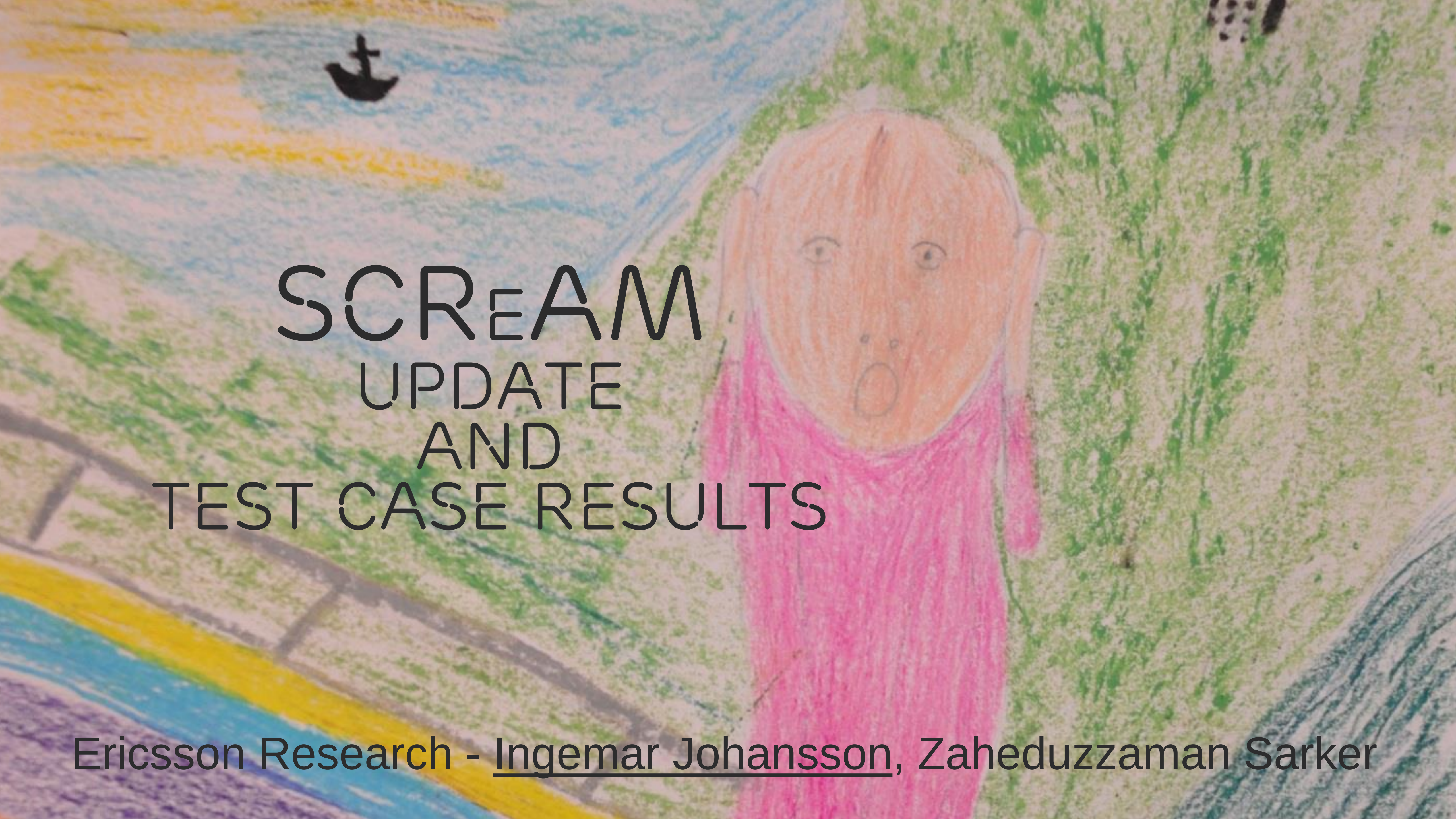


SCReAM
UPDATE
AND
TEST CASE RESULTS

Ericsson Research - Ingemar Johansson, Zaheduzzaman Sarker

DRAFT STATUS

- draft-johansson-rmcat-scream-cc-05
  - Congestion control and Rate control simplified somewhat
  - Matches C++ implementation

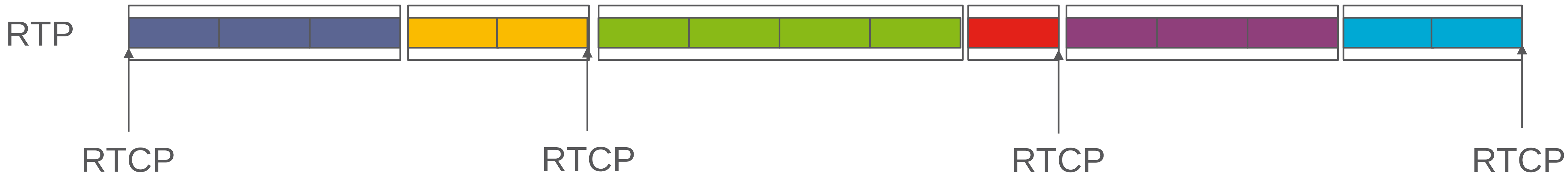
- Test cases according to draft-ietf-rmcat-eval-test executed (see later)

- Implementation experience welcome
  - C++ code supports integration in clients
    - Implementation of RTP queue and RTCP necessary
      - RFC3611 XR can be used for RTCP feedback
    - No ECN support (yet), trivial to add it (and L4S support)
  - Initial experiments and code update by Ralf Globisch

- **Ready for WGLC !**

FEEDBACK INTERVAL
OR.. PER (WHAT?) FEEDBACK

- SCReAM works best with feedback every N received RTP packets
  - Keeps ACK clocking in a good mood
- Constrained RTCP overhead → No more often than Tmin
- Avoid deadlocking to low bitrates → No more seldom than Tmax
- Useful values
  - N = 5, Tmin = 20ms, Tmax = 200ms
  - SCReAM works in the range ~20kbps to ~10Mbps



DESIGN ASPECTS
COMPETING FLOWS COMPENSATION

- The weakest part of SCReAM
- Designed to perform reasonably well for test cases 5.6 and 5.7 in draft-ietf-rmcat-eval-test
  - It is possible to improve performance for TC 5.6 and 5.7
  - However.. Higher risk of self inflicted congestion
- Algorithm tuned for reduced risk of self inflicted congestion (esp. in LTE test cases)
- Still a risk of self-inflicted congestion → turn off option if it competing TCP traffic is unlikely

TESTCASES

- Testcases according to draft-ietf-rmcat-eval-test-03
  - Best current understanding
  - TC 5.7 : Size distribution changed to uniform in interval [30,50] kB
  - RTT_{min} : 20ms, 100ms, 200ms
  - Jitter : 5ms or 30ms
  - Max RTP queue delay : 2s
    - RTP queue cleared if exceeded
  - AQM : Default = Tail-drop (300ms) or CoDel (5ms,100ms)

