draft-toutain-6lo-6lo-and-SCHC-00

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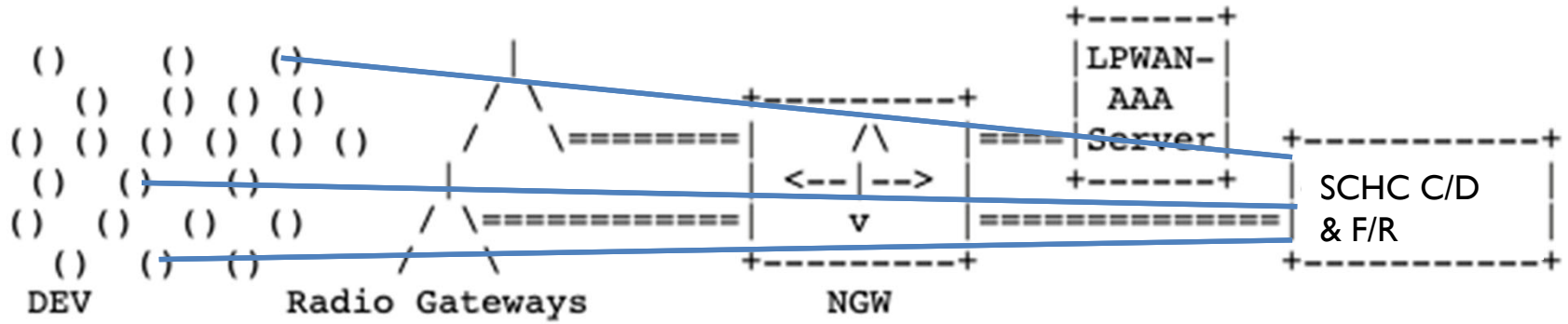
	LPWAN technologies			6LoWPAN/6Lo wireless technologies				
	LoRaWAN	**Sigfox**	**NB-IoT**	**IEEE 802.15.4**	**BLE**	**ITU-T G.9959**	**DECT-ULE**	**NFC**
Frequency band(s) (MHz)	868 (EU), 915 (US), 783 (China)	868 (EU), 915 (US), 923 (Japan)	Various: 416 (min), 2200 (max)	868 (EU), 915 (US), 2400 (worldwide)	2400	868 (EU), 915 (US)	1900	13.56
Type of band	Unlicensed	Unlicensed	Licensed	Unlicensed	Unlicensed	Unlicensed	Dedicated	Unlicensed
Modulation	CSS	DBPSK (uplink), GFSK (downlink)	π/2-BPSK or π/4-QPSK (upl.), QPSK (downlink)	BPSK (sub-GHz), O-QPSK (2.4 GHz)	GFSK	FSK/FSK/GFSK (R1/R2/R3)	GFSK	OOK, BPSK
Receiver sensitivity (dBm)	-137 (typical)	-142 (typical)	-141 (typical)	-92 min. (sub-GHz), -85 min. (2.4 GHz)	-70 (Bluetooth 4.0)	-95/-92/-89 (R1/R2/R3)	-86	N.A.
PHY layer data rate (kbit/s)	0.25 ÷ 5.47 (EU), 50 (optional)	0.1/0.6	250 (uplink), 226.7 (downlink)	20/40/250	125/500/ 1000/2000	9.6/40/100 (R1/R2/R3)	1152	106/212/424
Message rate constraints	Duty cycle < 1% (EU, China)	140/4 messages per day (uplink/downlink)	No	No	No	No	No	No
Capacity per device (order of magnitude, in bit/s)	10^{2} (DR0, EU), 10^{2} (DR5, EU)	10^{2} (uplink) 10^{-3} (down.)	10^{4}	10^{3} (sub-GHz), 10^{5} (2.4 GHz)	10^{5} (at 1 Mbit/s)	10^{3} (R1), 10^{4} (R2/R3)	10^{5}	10^{4} (at 424 kbit/s)
MAC mechanism	Aloha-based (optional ACKs + retries)	Aloha-based (3 transmissions)	Slotted Aloha (random access) + scheduling	CSMA/CA, TDMA	TDMA	CSMA/CA	TDMA	TDMA link initialization
Maximum frame payload size (bytes)	11 (DR0, USA) ÷ 242 (worldwide)	12 (uplink), 8 (downlink)	1600	105	23	158	38	125
Fragmentation and reassembly	No	No	Yes	No	Yes	Yes	Yes	Yes
Network topology	Star	Star	Star	Star, mesh	Star, mesh	Mesh	Star	Point-to-point
Standards Developm. Organization	LoRa Alliance ™	Sigfox (company)	3GPP	IEEE	Bluetooth SIG	ITU-T	ETSI	NFC Forum

