

6lo  
Internet-Draft  
Updates: [6282](#) (if approved)  
Intended status: Standards Track  
Expires: August 13, 2016

P. Thubert, Ed.  
Cisco  
X. Vilajosana  
Universitat Oberta de Catalunya  
S. Duquennoy  
Inria  
February 10, 2016

6LoWPAN Inner Compression  
[draft-thubert-6lo-inner-compression-00](#)

## 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. .

## Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of [BCP 78](#) and [BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <http://datatracker.ietf.org/drafts/current/>.

Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on August 13, 2016.

## Copyright Notice

Copyright (c) 2016 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to [BCP 78](#) and the IETF Trust's Legal Provisions Relating to IETF Documents (<http://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in [Section 4.e](#) of

the Trust Legal Provisions and are provided without warranty as described in the Simplified BSD License.

## Table of Contents

<a href="#">1.</a>	Introduction . . . . .	<a href="#">2</a>
<a href="#">2.</a>	Terminology . . . . .	<a href="#">3</a>
<a href="#">3.</a>	Updating <a href="#">RFC 6282</a> . . . . .	<a href="#">3</a>
<a href="#">4.</a>	Compression References . . . . .	<a href="#">3</a>
<a href="#">4.1.</a>	For Source IP From Encapsulating IP Header . . . . .	<a href="#">4</a>
<a href="#">4.2.</a>	For Destination IP From Encapsulating IP Header . . . . .	<a href="#">4</a>
<a href="#">4.3.</a>	Preceding 6LoRH Header . . . . .	<a href="#">4</a>
<a href="#">5.</a>	Stateless Compression of the Source Address . . . . .	<a href="#">5</a>
<a href="#">6.</a>	Stateless Compression of the Destination Address . . . . .	<a href="#">5</a>
<a href="#">7.</a>	Security Considerations . . . . .	<a href="#">6</a>
<a href="#">8.</a>	IANA Considerations . . . . .	<a href="#">6</a>
<a href="#">9.</a>	Acknowledgments . . . . .	<a href="#">6</a>
<a href="#">10.</a>	References . . . . .	<a href="#">6</a>
<a href="#">10.1.</a>	Normative References . . . . .	<a href="#">6</a>
<a href="#">10.2.</a>	Informative References . . . . .	<a href="#">7</a>
	Authors' Addresses . . . . .	<a href="#">7</a>

## [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

Thubert, et al.

Expires August 13, 2016

[Page 3]

---

Internet-Draft

6LoWPAN Inner Compression

February 2016

[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

The authors wish to thank Thomas Watteyne, Maria-Rita Palatella, Aurelie Sfez and Miguel Angel Reina Ortega for organizing the 6TiSCH PlugTest with the ETSI.

## 10. References

## 10.1. Normative References

- [I-D.ietf-6lo-routing-dispatch]  
Thubert, P., Bormann, C., Toutain, L., and R. Cragie,  
"6LoWPAN Routing Header", [draft-ietf-6lo-routing-dispatch-04](#) (work in progress), January 2016.
- [IEEE802154]  
IEEE standard for Information Technology, "IEEE std. 802.15.4, Part. 15.4: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Low-Rate Wireless Personal Area Networks".
- [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>>.
- [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>>.
- [RFC6282] Hui, J., Ed. and P. Thubert, "Compression Format for IPv6 Datagrams over IEEE 802.15.4-Based Networks", [RFC 6282](#), DOI 10.17487/RFC6282, September 2011, <<http://www.rfc-editor.org/info/rfc6282>>.

## 10.2. Informative References

- [I-D.ietf-6tisch-architecture]  
Thubert, P., "An Architecture for IPv6 over the TSCH mode of IEEE 802.15.4", [draft-ietf-6tisch-architecture-09](#) (work in progress), November 2015.
- [RFC6550] Winter, T., Ed., Thubert, P., Ed., Brandt, A., Hui, J.,

Kelsey, R., Levis, P., Pister, K., Struik, R., Vasseur, JP., and R. Alexander, "RPL: IPv6 Routing Protocol for Low-Power and Lossy Networks", [RFC 6550](#), DOI 10.17487/RFC6550, March 2012, <<http://www.rfc-editor.org/info/rfc6550>>.

[RFC6554] Hui, J., Vasseur, JP., Culler, D., and V. Manral, "An IPv6 Routing Header for Source Routes with the Routing Protocol for Low-Power and Lossy Networks (RPL)", [RFC 6554](#), DOI 10.17487/RFC6554, March 2012, <<http://www.rfc-editor.org/info/rfc6554>>.

[RFC7102] Vasseur, JP., "Terms Used in Routing for Low-Power and Lossy Networks", [RFC 7102](#), DOI 10.17487/RFC7102, January 2014, <<http://www.rfc-editor.org/info/rfc7102>>.

[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>>.

#### Authors' Addresses

Pascal Thubert (editor)  
Cisco Systems  
Building D - Regus  
45 Allee des Ormes  
BP1200  
MOUGINS - Sophia Antipolis 06254  
FRANCE

Phone: +33 4 97 23 26 34  
Email: [pthubert@cisco.com](mailto:pthubert@cisco.com)



Universitat Oberta de Catalunya  
156 Rambla Poblenou  
Barcelona, Catalonia 08018  
Spain

Phone: +34 (646) 633 681  
Email: xvilajosana@uoc.edu

Simon Duquennoy  
Inria  
40, avenue Halley  
Villeneuve d'Ascq 59650  
France

Phone: +33 768227731  
Email: simon.duquennoy@inria.fr