ECN++: Adding ECN to TCP Control Packets
draft-ietf-tcpm-generalized-ecn-06

Bob Briscoe, Independent
Marcelo Bagnulo, UC3M

IETF 109 Nov 2020

- Refreshed 05 → 06
- Minor changes
- In holding pattern, waiting for AccECN

More Accurate ECN Feedback in TCP

draft-ietf-tcpm-accurate-ecn-13

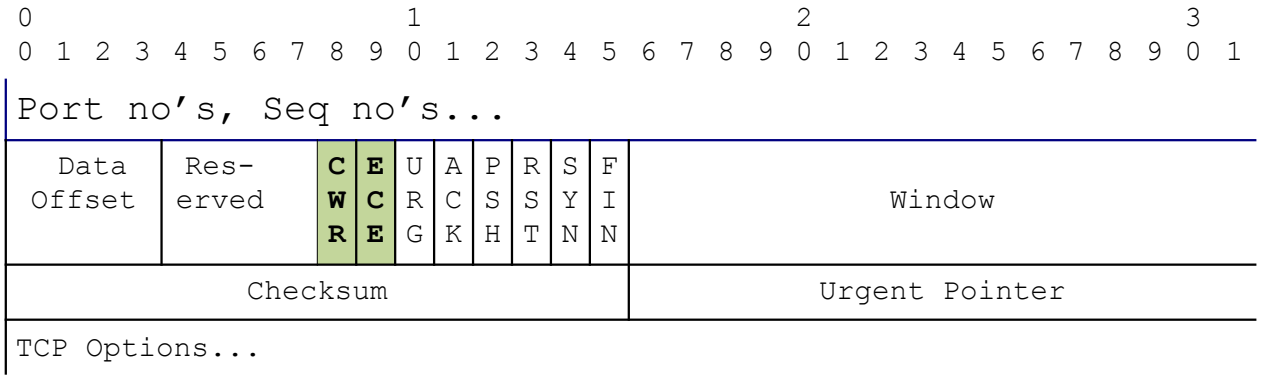
Bob Briscoe, Independent
Mirja Kühlewind, Ericsson
Richard Scheffenegger, NetApp

IETF 109 Nov 2020

Problem (Recap)
Congestion Existence, not Extent

- Explicit Congestion Notification (ECN)
  - routers/switches mark more packets as load grows
  - RFC3168 added ECN to IP and TCP

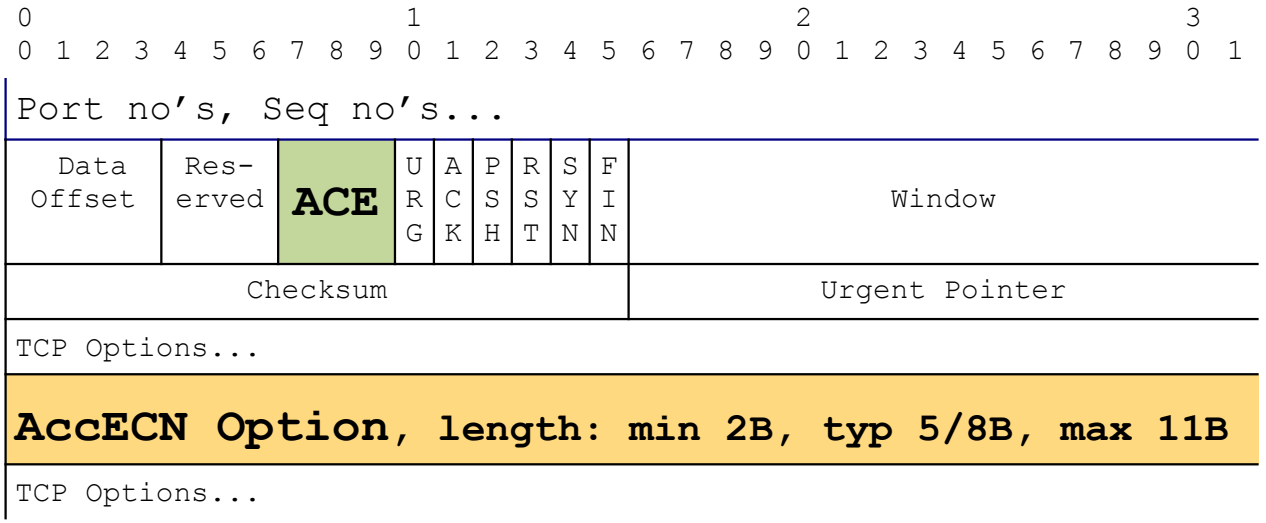
IP-ECN	Codepoint	Meaning
00	not-ECT	No ECN
10	ECT(0)	ECN-Capable Transport
01	ECT(1)	
11	CE	Congestion Experienced



