TCP Optimized for Short Flows

Nitin Kartik
Department of Electrical Engineering
Stanford University

nitin.kartik@motorola.com

Overview

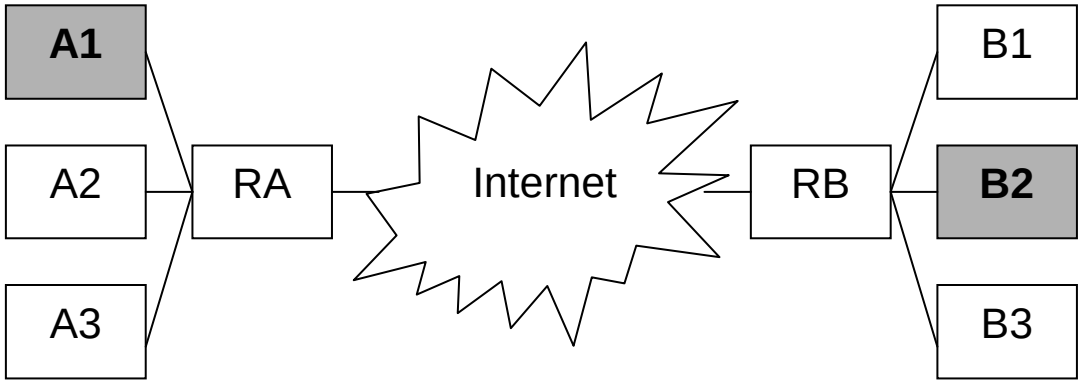
- Problem Statement
- Canonical Example
- Criteria for New Scheme
- Proposed Scheme
- Evaluation

Problem Statement

- TCP Congestion Control's purpose:
  - Congestion in Routers
- Today: Feedback based techniques
  - TCP Slow Start
- Short Flows suffer (e.g. HTTP)

- How to improve TCP Congestion Control for Short Flows while upholding TCP CC's semantics?

