

Transmission of SCHC-compressed packets over IEEE 802.15.4 networks

`draft-ietf-6lo-schc-15dot4-02`

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Introduction

This document

```
+-----+
| CoAP, other |
+-----+
| UDP, other  |
+-----+
|   IPv6     |
+-----+
| 6LoWPAN HC |
+-----+
|6LoWPAN Frag|
+-----+
| 802.15.4   |
+-----+
```

Traditional

```
+-----+
| CoAP, other |
+-----+
| UDP, other  |
+-----+
|   IPv6     |
+-----+
|  SCHC HC   |
+-----+
|6LoWPAN Frag|
+-----+
| 802.15.4   |
+-----+
```

Main goal

<-- NEW

```
+-----+
|   CoAP    |
+-----+
|   UDP     |
+-----+
| SCHC HC   |
+-----+
|   IPv6    |
+-----+
|6LoWPAN HC |
+-----+
|6LoWPAN Frag|
+-----+
| 802.15.4  |
+-----+
```

<-- NEW

Transition

SCHC exploits a priori knowledge of header field values

Status

- **WG adoption**
 - draft-ietf-6lo-schc-15dot4-00
 - Same content as draft-gomez-6lo-schc-15dot4-05
 - In January 2023

- **Version -02**
 - Several additions and updates
 - One coauthor, now a contributor
 - Flavien Moullec (had joined in -01)

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Main technical updates

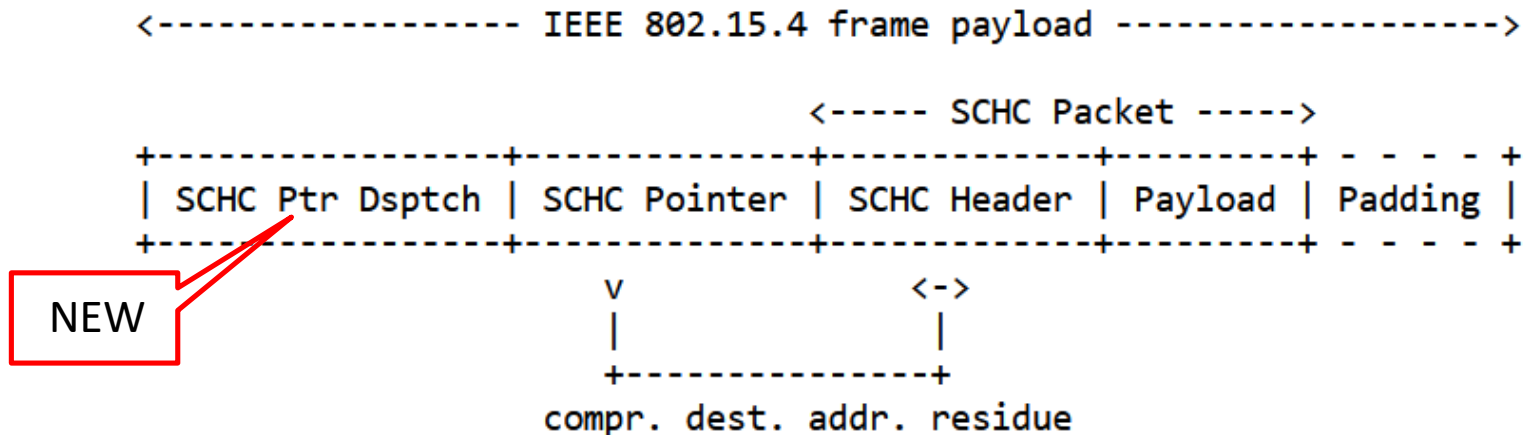


Main new additions



4.3. Pointer-based, R.O. frame format

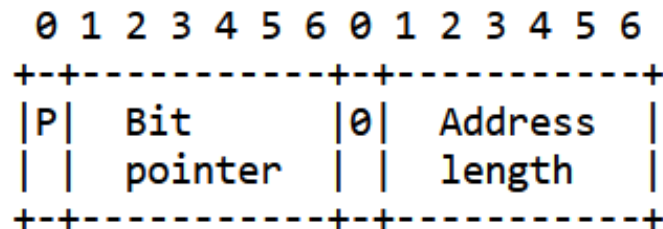
- SCHC Pointer Dispatch



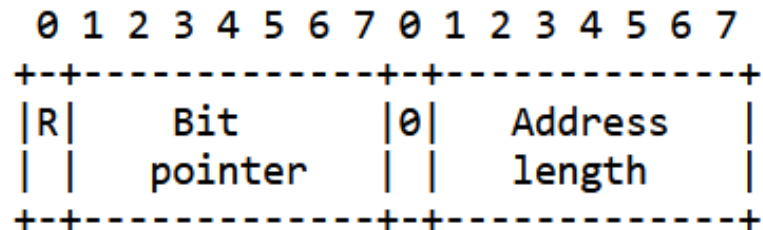
- Additional 6LoWPAN Dispatch Type (page 0):
 - Bit pattern 01000101 (to be confirmed by IANA)
 - Indicate whether this dispatch is followed by the SCHC Pointer from the dispatch itself
 - Allows all RuleIDs (starting by 1 or by 0) after the SCHC Dispatch

