

RTCP feedback for Congestion Control

RMCAT design team

IETF96, Berlin

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Agenda

- Recap on feedback requirements
- Design team activities
- Required feedback information
- Design rationale
- Feedback frequency and overhead
- Proposed wire format
- Open issues and discussions
- Way forward

Feedback Requirements – Summary

| Algorithm | Feedback | |
|--------------|--|---------------------------------|
| NADA | Recommended rate adaptation mode (rmode) | } Could be calculated from info |
| NADA | Aggregated congestion signal (x_curr) | |
| NADA | Recently measured receiving rate (r_recv) | |
| GCC | Packet identifier → Packet loss | |
| GCC | Packet arrival time | } arrival time |
| SCReAM | Arrival timestamp of highest received RTP sequence number | |
| SCReAM | List of received RTP packets → Packet loss | |
| SCReAM | ECN counter (optional) | |
| SCReAM | Source quench bit (optional) | |
| SBD (S1) | OWD measurements for every packet → Or packet send and arrival time? | |
| SBD (S2, S3) | Summary statistics, initialization of summary statistics to be collected | |
| SBD (S3) | Bottleneck determinations | |

Feedback Interval – Summary

- Tradeoff between overhead and responsiveness

| Algorithm | Indicated Range | Recommended / used |
|-----------|---|--------------------|
| NADA | 20 ms – 400 ms | 100 ms |
| GCC | 50 ms – 100 ms | 50 ms |
| SCReAM | 100-200 ms (low bitrates) 10-20 ms (high bitrates) | |
| SBD | | 350 ms |

Design Team (DT) activities

- 3 meetings since IETF95
 - 2 meetings with large attendance
 - 1 meeting with small attendance
- Meeting attendees :
 - Michael Ramalho, Xiaoqing Zhu, Stefan Holmer, David Hayes, Ingemar Johansson, Randell Jesup, Varun Singh, Colin Perkins, Zaheduzzaman Sarker.
- The DT produced a draft with the outcome from meetings
 - <https://www.ietf.org/internet-drafts/draft-dt-rmcat-feedback-message-00.txt>

Design Team Goal

"The RTP Media Congestion Avoidance Techniques (RMCAT) Working Group formed a design team to analyze feedback requirements from various congestion control algorithms and to design a generic feedback message to help ensure interoperability across those algorithms. The feedback message is designed for a sender-based congestion control, which means the receiver of the media will send necessary feedback to the sender of the media to perform the congestion control at the sender."

Required feedback information

- Packet level information block
 - **Packet Identifier** - RTP sequence number.
 - **Packet Arrival Time** - Arrival time stamp at the receiver of the media.
 - **Packet ECN marking** - If ECN [RFC3168] is used, it is necessary to report on the 2-bit ECN mark in received packets, indicating for each packet whether it is marked not-ECT, ECT(0), ECT(1), or ECN-CE.
 - The feedback messages can have one or more of the above information blocks.
- For RTCP based feedback message the packet information block will be grouped by Synchronization Source (SSRC) identifier.
- It needs a new signaling format for sender based congestion control.
 - As RTCP XR block when reported with RTCP SR/RR
 - As RTCP/AVPF feedback message when reported more frequently than regular RTCP report.

