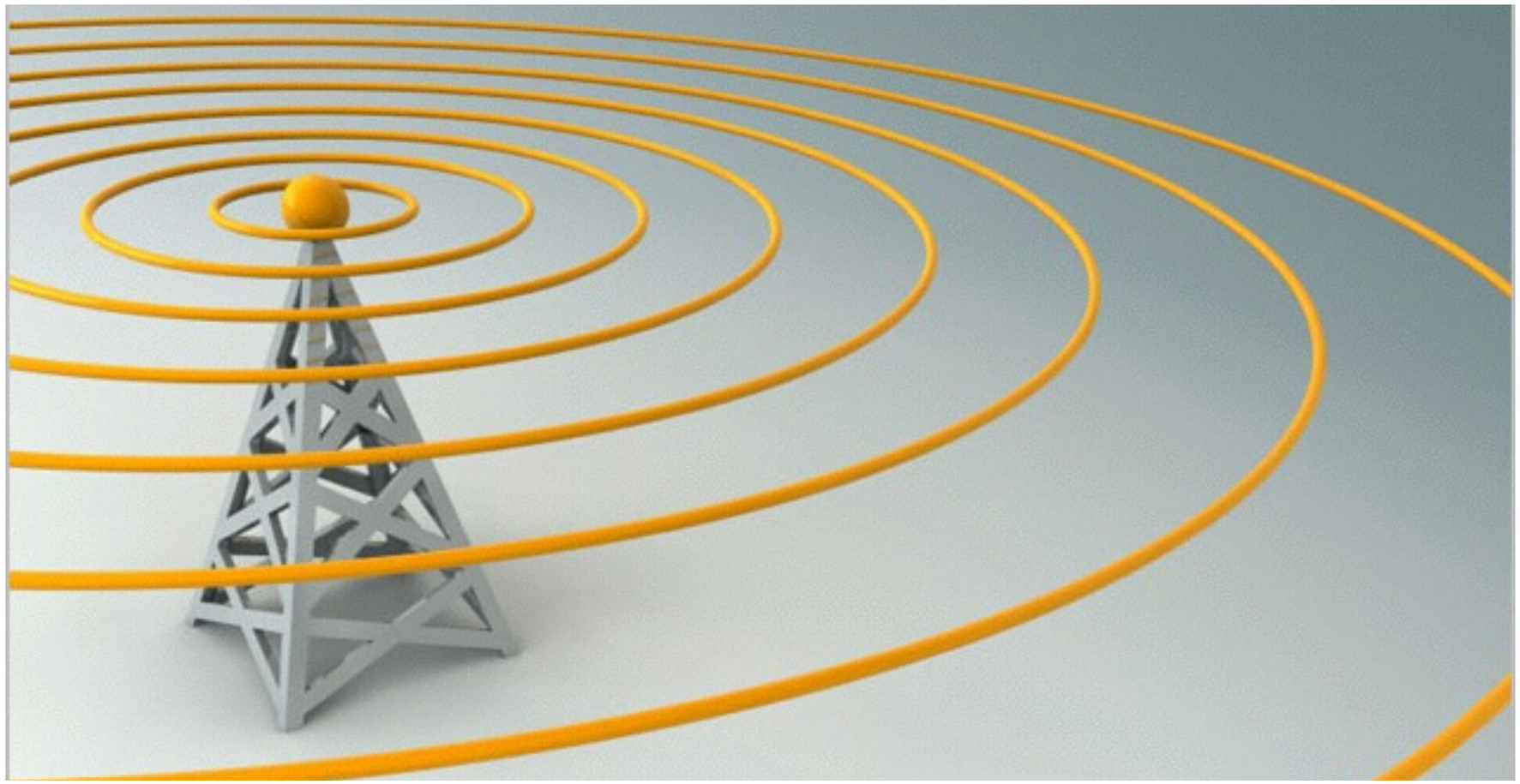


LEDBAT Performance in Sub-packet Regimes