- Problem with RFC3168 ECN feedback:
  - only one TCP feedback per RTT
  - rcvr repeats ECE flag for reliability, until sender's CWR flag acks it
  - suited TCP at the time – one congestion response per RTT

Solution (recap)
Congestion extent, not just existence

- AccECN: Change to TCP wire protocol
  - Repeated count of CE packets (ACE) - essential
  - and CE bytes (AccECN Option) – supplementary



- Key to congestion control for low queuing delay
  - 0.5 ms (vs. 5-15 ms) over public Internet
- Applicability: (see spare slide)

Activity since last update (Apr’20 interim)

- -11 to -12 (28 Oct ‘20):
  - Minor editorial fixes
- -12 to -13 (2 Nov ‘20)
  - Changed how to declare field order in AccECN TCP Option
  - SHOULD disable ECN if solid CE marking for a few rounds
  - Deeper and clearer recommendations for Proxies, offload engines and other middleboxes

Field Order of AccECN TCP Option

- How to distinguish 2 different field orders in the AccECN Option
  - ExxB = Echo Byte counter xx, where xx = E0, E1, CE (each 3 B)

kind0	length	EE0B	[ECEB	[EE1B]]
kind1	length	EE1B	[ECEB	[EE0B]]

- At IETF-109, two alternatives:
  1) Two Option Kinds [MScharf]
  2) Add flags byte to option [Ilpo]
  - No other proposals forthcoming
- Concern: Absence of a flags byte limits extensibility
  - But can we afford to burn 1B of option space on most packets?
  - Already ‘forward compatibility’ to add flags byte if needed
  - If length unrecognized, implementations MUST use as many 3-octet fields as fit
- Only choose the flags byte alternative, if prospect of other uses
  - Only one proposal, but logic for Ilpo’s proposed 2-bit Cnt field seemed circular
- Conclusion: Two Option Kinds selected and written up

Testing for IP-ECN Mangling (§3.2.2.4)

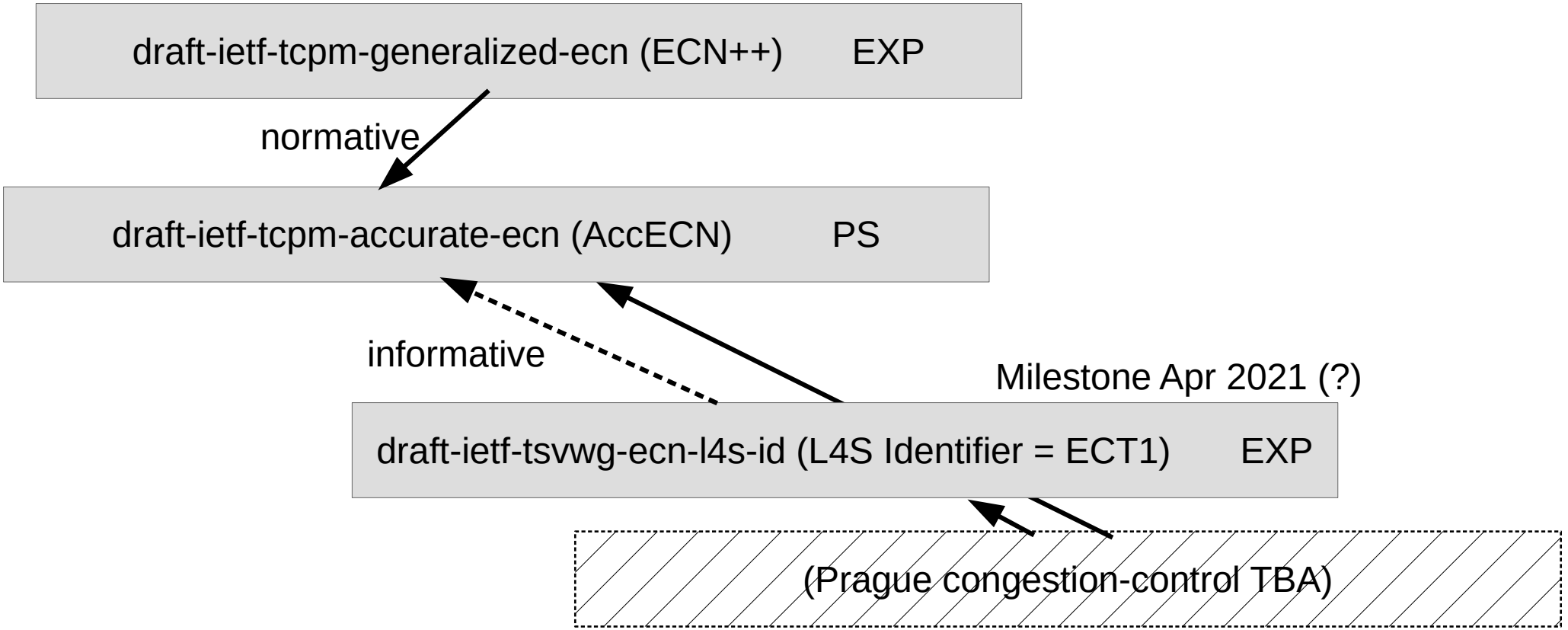
- Recommended additional test (paraphrased):
  - For first 3 or 4 rounds, AccECN Data Sender SHOULD check whether every packet it sent was CE-marked
  - If so, it SHOULD NOT send ECN-capable packets, but it MUST continue to feed back any ECN markings
- Already current practice for Classic ECN
  - in IoS, Linux, FreeBSD, at least

