

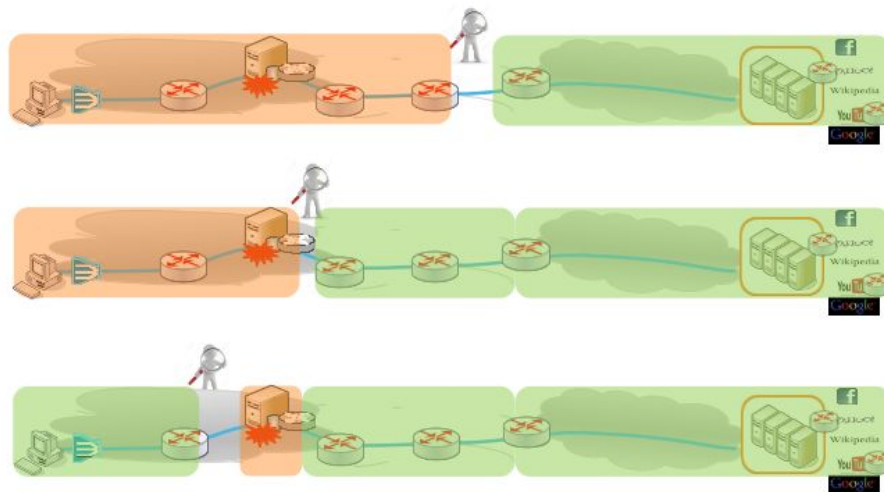
The case for passive measurement in QUIC

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Problem statement

Network troubleshooting = **dichotomy**

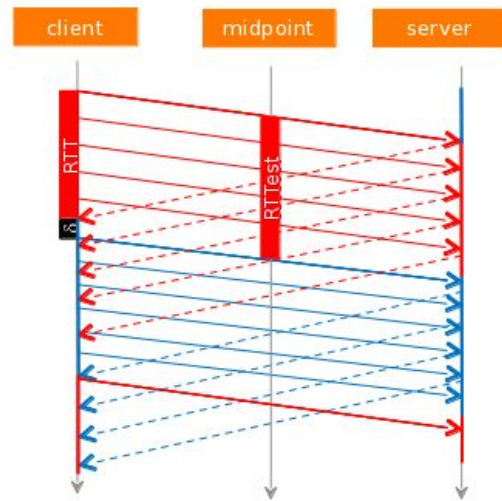
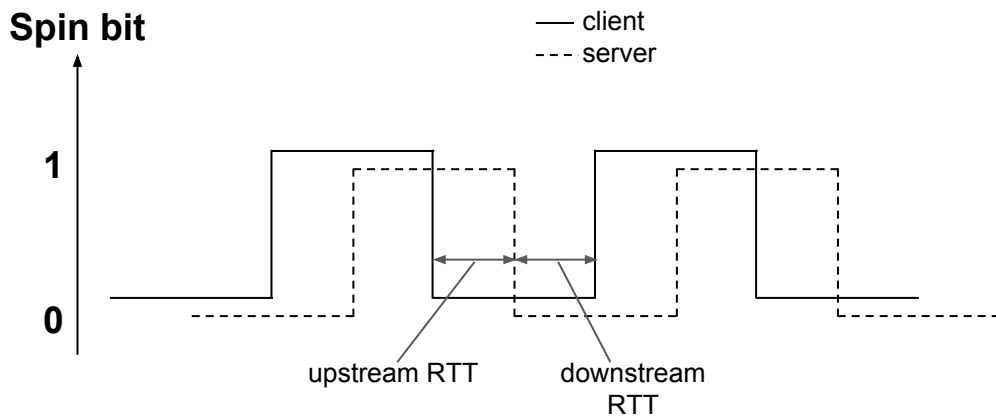
- Does it happen above or below me ? or both ? (yes, sometimes)
- Only local, unsynchronized, passive measurements allowed
- Clear TCP headers => RTT, loss, reordering
- QUIC blackbox => ?



