SCReAM – **S**elf-**C**locked **R**at**e** **A**daptation for **M**ultimedia

draft-johansson-rmcat-scream-cc

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MAIN FEATURES

Self-clocked framework similar to TCP

Functional split between

- Network congestion control
  - Transmission scheduling according to packet conservation principle
- Media rate adaptation

Congestion control based on LEDBAT (RFC6817)

Congestion Window Validation

- For proper handling of rate limited sources.
- Inspired by TCPM's new CWV

OTHER FEATURES

Fast start : Video bitrate ramps up in ~5s.

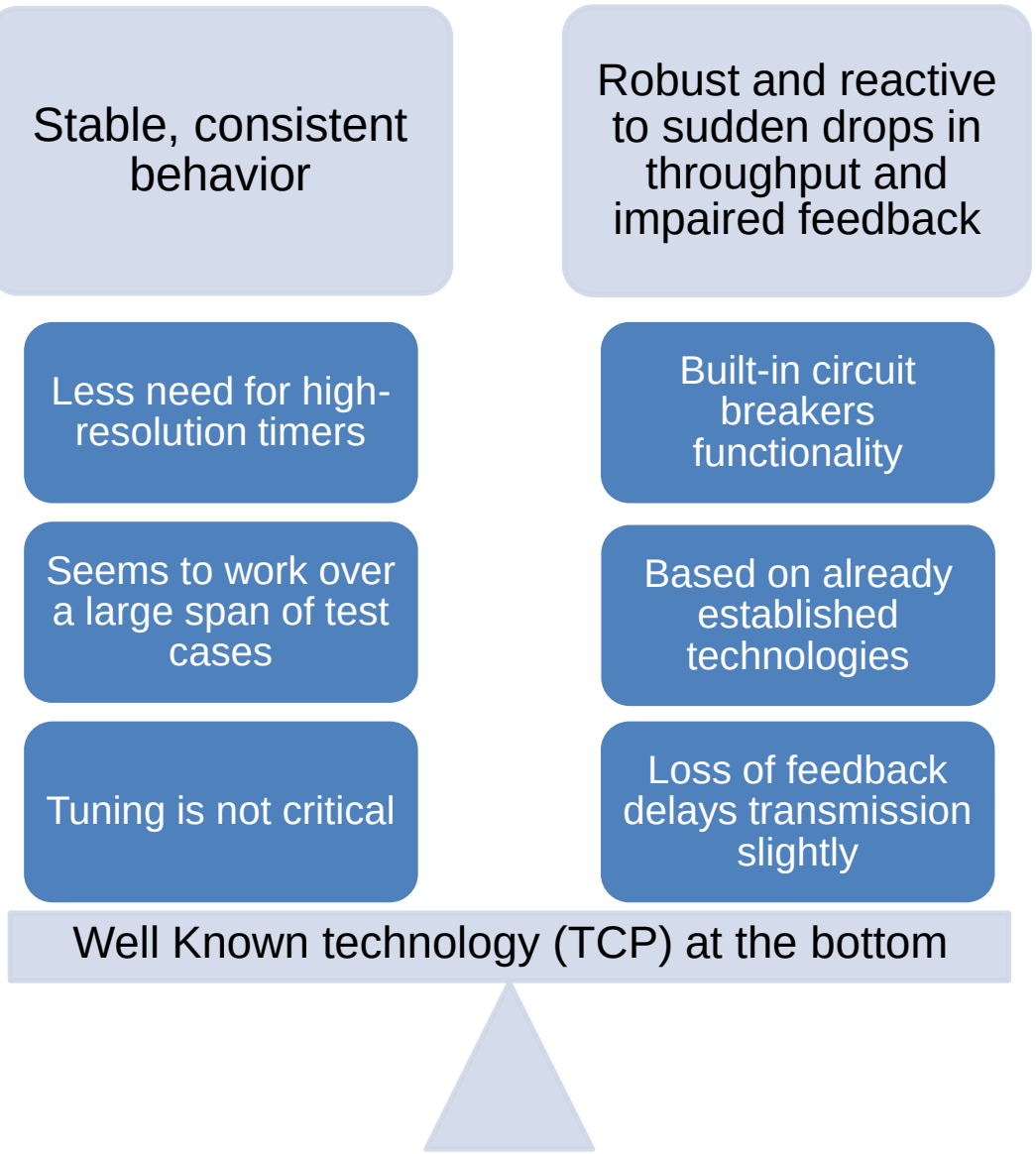
Packet pacing : Reduces jitter and packet loss, caused by coalescing (a.k.a ACK compression).

Frame skipping: Momentary fix for the mismatch between source bitrate and available channel bandwidth.