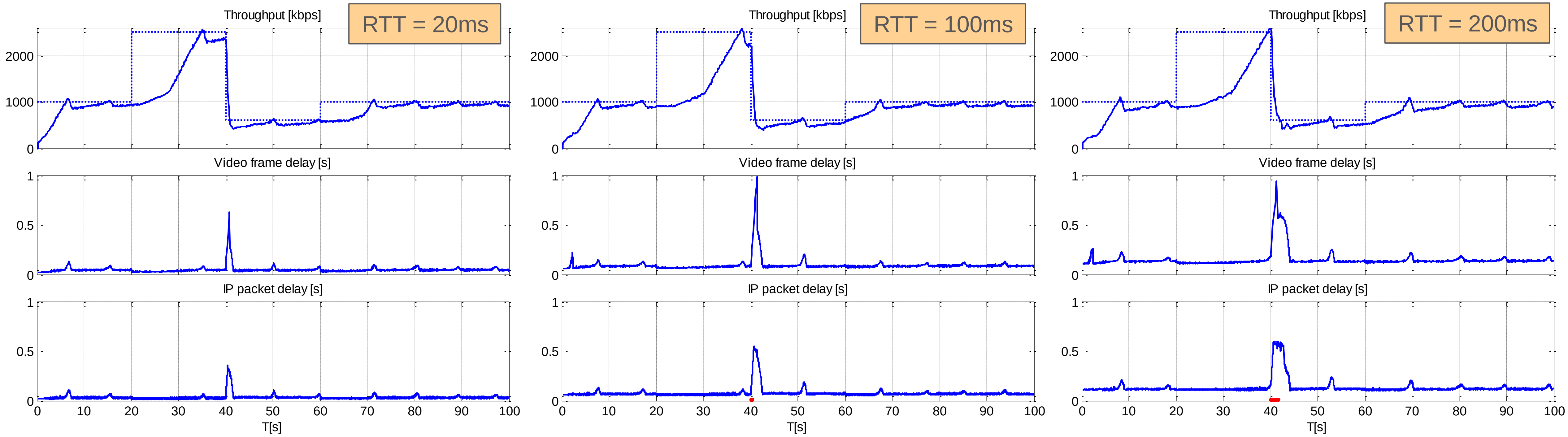
- Slide show example

TC 5.1

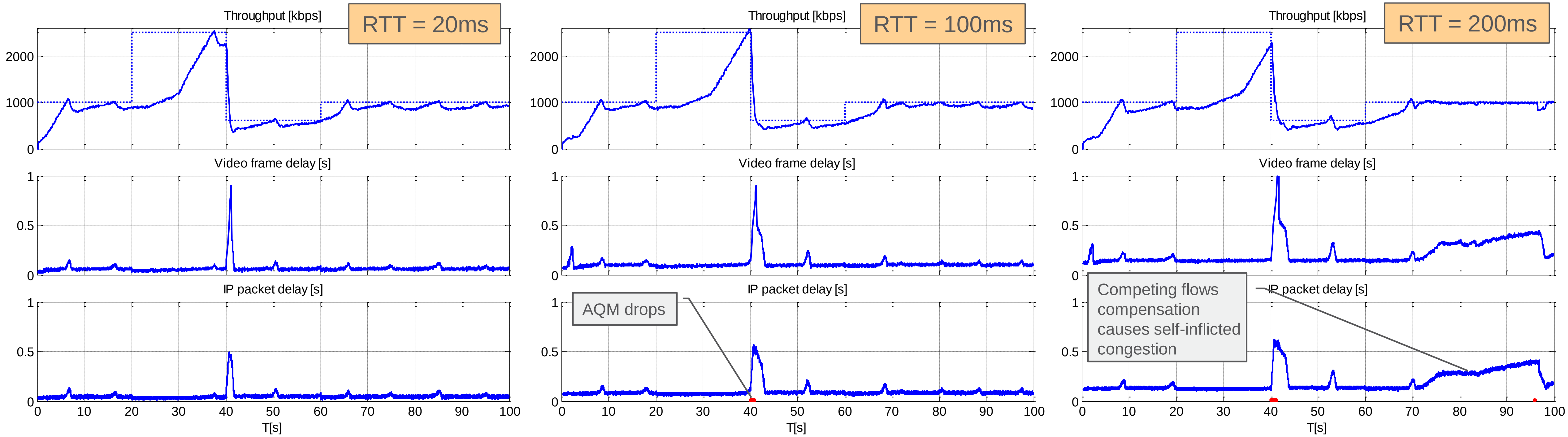
VARIABLE AVAILABLE CAPACITY WITH A SINGLE FLOW

- Larger RTTs give more delay spikes and jitter as expected
- Competing flows compensation can in some cases cause self inflicted congestion.

TC 5.1 5MS JITTER



TC 5.1 30MS JITTER

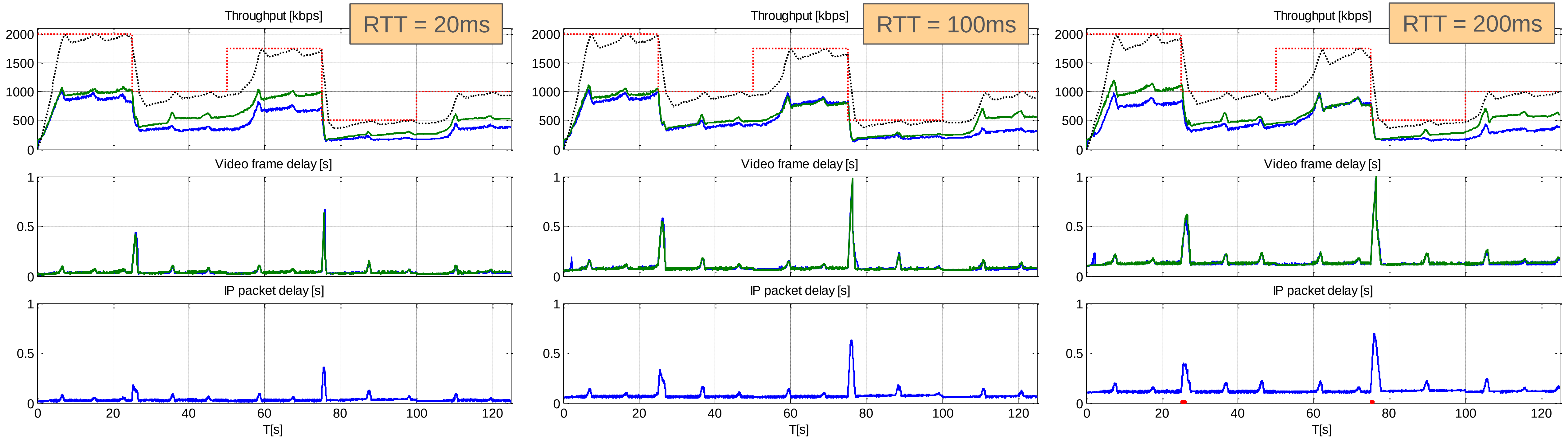


TC 5.2

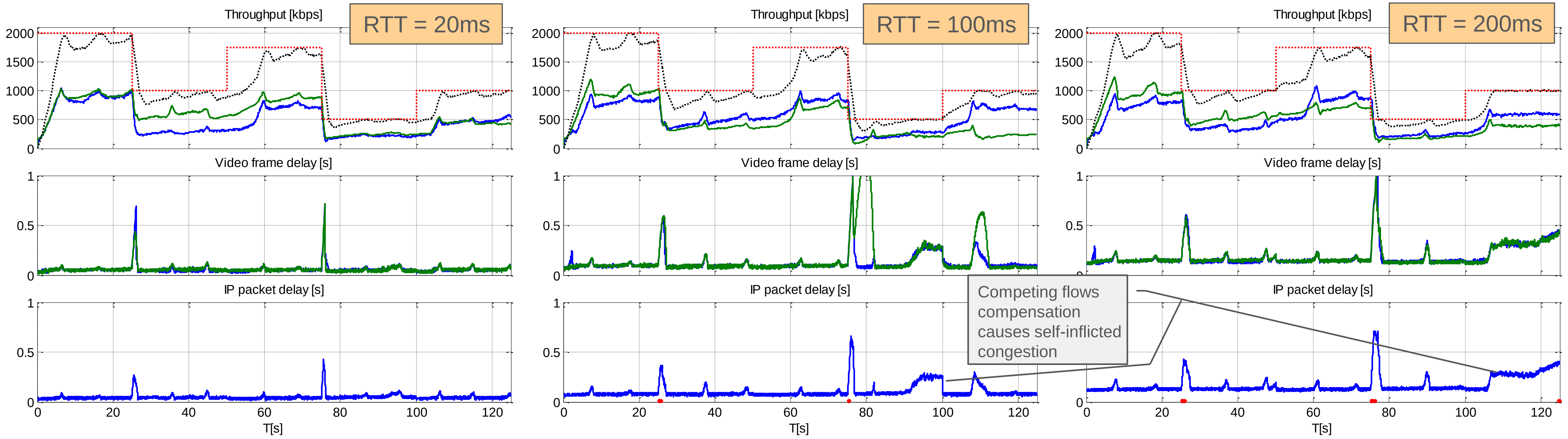
VARIABLE AVAILABLE CAPACITY WITH MULTIPLE FLOWS

- Reasonably fair rate allocation
- If video sources have the same sender/receiver address, better fairness can be achieved with 2 SCReAM streams
- Certain risk of self-inflicted congestion at high RTT and large jitter

