TCP Optimized for Short Flows

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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**

```
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
```

200 B Packets
100 Kbps
0.25 sec RTT
Canonical Example Illustrated

![Graph showing transfer time versus flow size for TCP-Reno Congestion Control and No Congestion Control.]
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
- $L_{opt} = \text{Running average length (}10,000\text{)}$
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

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