ECN for RTP over UDP/IP

draft-westerlund-avt-ecn-for-rtp-02.txt

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Overview of Proposal

• Discusses how ECN can be used with RTP sessions running over UDP/IP
  – Negotiation of ECN capability
  – Initiation of ECN use within an RTP session
  – Ongoing use of ECN
  – Detecting failures and receiver misbehaviour
Changes since last meeting

• Merged with draft-carlberg-avt-rtp-ecn-02.txt and draft-carlberg-avt-rtcp-xr-ecn-01.txt
• Added leap-of-faith initiation
• Made use of ECN nonce optional
• Updated signalling, RTCP packet formats
  – Receiver preference for sender ECT: 0, 1, or random
    • Recommend random, but allow non-random to avoid disrupting header compression, especially in controlled environments
    • Sender can still ignore preference to use random
  – Negotiate capability to read or set ECN bits independently for each session participant
• Editorial cleanup
Initiation of ECN Usage

• Three options
  – Probe using RTP data, use RTCP for feedback
    • Requires 3 RTCP reporting intervals with ECT marks received and stable receiver population before transition to full ECT
  – Probe using STUN request, feedback on STUN response
    • One additional RTT to verify ECN-support once candidate chosen
    • Only suitable for sessions using ICE for NAT traversal
  – Leap-of-faith: send RTP with ECT, report failure via RTCP
    • Assumes ECN-capable path; suitable for controlled network only
Initiation of ECN Usage

- STUN/ICE ideal, except not all sessions use ICE
- RTP/RTCP works for all sessions, but slow
- Leap of faith fast, potentially serious failure modes (ECN on non-ECN capable path -> total media loss)

Acceptable trade-off?
Ongoing use of ECN with RTP

• RTCP reporting and feedback
  – Regular RTCP reports to monitor continuous operation
  – Use RTP/AVPF with minimal reports for CE events
  – Optional ECN nonce + RLE of lost/marked packets in regular reports

• Congestion response
  – Sender driven, e.g. TFRC
  – Receiver driven, e.g. layered coding

• Detecting failure
  – Misbehaving receivers or middle-boxes
  – Path changes and/or mobility
  – Group membership changes

Continually monitor ECN operation and fallback to non-ECN mode if necessary
Rapid RTCP ECN-CE feedback

Sent in RTCP AVPF NACK to indicate CE-mark received; generally rapid feedback

Extended highest sequence number start value unpredictable

Counters are cumulative and start at zero
- provides some robustness to loss of feedback
- duplicates included in the count
Regular RTCP-based Feedback

Sent in regularly scheduled compound RTCP packet, with RTCP SR/RR ->O(seconds) reporting interval

Same statistics as rapid feedback report, when combined with SR/RR Provides robustness against lost reports
Handling duplication of RTP packets

• The counters have an issue with packet duplication
  – Each received packet will be counted by receiver => receiver will have counters where sum over them is larger than number sent
  – Duplicate packets may arrive with different markings, for example as ECN-CE and as ECT
  – This creates uncertainty in verification process
    • If number of duplicates are larger than re-marked packets it may not be detected.
    • Sender needs more advanced logic to determine issues
  – Tracking duplication requires substantial receiver state
    • Not done in regular RTCP Receiver reports
Transport of ECN nonce in RTCP

<table>
<thead>
<tr>
<th>BT</th>
<th>R</th>
<th>R</th>
<th>R</th>
<th>INV</th>
<th>RNV</th>
<th>Block Length</th>
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<tbody>
<tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Begin_seq</td>
<td>End_seq</td>
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</tr>
<tr>
<td>chunk 1</td>
<td>chunk 2</td>
<td></td>
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</table>

2-bit Nonce XOR sum; chunks run-length encoded list of lost/CE-marked packets

Use of ECN nonce is OPTIONAL, to detect cheating receivers – regular reports allow detection of non-ECN-capable middle-boxes
Other Issues

• Consider initiation optimizations to allow for multi-SSRC sender nodes to have rapid usage of ECN

• Feedback suppression for ECN-CE reports, both for groups, and in case an additional CE mark arrives within an RTT at the receiver
Actions and Future Directions

• Hope to charter as an AVT work item, with parallel review and last call in TSVWG
  – This draft will continue to focus on how to signal and convey ECN for use with RTP sessions over UDP/IP
  – Detailed congestion response for real-time traffic will not be specified in this draft
    • System must respond to ECN-CE marks in the same way it responds to packet loss (there are a range of solutions)