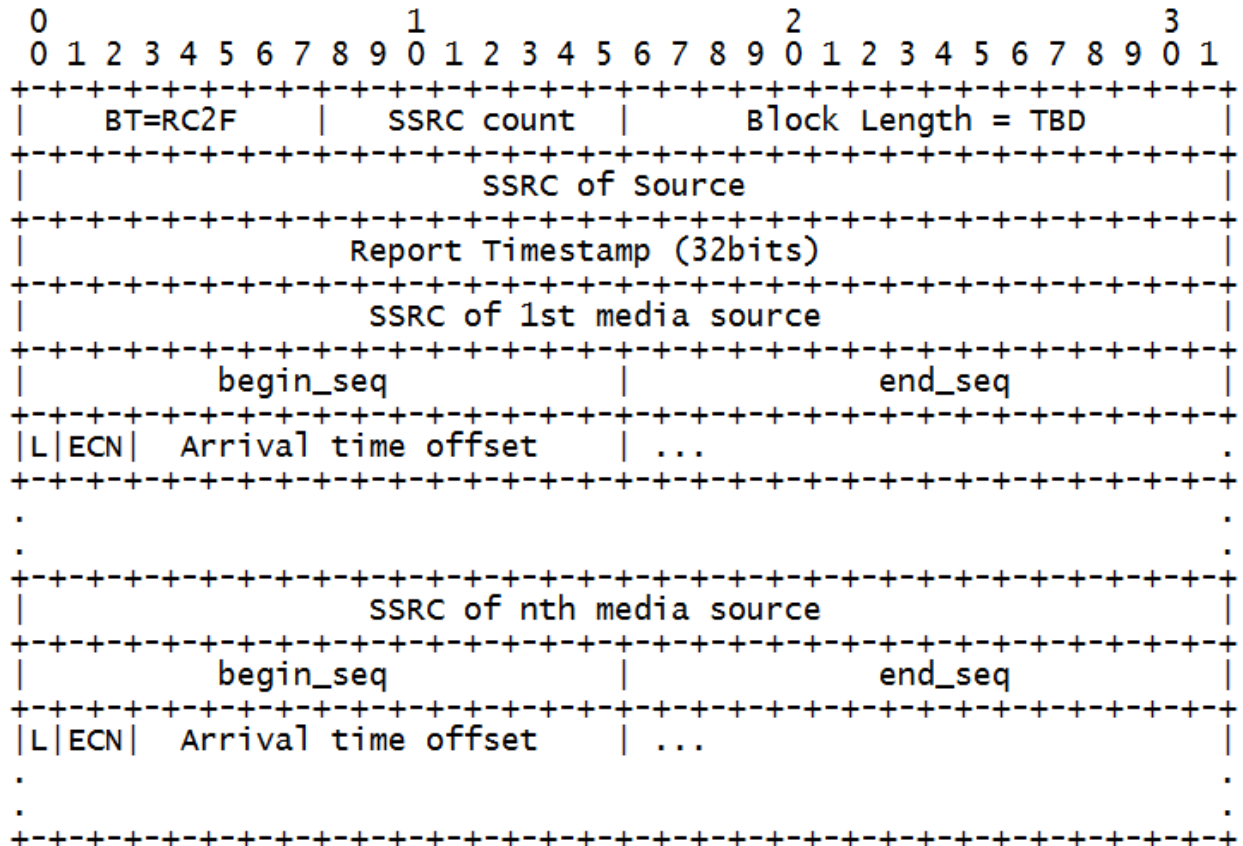
Design rationale

- **RTCP RR/SR** – needs more information than reported in the RTCP Receiver Report (RR) / Sender Report(SR) as deigned in RFC3550.
- **TMMBR/TMMBN** – TMMBR as defined in RFC5104 not useful for a sender based congestion control algorithm.
- **Existing RTCP XR blocks** – RTCP eXtended Report (XR) blocks has been defined for reporting delay, loss, aggregated ECN marking and 32-bit packet reception timing.
 - Unnecessary header
 - Duplicate information
 - it will be easier to design a new XR block to report the information required than taking part of information from different XR blocks.