Frame blanking : Video is put on hold for a short period (~1RTT) for the purpose of

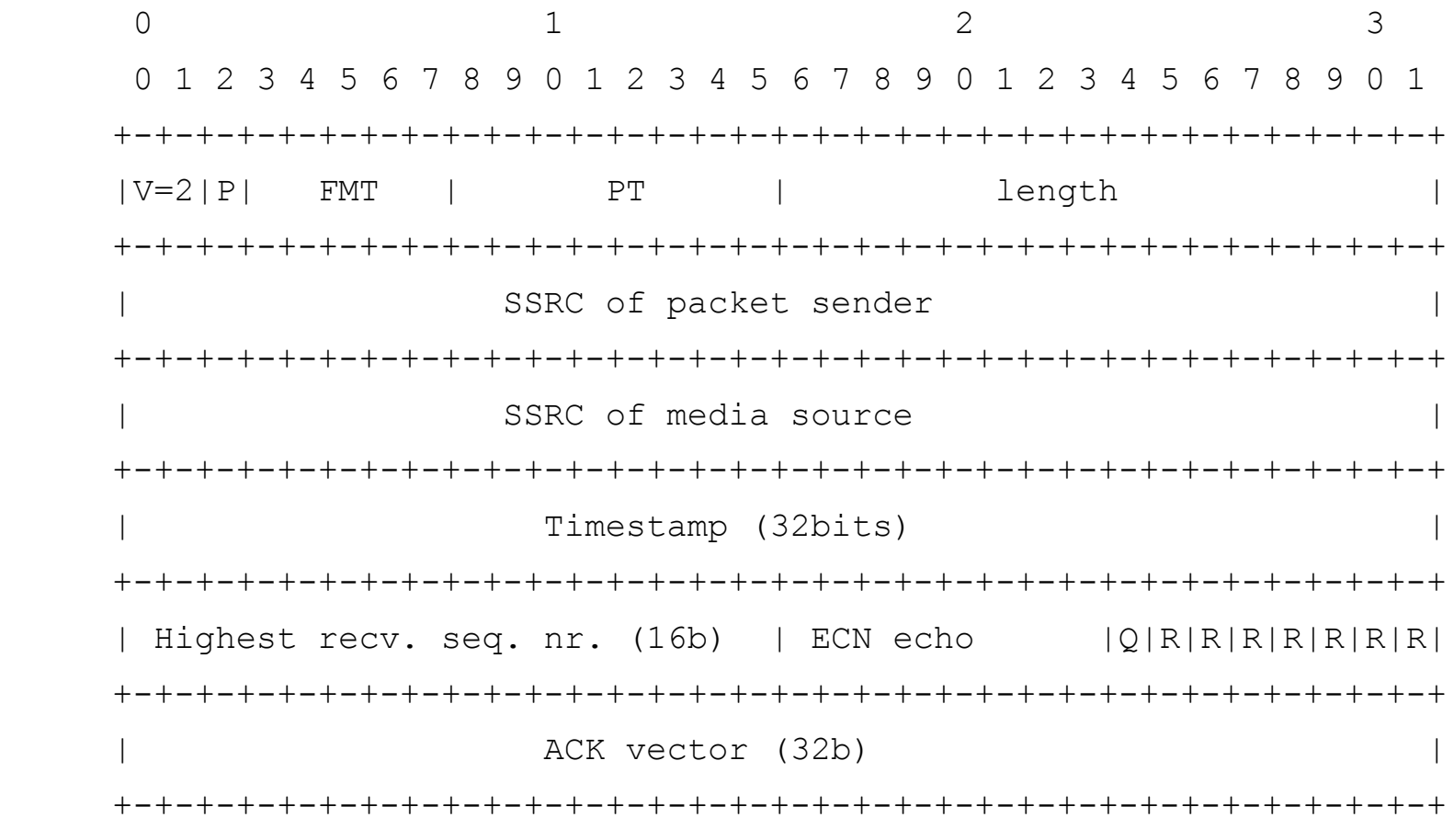
- Adjusting delay target to competing flows (specially TCP)
- Enforcing fairness between flows

WHY SELF-CLOCKING?



