Mind the Gap: Towards a Backpressure-Based Transport Protocol for the Tor Network

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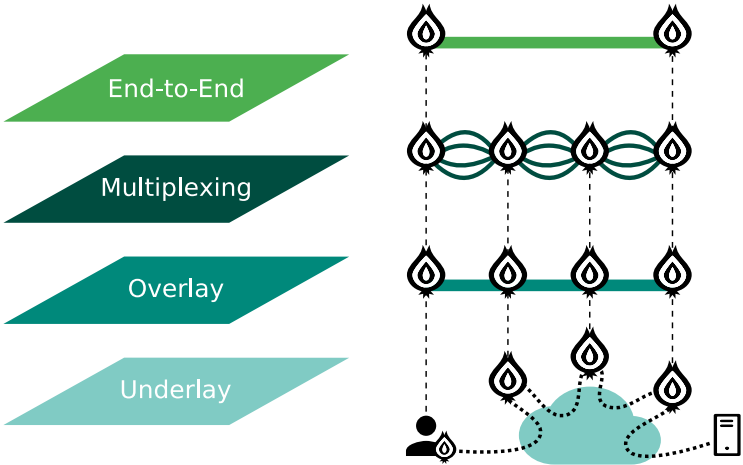
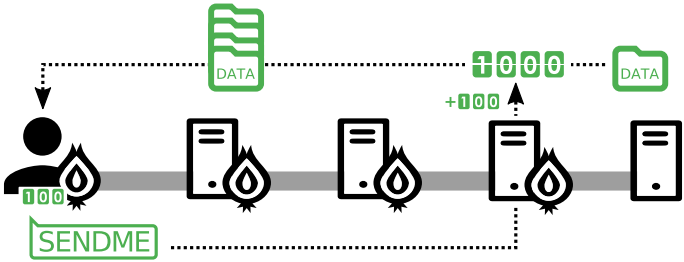
KEEP
CALM
AND
USE

