Increasing TCP's CWND based on Throughput

draft-you-iccrg-throughput-based-cwnd-increasing-00

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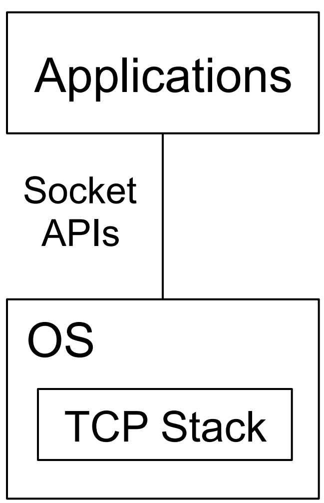
Motivation

- Extend TCP to support higher throughput and lower response time services such as 4K video.

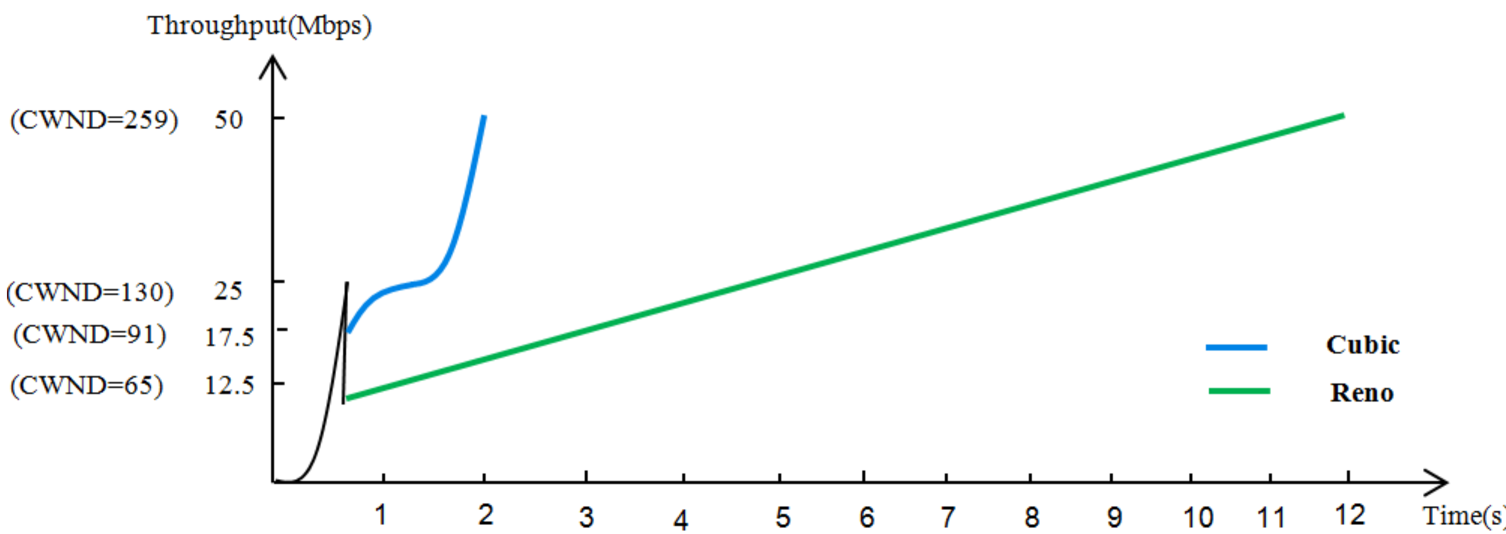
- Allow TCP to be configurable by applications, through which application could customize TCP congestion control algorithm and parameters according to the requirements.



- Extend socket APIs
  - Allow application to convey information
  - Improved congestion control algorithm
  - Applicable for 4K video transmission

Background

- Network Environment
  Target throughput = 50Mbps, RTT = 60ms, then target window size = 259MSS.
  Initial window = 10MSS. Assume packet loss occurs when cwnd = 130MSS.
- Reno
  TCP Reno needs 194 RTTs (about 11.64s) to reach the target throughput.
- Cubic
  TCP Reno needs 29 RTTs (about 1.74s) to reach the target throughput.