TC 5.2 5MS JITTER



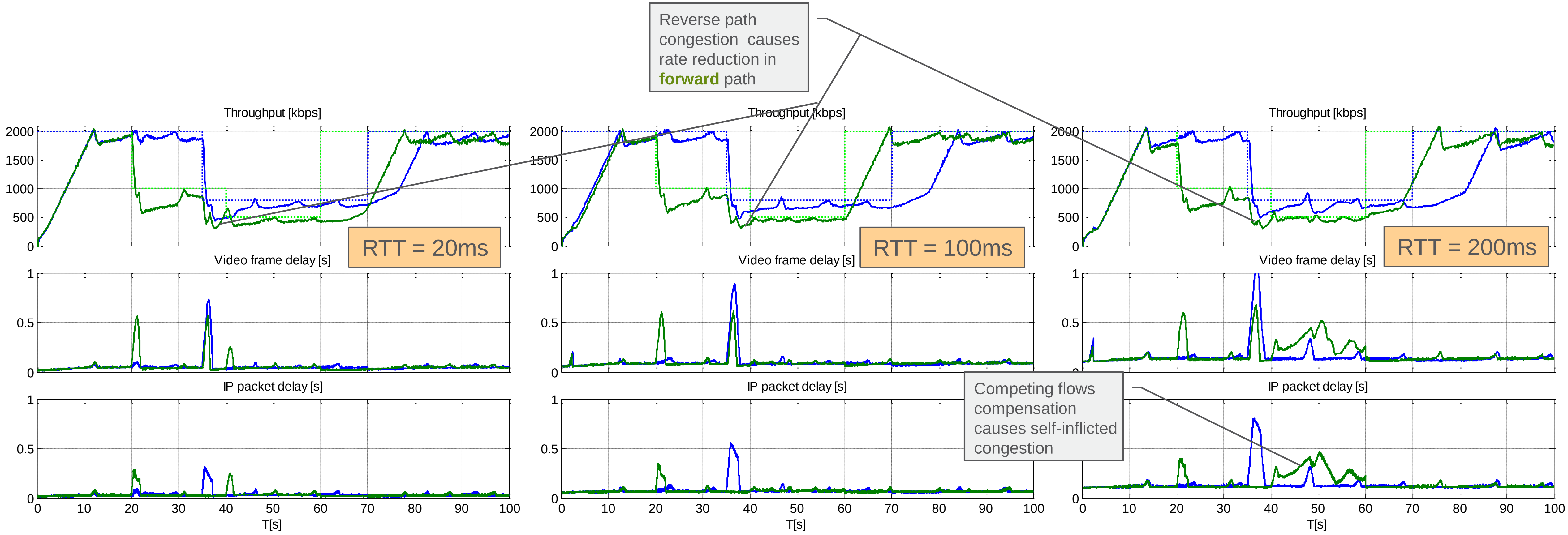
TC 5.2 30MS JITTER



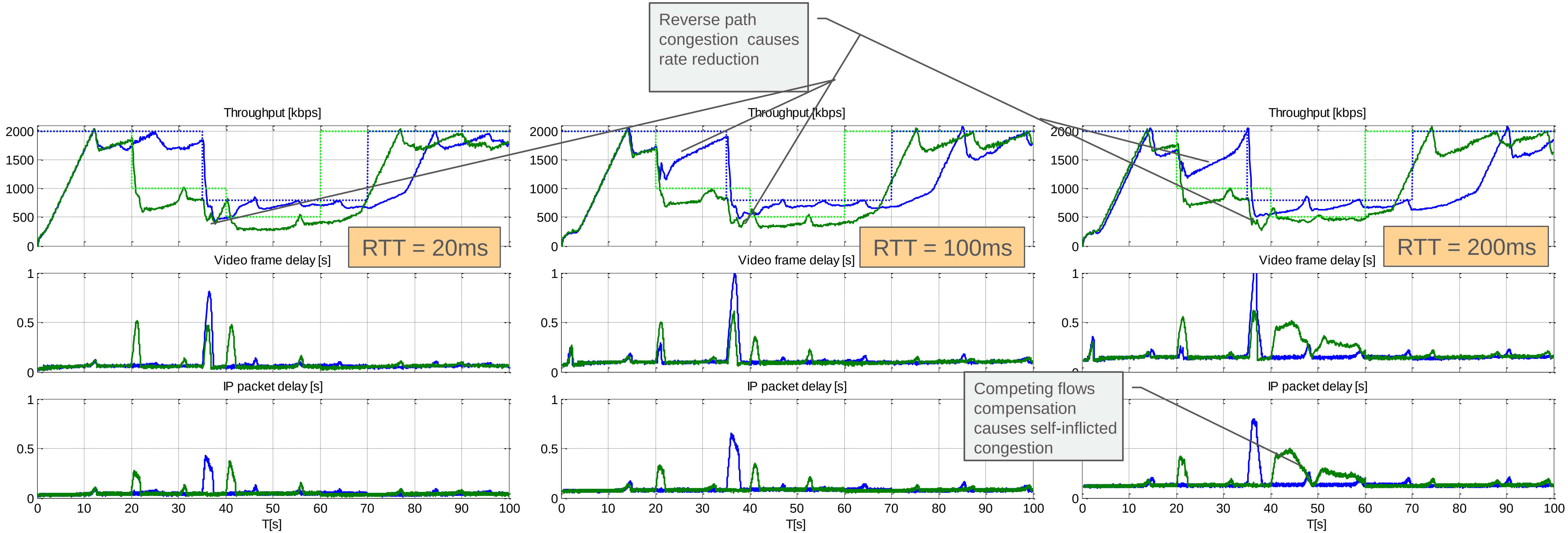
TC 5.3
CONGESTED FEEDBACK LINK WITH BI-DIRECTIONAL MEDIA FLOWS

- Some sensitivity to reverse path congestion with tail drop queue
- No sign of reverse path congestion issues with CoDel AQM