FEEDBACK MESSAGE

- RFC4585 Transport layer feedback message
- RFC5506 (Reduced size RTCP) is highly recommended



FUNCTIONAL OVERVIEW (SIMPLIFIED)

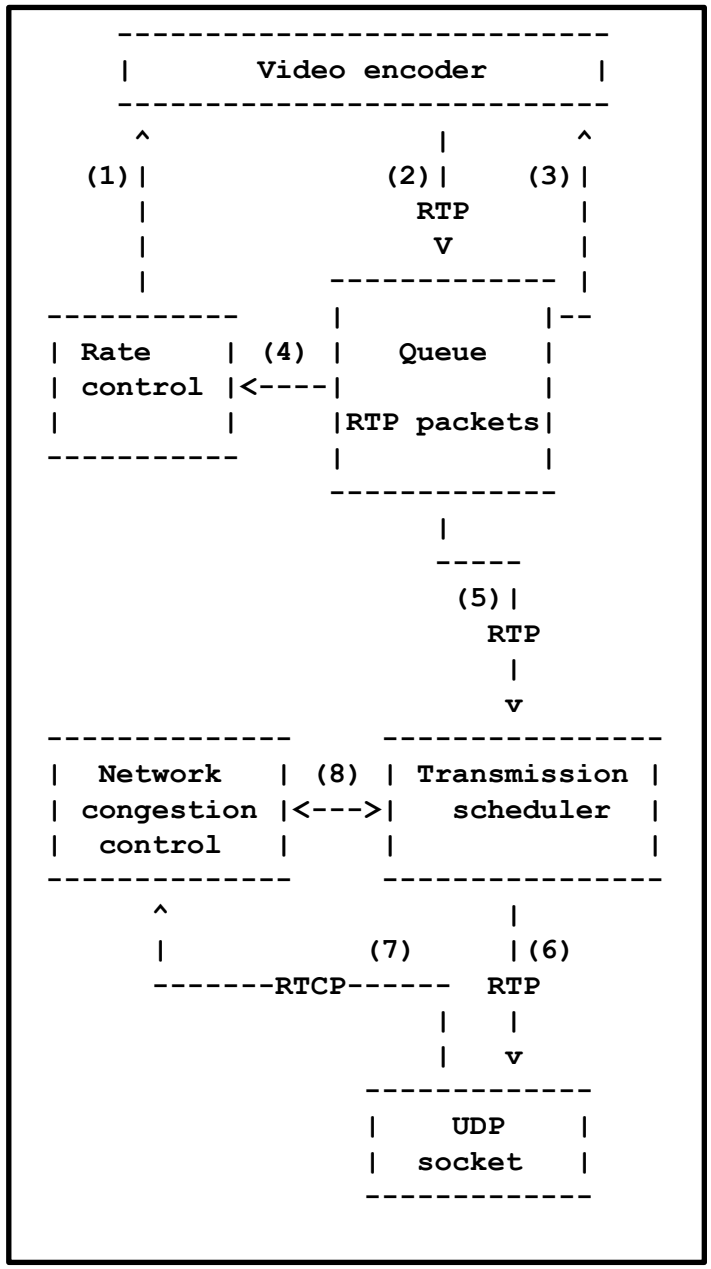
Video frames are inserted in queue (2)

Media rate adaptation inspects queue depth and adjusts video bitrate (1)

Skip frames command may be sent to video encoder if queue exceeds a threshold (3)

Encoded RTP packets are transmitted if bytes in flight < CWND (5,6)

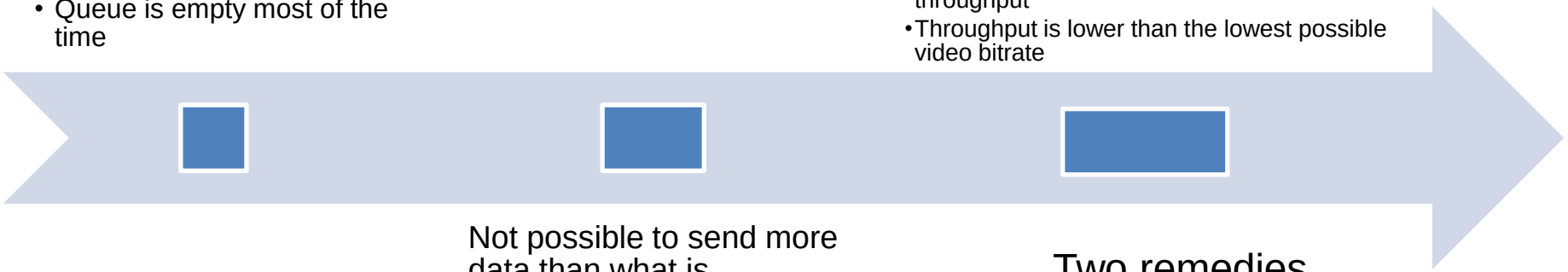
RTCP feedback packets are decoded and network congestion control is updated (7)



SENDER QUEUE HANDLING

Encoded frames (RTP packets) are temporarily stored in sender queue

- Queue is empty most of the time



Not possible to send more data than what is acknowledged

- Sender queue can grow when throughput drops
- Reduce bitrate to make queue shrink

But sender queue can still grow or grow too quickly for video rate adaptation to react properly..