Solution 1 = the Spin Bit (for RTT)

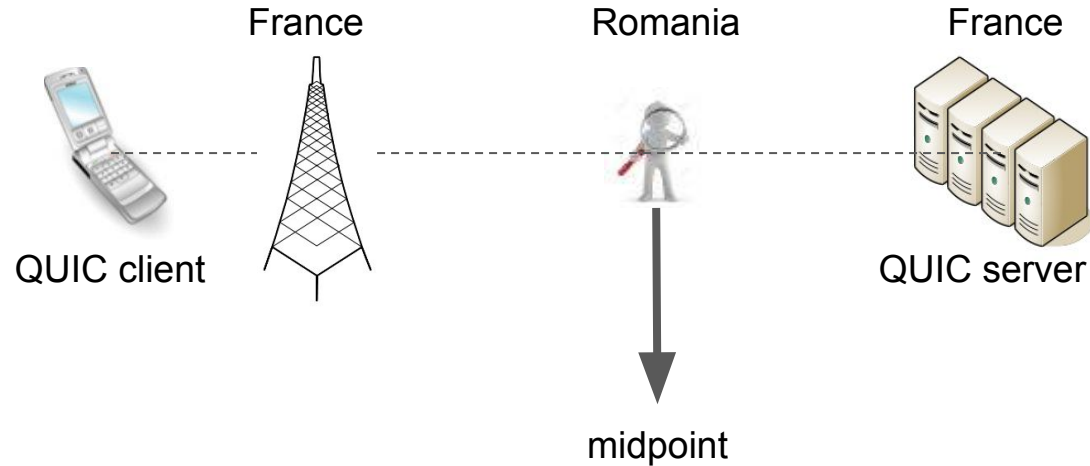
(see draft-trammel-quick-spin-00 and upcoming session Thursday morning)

- a single clear bit in (the most frequent) headers
- flipped by one endpoint; repeated by the other one
- => self-paced to RTT and congestion window
- => yields two “half-RTTs”: upstream , downstream