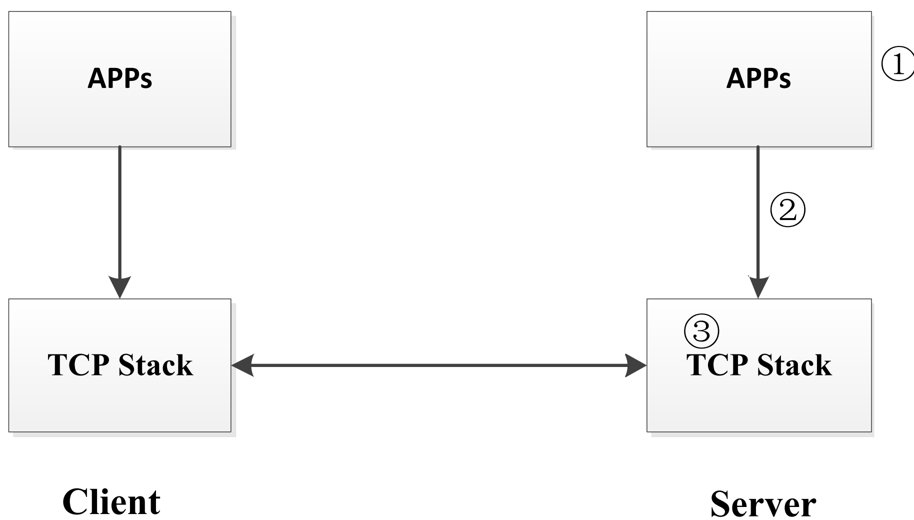
Transmitting 4K video poses a great challenge to current TCP.

Increasing CWND based on Throughput 1/3

- Step 1: APP calculates the target throughput.
  Take 4K VBR as an example, TARGET_THROUGHPUT=e×BR,
  where e>1, is a multiplication factor.

- Step 2: Extend TCP socket option: setsockopt(); add a new parameter:
  TARGET_THROUGHPUT, which will be transferred to TCP protocol stack.

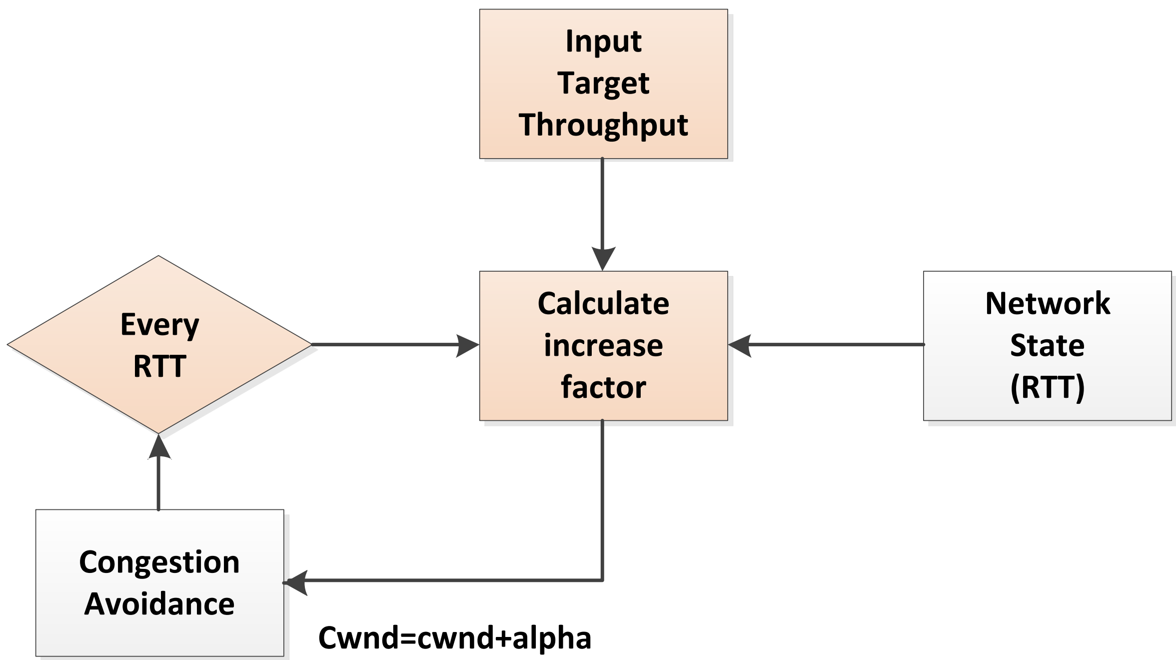
- Step 3: Calculate the increase factor alpha:
  alpha = TARGET_THROUGHPUT X RTT – cwnd