Feedback Frequency and Overhead

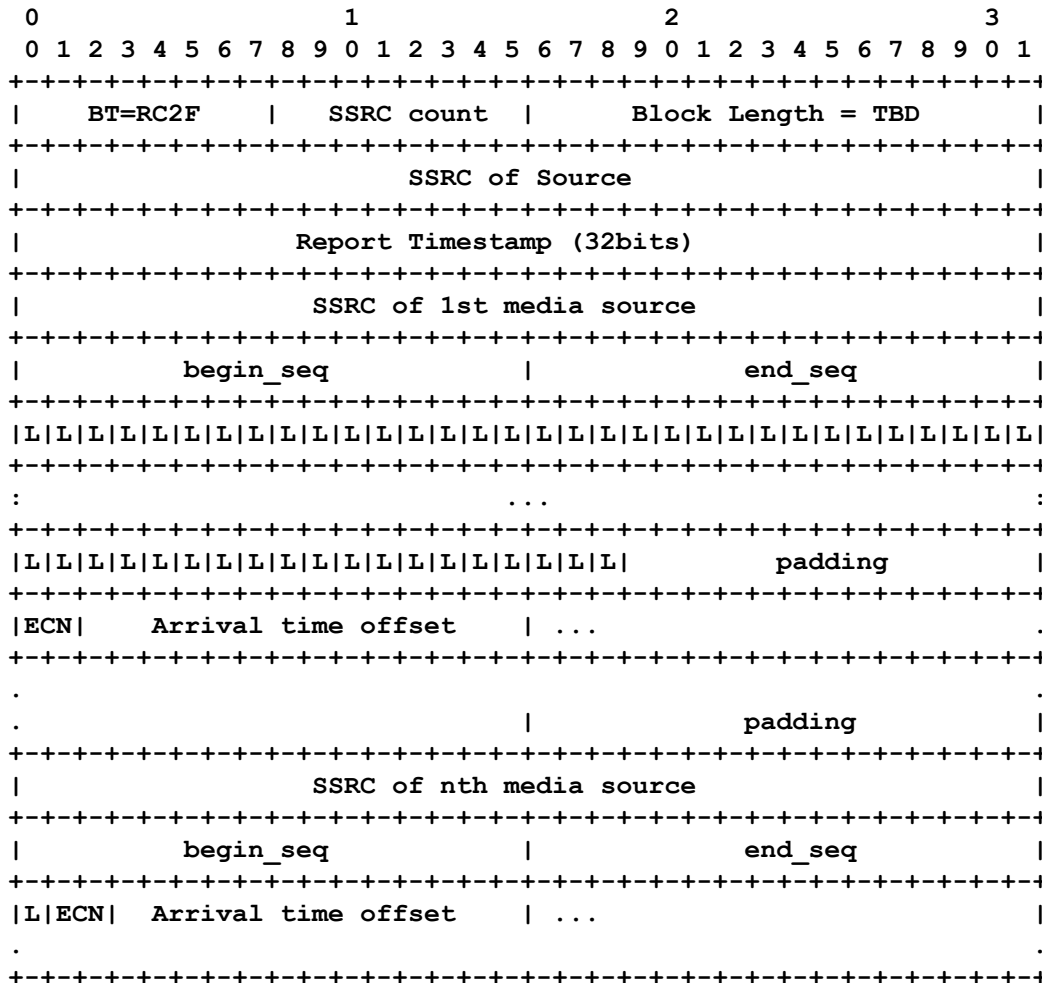
- It is a general understanding that the congestion control algorithms will work better with more frequent feedback
 - RTCP bandwidth puts a limit on how often these can be sent
 - Per-frame feedback is a reasonable assumption
 - Feedback message transmission should not compete with media traffic
- Candidate algorithms can work with a range of feedback (50-200 ms) intervals.
- Higher media rate may require higher feedback frequency.
- A feedback interval can be derived from parameters in session setup: media and RTCP bandwidth, T_{rr_int} , etc.

Feedback format – version 1



13 bit timestamp
 100us resolution gives
 0.8s reporting interval

Feedback format – version 2



14 bit timestamp
 100us resolution gives
 1.6s reporting interval

Expectation from CC proposals

- Each CC should have an implementation guidance section for using the feedback report
 - How often is the feedback generated (per frame, per rtt, per N frames, etc)
 - Should define how the feedback rate is calculated from the RTCP bandwidth?
 - What is the expected or operating range of the feedback rate?

Open issues

- Report timestamps : what clock to use?
- What happens when odd number of packets are reported?
- Security considerations.

Way forward

- Agree on the packet wire format.
- Update the draft and take the discussions in AVTEXT WG.
- Continue the design team?