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6LoWPAN Paging Dispatch
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Abstract

This specification updates RFC 4944 to introduce a new context switch mechanism for 6LoWPAN compression, expressed in terms of Pages and signaled by a new Paging Dispatch.

Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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1. Introduction

The design of Low Power and Lossy Networks (LLNs) is generally focused on saving energy, which often is a very constrained resource. Other constraints, such as memory capacity and duty cycle restrictions on LLN devices, usually derive from that primary concern. Energy is often available only from primary batteries that are expected to last for years, or is scavenged from the environment in very limited amounts. Any protocol that is intended for use in LLNs must be designed with a primary focus on saving energy, which is a strict requirement.

Controlling the amount of data transmission is one possible means of saving energy. In a number of LLN standards, the frame size is limited to much smaller values than the IPv6 maximum transmission unit (MTU) of 1280 bytes. In particular, an LLN that relies on the classical Physical Layer (PHY) of IEEE 802.15.4 [IEEE802154] is limited to 127 bytes per frame. The need to compress IPv6 packets over IEEE 802.15.4 led to the 6LoWPAN Header Compression [RFC6282] work (6LoWPAN-HC).

As more and more protocols need to be compressed, the encoding capabilities of the original dispatch defined in the 6lo adaptation layer framework ([RFC4944],[RFC6282]) becomes saturated. This specification introduces a new context switch mechanism for 6LoWPAN compression, expressed in terms of Pages and signaled by a new Paging Dispatch mechanism.

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 [RFC2119].

The Terminology used in this document is consistent with and incorporates that described in Terms Used in Routing for Low-Power and Lossy Networks [RFC7102] and Terminology for Constrained-Node Networks [RFC7228].

3. Updating RFC 4944

This draft adapts 6LoWPAN while maintaining backward compatibility with IPv6 over IEEE 802.15.4 [RFC4944] by introducing a concept of a "parsing context" in the 6LoWPAN parser, a context being identified by a Page Number. This specification defines 16 Pages.

Pages are delimited in a 6LoWPAN packet by a Paging Dispatch value that indicates the next current Page. The Page Number is encoded in a Paging Dispatch with the Value Bit Pattern of 1111xxxx where xxxx is the Page Number, 0 to 15, as described in Figure 1:

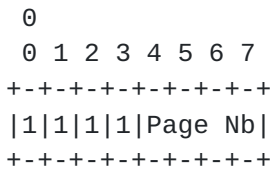

Figure 1: Paging Dispatch with Page Number Encoding.

Values of the Dispatch byte defined in [RFC4944] are considered as belonging to the Page 0 parsing context, which is the default and does not need to be signaled explicitly at the beginning of a 6LoWPAN packet. This ensures backward compatibility with existing implementations of 6LoWPAN.

The Dispatch bits defined in Page 0 by [RFC4944] are free to be reused in Pages 1 to 15. This specification allocates some values in Page 1 in Section 4 and leaves the rest open for future allocations.

Values opened by this specification in Page 1 to 14 are to be assigned for new protocols whereas Page 15 is reserved for experimentations.

Note: This specification does not use the Escape Dispatch, which extends Page 0 to more values, but rather allocates another Dispatch

Bit Pattern (1111xxxx) for a new Paging Dispatch, that is present in all Pages, including Page 0 and Pages defined in future specifications, to indicate the next parsing context represented by its Page Number. The rationale for avoiding that approach is that there can be multiple occurrences of a new header indexed by this specification in a single frame and the overhead on an octet each time for the Escape Dispatch would be prohibitive.

A Page (say Page N) is said to be active once the Page N Paging Dispatch is parsed, and remains active until another Paging Dispatch is parsed.

4. Page 1 Paging Dispatch

This specification defines some special properties for Page 1, detailed below:

The Dispatch bits defined for LOWPAN_IPHC by the Compression Format for IPv6 Datagrams over IEEE 802.15.4-Based Networks [RFC6282] are defined with the same values in Page 1 so there is no need to switch context from Page 1 to Page 0 to decode a packet that is encoded per [RFC6282].

Mesh Headers represent Layer-2 information and are processed before any Layer-3 information that is encoded in Page 1. If a 6LoWPAN packet requires a Mesh header, the Mesh Header MUST always be placed in the packet before the first Page 1 Paging Dispatch, if any.

For the same reason, Fragment Headers as defined in [RFC4944] MUST always be placed in the packet before the first Page 1 Paging Dispatch, if any.

The NALP Dispatch Bit Pattern as defined in [RFC4944] is only defined for the first octet in the packet. Switching back to Page 0 for NALP inside a 6LoWPAN packet does not make sense.

As a result, there is no need for restoring the Page 0 parsing context after a context was switched to Page 1, so the value for the Page 0 Paging Dispatch of 11110000 may not actually occur in those packets that adhere to 6LoWPAN specifications available at the time of writing this specification.

5. Security Considerations

The security considerations of [RFC4944] and [RFC6282] apply.

