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ICMP Extension Structure Length Field
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Abstract

The ICMP Extension Structure (RFC4884) does not have a length field. Therefore, unless the length of the Extension Structure can be inferred from other data in the ICMP message, the Extension Structure must be the last item in the ICMP message.

This document updates RFC 4884 to define a length field for the ICMP Extension Structure. When length information is provided, receivers can use it to parse ICMP messages. Specifically, receivers can use length information to determine the offset at which the item after the ICMP Extension Structure begins.

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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This Internet-Draft will expire on 6 February 2026.

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1. Introduction

The ICMP Extension Structure [RFC4884] does not have a length field. This means it is expected to be the last element of an ICMP message. However, there are cases where additional fields need to be inserted after the ICMP Extension Structure.

For example, [I-D.ietf-intarea-rfc8335bis] enhances the PROBE utility by adding a new field to ICMP Extended Echo and ICMP Extended Echo Reply messages. To maintain compatibility with existing PROBE implementations, this new field is placed after the ICMP Extension Structure.

Because the ICMP Extension Structure does not have a length field, [I-D.ietf-intarea-rfc8335bis] requires implementations to determine the length of the extension structure from the known message format and the assumption that these packets contain only a single ICMP Extension Object.

This special handling for PROBE packets is not ideal. For future use, a mechanism to explicitly specify the extension structure length would be beneficial.

This document adds a length field to the ICMP Extension Header. It UPDATES [RFC4884].

2. Conventions and Definitions

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 BCP14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

3. The ICMP Extension Structure

An ICMP Extension Structure contains exactly one Extension Header followed by one or more objects. The Extension Header format is defined in Section 7 of [RFC4884]. This document modifies the Extension Header format by allocating the lower 8 bits of the reserved field for a new length field. Figure 1 depicts the updated Extension Header format.

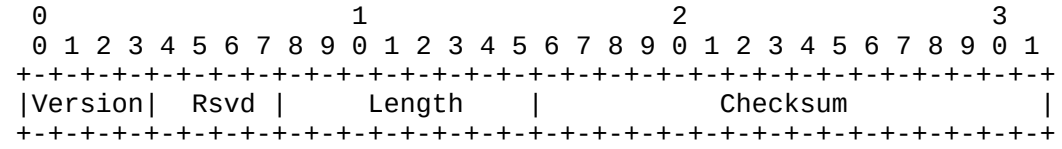

Figure 1: ICMP Extension Header As Updated By This Document

Version: 4 bits.

* ICMP Extension Header version number. This is version 2 as per [RFC4884].

Reserved (Rsvd): 4 bits

* MUST be set to 0 by the sender and MUST be ignored by the receiver.

Length: 8 bits

* This field represents the length of the ICMP Extension Structure, including all options and optional padding, but excluding the ICMP Extension Header. The length is measured in 4-byte words. Legacy implementations set this field to 0 as per section 7 of [RFC4884]. Therefore, implementation MUST NOT drop packets if this field is set to 0.

Checksum: 16 bits

* As per [RFC4884], the checksum is the one’s complement of the one’s complement sum of the data structure, with the checksum field replaced by zero for the purpose of computing the checksum. An all-zero value means that no checksum was transmitted. See Section 5.2 of [RFC4884] for a description of how this field is used.

The ICMP Extension Structure MUST be zero-padded so that it ends on a 4-byte boundary. If it does not end on a 4-byte boundary, the receiving node will parse the ICMP message incorrectly and may discard it.

4. Backwards Compatibility

Legacy implementations that do not support the mechanism defined in this document set the length field to zero when sending a packet and ignore the length field in received ICMP messages.

Such implementations require one of the following:

* The ICMP Extension Structure MUST be the final item in the ICMP packet.

* The length of the ICMP Extension Structure can be inferred from other fields in the packet (e.g., [I-D.ietf-intarea-rfc8335bis].

Currently, no mechanisms rely on the ICMP extension structure length field. Should such mechanisms be defined in the future, backward compatibility with legacy implementations should be discussed for each case.

5. UPDATES to RFC 4884

* In [RFC4884], the ICMP Extension Structure was not required to end on a 4-byte boundary. In this document,the ICMP Extension Structure MUST be zero-padded so that it ends on a 4-byte boundary.

* In [RFC4884], an ICMP Extension Structure contains exactly one Extension Header followed by one or more objects. The Extension Header contained a 12-bit reserved field. This document allocates the lower 8 bits of the reserved field for a new length field.

* In [RFC4884], the reserved field MUST be set to 0. In this document, the remaining 4 bits of the reserved field MUST be set to 0 by the sender and MUST be ignored by the receiver.

* In [RFC4884] the ICMP Extension Structure was expected to be the last data item in an ICMP message. Because this document adds a length field to the ICMP Extension Header, implementations can parse beyond the ICMP Extension Structure. Therefore, data items can be added after the ICMP Extension Structure.

6. IANA Considerations

This document requires no IANA actions.

7. Security Considerations

This document introduces no security vulnerabilities. However, it does inherit security considerations from [RFC4884].

8. Acknowledgements

Thanks to Tom Herbert, Jen Linkova, Erik Vynke and Michael Welzl for their review and helpful suggestions.

9. References

9.1. 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, <https://www.rfc-editor.org/rfc/rfc2119>.

[RFC4884] Bonica, R., Gan, D., Tappan, D., and C. Pignataro, "Extended ICMP to Support Multi-Part Messages", RFC 4884, DOI 10.17487/RFC4884, April 2007, <https://www.rfc-editor.org/rfc/rfc4884>.

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

9.2. Informative References

[I-D.ietf-intarea-rfc8335bis] Fenner, B., Bonica, R., Thomas, R., Linkova, J., Lenart, C., and M. Boucadair, "PROBE: A Utility for Probing Interfaces", Work in Progress, Internet-Draft, draft-ietf-intarea-rfc8335bis-01, 21 July 2025, <https://datatracker.ietf.org/doc/html/draft-ietf-intarea-rfc8335bis-01>.

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