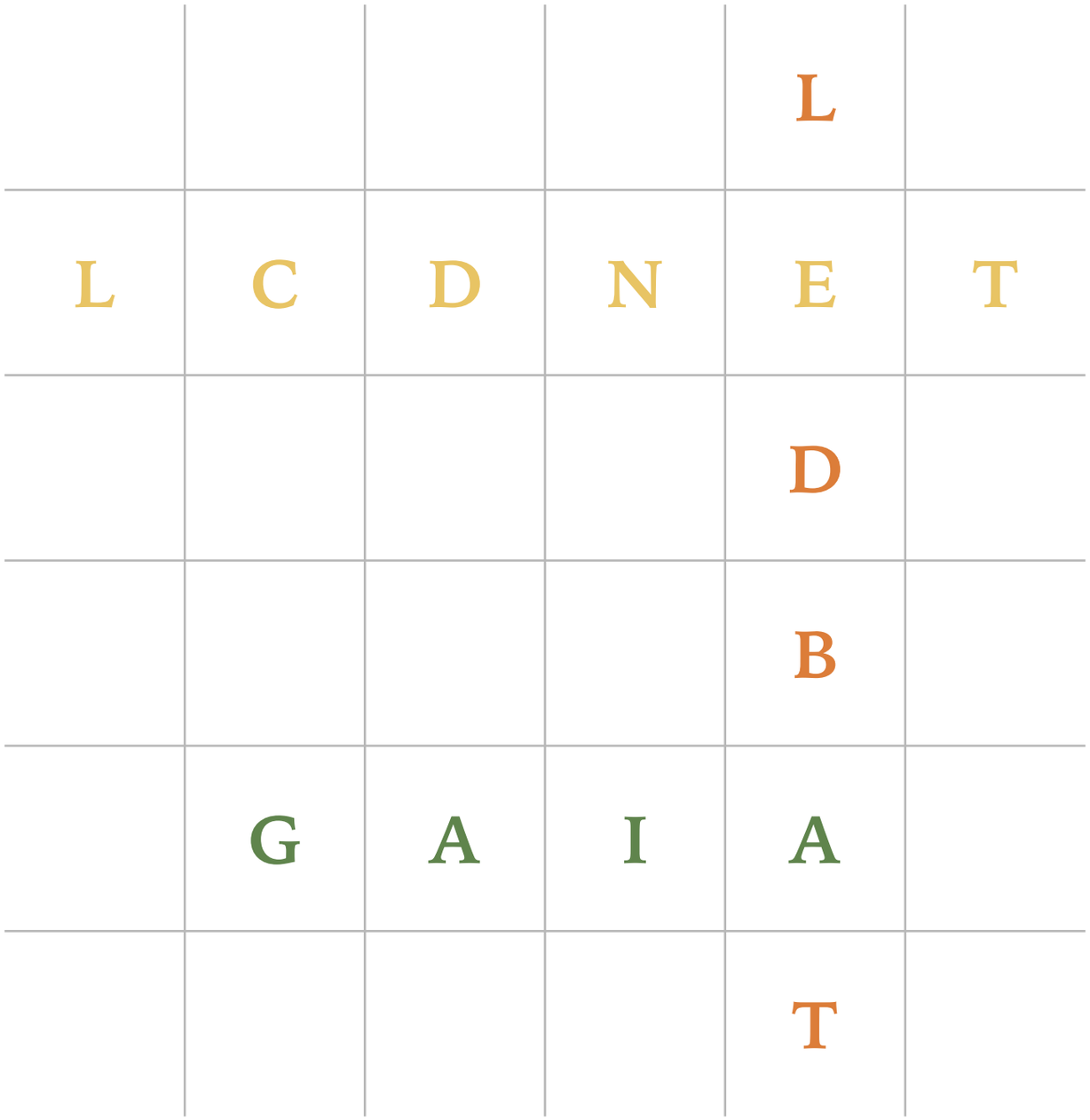
Ioannis Komnios, Arjuna Sathiaseelan and Jon Crowcroft