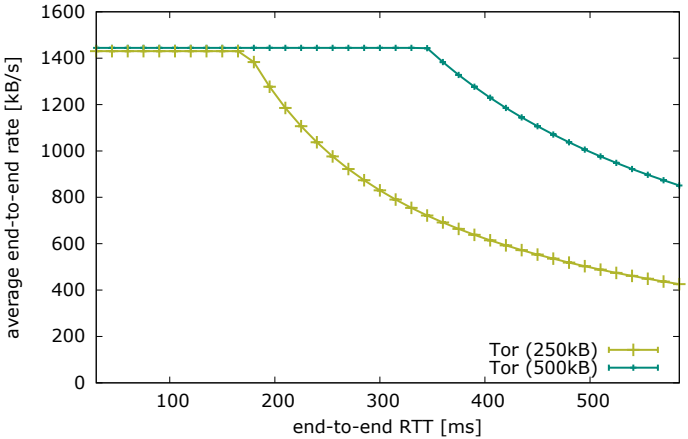
#bufferface


End-to-End
Multiplexing
Overlay
Underlay

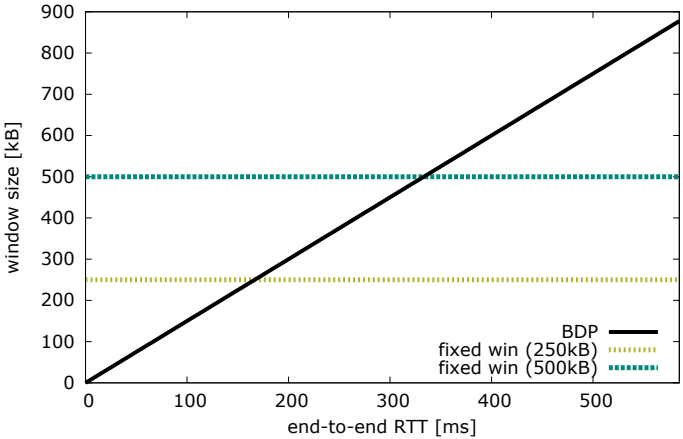
Looooooong queues are possible

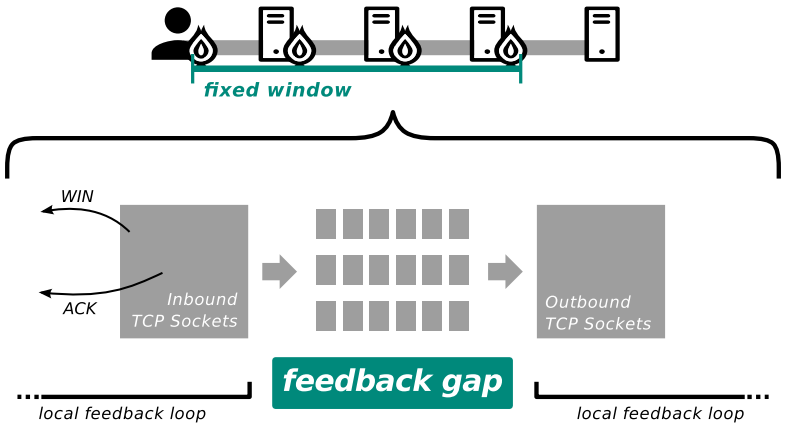


The Problem with Fixed Windows

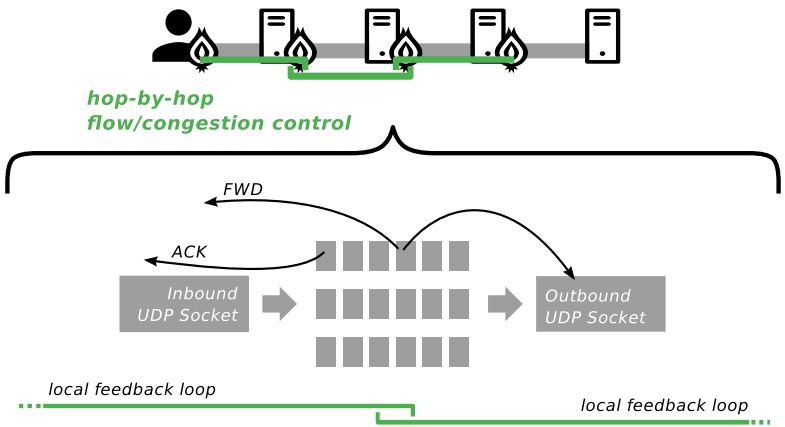


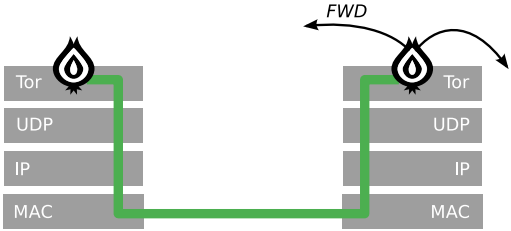
The Problem with Fixed Windows




fixed window
WIN
ACK
Inbound
TCP Sockets
Outbound
TCP Sockets
feedback gap
local feedback loop
local feedback loop

BackTap:
Backpressure-Based
Transport Protocol

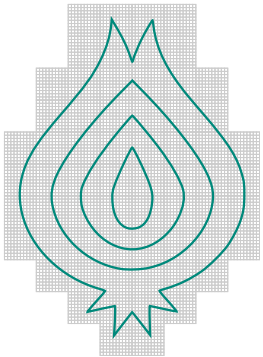

hop-by-hop
flow/congestion control
FWD
ACK
Inbound
UDP Socket
Outbound
UDP Socket
local feedback loop
local feedback loop



- yet another queue
- minimize queue lengths/ queuing delays
- delay-based window adjustment à la TCP Vegas

$$diff = swnd \cdot \frac{actualRtt}{baseRtt} - swnd$$

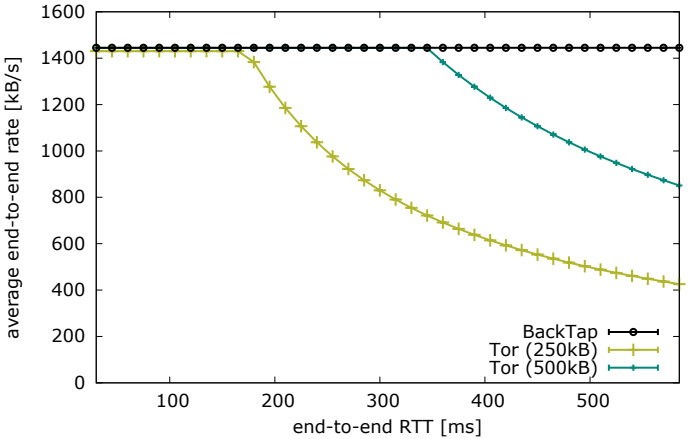
- additive increase additive decrease (AIAD)



