Multimedia Congestion Control: Circuit Breakers for RTP Sessions
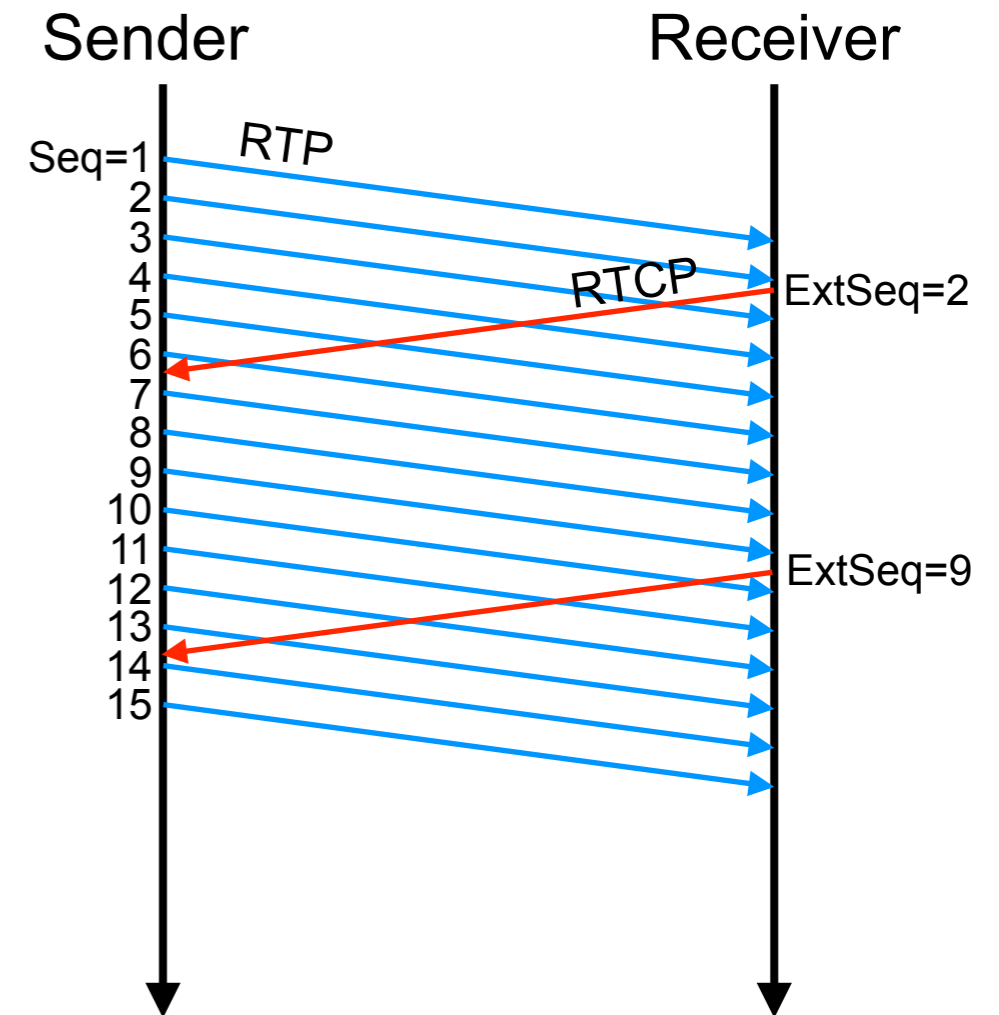
draft-ietf-avtcore-rtp-circuit-breakers-11

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Summary of Changes

- Update the media timeout and congestion circuit breakers after discussion with Magnus Westerlund – details follow

- Various clarifications based on feedback by Simon Perreault and Magnus Westerlund

Media Timeout Circuit Breaker

- Send RTP data packets, wait for returning RTCP SR/RR packets

- If the Extended Highest Sequence Number Received field in the RTCP SR/RR packets is increasing, the RTP packets are arriving

- If the Extended Highest Sequence Number Received field is non-increasing, after some reasonable time, cease transmission, since your packets are not arriving

- What is a "reasonable time", in this context (i.e., what is the media timeout interval)?