Obergurgl, 04 April 2014

SPICE
SPACE INTERNETWORKING CENTER

UNIVERSITY OF CAMBRIDGE

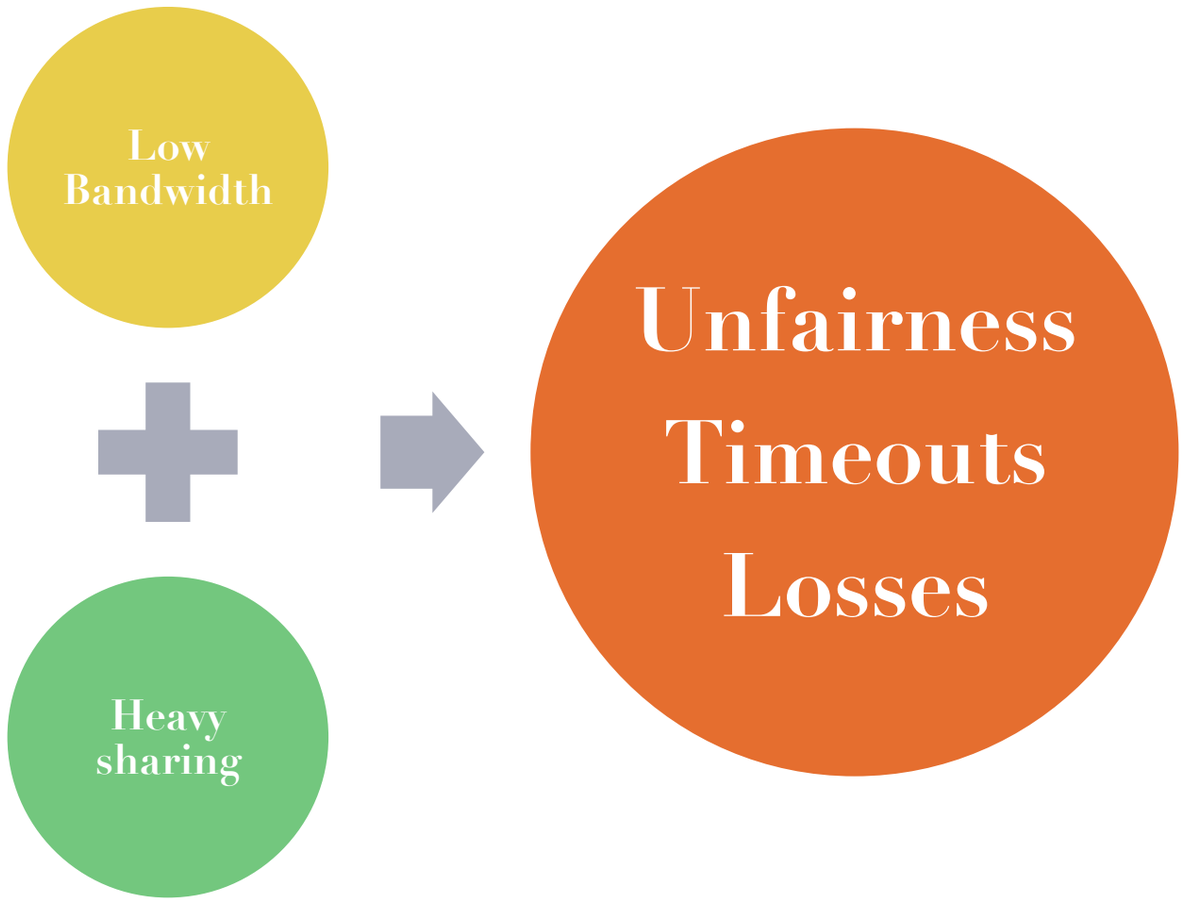
Global Access to the Internet for All



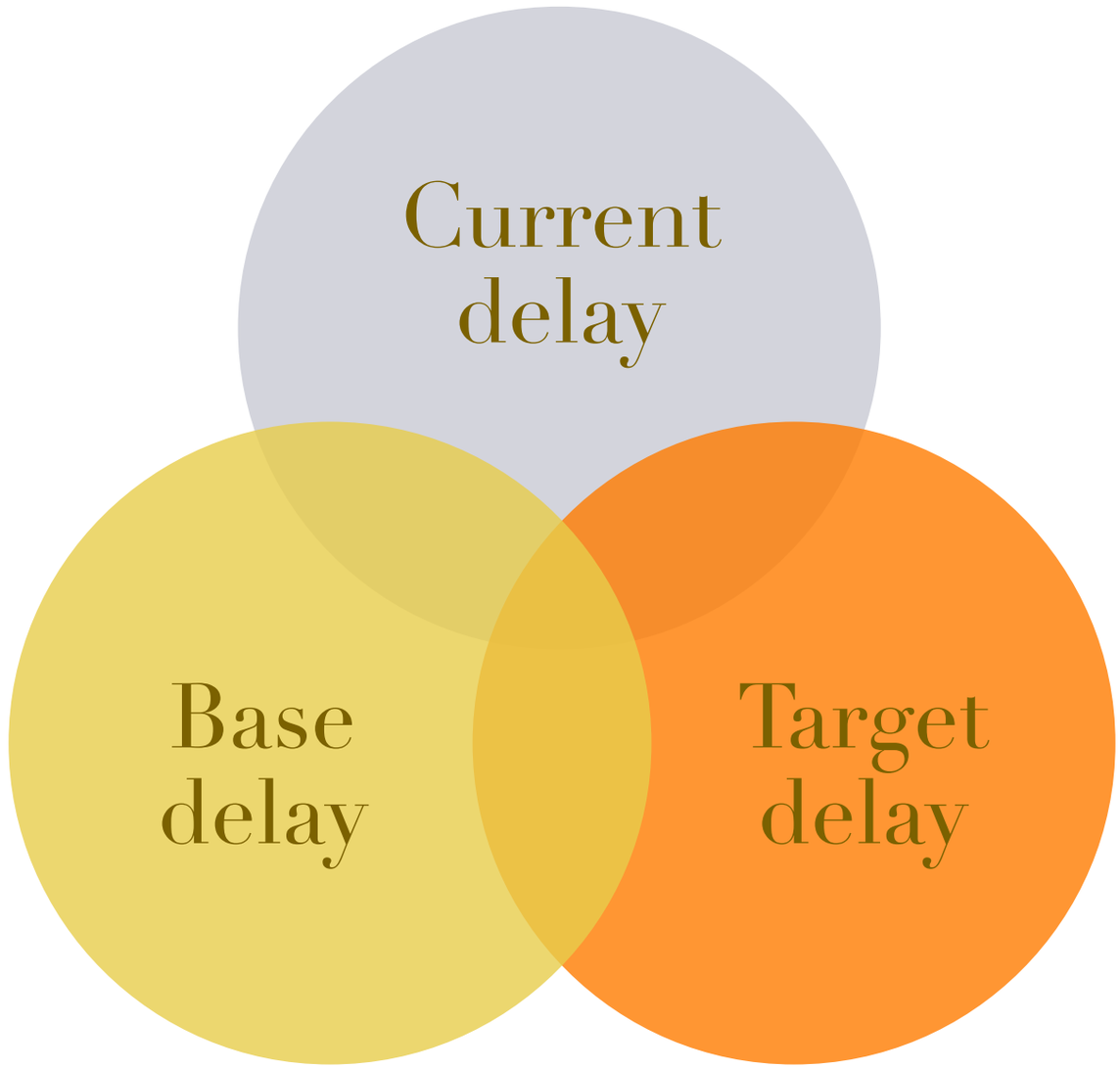
