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6LoWPAN Inner Compression
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Abstract

This specification modifies 6LoWPAN stateless address compression to enable the compression by 6LOWPAN_IPHC of non Link-Local addresses in an IP header when a reference address can be found in an encapsulation. .

Table of Contents

1. Introduction

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

Controlling the amount of data transmission is one possible venue to save 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).

6LoWPAN-HC is designed to support more than one IPv6 address per node and per Interface Identifier (IID), an IID being typically derived from a MAC address to optimize the compression. The stateless address compression modes (SAC/DAC=0) enable the compression of Link Local Addresses only. The suffix is found either in-line or in the

MAC header or an encapsulating IP header. The other addresses, Global and Unique-Local Addresses, can be only compressed with stateful address compression modes (SAC/DAC=1), whereby the prefix is found in a context.

In the case of an IP-in-IP encapsulation in a LLN, either or both the source or the destination address in the inner header is usually derived from the same prefix as the encapsulating header and could be compressed without a context. This specification updates [RFC6282] stateless address compression to use the prefixes found in encapsulating headers as compression reference as opposed to the link local prefix.

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 `Terminology in Low power And Lossy Networks' [RFC7102] and [RFC7228].

3. Updating RFC 6282

This draft updates the LOWPAN-IPHC compression specified in 6LoWPAN-HC [RFC6282] in the cases where SAC=0 and where M=0 and DAC=0.

The change is that the prefix that is used as compression reference is not necessarily derived from the link local prefix but may be obtained from a preceding header.

If no prefix is located in a preceding header then the stateless compression based on the link local prefix and specified in [RFC6282] still applies.

Locating a prefix for the compression of the source address (SAC=0) is discussed in Section 4.1 and Section 4.3. Locating a prefix for the compression of the destination address (M=0 and DAC=0) is discussed in Section 4.2 and Section 4.3.

4. Compression References

The native origin for a compression reference is in an IP-in-IP encapsulating header. This is discussed in Section 4.1 and Section 4.2. Other headers such as the 6LoWPAN Routing Header

[I-D.ietf-6lo-routing-dispatch] (6LoRH) can be also serve as reference; that particular case is discussed in Section 4.3.

4.1. For Source IP From Encapsulating IP Header

If the IP header that is compressed with LoWPAN_IPHC is encapsulated in another IP header, the compression reference is the source of that encapsulating header, that is the address of the node that performed the encapsulation, whether that encapsulating header was itself encapsulated again or not.

4.2. For Destination IP From Encapsulating IP Header

If the IP header that is compressed with LoWPAN_IPHC is encapsulated in another IP header, the compression reference is the address of the destination of the encapsulating IP packet, that is the node that eventually performs the decapsulation of the IP header.

If a routing header is present in the encapsulating IP header chain, this is the last address in the last routing header at the time the encapsulation is generated. In the uncompressed form of a Routing Header type 3 [RFC6554], it is swapped with the address of the destination at the time the packet reaches it, and thus found in the IP header as opposed to the routing header.

4.3. Preceding 6LoRH Header

The 6LoWPAN Routing Header [I-D.ietf-6lo-routing-dispatch] specification documents a compression scheme for the RPL artifacts in data packet. The compressed format places the artifacts in 6LoRH Headers that are located before the LOWPAN_IPHC, even when there is not IP-in-IP encapsulation.

If there is no IP-in-IP encapsulation but the IP header that is compressed with LoWPAN_IPHC is preceded in the compressed form by an RH3-6LoRH header, then the last address in the last RH3-6LoRH header is the compression reference for the destination address.

If there is an IP-in-IP encapsulation compressed with IP-in-IP-6LoRH, then the address of the destination of the encapsulating IP packet is encoded in a RH3-6LoRH as well, so the last address in the last RH3-6LoRH header is also the compression reference for the destination address.

If there is no IP encapsulation but the IP header that is compressed with LoWPAN_IPHC is preceded in the compressed form by an RPI-6LoRH header that identifies a RPL DODAG [RFC6550], then the address of the root of the DODAG is the compression reference for the source

address. It is also the compression reference for the destination address in the absence of an RH3-6LoRH header.

5. Stateless Compression of the Source Address

This section covers the case of stateless address compression (SAC=0) of the source address in a LOWPAN-IPHC.

If a compression reference Section 4.1 cannot be found, then [RFC6282] applies. Else, the compression depends on the value of the SAM bits as follows:

00: 128 bits. The full address is carried in-line

01: 64 bits. The first 64-bits of the address are elided and obtained from the compression reference; the remaining 64 bits are carried in-line

10: 16 bits. The first 112 bits of the address are elided and obtained from the compression reference; the remaining 16 bits are carried in-line

11: 0 bits. The address is fully elided, it is the same as the compression reference.

6. Stateless Compression of the Destination Address

This section covers the case of stateless unicast address compression (M=0, DAC=0) of the destination address in a LOWPAN-IPHC.

If a compression reference Section 4.2 cannot be found, then [RFC6282] applies. Else, the compression depends on the value of the DAM bits as follows:

00: 128 bits. The full address is carried in-line

01: 64 bits. The first 64-bits of the address are elided and obtained from the compression reference; the remaining 64 bits are carried in-line

10: 16 bits. The first 112 bits of the address are elided and obtained from the compression reference; the remaining 16 bits are carried in-line

11: 0 bits. The address is fully elided, it is the same as the compression reference.

7. Security Considerations

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

8. IANA Considerations

This document does not have requirements for IANA.

9. Acknowledgments

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10. References

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