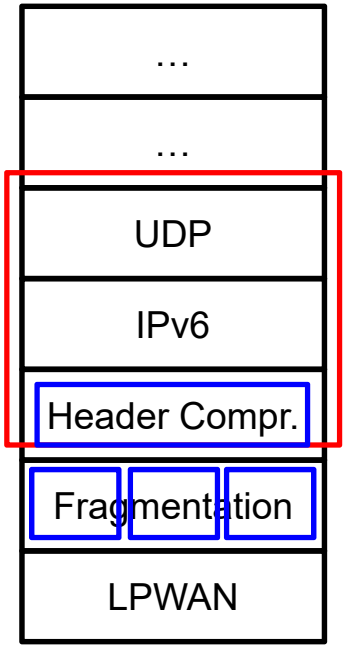
From: Gomez, Carles & Minaburo, Ana & Toutain, Laurent & Barthel, Dominique & Zuniga, Juan-Carlos. (2019). IPv6 over LPWANs: connecting Low Power Wide Area Networks to the Internet (of Things). IEEE Wireless Communications.



SCHC C/D
& F/R

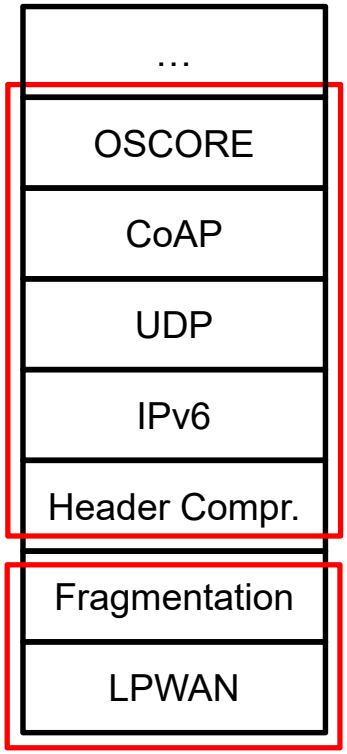
3 deliverables in one draft

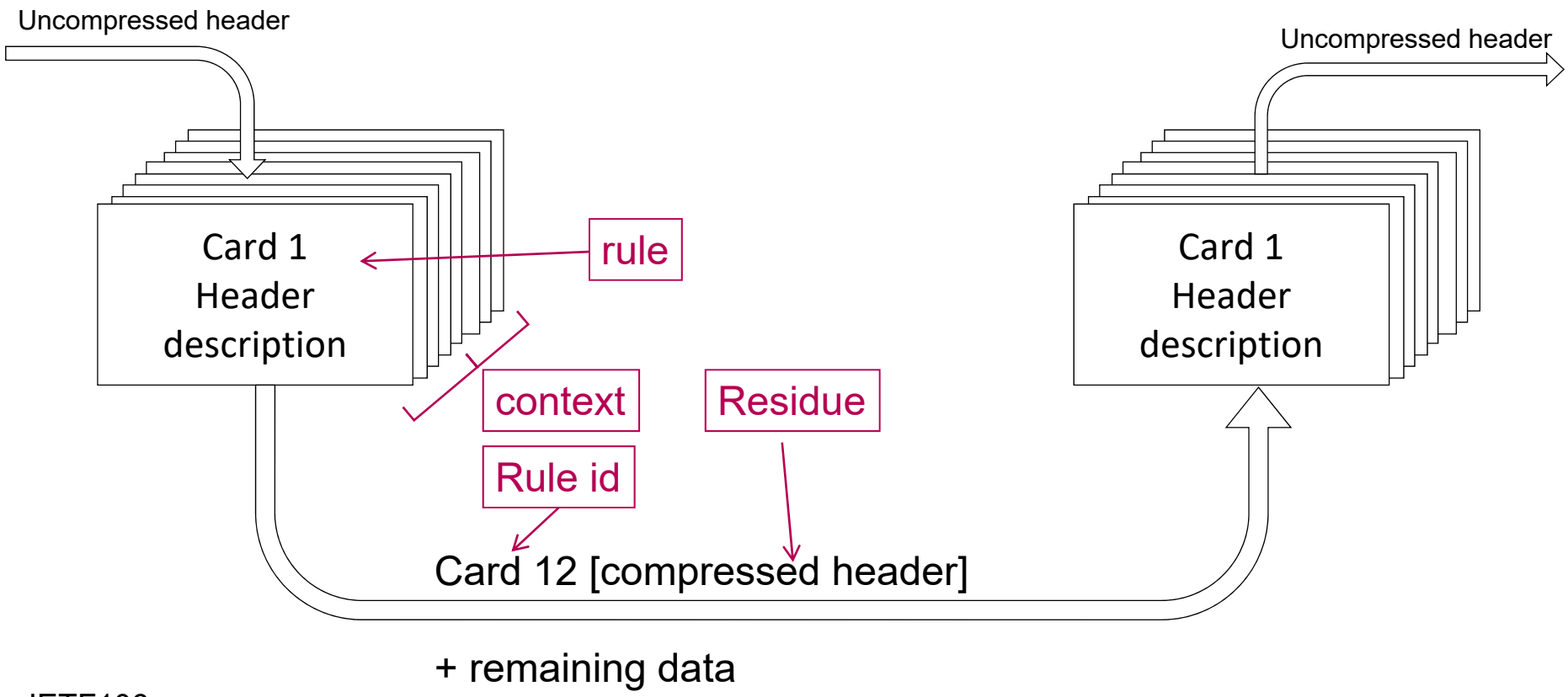
- Spec. of a Header Compression engine **(Section 7)**
  - Generic engine, uses Static Context (→ SCHC)
- Specification of a fragmentation protocol **(Section 8)**
  - Has 3 different "modes" described in this draft
  - The different modes address different requirements
- Spec. of simple UDP/IPv6 compression **(Section 10)**
  - Using this SCHC engine