TC 5.3 5MS JITTER
TAIL-DROP 300MS

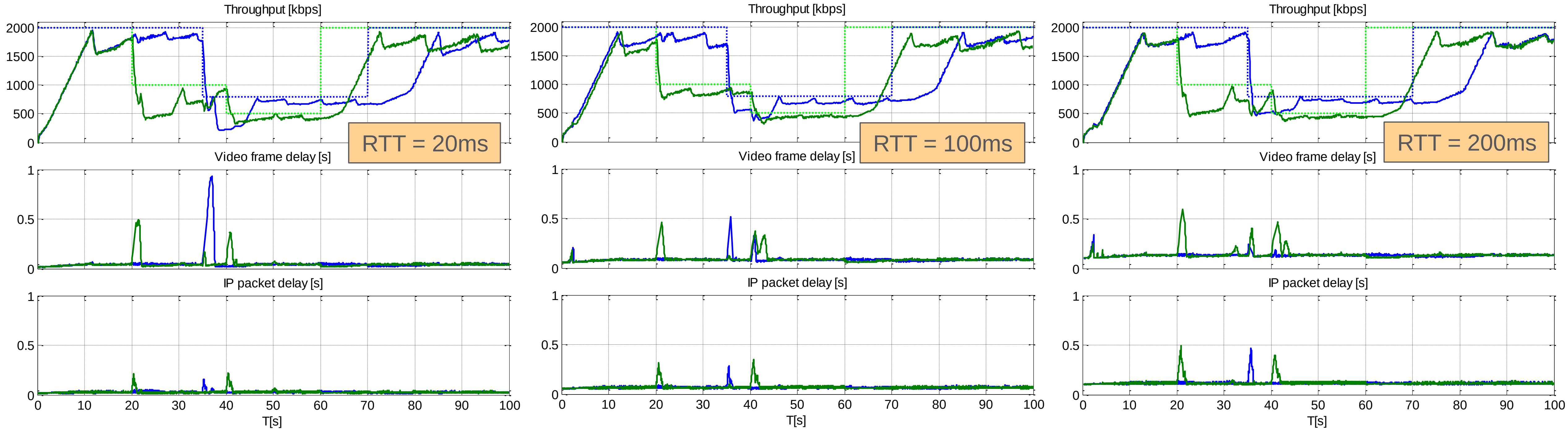


TC 5.3 30MS JITTER
TAIL-DROP 300MS

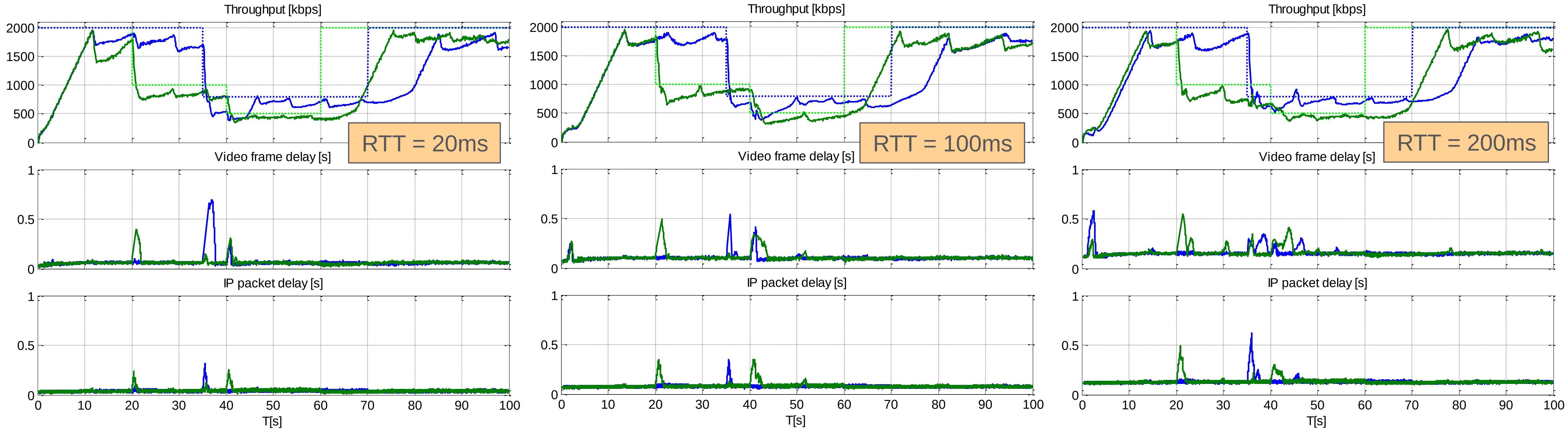


TC 5.3 5MS JITTER

CODEL



TC 5.3 30MS JITTER
CODEL

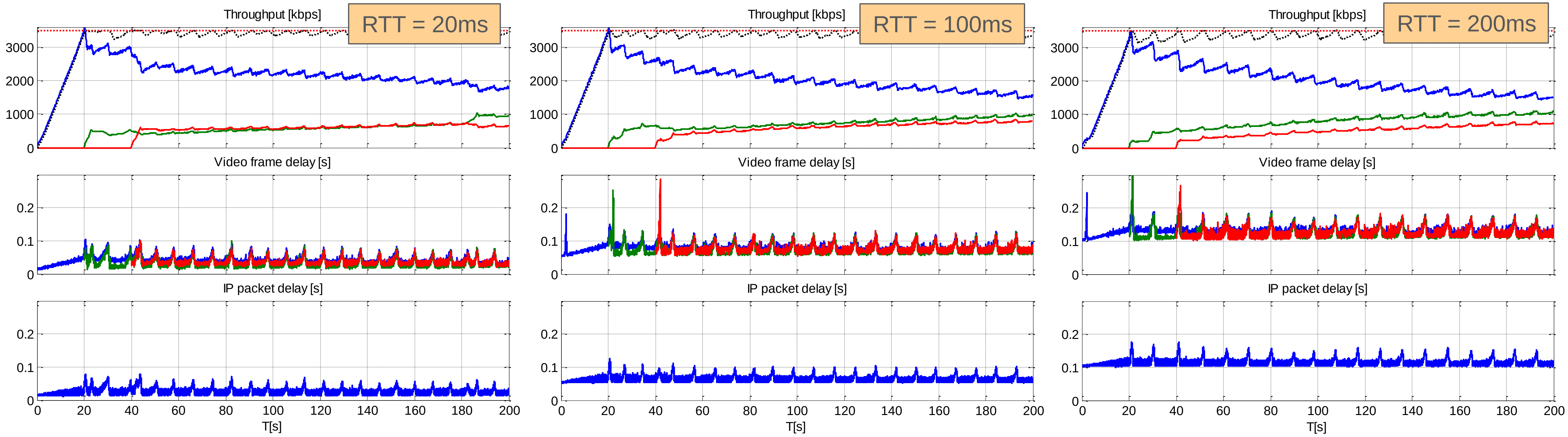


TC 5.4

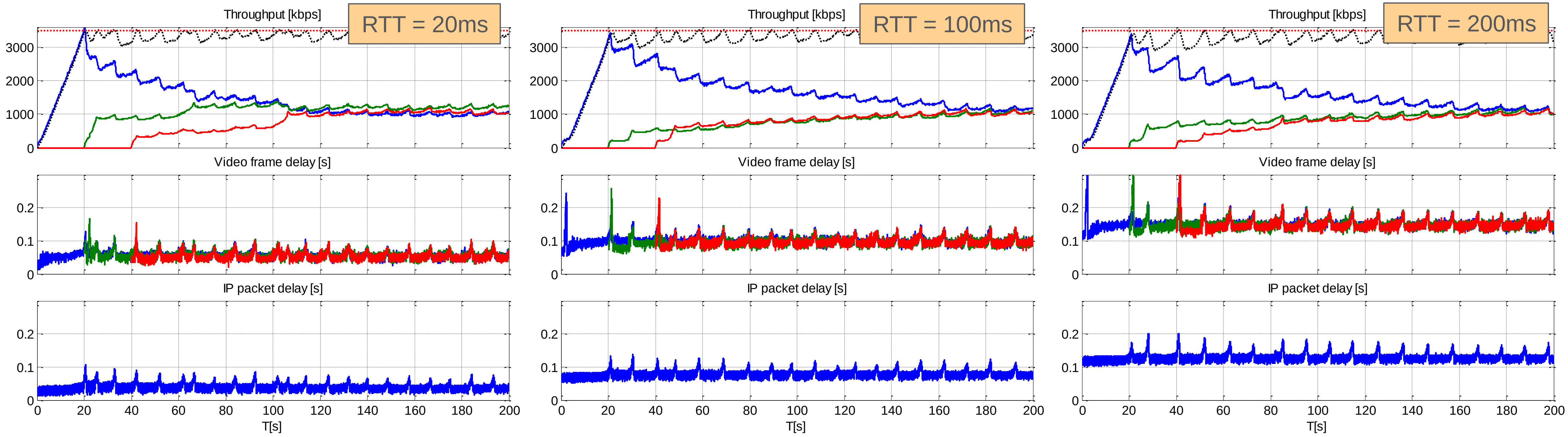
COMPETING MEDIA FLOWS WITH SAME CONGESTION CONTROL ALGORITHMS

- Flow rates converge slowly
- If video sources have the same sender/receiver address, faster convergence can be achieved with 3 SCReAM streams

