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A Larger Internet Key Exchange version 2 (IKEv2) Payload
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Abstract

The messages of the Internet Key Exchange version 2 (IKEv2) protocol are made up of payloads. The current protocol limits each of these payloads to 64KB by having a 2-byte length field. While this is usually enough, several of the payloads may need to be larger.

This document updates RFC 7296 by defining an extension that allows larger payloads.

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 18 September 2026.

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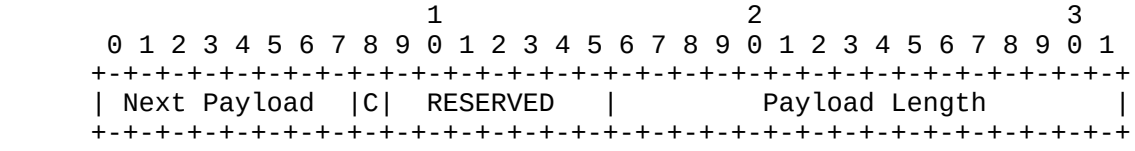
1. Introduction

The IKEv2 document ([RFC7296]) defines the IKE header in section 3.1. The IKE header includes a 4-byte length field, allowing for IKE messages of up to 4 GB. While the standard transport for IKEv2 is UDP, which is limited to 64KB packets even with IP-layer fragmentation, an extension called IKEv2 Message Fragmentation ([RFC7383]) allows for larger messages.

Using TLS for IKEv2, as defined in [RFC9329], could support arbitrarily-large messages, but the format defined in section 3.1 of that document limits each IKE message size to 64 KB, so message fragmentation will be necessary even when running over TCP.

Section 3.2 of the IKEv2 specification defines the generic payload header, which has a 16-bit Payload Length field, limiting the size of an individual payload to 64 KB. For reference, here's a copy of the generic payload header:



Some of the payloads defined in RFC 7296 could potentially be bigger than that. For example:

* The CERT payload, defined in section 3.6, may contain various kinds of content, including X.509 certificates and Certificate Revocation Lists. The sizes of these structures are not bounded and there are such structures in the wild that far exceed 64KB.

* The KE (Key Exchange) payload contains data that is defined by the Diffie-Hellman Group number. While the original D-H groups defined in RFC 7296 were limited to 1 KB, some of the candidates for post-quantum key exchange require much larger buffers. For example, classic McEliece ([I-D.josefsson-mceliece]) requires the transmission of public keys greater than 100KB.

* The Authentication payload depends on the authentication scheme, and some post-quantum schemes such as Sphics+ require very long signatures.

This document defines using larger payloads within IKEv2 by increasing the Payload Length field to 4 bytes, signaling this through the use of one of the RESERVED bits in the payload header.

1.1. Requirements and Other Notation

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 BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

The term "extended length payload header" is a revised payload header as described in Section 2.2 with the L bit set, and the term "extended length payload" is any payload that has such a header, even if its length does not exceed 64KB.

2. Protocol Details

2.1. Negotiating The Extension

This IKE peers negotiate this extension via Notify payloads in the IKE_SA_INIT exchange. Sending this Notify payload means that the sender can process the extended length payload headers defined in Section 2.2. This payload is sent by both Initiator and Responder. It is possible that one peer sends this Notify and the other does not. In such a case, the peer than sent the Notify MUST still process extended length payloads, and MUST NOT send such payloads to the peer. The details of the Notify are as follows:

* The "L" bit (see Section 2.2) is set to zero.

* The Payload Length field is set to 8 - the minimal length of a Notify payload.

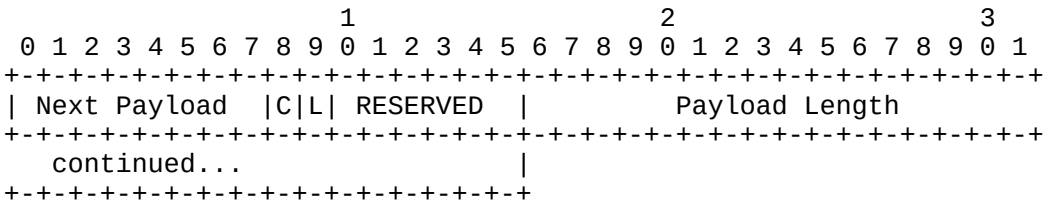
* The Protocol ID is set to zero as described in section 3.10 of RFC 7296.

* The SPI size is set to zero, like all other IKE SA-related Notify payloads.

