Internet Engineering Task Force (IETF)
Request for Comments: 8137
Category: Informational
ISSN: 2070-1721

T. Kivinen
INSIDE Secure
P. Kinney
Kinney Consulting LLC

May 2017

IEEE 802.15.4 Information Element for the IETF

Abstract

IEEE Std 802.15.4 defines Information Elements (IEs) that can be used to extend 802.15.4 in an interoperable manner. The IEEE 802.15 Assigned Numbers Authority (ANA) manages the registry of the Information Elements. This document formulates a request for ANA to allocate a number from that registry for the IETF and describes how the IE is formatted to provide subtypes.

Status of This Memo

This document is not an Internet Standards Track specification; it is published for informational purposes.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Not all documents approved by the IESG are a candidate for any level of Internet Standard; see Section 2 of RFC 7841.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at http://www.rfc-editor.org/info/rfc8137.

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1. Introduction

IEEE Std 802.15.4 [IEEE802.15.4] is a standard, referred to by RFC 4944 [RFC4944] and other documents, that enables very low-cost and low-power communications. The standard defines numerous optional Physical Layers (PHYs) operating in many different frequency bands with a simple and effective Medium Access Control (MAC).

IEEE Std 802.15.4 defines Information Elements (IEs) that can be used to extend 802.15.4 in an interoperable manner. An IE provides a flexible, extensible, and easily implementable method of encapsulating information. The general format of an IE as defined in Section 7.4 of IEEE Std 802.15.4-2015 [IEEE802.15.4] consists of an identification (ID) field, a length field, and a content field. Multiple IEs may be concatenated, and elements with unknown ID values in a list of IEs can be skipped since their length is known. IEs provide a flexible container for information that allows the addition of new IE definitions in future versions of the standard in a backwards-compatible manner.

There are two different IE types, Header IE and Payload IE. A Header IE is part of the MAC header; it is never encrypted, but it may be authenticated. Most of the Header IE processing is done by the MAC, and IETF protocols should not have any direct effect on that processing. A Payload IE is part of the MAC payload and may be encrypted and authenticated.

IETF protocols will need to insert information in the 802.15.4 frames; the 802.15.4 standard enables that by including one or more payload IEs in the frame that will contain the information. For this purpose, the IETF requests a dedicated Payload IE from the IEEE 802.15 Assigned Numbers Authority (ANA) [IEEE802.15-ANA]. The current 802.15 ANA database can be found at [IEEE802.15-ANA-DB].

The 802.15.4 operations manual [IEEE802.15-OPS] describes how a Standards Development Organization (SDO) may request an allocation of one IE. To make this request the SDO has to provide (i) the reason for the request, (ii) a description of the protocol format that shows an appropriate subtype capability, and (iii) an agreement that only one IE number will be allocated for use by the SDO.

This document provides the information needed for the request.

2. Terminology

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

3. Working Groups Benefiting from the IETF 802.15.4 IE

There are several IETF working groups such as 6TiSCH, 6lo, and CoRE that could benefit from the IETF IE. The 6TiSCH Working Group has already expressed the need for the IE; this allocation is expected to satisfy that need.

4. IETF IE Subtype Format

The maximum length of the Payload IE content is 2047 octets, and the 802.15.4 frame contains a list of payload IEs. A single frame can have multiple payload IEs, terminated with the payload IE terminator, which may then be followed by the payload.

Since the 802.15.4 standard defines a list of payload IEs along with their structures, there is no need for this document to specify the internal nesting structure of the IETF IE. The Payload IE format of 802.15.4 standard contains the Length field. The length of the subtype content can be calculated from the 802.15.4 Payload IE Length field of the IETF IE.

The format of the IETF IE is as follows:

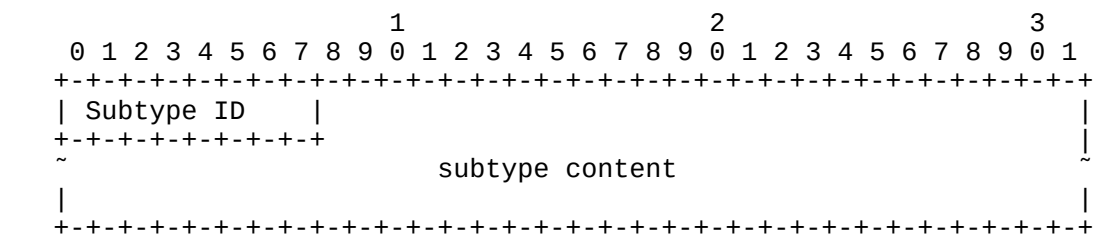

Figure 1: IETF IE Subtype Format

- Subtype ID is the IANA-allocated number specifying the subtype of the IETF IE. Value 0 is reserved for future extensibility, i.e., in case a longer subtype ID field is needed.