TC 5.4 5MS JITTER

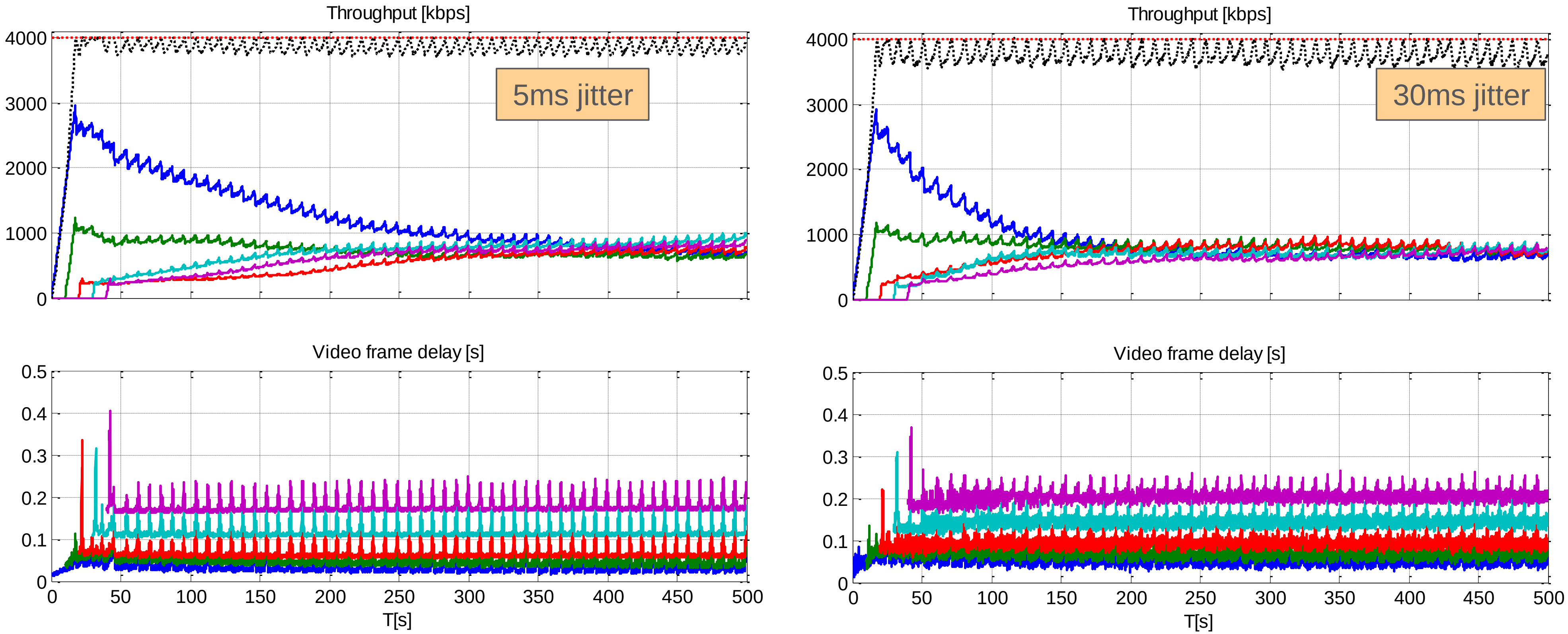


TC 5.4 30MS JITTER



TC 5.5

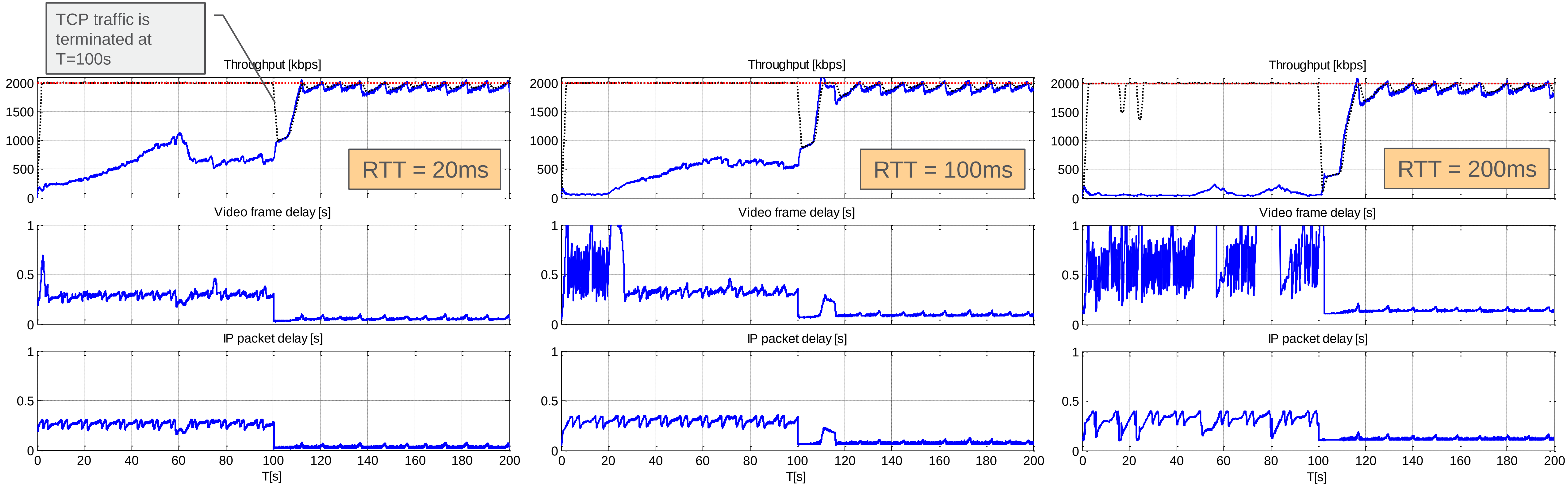
› Flow rates converge slowly



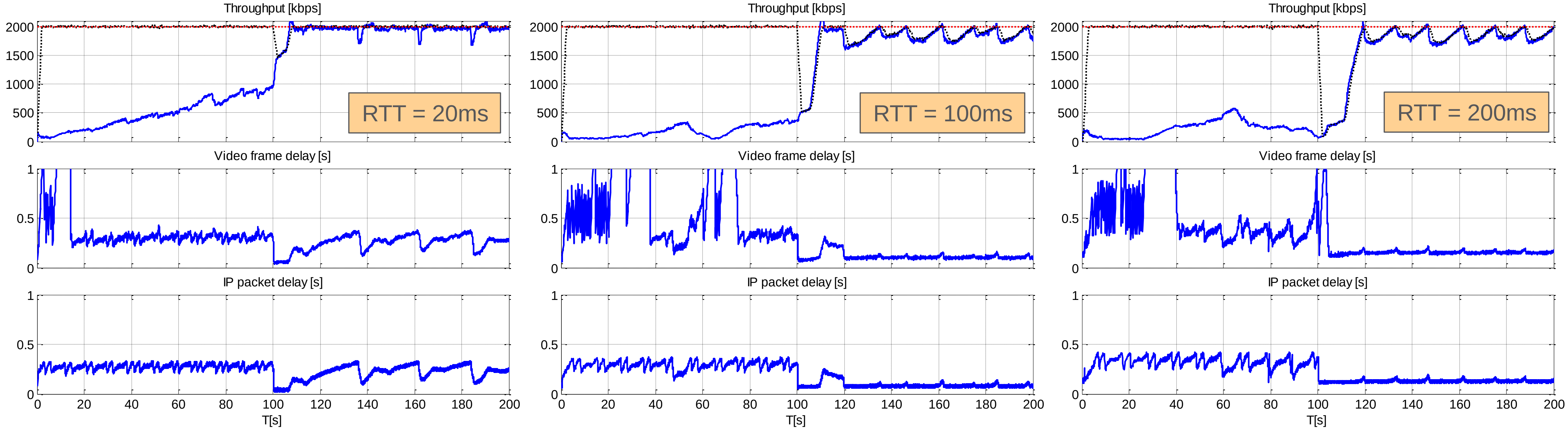
TC 5.6
MEDIA FLOW COMPETING WITH A LONG TCP FLOW

- Tail drop queues (300ms)
  - Performance is not optimal especially for tail drop and high RTT
  - Possible to improve media bitrate, however at the cost of a higher risk of self-inflicted congestion
- CoDel
  - Overall good performance
  - Media rate can be improved with a more aggressive setting
    - BETA_LOSS = 0.8 → 0.85