Assumption:
Network capacity can meet target throughput.

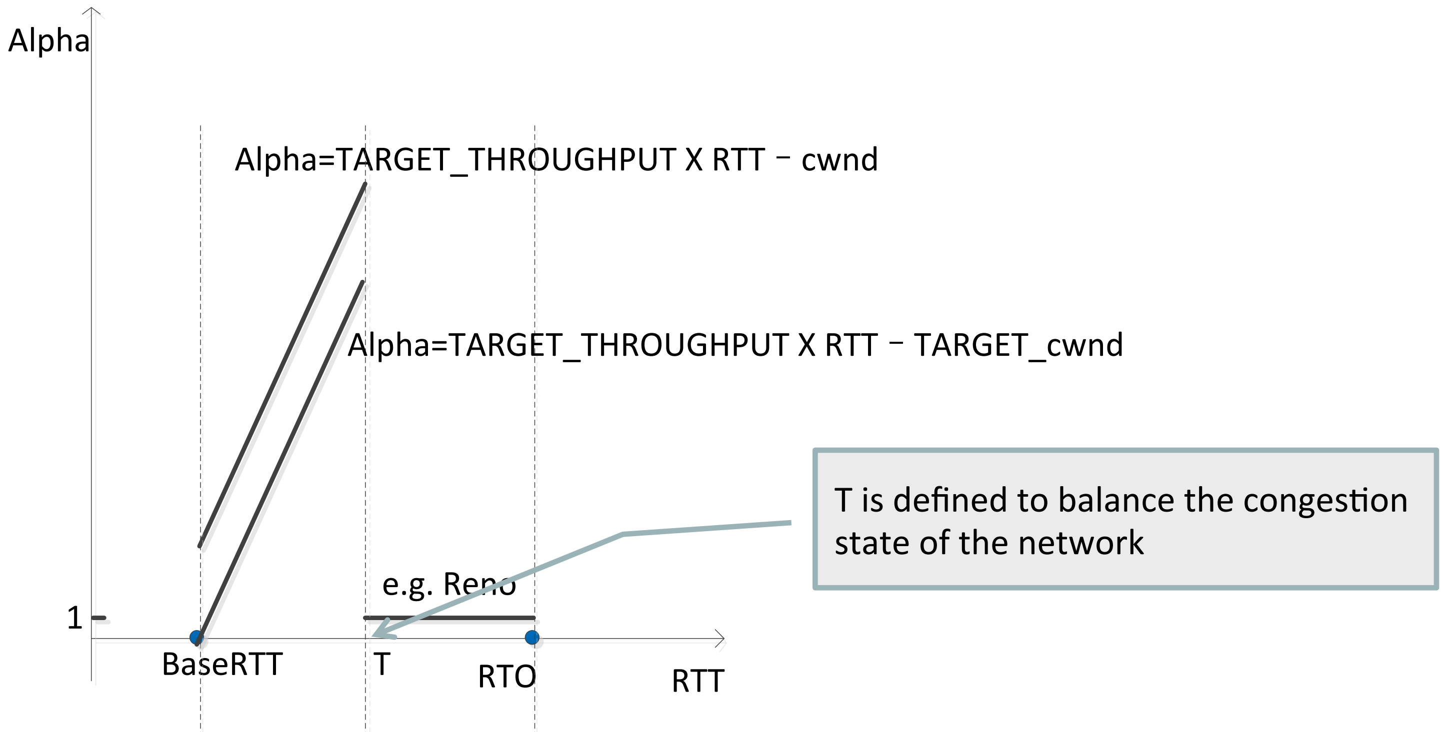
Increasing CWND based on Throughput 2/3

The increase factor for cwnd is calculated according to RTT and TARGET_THROUGHPUT.
The cwnd is adjusted for every RTT.