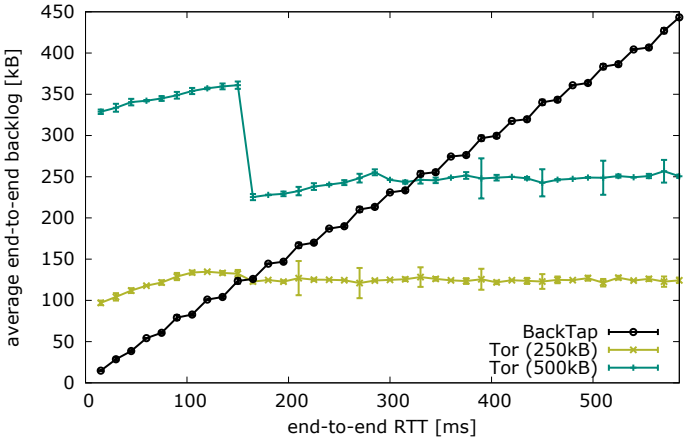
- UDP-based
- hop-by-hop feedback
- ACKs separate from FWDs
- delay-based congestion control
- joint congestion control

- nstor: a Tor module for ns-3
- BackTap prototype
- related approaches (PCTCP, N23)

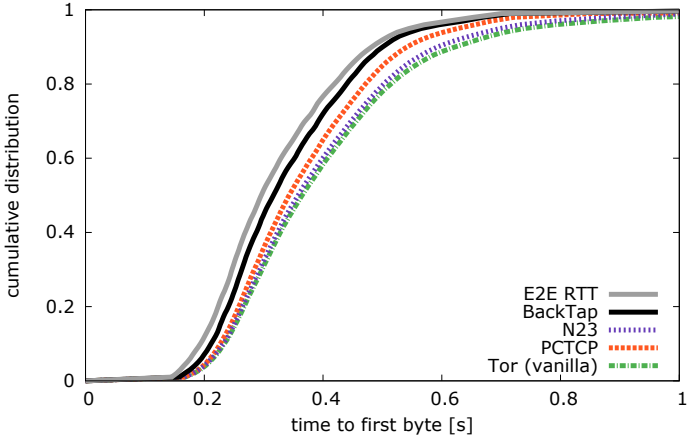
Evaluation (single circuit — rate)



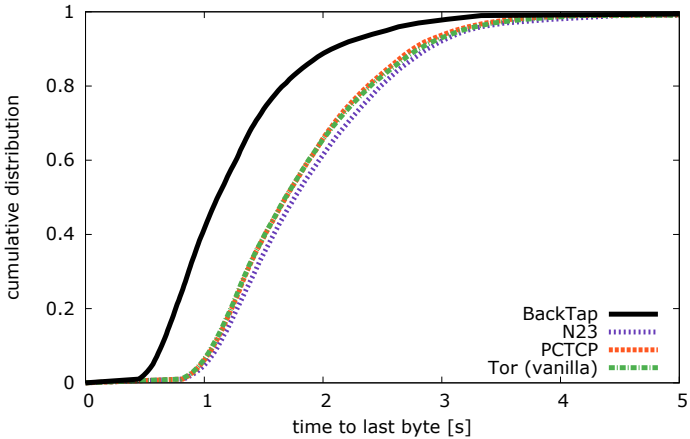
Evaluation (single circuit — backlog)



Evaluation (Responsiveness)



Evaluation (Web Traffic)



Conclusion

1. reason for performance problems: fixed end-to-end window + feedback gap

2. proposed solution: Backpressure-Based Transport Protocol (BackTap)