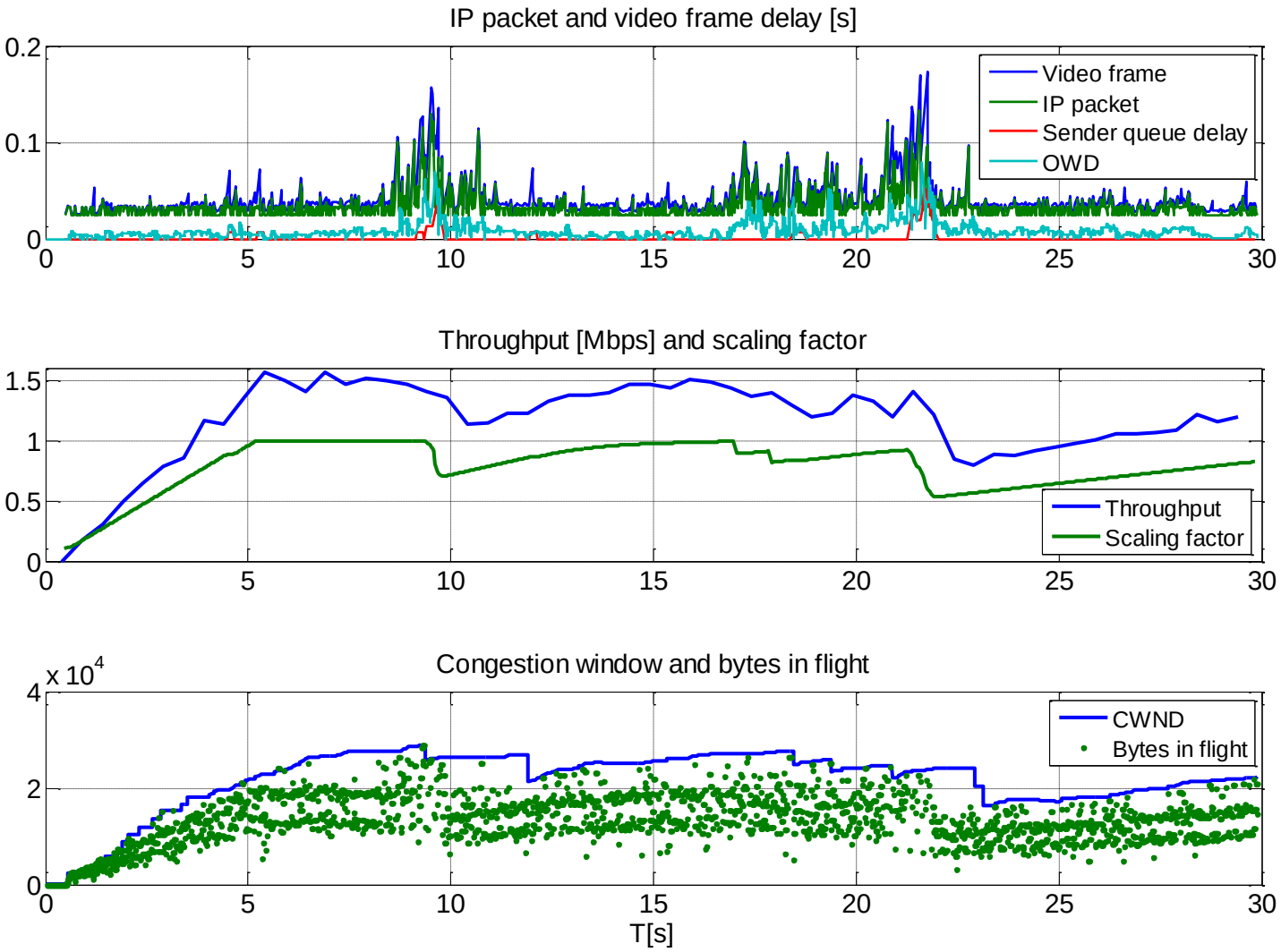
- Sudden, possibly temporary large drops in throughput
- Throughput is lower than the lowest possible video bitrate

Two remedies

- Frame skipping
  - Video encoder reduces frame rate temporarily
  - Video codec state is preserved
- Frame dropping
  - Encoded frames are dropped
  - Video codec state must be restored

EXAMPLE

› LTE DL test case, one user



CONCLUSION

Rate adaptation based on self-clocking is shown to work well in simulations.

- High throughput
- Prompt response to signs of congestion

Concept combines elements

- Self-clocking similar to TFWC for conformance to packet conservation principle
- LEDBAT congestion control
- Congestion Window Validation techniques

Framework is inherently stable against

- Feedback loss
- Sudden drops in throughput

BUZZ WORDS

- CWND : Congestion window, determines max number of bytes in flight, size depends on estimated network queuing delay and packet loss or ECN
- Bytes in flight
- OWD : One way (extra) delay. An estimate of how much the queues in the network increase