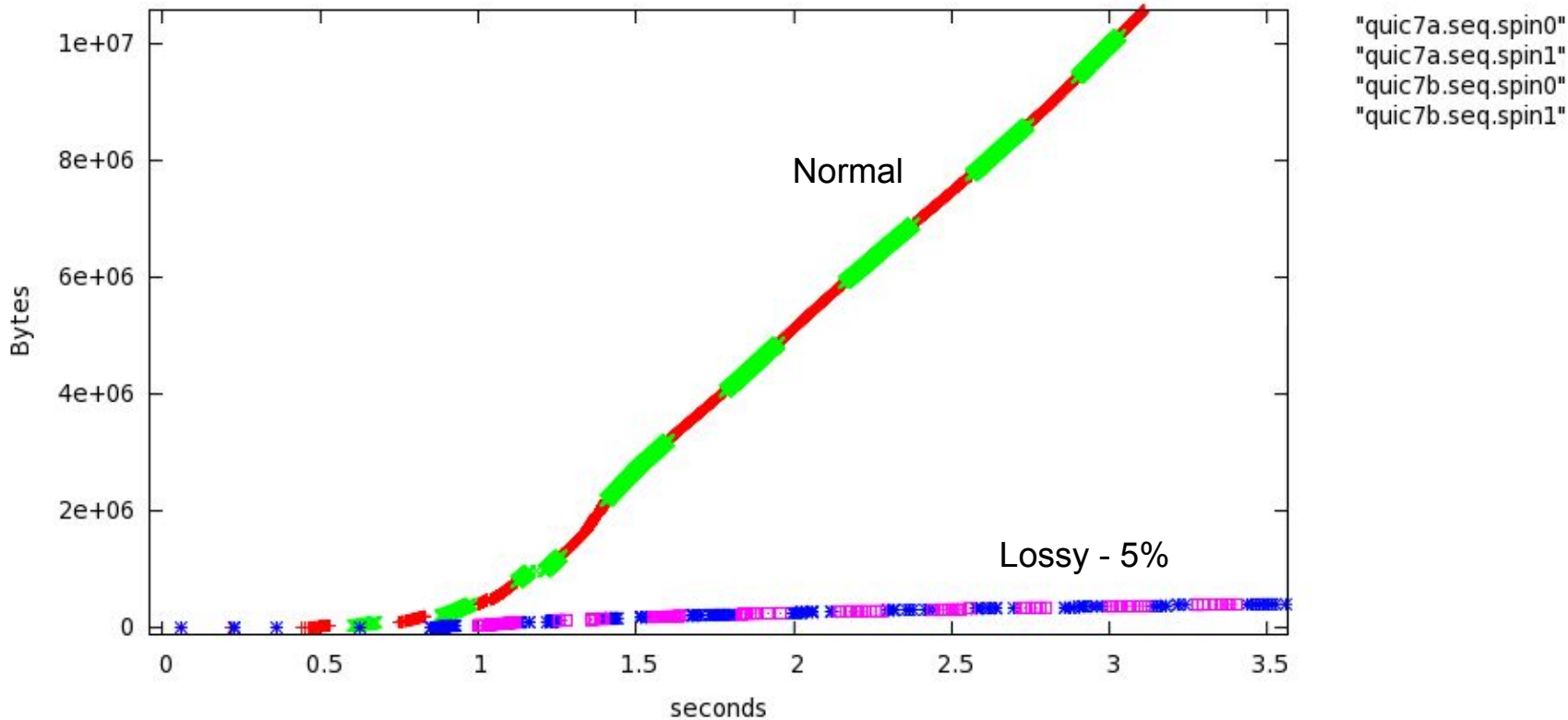
The Spin Bit at work

Testing on long distance, heterogeneous paths:

