QUIC Accurate ECN Acknowledgments

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RFC 9000: Acknowledging ECN

- ECN counts are cumulative for the packet number space
- It is not possible to deduce ECN code-points received for each packet, esp. which packets were not CE-marked.
- Knowing above helps in accurately increasing *cwnd* during congestion avoidance and avoid excessive queue build up.

```
ACK Frame {
  Type (i) = 0x02..0x03,
  Largest Acknowledged (i),
  ACK Delay (i),
  ACK Range Count (i),
  First ACK Range (i),
  ACK Range (..) ...,
  [ECN Counts (..)],
}

 ACK Range {
   Gap (i),
   ACK Range Length (i),
 }

 ECN Counts {
   ECT0 Count (i),
   ECT1 Count (i),
   ECN-CE Count (i),
 }
```

More Accurate ECN Feedback?

Congestion controllers like Prague, BBRv3 would benefit from knowing:

1. The size of packets that were not CE-marked
2. Which packet number was CE-marked

Idea: define a new ACCURATE_ACK_ECN frame

- include the ECN code-point in the ACK Range encoding

```
ACK Range {
  Gap (i),
  ACK Range Length (i),
  ECN Marking (8),
}
```

https://datatracker.ietf.org/doc/draft-seemann-quic-accurate-ack-ecn/