- Subtype content is the actual content of the Information Element, and its length can be calculated from the Length field of the IETF IE.

One IEEE 802.15.4 frame MAY contain multiple IETF IEs with the same or different subtypes.

5. Request to Allocate an IETF IE

Per the IETF's request, the IEEE 802.15 Working Group has allocated an ID (5) for a Payload IE for IETF use. The IETF understands that this is the only ID it will be issued.

6. Security Considerations

This document creates an IANA registry for IETF IE subtype IDs (see Section 7). The security of the protocols using the IEs MUST be described in the documents requesting allocations from this registry.

The IEEE Std 802.15.4 [IEEE802.15.4] contains methods in which security of the IE can be enforced when a frame is received, but this is only per IE type. Therefore, all IETF IEs will have the same security-level requirements regardless of the subtype ID used. This can cause issues if different security processing would be needed and any of those IEs would need to be processed in the MAC level. Since all IETF protocols should operate at a higher level than the MAC level, the higher-layer processing for these IEs SHOULD perform separate security policy checking based on the IETF IE subtype ID in addition to the checks done by the MAC.

7. IANA Considerations

The "IEEE Std 802.15.4 IETF IE Subtype IDs" registry has been created as follows:

Value	Subtype ID
0	Reserved
1-200	Unassigned
201-255	Experimental Use

Any change or addition to this registry requires Expert Review [RFC5226].

Note that there are vendor-specific IEs already defined in IEEE 802.15.4 (see Appendix A); because of this, there is no need to reserve any subtype IDs for the vendor-specific uses.

8. References

8.1. Normative References

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <http://www.rfc-editor.org/info/rfc2119>.

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <http://www.rfc-editor.org/info/rfc8174>.

8.2. Informative References

[IEEE802.15.4] IEEE, "IEEE Standard for Low-Rate Wireless Networks", IEEE Standard 802.15.4, <https://standards.ieee.org/about/get/802/802.15.html>.

[IEEE802.15-ANA] IEEE 802.15, "IEEE 802.15 Assigned Numbers Authority", <http://www.ieee802.org/15/ANA.html>.

[IEEE802.15-ANA-DB] IEEE, "IEEE 802.15 ANA database", <https://mentor.ieee.org/802.15/documents?is_dcn=257&is_group=0000>.

[IEEE802.15-OPS] IEEE, "IEEE 802.15 Operations Manual", <https://mentor.ieee.org/802.15/documents?is_dcn=235&is_group=0000>.

[RFC4944] Montenegro, G., Kushalnagar, N., Hui, J., and D. Culler, "Transmission of IPv6 Packets over IEEE 802.15.4 Networks", RFC 4944, DOI 10.17487/RFC4944, September 2007, <http://www.rfc-editor.org/info/rfc4944>.

[RFC5226] Narten, T. and H. Alvestrand, "Guidelines for Writing an IANA Considerations Section in RFCs", BCP 26, RFC 5226, DOI 10.17487/RFC5226, May 2008, <http://www.rfc-editor.org/info/rfc5226>.

Appendix A. Vendor Specific IE in IEEE 802.15.4

IEEE 802.15.4 already has several numbers for different Vendor Specific IE types. There is one for the Vendor Specific Header IE for Header IEs. There is one incorrectly named Vendor Specific

Nested IE for Payload IEs, and there is another one with exactly the same name, but under the MLME Nested IE long format. All of the Vendor Specific IEs start with a 3-octet vendor OUI to identify the organization.

Authors' Addresses

Tero Kivinen
INSIDE Secure
Lonnrotinkatu 11
Helsinki FI-00120
Finland

Email: kivinen@iki.fi

Pat Kinney
Kinney Consulting LLC

Email: pat.kinney@kinneyconsultingllc.com