Increasing CWND based on Throughput 3/3

- **Window Growth Function: Alpha**



TARGET_cwnd = TARGET_THROUGHPUT X BaseRTT
When cwnd reaches to TARGET_cwnd, Alpha is zero where RTT = BaseRTT

Implementation 1/3

- Network Environment
  Target throughput = 50Mbps, RTT = 60ms, then target window size = 259MSS.
  Initial window = 10MSS. If packet loss occurs, cwnd = ½ cwnd.
- Proposed Method
  Only one RTT is needed to reach to the target throughput during both slow start phase and congestion avoidance phase.

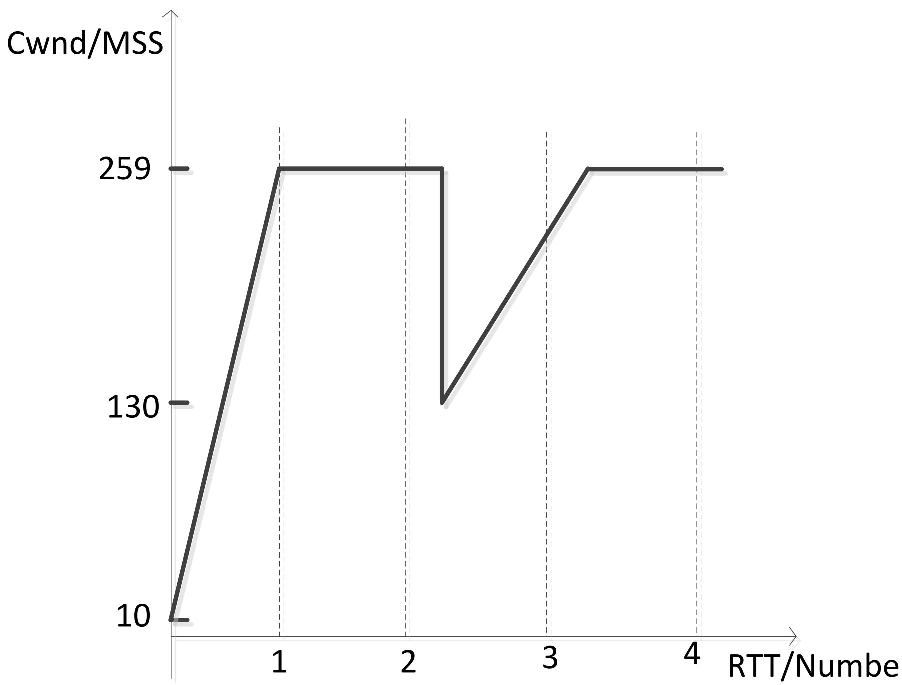


Figure 5: Window Curve with Packet Loss using Proposed Method

Implementation 2/3

fluctuates a little, but it can be stabilized by the proposed method.