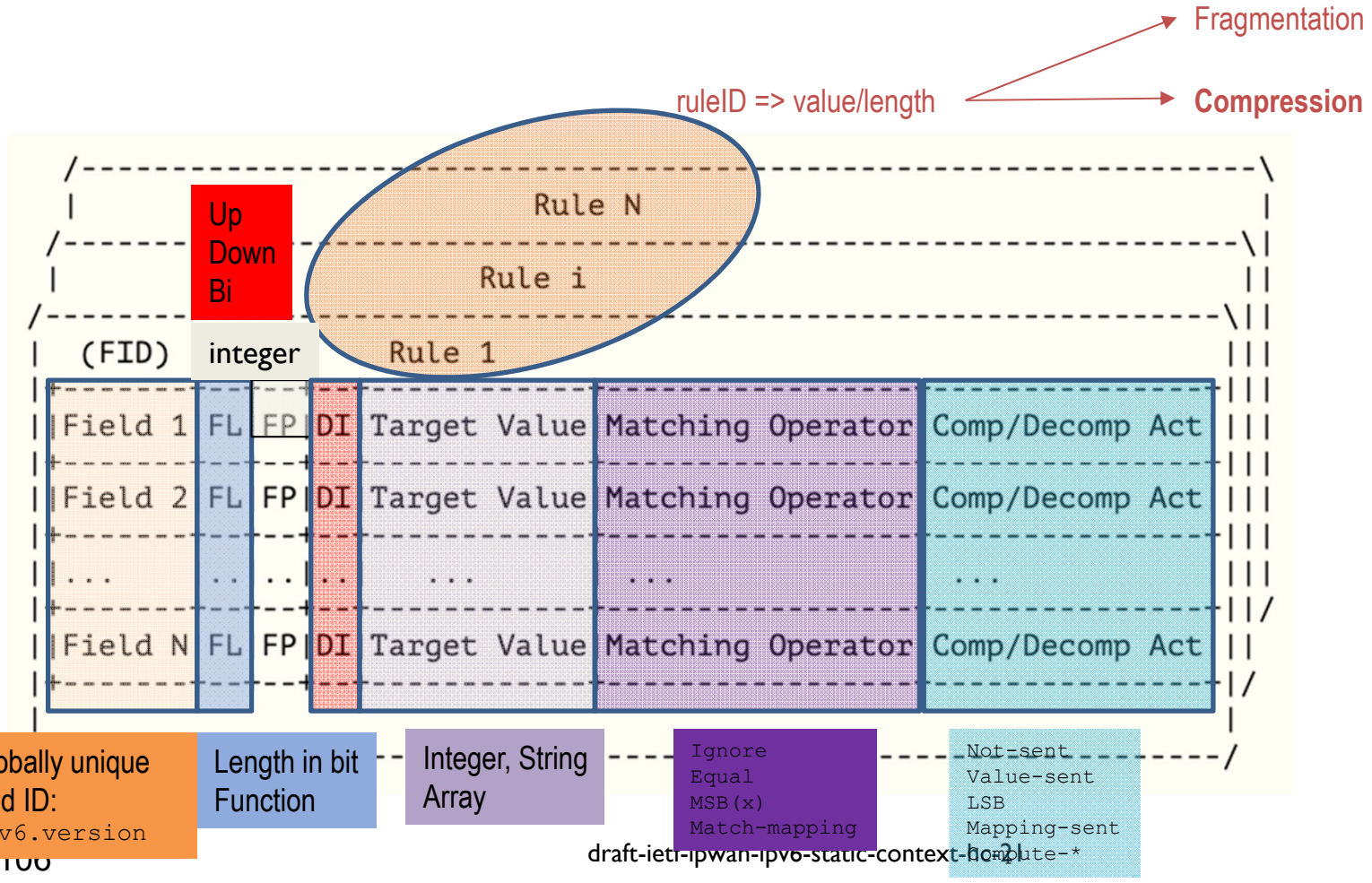


Other related drafts

- Canonical representation of context
- Apply SCHC compression to upper-layer protocols
  - For example, CoAP/UDP/IPv6
- Apply SCHC fragmentation to underlying networks
  - For example, Sigfox, LoRaWAN®




Uncompressed header
Uncompressed header
Card 1
Header
description
rule
context
Residue
Rule id
Card 12 [compressed header]
Card 1
Header
description
+ remaining data


Fragmentation
ruleID => value/length
Compression
Up
Down
Bi
Rule N
Rule i
Rule 1
(FID)
integer
Field 1 FL FP DI Target Value Matching Operator Comp/Decomp Act
Field 2 FL FP DI Target Value Matching Operator Comp/Decomp Act
... .
Field N FL FP DI Target Value Matching Operator Comp/Decomp Act
Globally unique field ID:
IPv6.version
Length in bit Function
Integer, String Array
Ignore
Equal
MSB(x)
Match-mapping
Not-sent
Value-sent
LSB
Mapping-sent
Compute-*

6lo and SCHC

- Context
  - 6lo: no state for C/D, rules are known by construction
  - SCHC: no state for C/D, rules must be known by both ends (called context)

6lo and SCHC

- Bitmap and Rule ID:
  - 6lo: A fixed size bitmap gives the compression behavior and residues
  - SCHC: The rule ID has no semantic, its size is variable
    - more frequent compression schemes may have smaller sizes

6lo and SCHC

- Compression / Decompression functions:
  - Both: Send/Elided/Mapping/Compute
  - SCHC: MSB/LSB, (+extensible)
- C/D Behavior:
  - 6lo: fixed in the RFC
  - SCHC: Rules define the behavior.

SCHC in meshed 6lo ?

- SCHC offers a generic field description tool:
  - Size, position, direction,
  - An extendable compression/decompression mechanism.
- 6lo and SCHC are complementary solutions
  - It is time to look at them together.