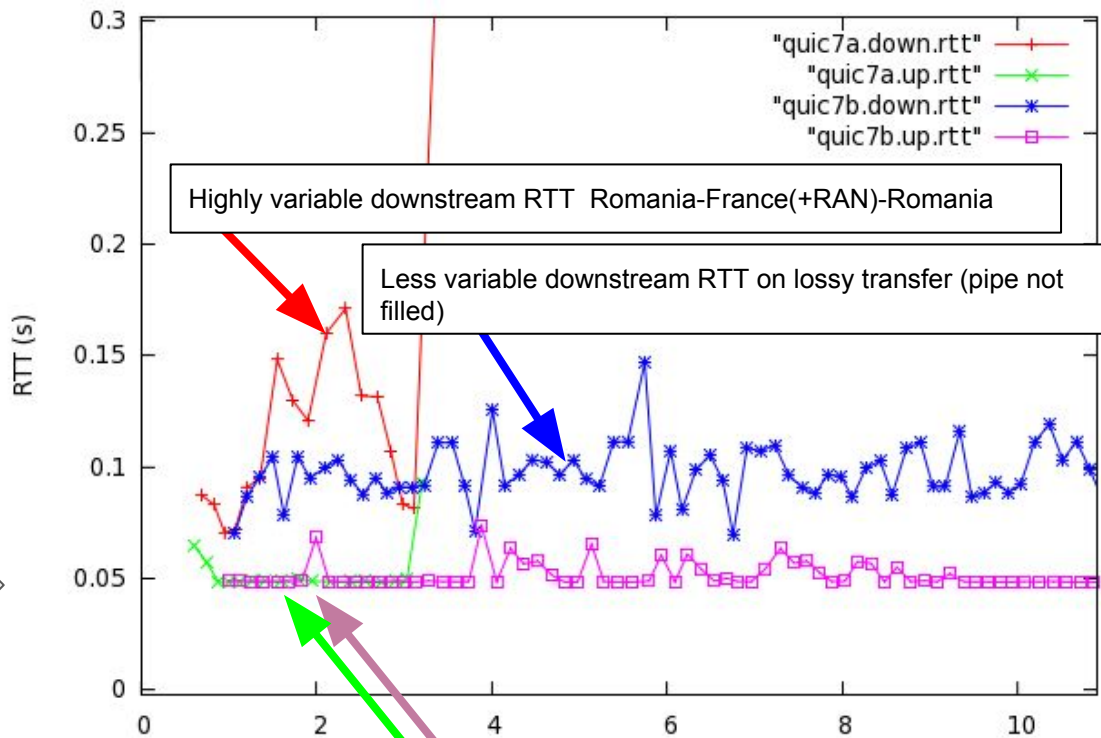
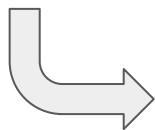
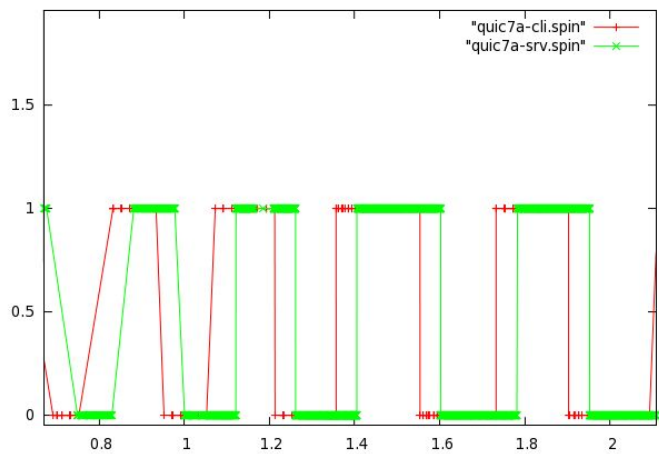