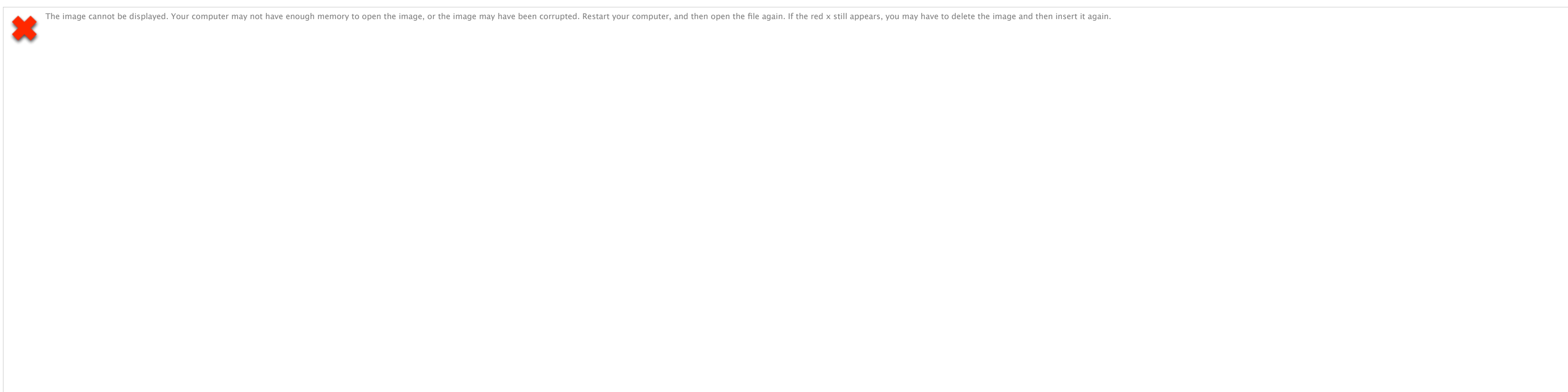


Figure 6: Window Curve with Packet Loss using Proposed Method

Implementation 3/3

Target throughput = 50Mbps, RTT = 60ms, then target window size = 259MSS.
Initial window = 10MSS. If packet loss occurs, cwnd = ½ cwnd.

- Proposed Method
  The beginning thirty MSSs are used to estimate the BaseRTT. The cwnd is balanced around the target cwnd.

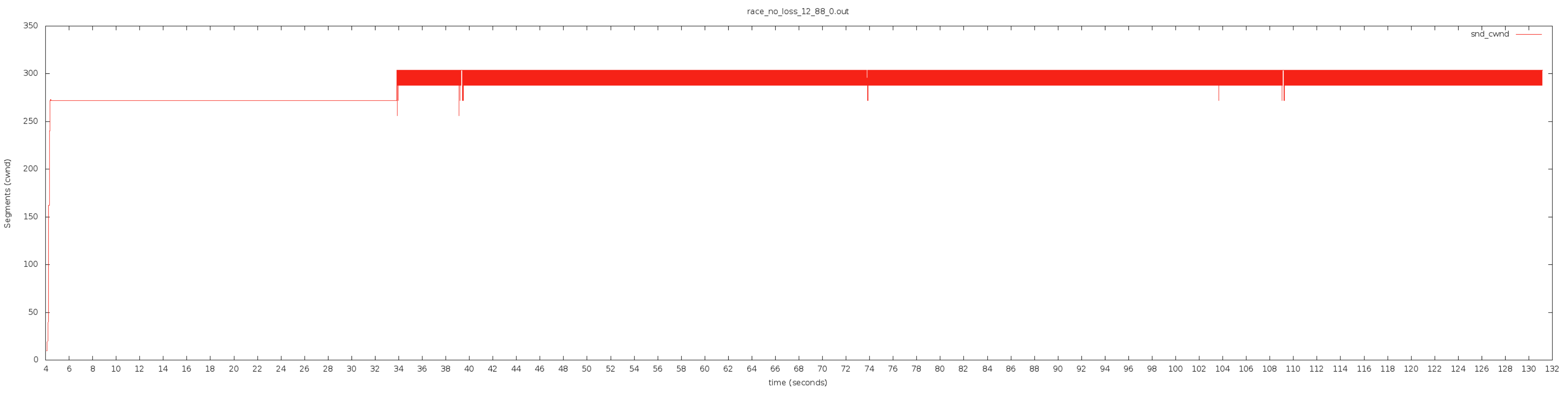


Figure 7: Window Curve with no Packet Loss using Proposed Method

Next Step

Thank You!