Wireless Community Networks

Sub-packet Regime

- BW fair-share per flow < 1 packet per RTT



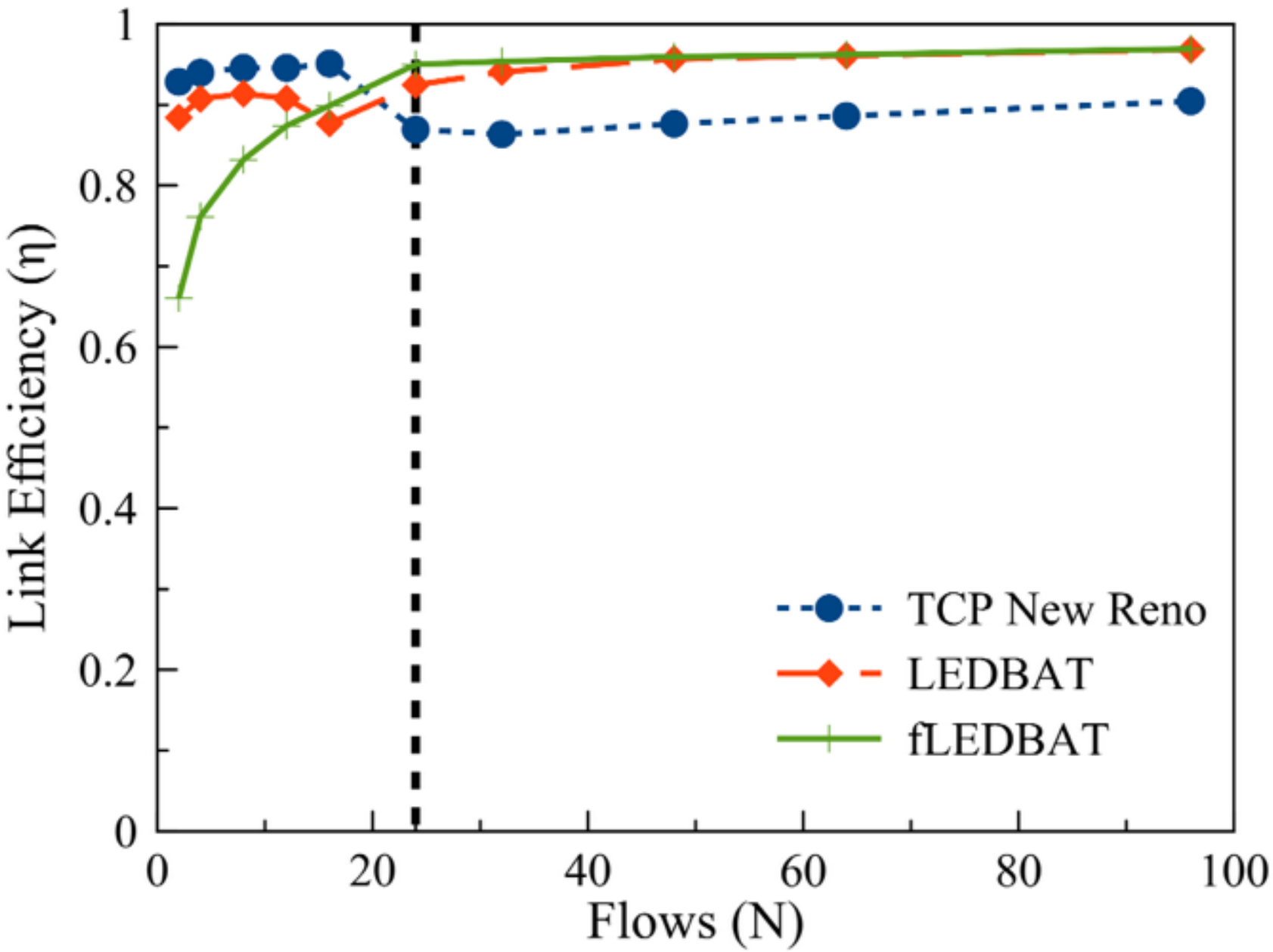
Low Extra Delay Background Transport



