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An uniform format for IPv6 extension headers
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Abstract

In IPv6, optional internet-layer information is encoded in separate headers that may be placed between the IPv6 header and the transport layer header. There are a small number of such extension headers currently defined. This document defines a format for defining a new family of IPv6 extension headers.

Table of Contents

1. Introduction

The base IPv6 standard [RFC2460] defines extension headers as an expansion mechanism to carry optional internet layer information. Extension headers, with the exception of the hop-by-hop options header, are not usually processed on intermediate nodes. However, some intermediate nodes such as firewalls, may need to look at the transport layer header fields in order to make a decision to allow or deny the packet. If new extension headers are defined and the intermediate node is not aware of them, the intermediate node cannot proceed further in the header chain since it does not know where the unknown header ends and the next header begins. The main issue is that the extension header format is not standardized and hence it is not possible to skip past the unknown header. This document defines a standard format for a new family of IPv6 extension headers.

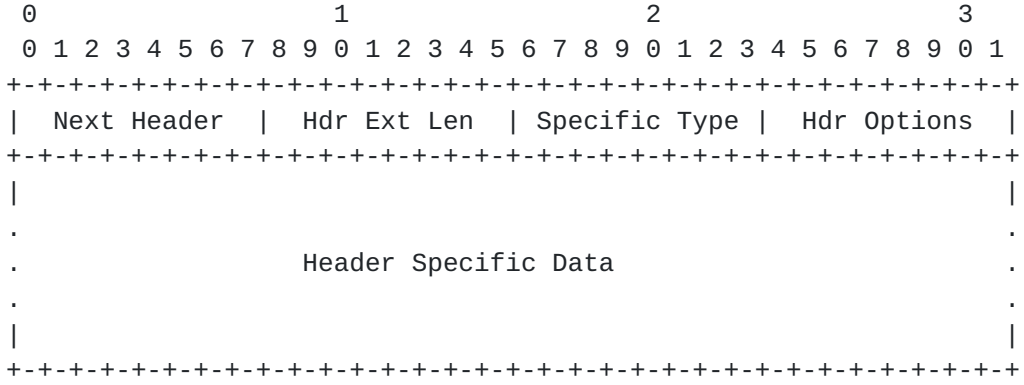
1.1. Conventions used in this document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL","SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

2. Generic IPv6 Extension Header (GIEH) format

This document proposes a new family of IPv6 extension headers that will be encoded in a consistent format so that it is possible for intermediate nodes to skip over unknown extension headers and continue to further process the header chain if they so desire. The intention of the base IPv6 Specification [RFC2460] that destination hosts not be permitted to skip unknown extension headers continues to apply. One key advantage of using such a generic IPv6 extension header is that it allows nodes to distinguish between unknown extension headers and unknown upper layer protocols, which was not possible earlier. Another one is that this generic extension header conserves values in the IPv4 protocol numbers registry.

This documents requires the allocation of a single IP protocol number for the Generic IPv6 extension header (GIEH), say TBA1. Specifications of new extension headers SHOULD use this generic extension header format whenever feasible. The generic extension header will be identified by the value TBA1 occuring in the Next Header field of the preceding extension header. The second octet contains the length of the extension header. The third octet of the GIEH contains a specific extension header type (that identifies the actual extension header). All other data in the GIEH is type-specific.



Next Header — 8-bit selector. Identifies the type of header immediately following this Extension header. Uses the same values as the IPv4 Protocol field.

Hdr Ext Len — 8-bit unsigned integer. Length of the Extension header in 8-octet units, not including the first 8 octets.

Specific Type — 8-bit unsigned integer. The actual IPv6 extension header type. This will be allocated

	from a new IANA registry.
Hdr Options	8-bit selector. The two most significant bits specify the action that must be taken if the processing IPv6 node does not recognize the extension header: 00 - skip over this option and continue processing the header. 01 - discard the packet. 10 - discard the packet and, regardless of whether or not the packet's Destination Address was a multicast address, send an ICMP Parameter Problem, Code 1, message to the packet's Source Address, pointing to the unrecognized value within the original packet. 11 - discard the packet and, only if the packet's Destination Address was not a multicast address, send an ICMP parameter Problem, Code 1, message to the packet's Source Address, pointing to the unrecognized value within the original packet. The other 6 bits in this field are reserved. They MUST be set to zero on transmission and SHOULD be ignored on reception.
Header Specific Data	Variable length. Fields specific to the extension header. This field MUST be padded as required in order to ensure that the complete GIEH is a multiple of 8 octets long.

Figure 1: Generic IPv6 Extension Header (GIEH) layout

3. Backward Compatibility

The scheme proposed in this document is not backward compatible with all the currently defined IPv6 extension headers. It only applies to newly defined extension headers. Specifically, the following extension headers predate this document and do not follow the format proposed in this document.

- IPv6 Hop-by-Hop Options Header
- IPv6 Routing Header
- IPv6 Fragment Header
- IPv6 Destination Options Header

4. Exceptions

The the Generic IPv6 extension header is generic enough that it is suitable to use for most applications. However, it is possible that the GIEH does not satisfy the requirements in all cases where new extension headers are required. Hence, the existence of this generic header does not necessarily preclude the definition of new independent IPv6 extension headers.

5. Future work

This document proposes one step in easing the inspection of extension headers by middleboxes. There is further work required in this area. Some issues that are left unresolved beyond this document include

- There can be an arbitrary number of extension headers.
- Extension headers must be processed in the order they appear.
- Extension headers may alter the processing of the payload itself, and hence the packet may not be processed properly without knowledge of said header.

6. IANA Considerations

This document requests a single allocation from the IANA for this generic IPv6 extension header type (TBA1) from the Assigned Internet Protocol Numbers registry located at http://www.iana.org/assignments/protocol-numbers.

This document also requests the creation of a new registry for GIEH sub-types. The allocation policy for these subtypes is Standards Action.

7. Security Considerations

This document proposes a standard format for the IPv6 extension headers so that intermediate nodes that do not understand the contents of these headers can look past them. Intermediate nodes, such as firewalls, skipping over unknown headers might end up allowing the setup of a covert channel from the outside of the firewall to the inside using the data field(s) of the unknown extension headers.

8. Acknowledgements

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9. Normative References

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