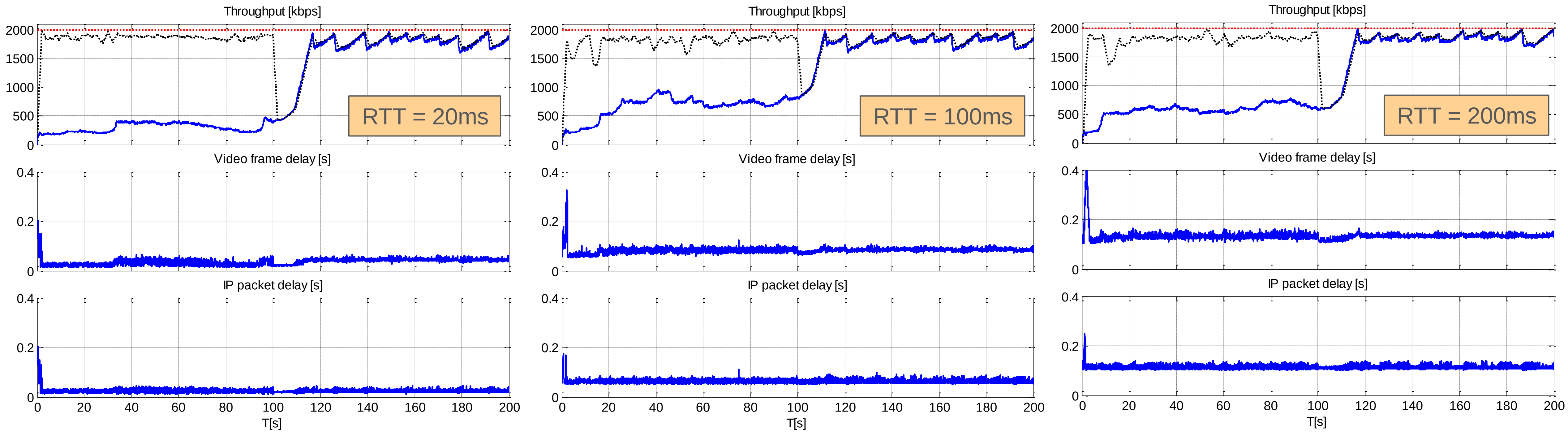
TC 5.6 5MS JITTER
TAIL-DROP 300MS



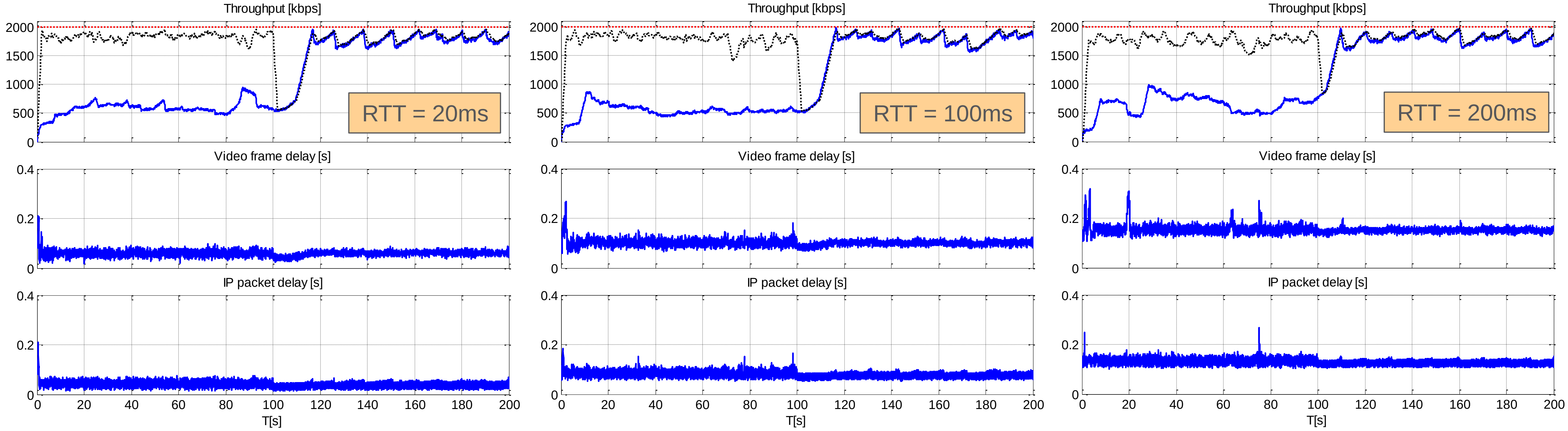
TC 5.6 30MS JITTER
TAIL-DROP 300MS



TC 5.6 5MS JITTER
CODEL



TC 5.6 30MS JITTER
CODEL



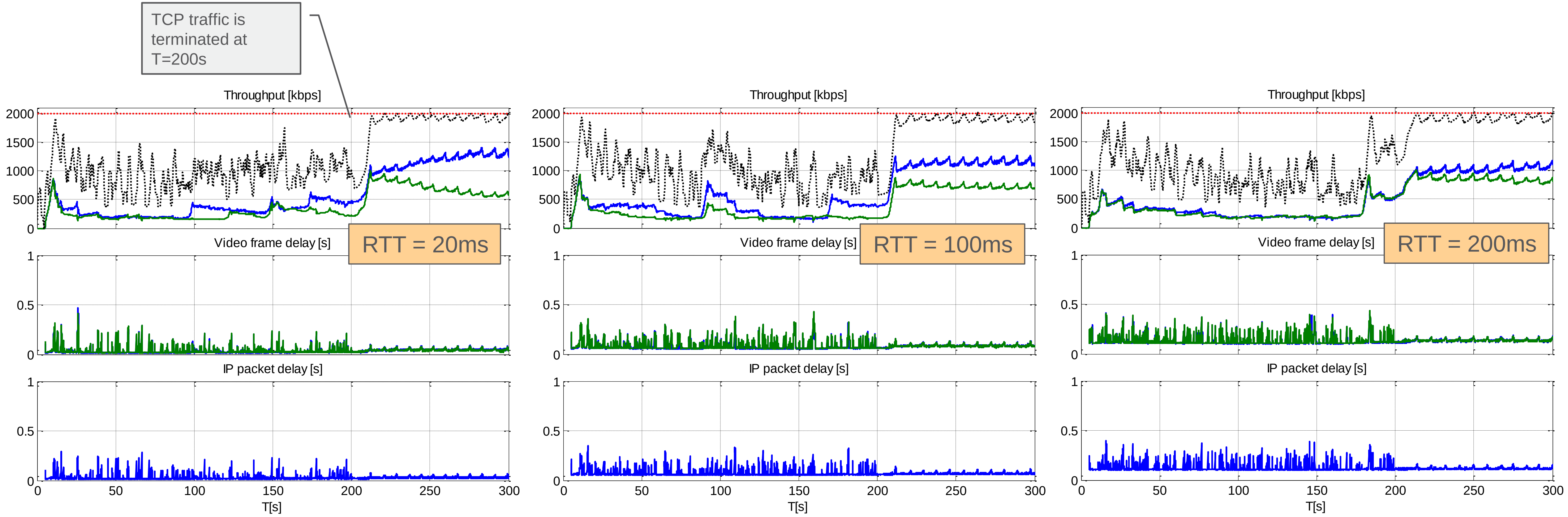
TC 5.7

MEDIA FLOW COMPETING WITH SHORT TCP FLOWS

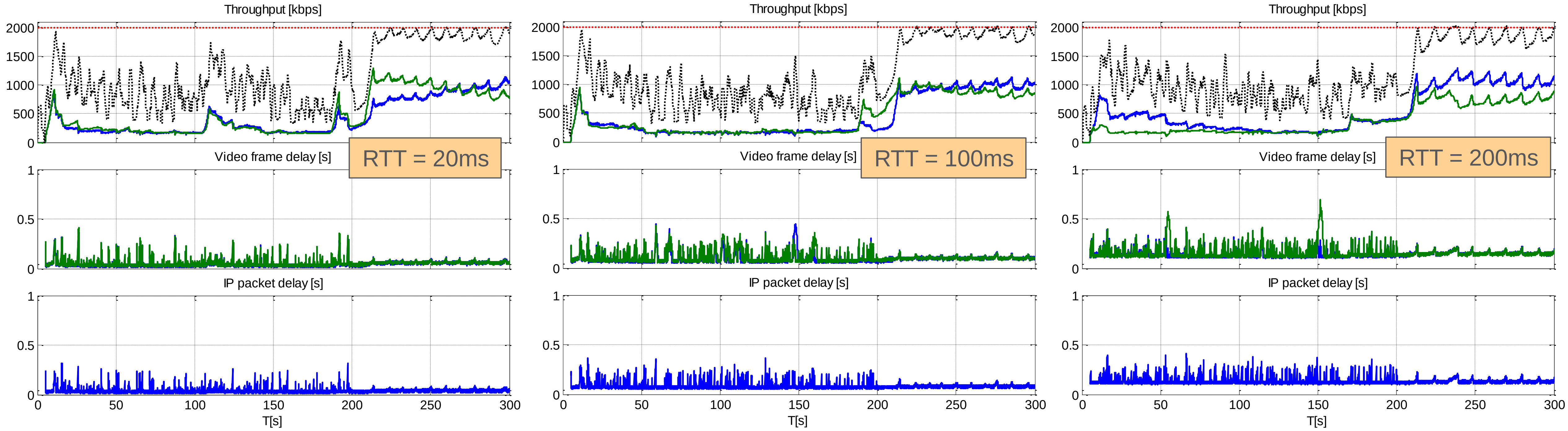
- Performance is not optimal
- Media bitrate is frequently forced down to the min value because of the delay sensitive nature of SCReAM
- Possible to improve media bitrate, however at the cost of a higher risk of self-inflicted congestion → Difficult to work around issue
- The two media streams have some problems to converge when TCP traffic is terminated

- Issues are less severe if FTP intensity is decreased (TC 5.7bis)