The Spin Bit at work - “colored snakes”

= cumulative sizes of QUIC packets over time, colored by spin bit



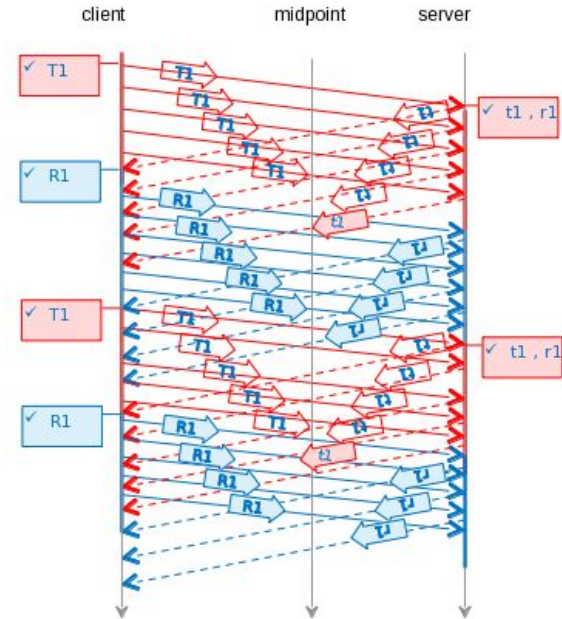
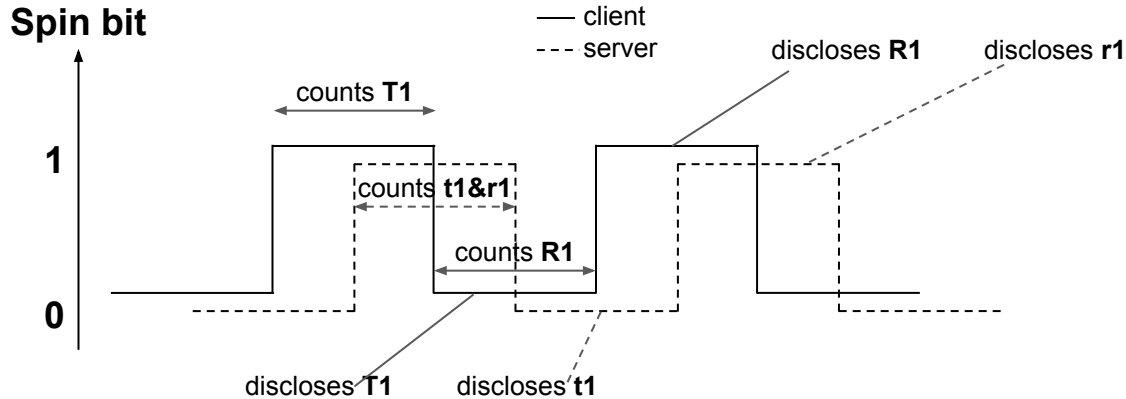
The Spin Bit at work - plotting half RTTs