* The Notify Message Type is set to xxxxx, the value to-be-assigned by IANA to the LARGE_PAYLOAD_SUPPORTED status type.

2.2. Revised Payload Header

The Payload header from section 3.2 of RFC 7296 is revised as follows:



The two changes are the addition of the L (or Large) bit, and the change in the length of the Payload Length field. When the L bit is set, the Payload Length field is 4 bytes long. When the L bit is zero, the Payload Length field is 2 bytes long, just as in RFC 7296.

Upon receiving a payload with the Large bit set, the receiver MUST verify that the remaining length of the packet is sufficient for the payload length promised in the Payload Length field. If not, an INVALID_SYNTAX error message type is returned. If the length is sufficient, the receiver MUST process the incoming payload just like any other. The receiver MUST NOT reject a payload that had the extended length field just because it was not needed.

2.3. Sending an Extended-Length Payload

Peers MUST NOT send an extended-length payload before receiving the LARGE_PAYLOAD_SUPPORTED status type. So the IKE_SA_INIT request cannot have an extended-length payload. The IKE_SA_INIT response could have such a payload, but as the fragmentation extension ([RFC7383]) does not apply to the IKE_SA_INIT exchange, extended-length payloads that are actually long cannot be sent. For this reason and to simplify implementations, extended-length payloads MUST NOT be used in IKE_SA_INIT.

If big payloads are required for the initial exchange, such as a post-quantum KE payload, it is RECOMMENDED that implementations use the Intermediate Exchange ([RFC9242]).

3. IANA Considerations

IANA is requested to assign a Notify Message Type from the status types registry with name LARGE_PAYLOAD_SUPPORTED and this document as reference.

4. Security Considerations

The extension described in this document allows larger payloads to be sent within the IKEv2 protocol. Care must be taken when updating existing implementation to remove assumptions about the length of payloads and to check inputs in ways that were not necessary before.

Similarly, assumptions about the amount of content that fits in a single payload need to be revised. For example, a DELETE payload without an extended length can hold up to 16,382 SPIs. This is no longer true with an extended length payload, and it can reach 65,535 SPIs and a total length of 262,150 bytes. Implementations may still impose so-called "sanity" limits on input and choose to reject payloads with an unreasonable amount of data. This is no different from RFC 7296.

Other than such software issues, this extension does not provide the IKEv2 implementation with any new kind of data, and the existing considerations for [RFC7296], [RFC7383], and [RFC9242] still apply and are sufficient.

5. Acknowledgements

The idea for writing this came from reading the document proposing an alternative solution, [I-D.tjhai-ikev2-beyond-64k-limit]. I preferred a solution that does not involve yet another layer of fragmentation, because with fragmenting the individual payloads into smaller payloads, the fragmentation of the entire IKE message using [RFC7383] is still required.

6. References

6.1. 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/info/rfc2119>.

[RFC7296] Kaufman, C., Hoffman, P., Nir, Y., Eronen, P., and T. Kivinen, "Internet Key Exchange Protocol Version 2 (IKEv2)", STD 79, RFC 7296, DOI 10.17487/RFC7296, October 2014, <https://www.rfc-editor.org/info/rfc7296>.

[RFC7383] Smyslov, V., "Internet Key Exchange Protocol Version 2 (IKEv2) Message Fragmentation", RFC 7383, DOI 10.17487/RFC7383, November 2014, <https://www.rfc-editor.org/info/rfc7383>.

[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/info/rfc8174>.

6.2. Informative References

[I-D.josefsson-mceliece] Josefsson, S., "Classic McEliece", Work in Progress, Internet-Draft, draft-josefsson-mceliece-03, 7 July 2025, <https://datatracker.ietf.org/doc/html/draft-josefsson-mceliece-03>.

[I-D.tjhai-ikev2-beyond-64k-limit] Tjhai, C., Heider, T., and V. Smyslov, "Beyond 64KB Limit of IKEv2 Payloads", Work in Progress, Internet-Draft,

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[RFC9242] Smyslov, V., "Intermediate Exchange in the Internet Key Exchange Protocol Version 2 (IKEv2)", RFC 9242, DOI 10.17487/RFC9242, May 2022, <https://www.rfc-editor.org/info/rfc9242>.

[RFC9329] Pauly, T. and V. Smyslov, "TCP Encapsulation of Internet Key Exchange Protocol (IKE) and IPsec Packets", RFC 9329, DOI 10.17487/RFC9329, November 2022, <https://www.rfc-editor.org/info/rfc9329>.

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