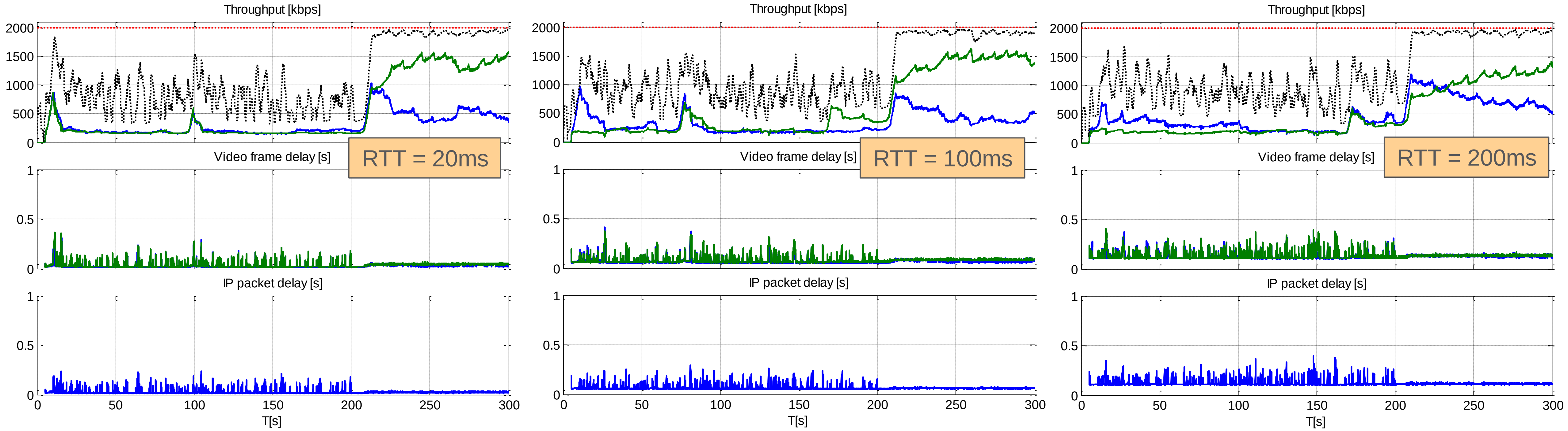
TC 5.7 5MS JITTER
TAIL-DROP 300MS



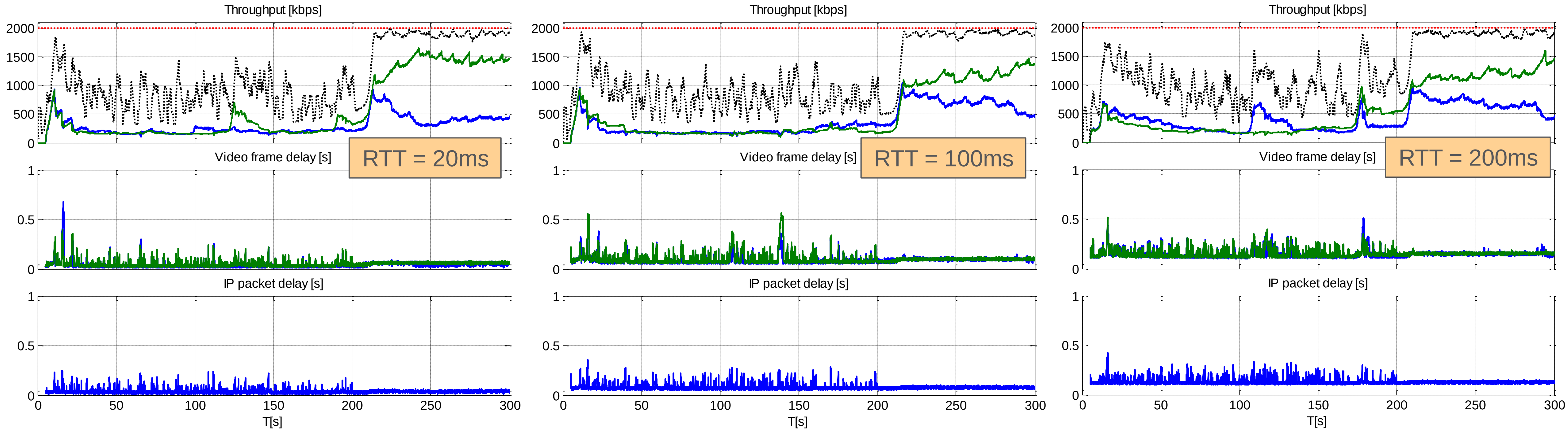
TC 5.7 30MS JITTER
TAIL-DROP 300MS



TC 5.7 5MS JITTER
CODEL

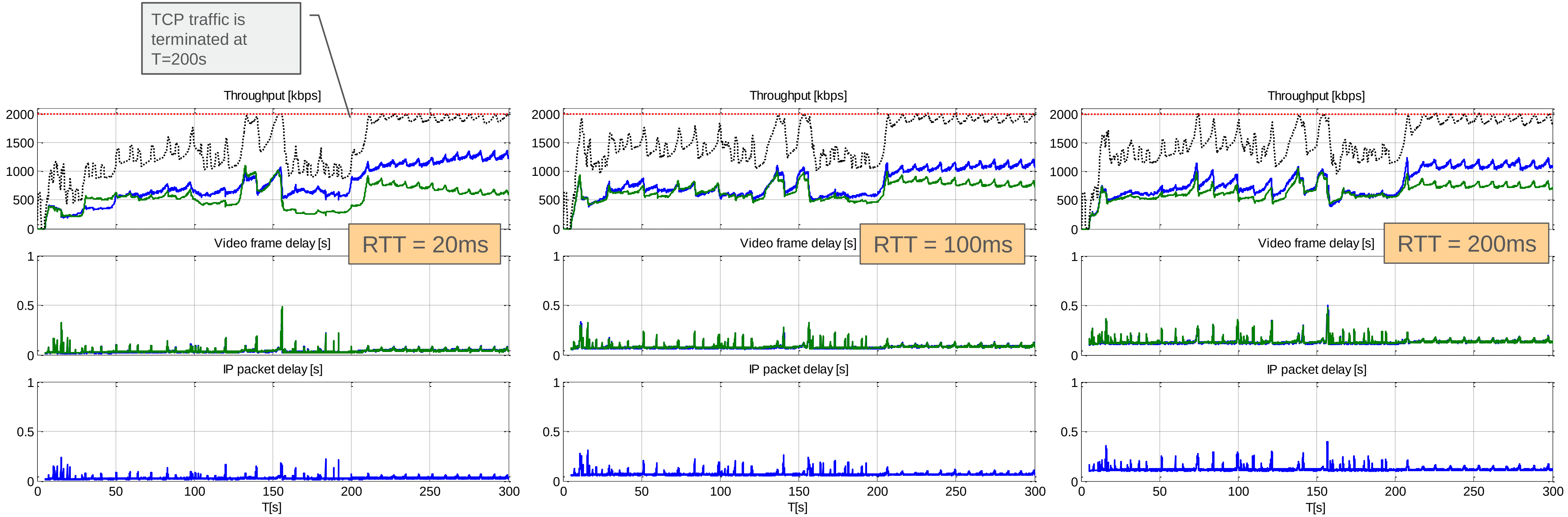


TC 5.7 30MS JITTER
CODEL



TC 5.7BIS 5MS JITTER TAIL-DROP 300MS

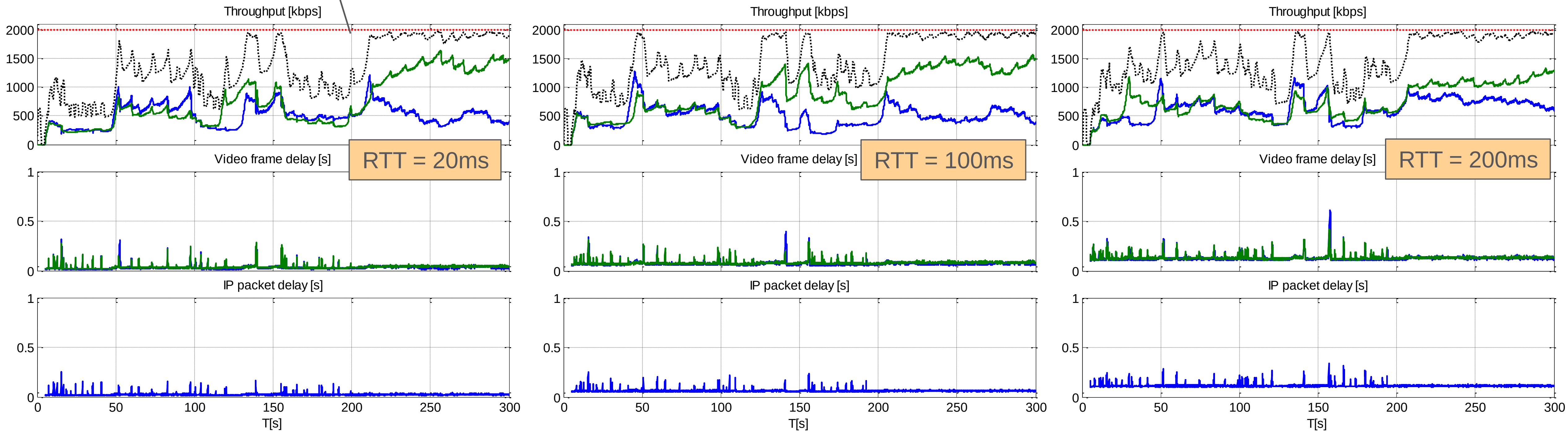
› Mean reading time increased from 10s to 50s



