

6LoWPAN Selective Fragment Recovery

draft-thubert-6lo-fragment-recovery-01

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IETF 102

Montréal

Features

- New formats for the fragment header
- Selective Fragments Recovery
 - Expects but does not depend on IOD
- Window-based Flow Control
 - ACK at the end of the window
- Explicit Congestion Notification
 - ECN flag echoed to the source
- Explicit Signaling to both set up and clean up
 - Including Abort and Fin

Status

- Draft -01
 - Replaces [draft-thubert-6lo-forwarding-fragments](#)
 - Removed the virtual Recovery Buffer operation
 - Now in draft-Watteyne-6lo-minimal-fragment
 - Specify that the slack for variation of 6LoWPAN HC overhead must be in the first buffer
 - This is not “needed” by VRB, but here we ack and retry fragments end to end

Past IETF presentation

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History

- Presented 6lo Fragmentation issues in Chicago
 - In appendix of this slideware
 - Mostly issues for route-over
 - Summarized in next slide
- Work on fragmentation at LPWAN
 - As part of the SCHC IP/UDP draft
 - Optional: Windowing/individual retry of fragments
 - Does not need to support multihop

Context

- TCP rarely used,
 - Pro is MSS to avoid fragmentation
- 6LoWPAN applications handle their reliability
 - UDP
 - to get exactly what they need
 - They also expect very long round trips.
- Time gained by streamlining fragments is available for retries without a change in the application behavior.

6lo Route-Over fragmentation issues

- Recomposition at every L3 hop
 - Cause latency and buffer overutilization
- Uncontrolled sending of multiple fragments
 - Interferences in single frequency meshes
- Fragment flows interfere with one another
 - Buffer bloat / congestion loss
- Loss locks buffers on receiver till time out
 - Readily observable, led to RFC 7388

6lo Fragmentation reqs

- Provide Fragment Forwarding
 - There are pitfalls, better specify one method
 - E.g. datagram tag switching ala MPLS
 - Stateful => state maintenance protocol
- Provide pacing/windowing capabilities
 - Mesh awareness? (propagation delay, nb hops)
- Provide fragment reliability
 - individual ack/retry/reset, e.g. ala SCHC
- Provide congestion control for multihop
 - E.g. ECN

Path Forward

- Solutions exist (as shown by draft-thubert..):
 1. Produce a problem statement at 6lo
 - Based on this slideware
 2. Form a design team
 - Need TSV skills to solve the problem
 - Also MPLS and radio skill, CoAP, CoCoA
 3. Find a host WG and produce a std track
 - at TSVWG?
 4. Also recommendations for application design

APPENDIX

Backup slides

The problem with fragments in 6lo mesh networks

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[draft-thubert-6lo-forwarding-fragments-04](#)

Recomposition at every hop

- Basic implementation of RFC 4944 would cause reassembly at every L3 hop
- In a RPL / 6TiSCH network that's every radio hop
- In certain cases, this blocks most (all?) of the buffers
 - Buffer bloat
- And augments latency dramatically

Research was conducted to forward fragments at L3.

Early fragment forwarding issues #1

- Debugging issues due to Fragments led to RFC 7388
- Only one full packet buffer
- Blocked while timing out lost fragments
- Dropping all packets in the meantime
- Arguably there could be implementation tradeoffs
 - but there is no good solution with RFC4944,
 - either you have short time outs and clean up too early,
 - or you lose small packets in meantime

