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# Suite B Cryptographic Suites for IPsec

## Status of This Memo



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## Abstract

This document proposes four optional cryptographic user interface suites ("UI suites") for IPsec, similar to the two suites specified in RFC 4308. The four new suites provide compatibility with the United States National Security Agency's Suite B specifications.

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## 1. Introduction

[RFC4308] proposes two optional cryptographic user interface suites ("UI suites") for IPsec. The two suites, VPN-A and VPN-B, represent commonly used present-day corporate VPN security choices and anticipated future choices, respectively. This document proposes four new UI suites based on implementations of the United States National Security Agency's Suite B algorithms (see [SuiteB]).

As with the VPN suites, the Suite B suites are simply collections of values for some options in IPsec. Use of UI suites does not change the IPsec protocols in any way.

## 2. Requirements Terminology

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

## 3. New UI Suites

Each of the following UI suites provides choices for ESP (see [RFC4303]) and for IKEv1 and IKEv2 (see [RFC2409] and [RFC4306]). The four suites are differentiated by the choice of cryptographic algorithm strengths and a choice of whether the Encapsulating Security Payload (ESP) is to provide both confidentiality and integrity or integrity only. The suite names are based on the Advanced Encryption Standard [AES] mode and AES key length specified for ESP.

IPsec implementations that use these UI suites SHOULD use the suite names listed here. IPsec implementations SHOULD NOT use names different than those listed here for the suites that are described, and MUST NOT use the names listed here for suites that do not match these values. These requirements are necessary for interoperability.

### 3.1. Suite "Suite-B-GCM-128"

This suite provides ESP integrity protection and confidentiality using 128-bit AES-GCM (see [RFC4106]). This suite or the following suite should be used when ESP integrity protection and encryption are both needed.

ESP:

| | |
|---|---|
| Encryption | AES with 128-bit keys and 16-octet Integrity Check Value (ICV) in GCM mode [RFC4106] |
| Integrity | NULL |

IKEv1:

| | |
|---|---|
| Encryption | AES with 128-bit keys in CBC mode [RFC3602] |
| Pseudo-random function | HMAC-SHA-256 [RFC4868] |
| Hash | SHA-256 [FIPS-180-2] [RFC4634] |
| Diffie-Hellman group | 256-bit random ECP group [RFC4753] |
| Group Type | ECP |

For IKEv1, Phase 1 SHOULD use Main mode. IKEv1 implementations MUST support pre-shared key authentication [RFC2409] for interoperability. The authentication method used with IKEv1 MAY be either pre-shared key [RFC2409] or ECDSA-256 [RFC4754].

IKEv2:

| | |
|---|---|
| Encryption | AES with 128-bit keys in CBC mode [RFC3602] |
| Pseudo-random function | HMAC-SHA-256 [RFC4868] |
| Integrity | HMAC-SHA-256-128 [RFC4868] |
| Diffie-Hellman group | 256-bit random ECP group [RFC4753] |
| Authentication | ECDSA-256 [RFC4754] |

Rekeying of Phase 2 (for IKEv1) or the CREATE_CHILD_SA (for IKEv2) MUST be supported by both parties in this suite.

## 3.2. Suite "Suite-B-GCM-256"

This suite provides ESP integrity protection and confidentiality using 256-bit AES-GCM (see [RFC4106]). This suite or the preceding suite should be used when ESP integrity protection and encryption are both needed.

ESP:

| | |
|---|---|
| Encryption | AES with 256-bit keys and 16-octet ICV in GCM mode [RFC4106] |
| Integrity | NULL |

IKEv1:

| | |
|---|---|
| Encryption | AES with 256-bit keys in CBC mode [RFC3602] |
| Pseudo-random function | HMAC-SHA-384 [RFC4868] |
| Hash | SHA-384 [FIPS-180-2] [RFC4634] |
| Diffie-Hellman group | 384-bit random ECP group [RFC4753] |
| Group Type | ECP |

For IKEv1, Phase 1 SHOULD use Main mode. IKEv1 implementations MUST support pre-shared key authentication [RFC2409] for interoperability. The authentication method used with IKEv1 MAY be either pre-shared key [RFC2409] or ECDSA-384 [RFC4754].

IKEv2:

| | |
|---|---|
| Encryption | AES with 256-bit keys in CBC mode [RFC3602] |
| Pseudo-random function | HMAC-SHA-384 [RFC4868] |
| Integrity | HMAC-SHA-384-192 [RFC4868] |
| Diffie-Hellman group | 384-bit random ECP group [RFC4753] |
| Authentication | ECDSA-384 [RFC4754] |

Rekeying of Phase 2 (for IKEv1) or the CREATE_CHILD_SA (for IKEv2) MUST be supported by both parties in this suite.

### 3.3. Suite "Suite-B-GMAC-128"

This suite provides ESP integrity protection using 128-bit AES-GMAC (see [RFC4543]) but does not provide confidentiality. This suite or the following suite should be used only when there is no need for ESP encryption.