TC 5.7BIS 5MS JITTER CODEL

› Mean reading time increased from 10s to 50s

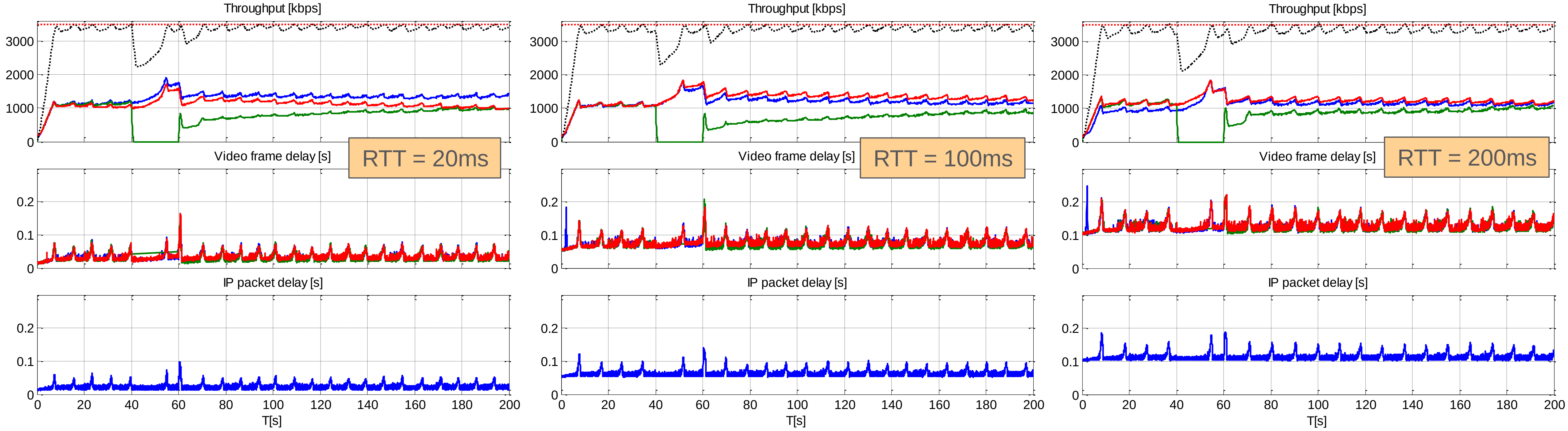
TCP traffic is terminated at T=200s



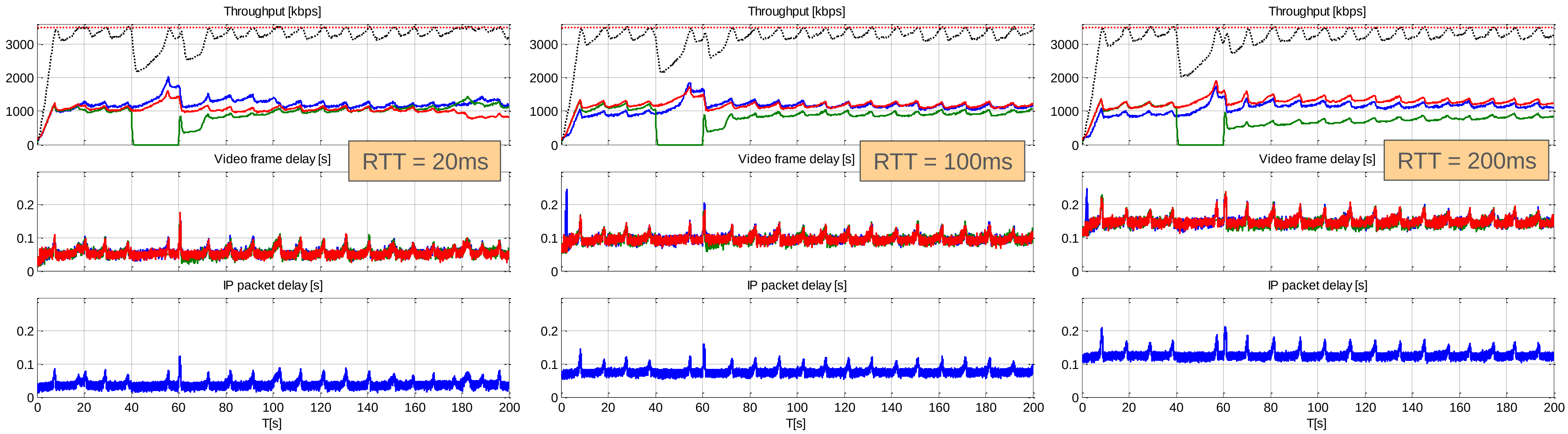
TC 5.8
MEDIA PAUSE AND RESUME

- Acceptable performance
- Media rate of paused stream picks up again and media rates converge
- If video sources have the same sender/receiver address, faster convergence can be achieved with 3 SCReAM streams

TC 5.8 5MS JITTER



TC 5.8 30MS JITTER

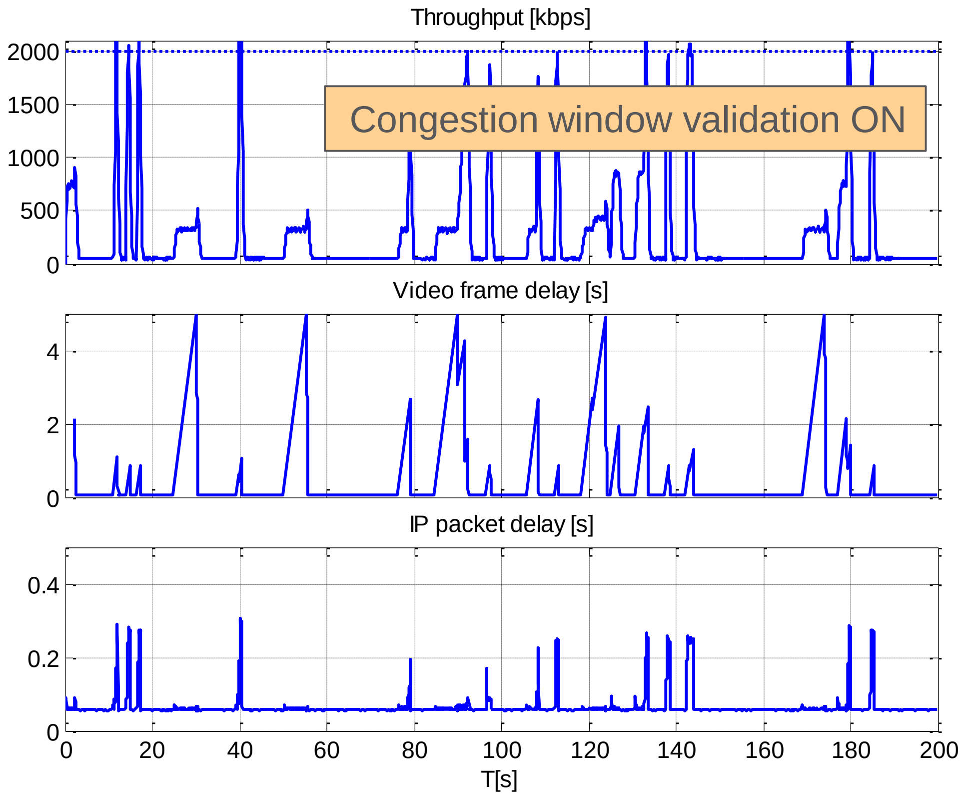


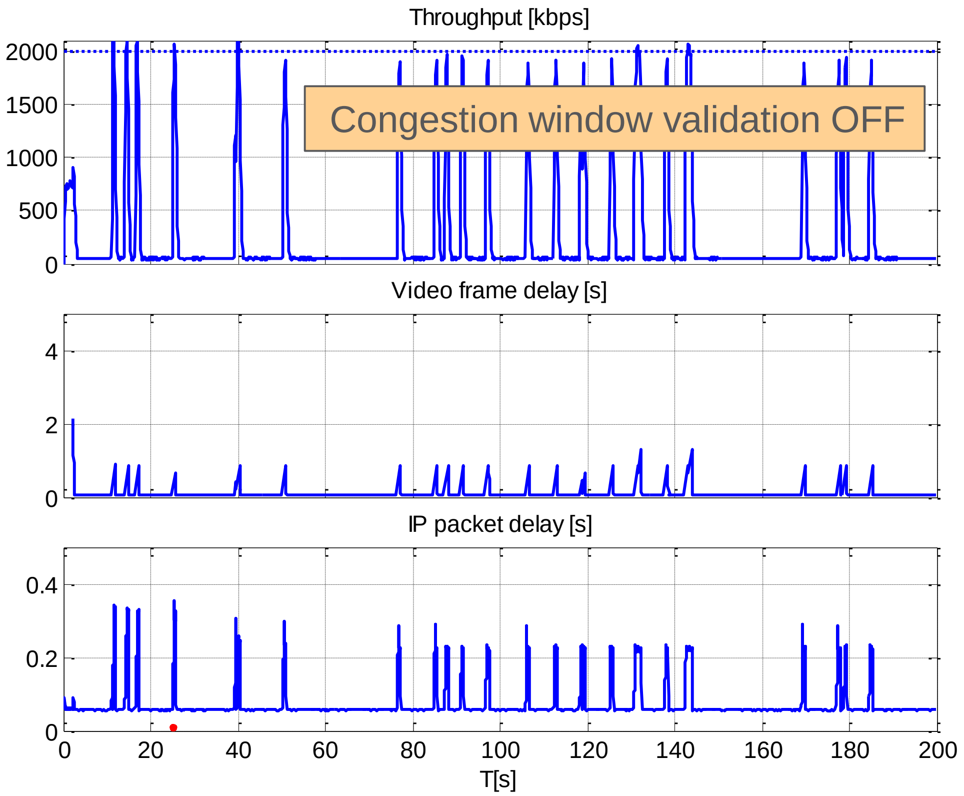
SLIDE SHOW EXAMPLE

- Max RTP queue delay (for RTP queue clear) set to 100s
- Congestion window validation on or off
- RTT_{min} = 100ms, 5ms jitter
- BW = 2Mbps
- Slideshow properties
  - No rate control enabled
  - Average rate : 209kbps
  - Max object size : 200kB
  - Frame rate : 5fps

SLIDE SHOW EXAMPLE

› It is beneficial to turn off congestion window validation for slide show content





Questions/comments?

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