Flat 50ms upstream Internet RTT Romania-France-Romania

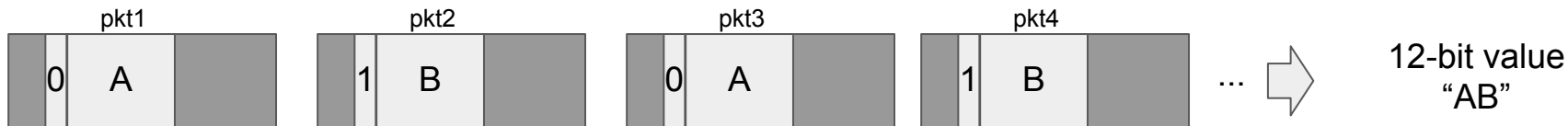
Solution 2 = the Spin Counters (for packet loss)

- builds on top of the Spin Bit
- 7 clear bits in (the most frequent) headers
- each endpoint discloses its number of received and transmitted packets in last spin bit flight
- => yields four “half-losses”:
(upstream , downstream) x (up , down)



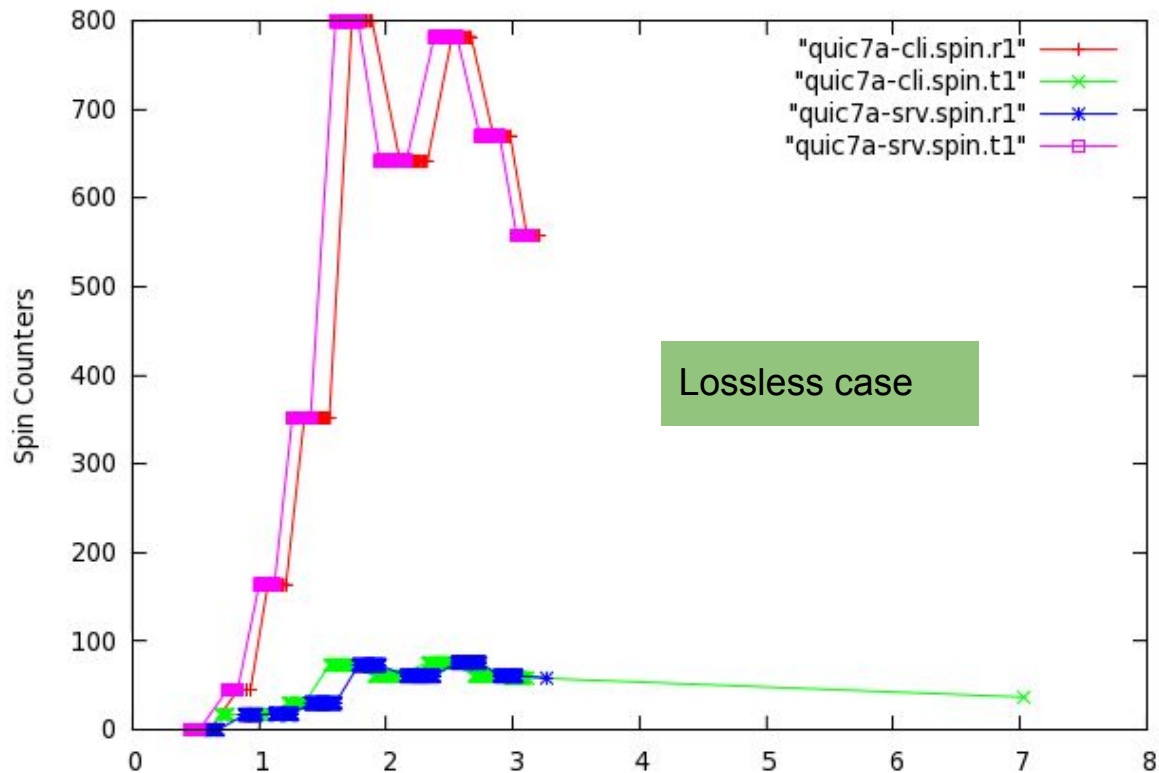
Solution 2 = the Spin Counters (for packet loss)