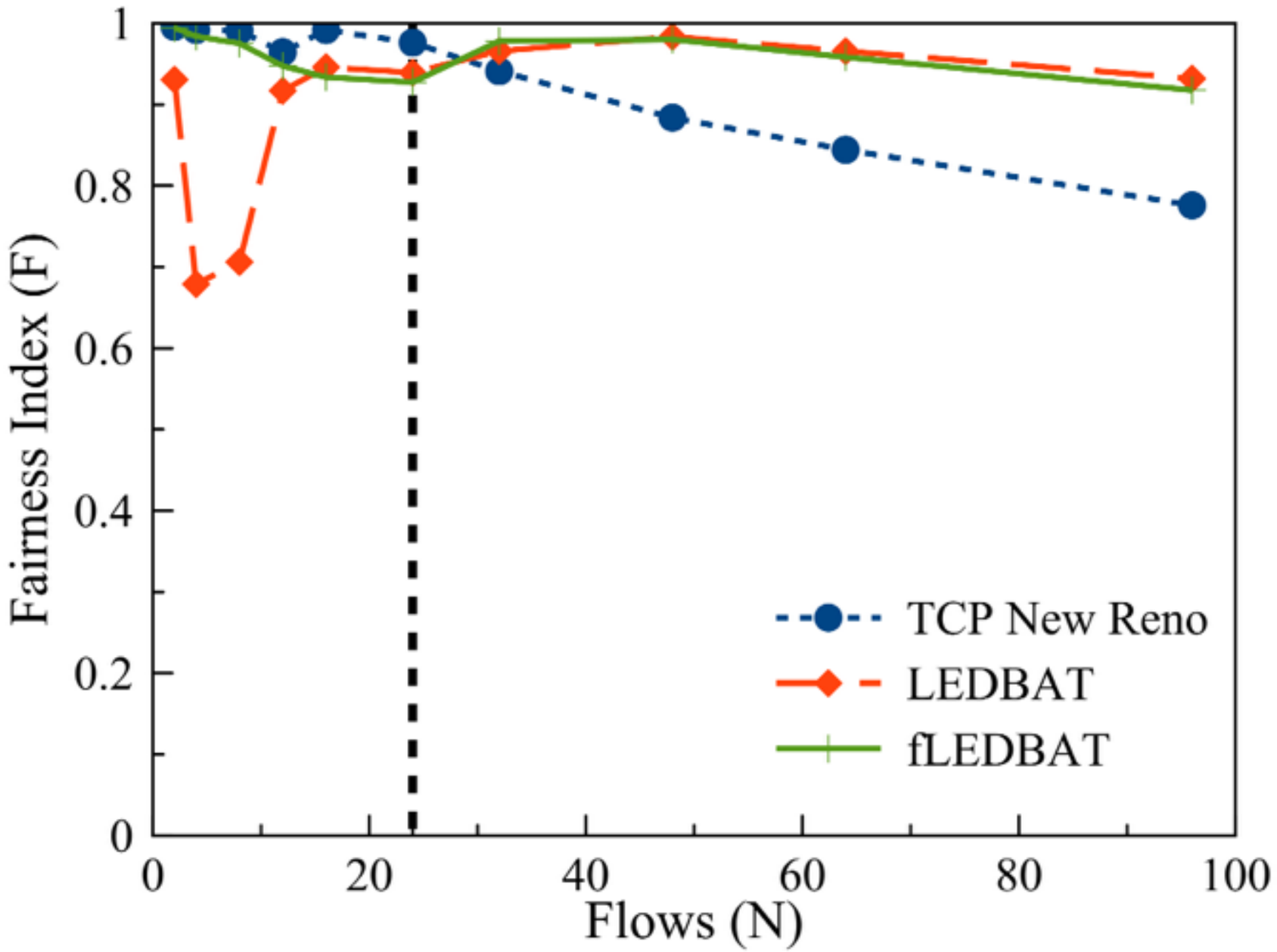
Scenario Characteristics

2 - 96 users	UL capacity: 600 Kbps	DL capacity: 1.2 Mbps
RTT: 450 ms	Buffer size: BWxDelay	Packet size: 1500 Bytes
$\alpha : 1$	$\zeta : 5$	Target: 100 ms