ESP:

| | |
|---|---|
| Encryption | NULL |
| Integrity | AES with 128-bit keys in GMAC mode [RFC4543] |

IKEv1:

| | |
|---|---|
| Encryption | AES with 128-bit keys in CBC mode [RFC3602] |
| Pseudo-random function | HMAC-SHA-256 [RFC4868] |
| Hash | SHA-256 [FIPS-180-2] [RFC4634] |
| Diffie-Hellman group | 256-bit random ECP group [RFC4753] |
| Group Type | ECP |

For IKEv1, Phase 1 SHOULD use Main mode. IKEv1 implementations MUST support pre-shared key authentication [RFC2409] for interoperability. The authentication method used with IKEv1 MAY be either pre-shared key [RFC2409] or ECDSA-256 [RFC4754].

IKEv2:

| | |
|---|---|
| Encryption | AES with 128-bit keys in CBC mode [RFC3602] |
| Pseudo-random function | HMAC-SHA-256 [RFC4868] |
| Integrity | HMAC-SHA-256-128 [RFC4868] |
| Diffie-Hellman group | 256-bit random ECP group [RFC4753] |
| Authentication | ECDSA-256 [RFC4754] |

Rekeying of Phase 2 (for IKEv1) or the CREATE_CHILD_SA (for IKEv2) MUST be supported by both parties in this suite.

### 3.4. Suite "Suite-B-GMAC-256"

This suite provides ESP integrity protection using 256-bit AES-GMAC (see [RFC4543]) but does not provide confidentiality. This suite or the preceding suite should be used only when there is no need for ESP encryption.

ESP:

| | |
|---|---|
| Encryption | NULL |
| Integrity | AES with 256-bit keys in GMAC mode [RFC4543] |

IKEv1:

| | |
|---|---|
| Encryption | AES with 256-bit keys in CBC mode [RFC3602] |
| Pseudo-random function | HMAC-SHA-384 [RFC4868] |
| Hash | SHA-384 [FIPS-180-2] [RFC4634] |
| Diffie-Hellman group | 384-bit random ECP group [RFC4753] |
| Group Type | ECP |

For IKEv1, Phase 1 SHOULD use Main mode. IKEv1 implementations MUST support pre-shared key authentication [RFC2409] for interoperability. The authentication method used with IKEv1 MAY be either pre-shared key [RFC2409] or ECDSA-384 [RFC4754].

IKEv2:

| | |
|---|---|
| Encryption | AES with 256-bit keys in CBC mode [RFC3602] |
| Pseudo-random function | HMAC-SHA-384 [RFC4868] |
| Integrity | HMAC-SHA-384-192 [RFC4868] |
| Diffie-Hellman group | 384-bit random ECP group [RFC4753] |
| Authentication | ECDSA-384 [RFC4754] |

Rekeying of Phase 2 (for IKEv1) or the CREATE_CHILD_SA (for IKEv2) MUST be supported by both parties in this suite.

## 4. Security Considerations

This document inherits all of the security considerations of the IPsec, IKEv1, and IKEv2 documents. See [CNSSP-15] for guidance on the use of AES in these suites for the protection of U.S. Government information.

Some of the security options specified in these suites may be found in the future to have properties significantly weaker than those that were believed at the time this document was produced.

## 5. IANA Considerations

IANA has created and will maintain a registry called "Cryptographic Suites for IKEv1, IKEv2, and IPsec" (see [IANA-Suites]). The registry consists of a text string and an RFC number that lists the associated transforms. The four new suites in this document have been added to this registry after approval by an expert designated by the IESG.

The new values for the registry are:

| Identifier | Defined in |
|---|---|
| Suite-B-GCM-128 | RFC 4869 |
| Suite-B-GCM-256 | RFC 4869 |
| Suite-B-GMAC-128 | RFC 4869 |
| Suite-B-GMAC-256 | RFC 4869 |

## 6. References

### 6.1. Normative References

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[RFC4303] Kent, S., "IP Encapsulating Security Payload (ESP)", RFC 4303, December 2005.

[RFC4306] Kaufman, C., "Internet Key Exchange (IKEv2) Protocol", RFC 4306, December 2005.

[RFC4308] Hoffman, P., "Cryptographic Suites for IPsec", RFC 4308, December 2005.

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[RFC4753] Fu, D. and J. Solinas, "ECP Groups for IKE and IKEv2", RFC 4753, November 2006.

[RFC4754] Fu, D. and J. Solinas, "IKE and IKEv2 Authentication Using ECDSA", RFC 4754, November 2006.

[RFC4868] Kelly, S. and S. Frankel, "Using HMAC-SHA-256, HMAC-SHA-384, and HMAC-SHA-512 with IPsec", RFC 4868, May 2007.

## 6.2. Informative References

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[CNSSP-15] Committee on National Security Systems, "National Policy on the Use of the Advanced Encryption Standard (AES) to Protect National Security Systems and National Security Information", June 2003, <http://www.cnss.gov/Assets/pdf/cnssp_15_fs.pdf>.

[RFC4634] Eastlake 3rd, D. and T. Hansen, "US Secure Hash Algorithms (SHA and HMAC-SHA)", RFC 4634, July 2006.

[SuiteB] U.S. National Security Agency, "Fact Sheet NSA Suite B Cryptography", July 2005, <http://www.nsa.gov/ia/industry/crypto_Suite_b.cfm?MenuID=10.2.7>.

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