Transmission of SCHC-compressed packets over IEEE 802.15.4 networks

draft-gomez-6lo-schc-15dot4-02

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Introduction (I/III)

• RFC 6282: the basis for header compression in 6Lo(WPAN)
  • Designed for IEEE 802.15.4 as the target technology
  • Adapted/Reused for relatively similar IoT technologies
  • Compressed IPv6/UDP header size of 7 bytes
    – Best case, with global addresses

• RFC 8724 (aka “SCHC”), a product of the LPWAN WG
  • Adaptation layer functionality:
    – Header compression
    – Fragmentation
  • Designed for even more constrained (LPWAN) technologies

• SCHC header compression
  • Compressed IPv6/UDP header size of e.g. 1 byte
    – Best case, with global addresses
  • Static Context: exploit a priori knowledge of header field values
Introduction (II/III)

• Compressed IPv6/UDP/CoAP header size
  • 6Lo(WPAN) compression:
    – No CoAP header options: \(11\) bytes
    – CoAP header options (Table 6, RFC 8824): \(23\) bytes
  • SCHC compression: e.g. \(2\) bytes

Assumptions:
- Best case
- Global addresses

• Theoretical battery lifetime improvement over IEEE 802.15.4 by a factor up to >2
  • Including a 1-byte SCHC Dispatch
  • Actual improvement will be lower, depending on various parameters and features: device hardware, MAC settings, application settings, payload size, network topology, etc.
Introduction (III/III)

• Maximum battery lifetime improvement factor
  • Short MAC addresses, intra-PAN
  • E.g. a battery-operated sensor that periodically sends a message over IEEE 802.15.4

NOTE: actual improvement will be lower
Status

• Related document: draft-gomez-6lo-schc-dispatch
  • Proposal of a dispatch to signal SCHC HC
  • Presented at IETF 110

• draft-gomez-6lo-schc-15dot4
  • Greater scope
    – Transmission of SCHC-compressed packets over IEEE 802.15.4 networks
  • -00 presented in IETF 111
  • -01 presented in IETF 112

• Revision -02
  • Aims to incorporate the feedback from IETF 112 and LPWAN WG interims
4. Frame format

• Frame format (i.e. L2 frame payload)
  – Encapsulated SCHC compressed packet:

```
<-------- IEEE 802.15.4 frame payload -------->

<---- SCHC Packet ---->
+-----------------------------+---+---+---+---+---+---+---+---+
| SCHC Dispatch | SCHC Header | Payload | Padding |
+-----------------------------+---+---+---+---+---+---+---+---+
```

  – RuleID size:
    • In -01: 8 bits (MUST)
    • In -02: 1-16 bits (RECOMMENDED)
      – Allow an appropriate RuleID size to be used in each deployment
      – Avoid a hard limit on network size and number of endpoint pairs that can benefit from SCHC HC
5.1. IPv6/UDP header compression

• As per Section 10 of RFC 8724
• Problem: IPv6 addresses and UDP ports
  – Dev and App terms (RFC 8724) allow a single Rule to be usable in both directions

LPWAN architecture (RFC 8724):

– In -02: some 802.15.4 scenarios can use this optimization “as is” (e.g., star topology networks)
5.1. IPv6/UDP header compression

• Problem: IPv6 addresses and UDP ports
  – In -02: in some 802.15.4 scenarios (e.g. two peers within a mesh topology), additional functionality (TBD) needed to use Dev and App
    • Each endpoint needs to know whether it is Dev or App when talking to another device
    • Uplink and Downlink have a meaning specific to each pair of endpoints
  – In -02, removed the tentative solution in -01:
    • Using “source” and “destination” in the Rules
    • “Transmit” and “Receive” terms (intended as replacements of Uplink and Downlink)
5.1.1. Compression of IPv6 addresses

- In RFC 8724, AppIID CDA cannot be used on LPWAN technologies that only carry the Dev identifier.
- In -02: in 802.15.4, data frames carry both a source and a destination field, therefore AppIID CDA can be used.
  - If the IID can be reconstructed based on information available at the L2 header.
8. Security considerations

• No header compression functionality beyond the one in RFC 8724
  – Security considerations of Sec. 12.1 (RFC 8724) apply
  – Also, secur. considerations of Sec. 9 (RFC 8824) apply

• 802.15.4 networks support link-layer encryption and authentication
  – As in RFC 8824: cryptographic integrity-protection mechanism REQUIRED to protect SCHC headers
Next steps

• Who is Dev or App, and writing the Rules accordingly
• Do all nodes need to store all the Rules used in the 802.15.4 network?
  – If not, can RuleIDs be reused across disjoint pairs of endpoints?
• Scope of SCHC header compression of IPv6/UDP in peer-to-peer 802.15.4 topologies:
  – One hop between source and destination
  – Several hops between source and destination
    • Mesh under
    • Route over: challenging...
WG adoption?

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