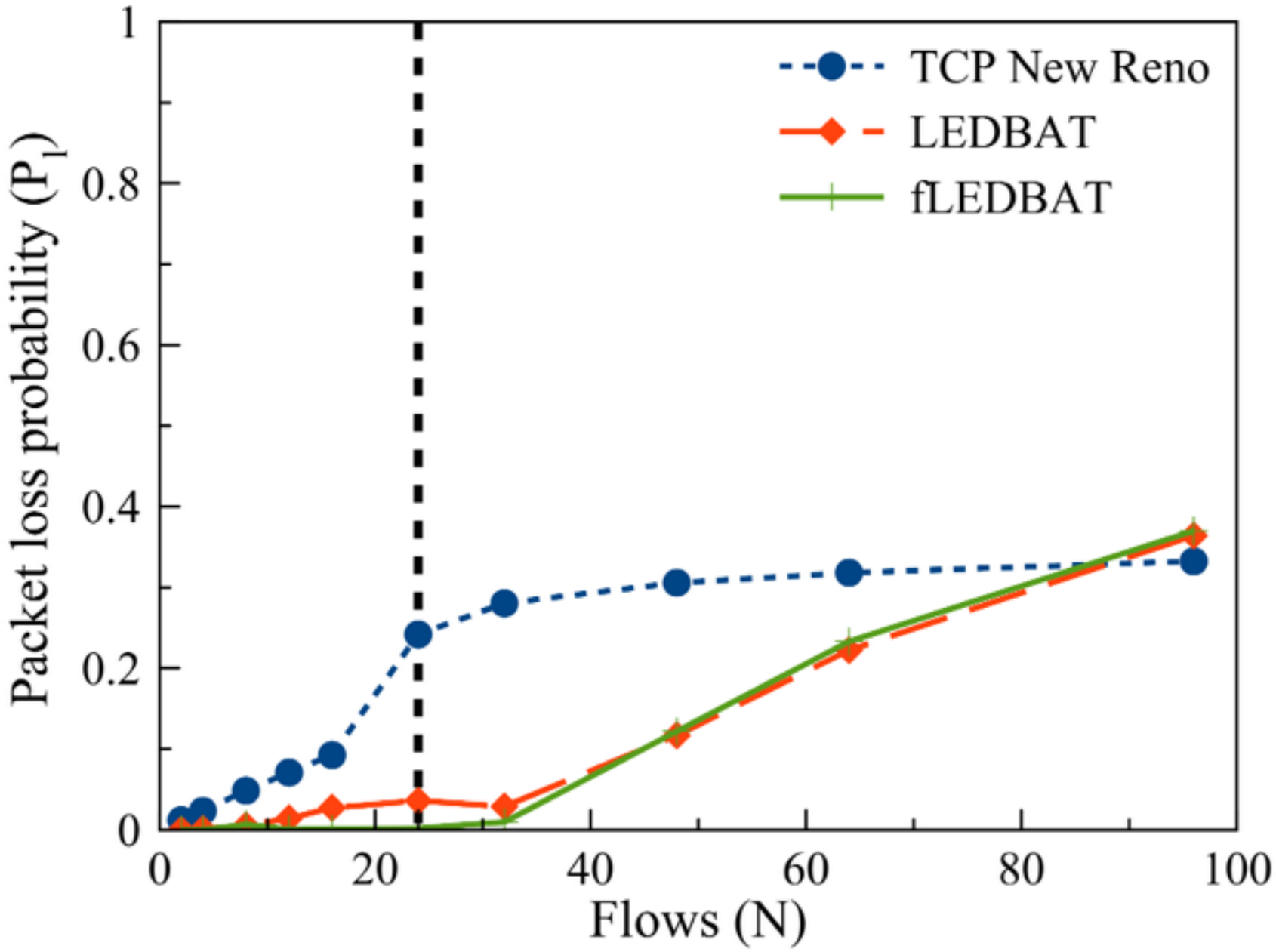
Link Efficiency



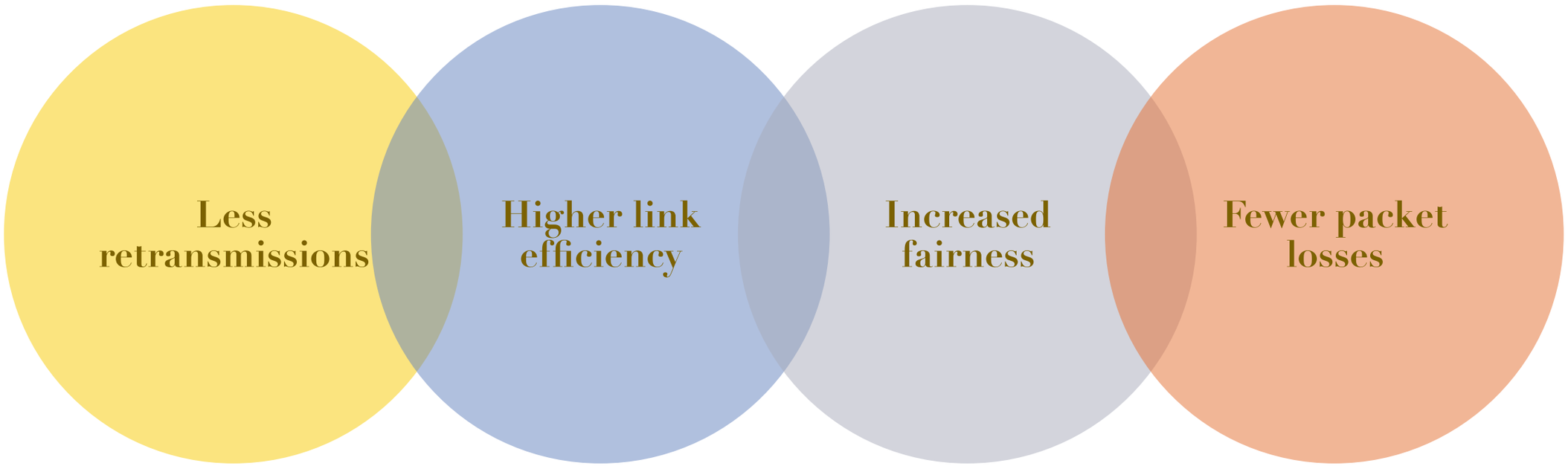
Fairness Index



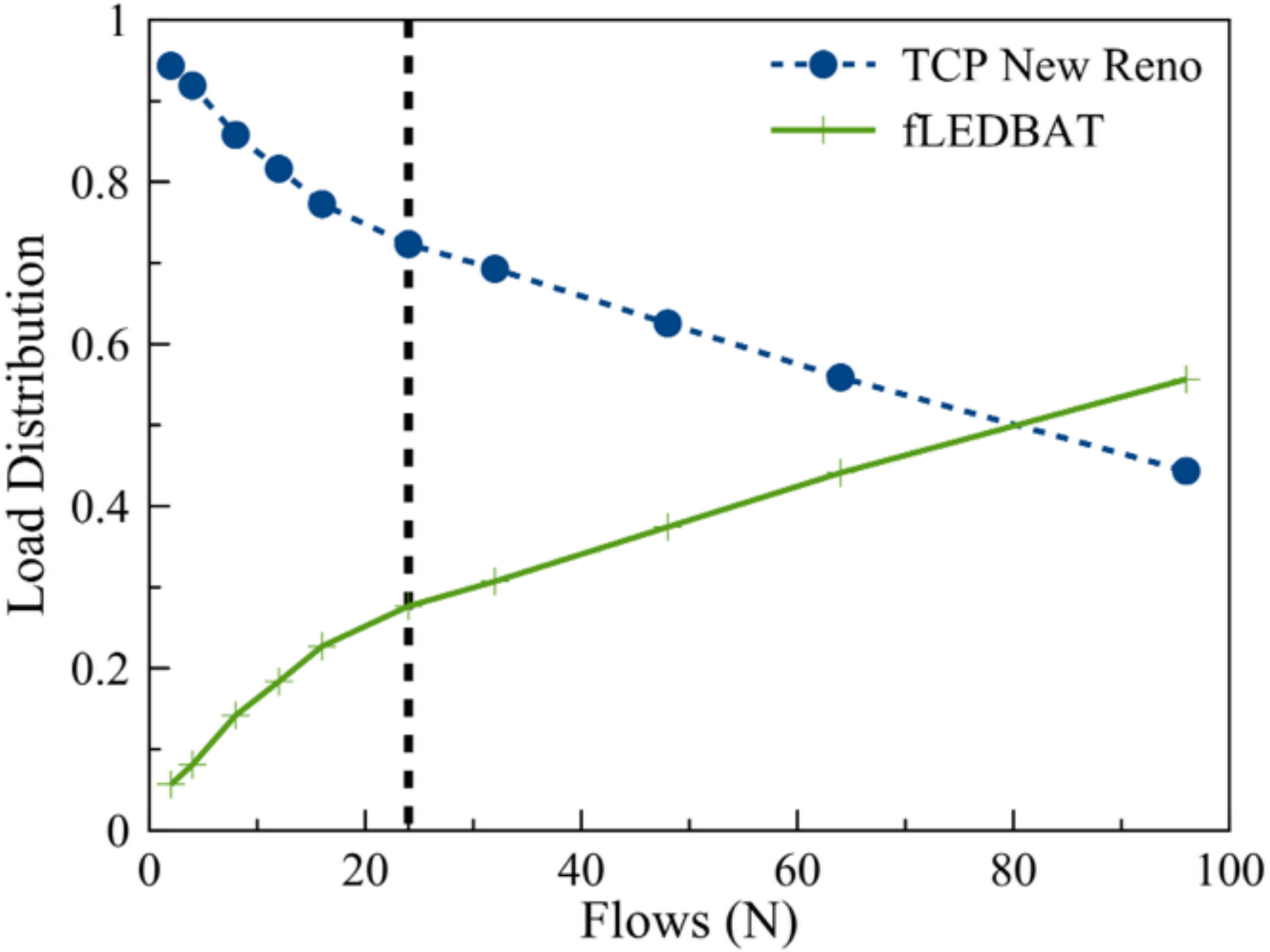
Packet Loss Probability



When having only LEDBAT flows



Parallel LEDBAT and TCP flows



LEDBAT flows

Fail to measure actual base delay

Consume more resources than TCP flows

Become aggressive

Recommendations

- Base delay estimation methods
- Shared bottleneck detection
- Conservative reaction to timeouts
- Prioritisation of retransmitted packets
- Admission control

✤ Thank you!

Research funded by

- The research leading to these results has received funding from the European Community's Seventh Framework Programme (FP7/2007-2013, FP7-REGPOT-2010-1, SP4 Capacities, Coordination and Support Actions) under Grant Agreement n° 264226 (Project title: Space Internetworking Center - SPICE).

LEDBAT

- Queuing delay = Current delay - Base delay
- $\Delta(t)$ = Queuing delay - Target
- If no loss,

  $cwnd(t+1) = cwnd(t) + \alpha(Target - \Delta(t))/(Target \times cwnd(t))$
- If loss,

  $cwnd(t+1) = cwnd(t)/2$

fLEDBAT

- If $\Delta(t) \leq 0$,
  $cwnd(t+1) = cwnd(t) + \alpha / cwnd(t)$

- If $\Delta(t) > 0$,
  $cwnd(t+1) = cwnd(t) + \alpha / cwnd(t) - \zeta \times \Delta(t) / Target$

- If loss,
  $cwnd(t+1) = cwnd(t) / 2$

Queuing Delay Index