SCREAM
UPDATE
AND
TEST CASE RESULTS

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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 !
SCReAM works best with feedback every N received RTP packets
  - Keeps ACK clocking in a good mood

Constrained RTCP overhead $\rightarrow$ No more often than $T_{\text{min}}$

Avoid deadlocking to low bitrates $\rightarrow$ No more seldom than $T_{\text{max}}$

Useful values
  - $N = 5$, $T_{\text{min}} = 20\text{ms}$, $T_{\text{max}} = 200\text{ms}$
  - 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 according to draft-ietf-rmcat-eval-test-03

- Best current understanding
- TC 5.7: Size distribution changed to uniform in interval [30, 50] kB
- $\text{RTT}_{\text{min}}$: 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

- Throughput [kbps]
- Video frame delay [s]
- IP packet delay [s]

RTT = 20ms
RTT = 100ms
RTT = 200ms
TC 5.1 30MS JITTER

RTT = 20ms

RTT = 100ms

RTT = 200ms

Competing flows compensation causes self-inflicted congestion

AQM drops
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

Competing flows compensation causes self-inflicted congestion.
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

Reverse path congestion causes rate reduction in forward path

Competing flows compensation causes self-inflicted congestion
TC 5.3 30MS JITTER
TAIL-DROP 300MS

Reverse path congestion causes rate reduction

Competing flows compensation causes self-inflicted congestion
TC 5.3 5MS JITTER
CODEL

Throughput [kbps]
Video frame delay [s]
IP packet delay [s]

RTT = 20ms
RTT = 100ms
RTT = 200ms
TC 5.3 30MS JITTER
CODEL
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

Throughput [kbps]

Video frame delay [s]

IP packet delay [s]
TC 5.4 30MS JITTER

![Graphs showing Throughput, Video frame delay, and IP packet delay for different RTTs: RTT = 20ms, RTT = 100ms, RTT = 200ms.]

- Throughput [kbps]
- Video frame delay [s]
- IP packet delay [s]

- TC 5.4
- 30ms jitter
- RTT = 20ms
- RTT = 100ms
- RTT = 200ms
TC 5.5

› Flow rates converge slowly
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

TCP traffic is terminated at $T=100s$
TC 5.6 30MS JITTER TAIL-DROP 300MS
TC 5.6 5MS JITTER
Codel

RTT = 20ms

RTT = 100ms

RTT = 200ms
TC 5.6 30MS JITTER CODEL

Throughput [kbps]
Video frame delay [s]
IP packet delay [s]

0 20 40 60 80 100 120 140 160 180 200 T[s]

RTT = 20ms

RTT = 100ms

RTT = 200ms
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)
TCP traffic is terminated at $T=200s$
TC 5.7 30MS JITTER
TAIL-DROP 300MS
TC 5.7 5MS JITTER CODEL

Throughput [kbps]

Video frame delay [s]

IP packet delay [s]

RTT = 20ms

RTT = 100ms

RTT = 200ms
TC 5.7 30MS JITTER
Codel

Throughput [kbps]

Video frame delay [s]

IP packet delay [s]

RTT = 20ms

RTT = 100ms

RTT = 200ms
› Mean reading time increased from 10s to 50s
Mean reading time increased from 10s to 50s

TCP traffic is terminated at $T=200s$
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

Throughput [kbps]
Video frame delay [s]
IP packet delay [s]

RTT = 20ms
RTT = 100ms
RTT = 200ms
TC 5.8 30MS JITTER
Max RTP queue delay (for RTP queue clear) set to 100s
Congestion window validation on or off
RTT$_{\text{min}}$ = 100ms, 5ms jitter
BW = 2Mbps
Slideshow properties
  - No rate control enabled
  - Average rate : 209kbps
  - Max object size : 200kB
  - Frame rate : 5fps
It is beneficial to turn off congestion window validation for slide show content.
Questions/comments?

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