ECN in QUIC - Update

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Relevant drafts:
draft-ietf-quic-transport-16
draft-ietf-quic-recovery-16
ECN in QUIC Overview

- Packets with ECT or ECN-CE marks acknowledged in ACK Frame with ECN Section
- Counters for the markings types
- Immediate ACK on ECN-CE mark
- Per direction verification of ECT
  - At Start of Connection
  - At Connection Migration
  - Not-ECT will result in ACK frame
- Continuous Verification
- ECN Blackhole Mitigation
  - Optional: Retransmission timeout (RTO) -> retransmit without ECT
  - Implementation freedom

The ACK Format

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<td>Largest Acknowledged (i)</td>
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<td>+++++++</td>
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<td>ACK Delay (i)</td>
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<td>+++++++</td>
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<tr>
<td>ACK Block Count (i)</td>
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<td>ACK Blocks (*)</td>
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<td>[ECN Section]</td>
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The ECN Section Format

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<td>ECT(0) Count (i)</td>
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<td>+++++++</td>
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<tr>
<td>ECT(1) Count (i)</td>
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<tr>
<td>ECN-CE Count (i)</td>
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Packets with ECT or ECN-CE marks acknowledged in ACK Frame with ECN Section

Immediate ACK on ECN-CE mark

Per direction verification of ECT

Continuous Verification

ECN Blackhole Mitigation

Optional: Retransmission timeout (RTO) -> retransmit without ECT

Implementation freedom
Changes since Montreal

- ACK_ECN replaced by ECN Section in ACK frame
  - Indicated using lowest bit in frame type
  - Moved to end of Frame

- Different Packet Sequence Number space have their own counters

- Coalescing of QUIC packets
  - Each QUIC packet reports the IP ECN field value

- Text in draft-ietf-quic-transport restructured
  - Please review
Changes since Montreal

- Had extensive discussion about explicit marking reporting
  - Concluded at September interim to not change from counters
  - Issues with overhead for high BDP flows
  - Utility of detailed CE format
  - Which transitions are relevant?
    - What optimizations are safe?
  - L4S results in a much higher degree of ECT to CE transitions
    - Efficient encoding of explicit information costly
  - Possible for future QUIC versions
Further Discussions

- These are not really open issues in QUIC v1
- Choices have been made that avoids them
  - Likely to arise in the future
Q4: Delayed Acknowledgement and ECN

- QUIC allows delayed acknowledgment
  - 25 ms (configurable)
  - ACK every 2 packets (Reno style)

- ECN-CE Immediate Acknowledgement
  - Rapid response to Congestion Event

- Currently all ECN-CE marked are sent as immediate ACK
  - Unnecessary many Acknowledgements

- L4S will result in high marking frequency at steady state
Q4: Delayed Acknowledgement and ECN

- But what is required for additional ECN-CE marks during the recovery period?
  - Could be delayed while in recovery
    - Will not affect congestion state

- ECN-CE marks after recovery ends
  - New Recovery period
    - Counters don’t give explicit indication of packet numbers marked

- Different behavior for L4S?
Q5: Utility of Detailed CE information

- Using bit/ack vector to provide per packet CE vs ECT information
  - Suggested in discussion of Optimizing the ACK format
- Useful to handle Q4 issues
- What other benefits exists applicable in QUIC?
- How to encode it efficiently
- Need for difference between ECT(0) and ECT(1)