

ECN in QUIC - Update



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Relevant drafts:

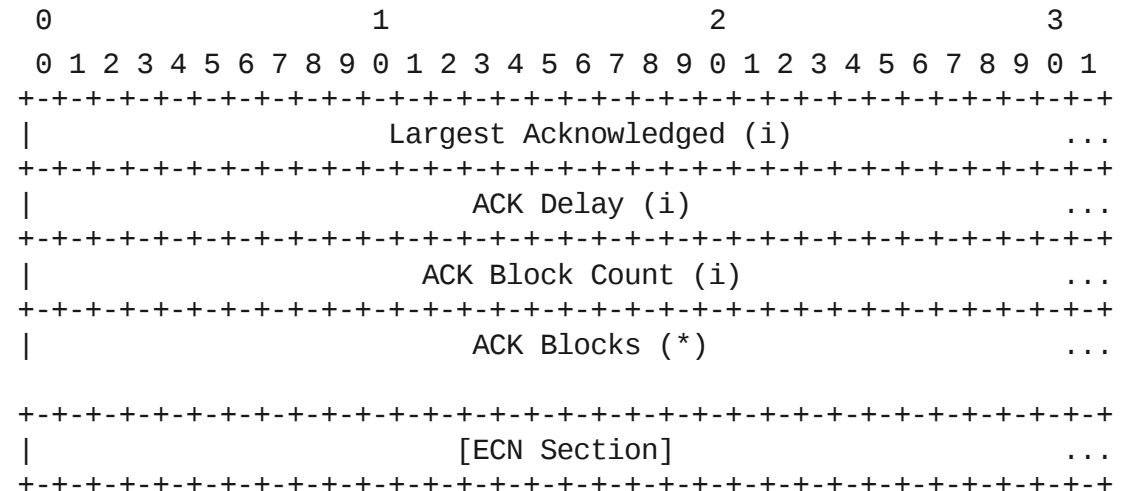
[draft-ietf-quic-transport-16](#)

[draft-ietf-quic-recovery-16](#)

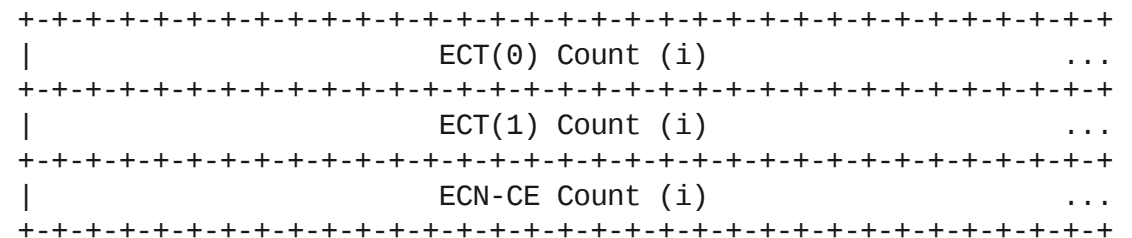
ECN in QUIC Overview



- 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



The ECN Section Format

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)