ECN++: Adding ECN to TCP Control Packets
draft-ietf-tcpm-generalized-ecn-12

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ECN++ motivation

- Cuts flow completion time variance
- 1s timeouts: due to loss of TCP SYN or SYN/ACK
  - ECN++ protects TCP control packets from loss

Experiment Details
Each point represents FCT (SYN-FIN) of one ECN-Cubic flow over 7ms base RTT ADSL bottleneck @40Mb/s. With 2 long-running background flows. AQM: PIE in default config. Green line is ideal FCT if long-running flows were not present.
## ECN++ Recap

<table>
<thead>
<tr>
<th>TCP packet type</th>
<th>RFC3168</th>
<th>ECN++ [draft-ietf-tcpm-generalized-ecn-11]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AccECN f/b negotiated</td>
<td>RFC3168 f/b negotiated</td>
</tr>
<tr>
<td>SYN$^1$</td>
<td>not-ECT</td>
<td>ECT</td>
</tr>
<tr>
<td>SYN-ACK</td>
<td>not-ECT</td>
<td>ECT</td>
</tr>
<tr>
<td>Pure ACK</td>
<td>not-ECT</td>
<td>ECT</td>
</tr>
<tr>
<td>Window probe</td>
<td>not-ECT</td>
<td>ECT</td>
</tr>
<tr>
<td>FIN</td>
<td>not-ECT</td>
<td>ECT</td>
</tr>
<tr>
<td>RST</td>
<td>not-ECT</td>
<td>ECT</td>
</tr>
<tr>
<td>Re-XMT</td>
<td>not-ECT</td>
<td>ECT</td>
</tr>
<tr>
<td>Data</td>
<td>ECT</td>
<td>ECT</td>
</tr>
</tbody>
</table>

$^1$ For SYN, 'negotiated' means requested

$^2$ Obviously only in AccECN case

$^3$ ECT if IW1 (client → server)
Recent technical changes (1/2)
draft-ietf-tcpm-generalized-ecn-11 → 12

• Distinguishing ACKs of ACKs from DupACKs
  • now 3 mandatory conditions before send ECN-capable pure ACKS (§3.2.3.2):
    - AccECN feedback mode negotiated
    - SACK-negotiated (made RFC2018 normative)
    - test whether incoming pure ACKs are DupACKs using absence of SACK blocks
  • AccECN draft mandates but no longer describes the DupACK test
  • removed TSopt as alternative to SACK in DupACK test (not a reliable test)

• Already, no obligation to set ECT on all control packets
  • added: not compliant if implementation doesn't set ECT at all
Recent technical changes (2/2)
draft-ietf-tcpm-generalized-ecn-11 → 12

- Caching failed attempts to use ECT on SYN-ACKs
  - §4.3.3: more detail on limitations of client-based caching as an alternative to server-based

- Reliability argument widened (§4.1)
  - ECN-capable control packets deliver control more reliably
  - more important than concerns about loss of a congestion signal if drop of a CE marked control packet goes undetected

- More concise & precise arguments for ECN-capable pure ACKs (§4.4.2)

- Corrected outline of 3rd argument against ECN-capable retransmissions in RFC 3168
Recent editorial changes
draft-ietf-tcpm-generalized-ecn-11 → 12

- Corrected outline of ACK congestion control [RFC5690]
  - informational, incomplete – didn't assign a TCP Option
  - previously described as if it was a complete solution

- Numerous other improvements
  - brought up to date after long period on hold
  - improved precision of arguments
  - readying for WG last call
Next Steps

● Ready for WGLC
  • Normative ref to accurate-ecn
  • So will follow WGLC of that

● Please now review closely