Improving Speed Tests

Srikanth Sundaresan (Princeton),
Amogh Dhamdhere and k claffy (CAIDA)

AIMS 2017

Speed tests have not changed in years

- They still just run TCP stream(s) between two hosts and report a number
- None of the popular tools try to do anything more
  - No attempt at any type of diagnosis
    - Where did congestion occur (if it occurred)?
    - Was it the access link or the wireless link or something else?

Very little needs to change to be able to answer (some of) these questions

- Packet captures at servers can tell us about RTT
  - Which in turn can tell us about the conditions that the flow encounters
- The TCP flow has already punched a hole in the NAT
  - Which ought to let us probe the path all the way to the end host

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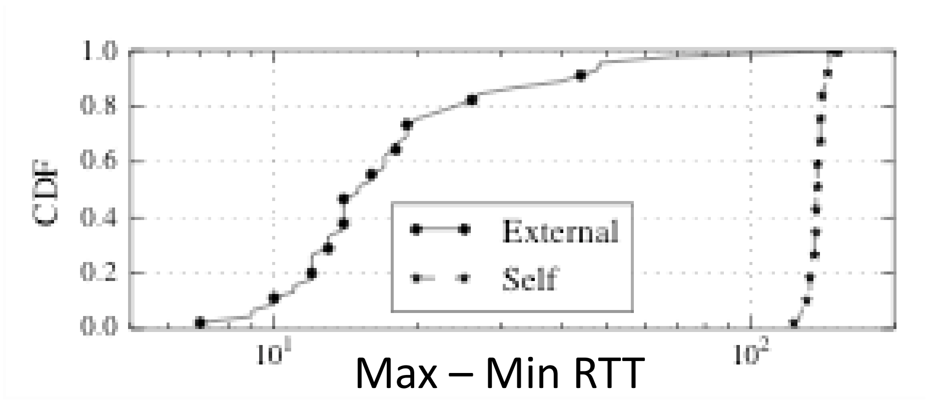
What *sort* of congestion did a TCP flow encounter?

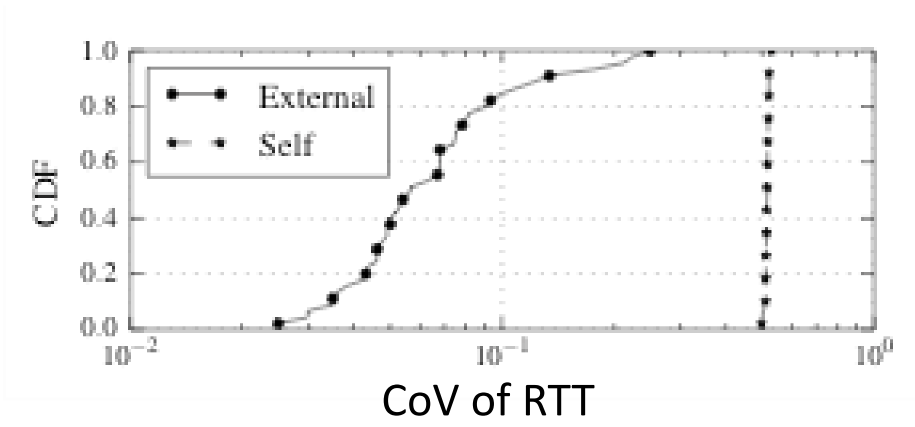
- Self-induced congestion?
  - Clear path, the flow itself induced congestion
  - Access links with plan rates
- Already congested path?
  - Low available capacity
  - Congested interconnect
- Cannot distinguish using just throughput numbers
  - Plan rates vary widely

TCP Congestion Signatures

- Self-induced congestion fills up an empty buffer during slow start
  - This causes the RTT to increase (Max RTT – Min RTT)
  - Also increases variability (Coeff. Of Variation of RTT)
- Simple Decision Tree Model Using the RTT Parameters

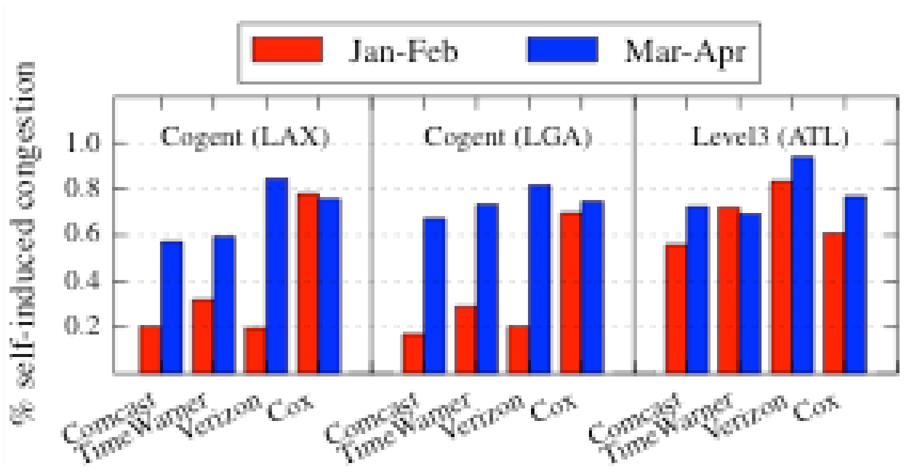
Does it work?

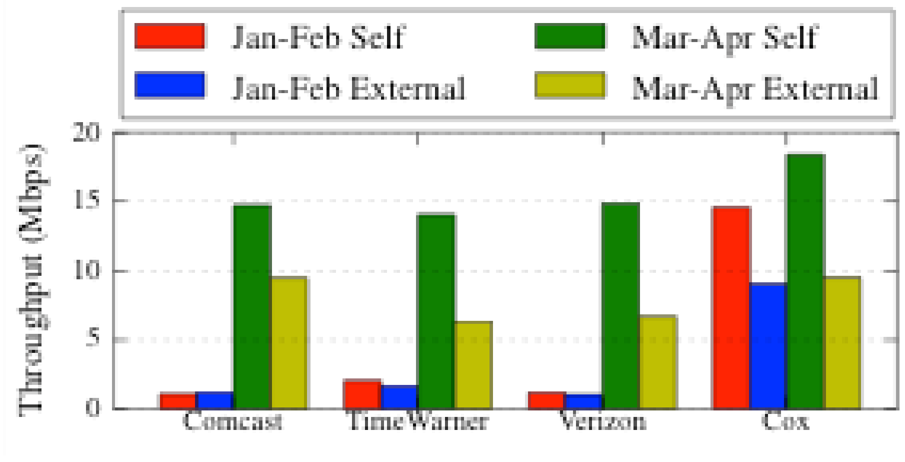




- Extensive validation using controlled experiments testbed
  - Build model using testbed data
  - Minimize complexity

"Validation" using M-Lab data





- Time-span – Cogent interconnection issue (~Feb 2014)
  - Coarse ground truth
  - The two event periods clearly stand out

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Probing the TCP Path Using BufferTrace

- The Idea: Send TTL-limited packets *within a TCP flow*
  - Observe the buildup of buffers
  - Trace the path that the flow actually takes
  - Send zero-payload TCP packets so as to not break the application layer
  - Encode hop ID in the sequence number
    - Some NATs rewrite the IPID field

Demo

https://github.com/ssundaresan/buffertrace

[Private repo, ping me for access]

Based on:

https://github.com/robertswiecki/intrace

Drawbacks

- Both techniques depend on buffering
  - How much?
- Lack of solid ground truth for congestion signatures
  - Any labeled data source for interconnect congestion?

srikanths@princeton.edu