4.3. Pointer-based, R.O. frame format

- SCHC Pointer format:
 - OLD:



- NEW:



- Byte-aligned
- Allows to represent a full 128-bit IPv6 destination address (if needed)

Appendix A. Header compr. examples (I/II)

- A.1. Single-hop or Straightforward Route-Over
 - IPv6/UDP uplink packet
- A.2. Tunneled, RPL-based Route-Over
 - TO-DO
- A.3. Pointer-based Route-Over
 - IPv6/UDP uplink packet
- A.4. Mesh-Under
 - TO-DO
- A.5. Enabling the transition protocol stack
 - IPv6/UDP/CoAP uplink packet

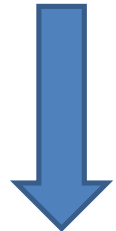
Appendix A. Header compr. examples (II/II)

- A.1. Single-hop or Straightforward Route-Over

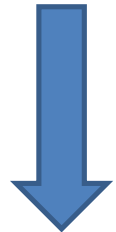
Uncompressed IPv6/UDP packet:

```
60 00 00 00 00 17 00 40   FD 00 00 00 00 00 00 00
02 02 00 02 00 02 00 02   20 01 00 00 00 00 00 00
00 00 00 00 00 00 00 01   22 3D 16 2E 00 0F 33 68
68 65 6C 6C 6F 20 31
```

} 55 bytes



Compression
(RuleID 0x20)



SCHC Dispatch

SCHC-compressed packet:
44 20 02 02 00 02 00 02
 00 02 68 65 6C 6C 6F 20
 31

} 17 bytes

FID	FL	FP	DI	TV	MO	CDA	Sent [bits]
IPv6 Version	4	1	Bi	6	ignore	not-sent	
IPv6 Diffserv	8	1	Bi	0	equal	not-sent	
IPv6 Flow Label	20	1	Bi	0	equal	not-sent	
IPv6 Length	16	1	Bi		ignore	compute-*	
IPv6 Next Header	8	1	Bi	17	equal	not-sent	
IPv6 Hop Limit	8	1	Bi	64	ignore	not-sent	
IPv6 DevPrefix	64	1	Bi	FD00::/64	equal	not-sent	
IPv6 DevIID	64	1	Bi		ignore	value-sent	64
IPv6 AppPrefix	64	1	Bi	2001::/64	equal	not-sent	
IPv6 AppIID	64	1	Bi	:::1	equal	not-sent	
=====							
UDP DevPort	16	1	Bi	8765	equal	not-sent	
UDP AppPort	16	1	Bi	5678	equal	not-sent	
UDP Length	16	1	Bi		ignore	compute-*	
UDP checksum	16	1	Bi		ignore	compute-*	

Appendix B. Analysis of RO multihop approaches (I/III)

- Straightforward RO approach:
 - Header overhead: 1 byte
 - All nodes (incl. intermediate nodes) must store all the Rules in use in the whole network
 - Suitable for rather small and static networks
- Tunneled, RPL-based RO approach:
 - Header overhead: 2 bytes + variable part
 - Variable part: ≥ 6 bytes (uplink); 12 bytes, 16 bytes... (downlink)
 - A node only stores the Rules for the communications it is involved in as an endpoint
 - Reduces memory requirements and the impact of context updates (if any)
 - Scalable with network size
 - Requires RPL non-storing mode
 - Intranetwork communication requires traversing the root node (might not be necessarily optimal)

Appendix B. Analysis of RO multihop approaches (II/III)

- Pointer-based RO approach:
 - Header overhead: 2 bytes + variable part
 - Variable part is the IPv6 destination address compression residue:
 - Could be 0 bytes in special cases (full address known beforehand)
 - Could be 2-8 bytes in intranetwork communications (prefix known)
 - Could be 16 bytes in communications with external nodes (if several possible destination prefixes)
 - A node only stores the Rules for the communications it is involved in as an endpoint
 - Reduces memory requirements and the impact of context updates (if any)
 - Scalable with network size
 - Does not require RPL
 - Intranetwork communication: not constrained to traversing a root node

Appendix B. Analysis of RO multihop approaches (III/III)

- Best fit:
 - Small networks
 - Straightforward
 - Larger networks
 - Tunneled, RPL-based
 - Communication with (several) external networks
 - Pointer-based
 - Intranetwork communication + special cases of external comm.