6. IANA Considerations

6.1. Consuming Dispatch Types

This document allocates 16 values from the Dispatch type field registry that was created for [RFC4944]. The allocated values are from 11 110000 through 11 111111 and represent Page Numbers 0 through 15 as discussed in this document.

6.2. New Column in Dispatch Type Registry

This document extends the Dispatch type field registry that was created for [RFC4944] and updated by the [RFC6282], by adding a new column called "Page".

This document defines 16 Pages, "Page 0" to "Page 15".

The content of the incumbent registry is assigned to "Page 0".

This document also places in the registry associated to Page 1 the Dispatch type field values that are allocated for LOWPAN_IPHC by [RFC6282]. These values range from 01 100000 through 01 111111 and have the same definition in Page 1 as they do in Page 0; as a result, the registry entries for Page 0 and Page 1 are an exact overlap in this range.

Values ranging from 00000000 to 11101111 in Page 15 (that is all of Page 15 but the space used for Page switch) is reserved for experimentations and shall not be assigned.

The resulting registry may be represented as a table as follow (partial):

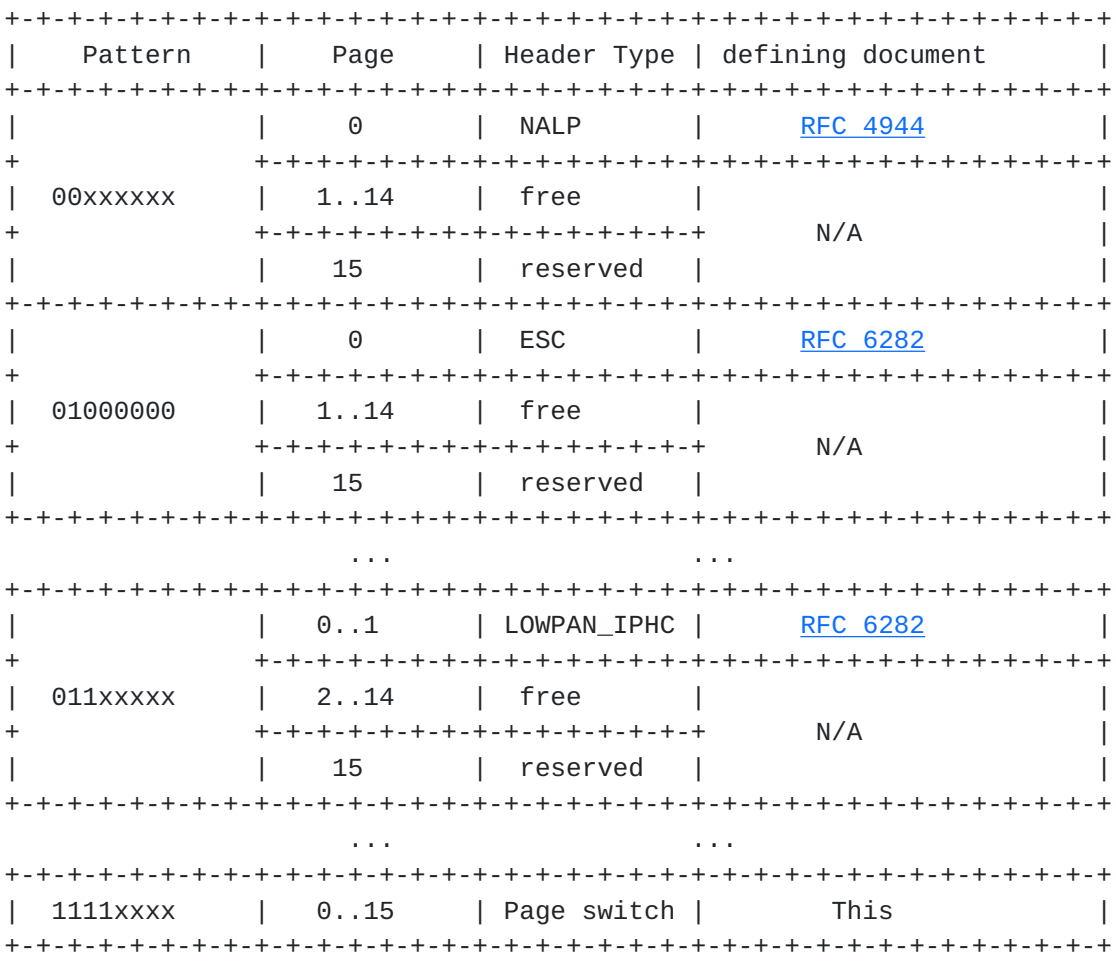

Figure 2: Integrating the new Page column

Future assignments in these registries are to be coordinated via IANA under the policy of "Specification Required" [RFC5226]. It is expected that this policy will allow for other (non-IETF) organizations to more easily obtain assignments.

7. Acknowledgments

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8. References

8.1. Normative References

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[RFC7228] Bormann, C., Ersue, M., and A. Keranen, "Terminology for Constrained-Node Networks", RFC 7228, DOI 10.17487/RFC7228, May 2014, <http://www.rfc-editor.org/info/rfc7228>.

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