TCP Friendly is an Oxymoron

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High level view

- TCP requires queues for correct operation
- RT traffic cannot tolerate queues
- The only solution is traffic segregation
  - Implies QoS or something
It is known that RT CC can't fix:

- No AQM - Buffer bloat
  - Bad all around
- Weak or misstuned AQM + high load
  - Bad all around
- Ideal AQM + medium RTT TCP slowstart
  - Good queue required to generate TCP's clock
- Ideal AQM + long RTT AIMD sawtooth
  - Good queue required to absorb peaks
- Ledbat with 100 mS threshold
  - Oops, could have been better
- Streaming video
Streaming video

● Application pacing
  ○ Read or write "copy buffer" on a timer
  ○ Every 5-10 seconds typical
  ○ 65kB-4MB depending on video quality

● With enough bandwidth or queue space:
  ○ lossless
  ○ cwnd rises above burst size
  ○ bursts go out at server interface rate

● We can fix this...
Trickle: Rate Limiting YouTube Video Streaming

Monia Ghobadi, Yuchung Cheng, Ankur Jain, Matt Mathis
USENIX ATC, June 2012

- Adaptive cwnd clamp to spread bursts
- No effect on user experience
- Improve ephemeral statistics
  - RTT statistics
  - Loss rate, but only in corner cases
- Risks to deployment
  - e.g. Impair adaptive quality selection, etc
Observations

- **TCP creates queues**
  - Always explicitly permitted
  - Sometimes even an explicit goal

- **RT traffic sharing a queue with TCP**
  - Is *always* at risk
  - It only works if TCP is otherwise throttled

- **RT only works if the queue is mostly empty**
  - This is an easily created corner case
    - Keep other user off of the network
    - Constrain applications
    - But these are just workarounds, not real soln's

- **RT really requires traffic segregation**
  - e.g. QoS with separate queues
What happened to QoS?

● A decade ago all TCPs were lame
  ○ Cheaper to outbuild the load than deploy QoS

● Modern stacks are not lame
  ○ Every connection between any pair of hosts always does at least one of:
    ■ Raise the RTT
    ■ Raise the loss rate
    ■ Run out of data
  ○ It is not possible to out build the load

● So now we need QoS yesterday
  ○ This conversation is (mostly) out of scope here
  ○ But we can help
Expose the problem

- Build standard metrics into codecs
  - e.g. See RFC 5481
  - Must also distill into a simple quality parameter
- ISPs can benchmark with same metric
- Users can compare values
  - Bring market pressure to ISPs
RT CC design

- Assume (mostly) empty queue
- Estimate ("fair") RT capacity
  - Avoid self inflicted queueing delay
- If there is too much cross traffic
  - TFRC or a circuit breaker are all you can do
  - Note that you cannot avoid adding to the queue
- Don't over optimize the failure cases
  - e.g. a "better too much" estimator
  - e.g. a "better TFRC"
  - We want them to go away, not work around
Closing

Protecting TCP is unnecessary, it will not return the favor.

- Andrew McGregor