme designed independently from control functions of protocols and is thus universal in sense that it operates effectively in a number of CC protocols

- proposed estimation scheme used to design 3 representative Internet CC protocols: ACP, DMM and QLB
  - demonstrate using simulations satisfy key design requirements.
    - stable equilibrium characterized by high network utilization, small queue sizes and max-min fairness
    - scalable with respect to changing bandwidths, delays and number of users
    - generate smooth responses which converge fast to the desired equilibrium

M. Lestas, A. Pitsillides, P. Ioannou, G. Hadjipollas A universal estimator for Internet Congestion Control, accepted subject to a revision, IEEE/ACM Transactions on Networking
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Theorem 1: At each link $j = \{1, 2, \ldots, m\}$, if $N_j^*(k) = N_j^*$, $\forall k$, then $\lim_{k \to \infty} \hat{N}_j(k) = N_j^*$ and $N_j^* \in D_j$, where:

$$D_j = \{ \hat{N}_j \in R \mid N_j \leq \hat{N}_j \leq n_j \}$$

number of users changes from 30 to 10, at 30 seconds and from 10 to 50 at 45 seconds.

Fig. 4. Parking lot topology used to investigate the ability of the estimation algorithm to calculate the effective number of users utilizing each link in the network.

Link 4 is the bottleneck link, where 40 users share it. In all other links the effective number of users is equal to 27.