Recommendations for Middleboxes

Divided up existing section:

- Proxies (no change)
- Normalizers (no change)
- ACK Filtering
  - Made “SHOULD NOT coalesce” conditional on ”If AccECN packet and middlebox can ECN mark”
  - Considerable list discussion
- Segmentation Offload
  - Described incremental deployment strategy
  - From today’s “Eject segment if ECN flags change at all”
  - To “Allow ACE field to change, but eject before wrap”

Draft dependencies



- ecn-l4s-id gives requirements for what L4S CC RFCs will have to say
- “Support for the accurate ECN feedback requirements [RFC7560] (such as that provided by AccECN [I-D.ietf-tcpm-accurate-ecn]) by both ends is a prerequisite for scalable congestion control in TCP.“

Status & Next Steps

draft-ietf-tcpm-accurate-ecn-13

- Ready for WGLC
- draft-ietf-tcpm-generalized-ecn dependent on this
- April’20 tcpm interim:
    - WG resolved to wait a while for L4S, but go ahead soon if still waiting

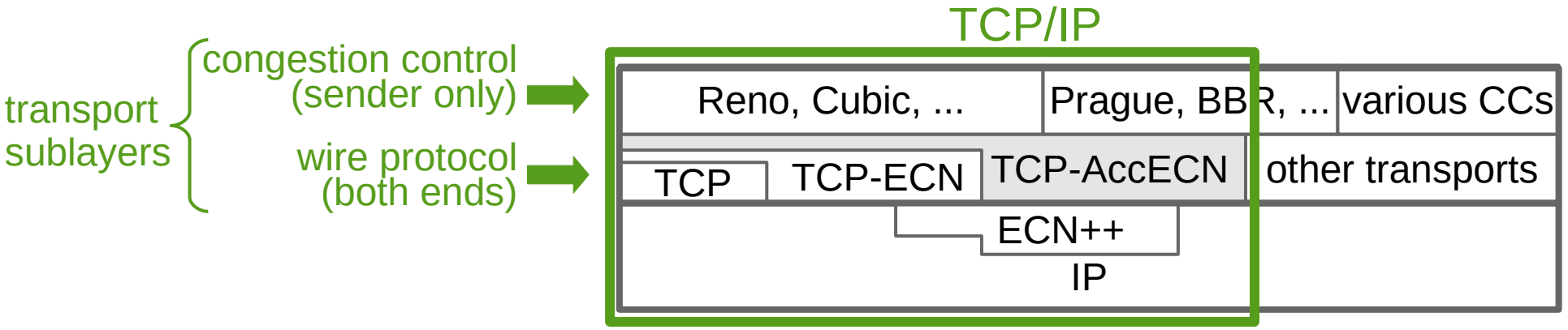
AccECN

Q&A

spare slides

Where AccECN Fits

- Can only enable AccECN if both TCP endpoints support it (1)
  - but no dependency on network changes
- Extends the feedback part of TCP wire protocol
- Foundation for new sender-only changes (and for existing TCP), e.g.
  - congestion controls (TBA):
    - 'TCP Prague' for L4S (2)
    - BBR+ECN
  - Full benefit of ECN-capable TCP control packets (ECN++) (3)



(1) Backwards compatible handshake
- SYN: offer AccECN
  SYN-ACK can accept AccECN, ECN or non-ECN

(2) Low Latency Low Loss Scalable throughput [draft-ietf-tsvwg-l4s-arch]

(3) Without AccECN, benefit of ECN++ excluded from SYN [draft-ietf-tcpm-generalized-ecn]