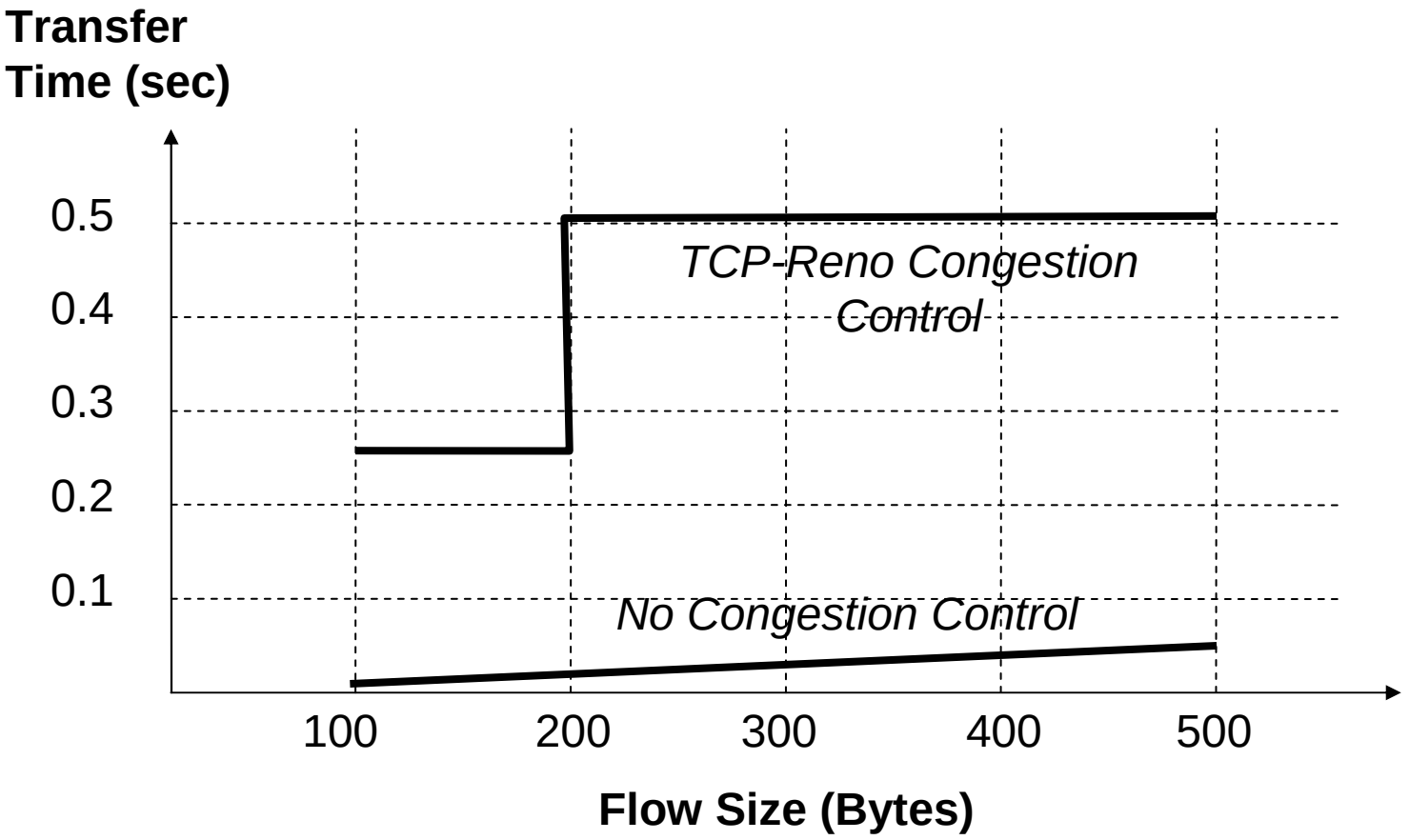
Canonical Example



200 B Packets
100 Kbps
0.25 sec RTT

Flow Size	TCP-Reno	None
100 B	0.25 sec (1 RTT)	0.01 sec
200 B	0.25 sec (1 RTT)	0.02 sec
300 B	0.5 sec (2 RTT)	0.03 sec
500 B	0.5 sec (2 RTT)	0.05 sec

Canonical Example Illustrated

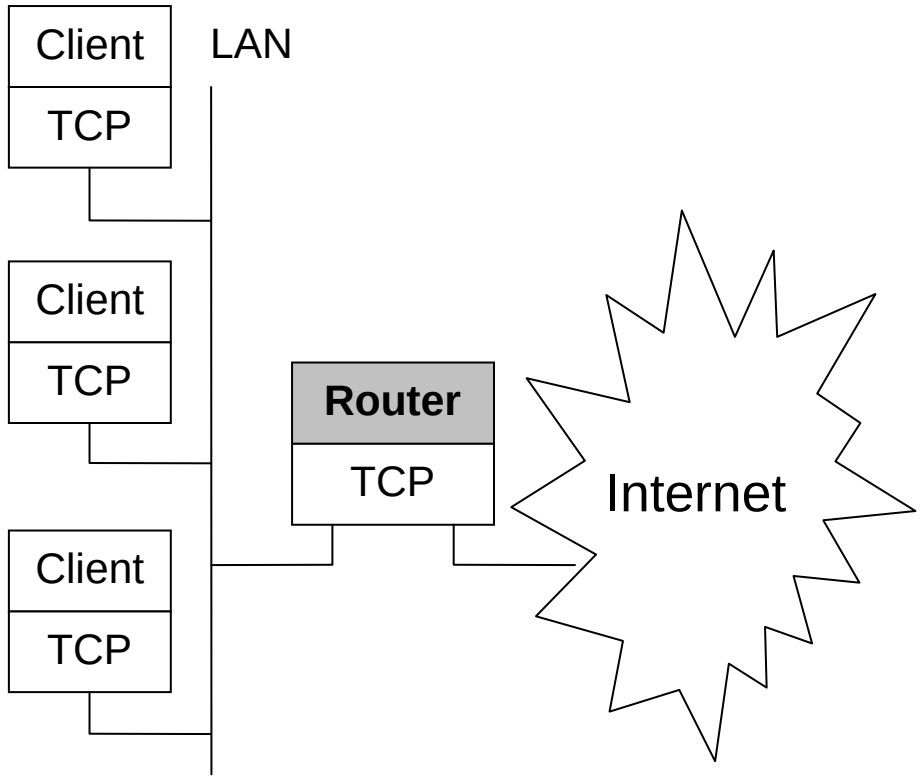


Criteria for New Scheme

- Performance
  - No worse than traditional Cong. Control
- Interoperability
  - Transparent to Client applications
- Fairness
  - Not too aggressive

Proposal: System Overview

- Resides in Router
- Intercepts outbound / inbound packets
- Performs handshaking to ensure transparency



Proposal: Handshaking

- Send *Phantom Acks* for T_{opt} millisec (= 500 initial)
- After T_{opt}, resume regular TCP CC
- If real Acks before T_{opt}, resume regular TCP CC
- Transaction Number book-keeping
- Drop packets if queue overflow imminent

Proposal: T_{opt} Autocorrection

- If T_{opt} is wrong, causes unfairness
- Keep running average
  - Update on every TCP close
  - Time before first real Ack
- L_{opt} = Running average length (10,000)

Proposal: Shared TCP State

- Router remembers optimal bandwidth between local clients and remote hosts
- Router reuses this information if another client contacts the same destination subnet

Evaluation

- Performance
  - Zero Congestion Control overhead for Short Flows
- Interoperability
  - Router approach ensures transparency
- Fairness
  - Resume regular TCP Congestion Control after T_{opt}, autocorrecting

What We Covered

- Problem Statement
- Canonical Example
- Criteria for New Scheme
- Proposed Scheme
- Evaluation

nitin.kartik@motorola.com