Media Timeout Circuit Breaker (-10)

- In draft-ietf-avtcore-rtp-circuit-breaker-10, media timeout interval was:

$$\min(\text{floor}(3 + 2.5/T_{dr}), 30)$$

RTCP SR/RR packets, where:

- T_{dr} is the estimated deterministic RTCP reporting interval of the receiver
  (the draft used Td, the deterministic RTCP interval at the sender, but should have used Tdr)

Td (s)	RTCP to trigger	Time to trigger (s)
0.016	30	0.48
0.033	30	0.99
0.100	28	2.80
0.500	8	4.00
1.000	5	5.00
2.000	4	8.00
5.000	3	15.00
10.000	3	30.00

- Problematic if Tdr is small, and less than one RTP packet is sent per RTCP reporting interval – small amounts of loss could cause erroneous timeout

- Problematic if Tdr is less than the RTT – reports start being returned before data could have been received

Media Timeout Circuit Breaker (-11)

- In draft-ietf-avtcore-rtp-circuit-breaker-11, media timeout interval changed to:

  $$\text{ceil}(5 * \max(Tf, Tr, Tdr) / Tdr)$$

  RTCP SR/RR packets, where:

  - Tdr is the estimated deterministic RTCP reporting interval of the receiver
  - Tr is the RTT
  - Tf is the media framing interval – approximation to inter-RTP packet interval

- When RTCP interval is larger than inter-RTP packet interval and RTT, media timeout after 5 RTCP reports showing non-increasing sequence number
- Otherwise, scale media timeout to compensate:

  - e.g., if RTCP interval = 0.5 seconds, Tf = 1.0 seconds, Tr < 1.0 seconds, media timeout will be 10 RTCP reports (where every other report should show receipt of an RTP packet)

Congestion Circuit Breaker

- Aim: to stop flows that cause persistent congestion

- When sending > minimum rate:

    - Estimate the rate a TCP connection would achieve over the path used by the RTP flow, based on RTCP reports over some measurement interval

    - If RTP sending rate > 10x estimated TCP rate, then cease transmission, since network is being congested

- What should be the minimum rate?

- What should be the measurement interval?

Congestion Circuit Breaker (-10)

- ## In draft-ietf-avtcore-rtp-circuit-breaker-10,

  - Minimum rate was 1 packet per RTT

  - Measurement interval was min(floor(3 + 2.5/Tdr), 30) – same as was used for the media timeout

- ## Problems:

  - When RTCP interval > RTT, minimum rate of 1 packet per RTT can allow many packets before receiving congestion feedback

  - Measurement interval has the same problem as for media timeout circuit breaker

Congestion Circuit Breaker (-11)

- ## In draft-ietf-avtcore-rtp-circuit-breaker-11,

  - Minimum rate is 1 packet per max(Tdr, Tr)

  - If RTCP interval > RTT, need to use the congestion circuit breaker if sending more than one packet per RTCP reporting interval

  - Otherwise, limit to one packet per RTT, to match TCP minimum rate

Congestion Circuit Breaker (-11)

- ## In draft-ietf-avtcore-rtp-circuit-breaker-11,

  - Minimum rate is 1 packet per max(Tdr, Tr)

  - Measurement interval is:

    ceil(3*min(max(10*G*Tf, 10*Tr, 3*Tdr), max(15, 3*Td))/(3*Tdr))

    where G is the GoP size for the codec (G=1 if frames are independent)

  - This gives the congestion controller at least ten GoPs, ten RTTs, and three RTCP reporting intervals to adapt (capped at a maximum of 15 seconds)

  - Congestion control expected to adapt within a small number of frames

Status and Next Steps

- New circuit breakers are a little more complex, but address limitations of the previous algorithms

- The draft should hopefully also be easier to read

- However, new mechanisms not yet well tested

- Consider a long working group last call, to allow time for implementation and validation?