- How to disclose a packet counter in few (7) bits ?
 - Counter may be large (thousands) for big congestion windows
 - Needed resolution $\sim 2 \cdot 10^{-3}$ (typical onset of loss effects for TCP on international RTTs)
- => 12-bit floating-point representation: 3-bit exp + 9-bit mantissa
 - 9-bit mantissa gives resolution $1/512$
 - 3-bit exp gives scaling factor from 1 to 128 => up to counts of 64k
- How to transmit these 12 bits over a flight of the spin bit ?
 - Sequential transmission, 6 bits per QUIC packet, repeated => robust to loss
 - 7th bit is “address”: gives position of 6-nibble in the 12 bits => robust to reordering



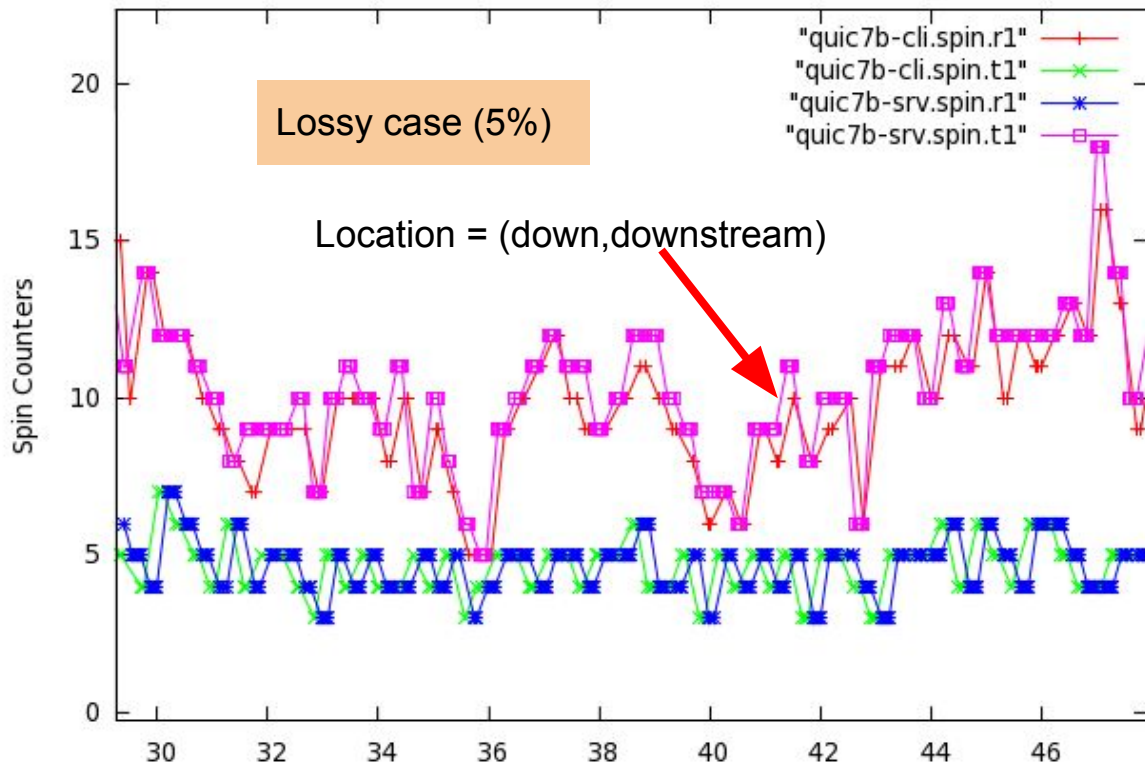
The Spin Counters at work

= plotting disclosed counters against time



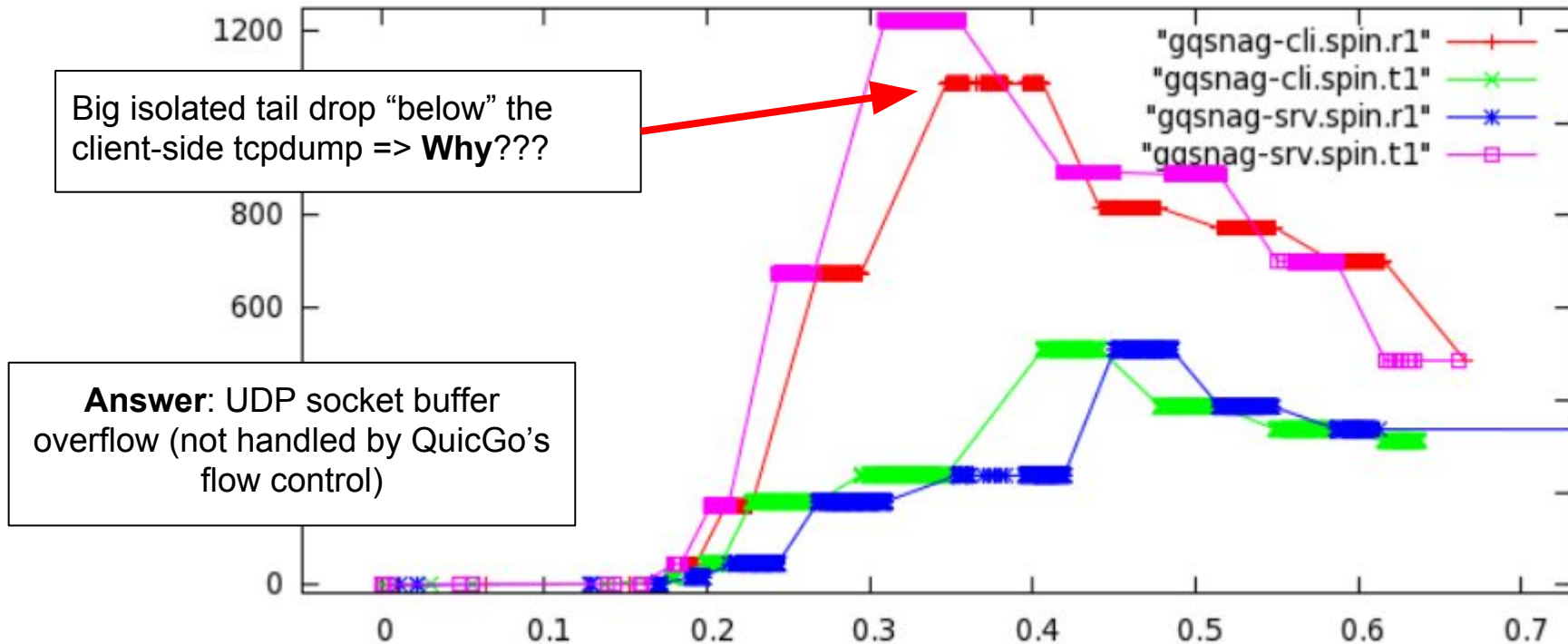
The Spin Counters at work

= plotting disclosed counters against time



The Spin Counters at work

Finding an unexpected loss location !!!



Wrap Up

- Passive measurement of QUIC is very useful
- A few bits are enough ...