Question 1

- **Keep or reduce the number of multihop RO approaches?**
 - Currently, 3 existing approaches
- Authors opinion:
 - Enable all of them:
 - Relatively complementary
 - The most suitable one can be chosen for each deployment
- Thoughts?

Question 2

- **IEEE 802.15.4-specific document or generic document?**
 - Currently, IEEE 802.15.4-specific
- Authors opinion:
 - IEEE 802.15.4-specific is more straightforward
 - Well defined scope
- Observations:
 - IEEE 802.15.4-specific doc may be the basis for other similar documents focusing on other similar technologies
 - If generic approach, then one technology-specific document is needed for each technology of interest
 - In addition to the base document
- Thoughts?

Comments/Questions?

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Introduction

Assumptions:

- Best case, global addr.
- CoAP
 - a) No header options
 - b) Table 6, RFC 8824

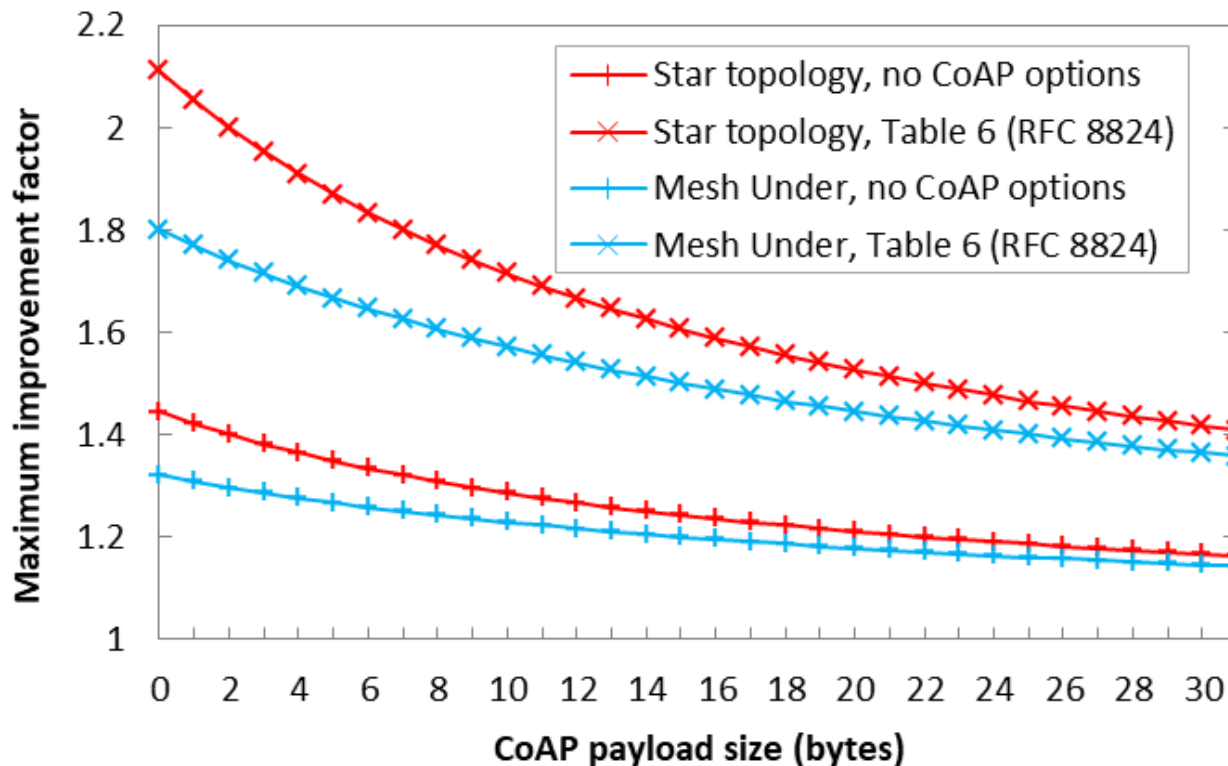
- IPv6/UDP/CoAP header size

	IPv6/UDP (bytes)	CoAP (bytes)		TOTAL (bytes)	
		a)	b)	a)	b)
No compression	48	4	16	52	64
6Lo(WPAN) - RFC 6282	7	4	16	11	23
SCHC - RFC 8724, 8824	1	1	1	2	2

- SCHC: static context, a priori knowledge of header field values
- Theoretical battery lifetime improvement over IEEE 802.15.4 by a factor up to >2
 - **Actual improvement will be lower**, depending on device HW, MAC/adaptation/application layer settings, payload size, network topology, etc.

Introduction (II)

- 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