

TLS Working Group
Internet Draft
Intended status: Standards Track
Expires: February 2009

Mohamad Badra
LIMOS Laboratory
September 23, 2008

**Pre-Shared Key Cipher Suites for Transport Layer Security (TLS) with
SHA-256/384 and AES Galois Counter Mode
draft-ietf-tls-psk-new-mac-aes-gcm-02.txt**

Status of this Memo

By submitting this Internet-Draft, each author represents that any applicable patent or other IPR claims of which he or she is aware have been or will be disclosed, and any of which he or she becomes aware will be disclosed, in accordance with [Section 6 of BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF), its areas, and its working groups. Note that other groups may also distribute working documents as Internet-Drafts.

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."

The list of current Internet-Drafts can be accessed at
<http://www.ietf.org/ietf/1id-abstracts.txt>

The list of Internet-Draft Shadow Directories can be accessed at
<http://www.ietf.org/shadow.html>

This Internet-Draft will expire on February 23, 2009.

Copyright Notice

Copyright (C) The IETF Trust (2008).

Abstract

[RFC 4279](#) and [RFC 4785](#) describe pre-shared key cipher suites for Transport Layer Security (TLS). However, all those cipher suites use SHA-1 as their MAC algorithm. This document describes a set of cipher suites for TLS/DTLS which uses stronger digest algorithms (i.e., SHA-256 or SHA-384) and another which uses the Advanced Encryption Standard (AES) in Galois Counter Mode (GCM).

Table of Contents

1.	Introduction.....	3
1.1.	Conventions used in this document.....	3
2.	PSK, DHE_PSK and RSA_PSK Key Exchange Algorithms with AES-GCM..	3
3.	PSK, DHE_PSK and RSA_PSK Key Exchange with SHA-256/384.....	4
3.1.	PSK Key Exchange Algorithm with SHA-256/384.....	4
3.2.	DHE_PSK Key Exchange Algorithm with SHA-256/384.....	4
3.3.	RSA_PSK Key Exchange Algorithm with SHA-256/384.....	5
4.	Security Considerations.....	5
5.	IANA Considerations.....	5
6.	Acknowledgments.....	5
7.	References.....	6
7.1.	Normative References.....	6
7.2.	Informative References.....	7
	Author's Addresses.....	7
	Intellectual Property and Copyright Statements.....	7

1. Introduction

TLS 1.2 [[RFC5246](#)] adds support for authenticated encryption with additional data (AEAD) cipher modes [[RFC5116](#)]. This document describes the use of Advanced Encryption Standard (AES) [[AES](#)] in Galois Counter Mode (GCM) [[GCM](#)] (AES-GCM) with various pre-shared key (PSK) key exchange mechanisms ([[RFC4279](#)] and [[RFC4785](#)]) as a cipher suite for Transport Layer Security (TLS).

This document also specifies PSK cipher suites for TLS which replace SHA-1 by SHA-256 or SHA-384 [[SHS](#)]. [RFC 4279](#) [[RFC4279](#)] and [RFC 4785](#) [[RFC4785](#)] describe PSK cipher suites for TLS. However, all of the [RFC 4279](#) and the [RFC 4785](#) cipher suites use HMAC-SHA1 as their MAC algorithm. Due to recent analytic work on SHA-1 [[Wang05](#)], the IETF is gradually moving away from SHA-1 and towards stronger hash algorithms.

ECC based cipher suites with SHA-256/384 and AES-GCM are defined in [[RFC5289](#)]; RSA, DSS and Diffie-Hellman based cipher suites are specified in [[RFC5288](#)]. The reader is expected to become familiar with these two memos prior to studying this document.

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. PSK, DHE_PSK and RSA_PSK Key Exchange Algorithms with AES-GCM

The following six cipher suites use the new authenticated encryption modes defined in TLS 1.2 with AES in Galois Counter Mode (GCM) [[GCM](#)]. The cipher suites with DHE_PSK key exchange algorithm (TLS_DHE_PSK_WITH_AES_128_GCM_SHA256 and TLS_DHE_PSK_WITH_AES_256_GCM_SHA384) provide Perfect Forward Secrecy (PFS).

CipherSuite TLS_PSK_WITH_AES_128_GCM_SHA256	= {0xxx, 0xxx};
CipherSuite TLS_PSK_WITH_AES_256_GCM_SHA384	= {0xxx, 0xxx};
CipherSuite TLS_DHE_PSK_WITH_AES_128_GCM_SHA256	= {0xxx, 0xxx};
CipherSuite TLS_DHE_PSK_WITH_AES_256_GCM_SHA384	= {0xxx, 0xxx};
CipherSuite TLS_RSA_PSK_WITH_AES_128_GCM_SHA256	= {0xxx, 0xxx};
CipherSuite TLS_RSA_PSK_WITH_AES_256_GCM_SHA384	= {0xxx, 0xxx};

These cipher suites use authenticated encryption with additional data (AEAD) algorithms AEAD_AES_128_GCM and AEAD_AES_256_GCM described in [RFC 5116](#). GCM is used as described in [[RFC5288](#)].

The PSK, DHE_PSK and RSA_PSK key exchanges are performed as defined in [\[RFC4279\]](#).

The PRFs SHALL be as follows:

For cipher suites ending with _SHA256, the PRF is the TLS PRF [\[RFC5246\]](#) with SHA-256 as the hash function.

For cipher suites ending with _SHA384, the PRF is the TLS PRF [\[RFC5246\]](#) with SHA-384 as the hash function.

Implementations MUST send TLS Alert bad_record_mac for all types of failures encountered in processing the AES-GCM algorithm.

[3. PSK, DHE_PSK and RSA_PSK Key Exchange with SHA-256/384](#)

The cipher suites described in this section use AES [\[AES\]](#) in CBC [\[CBC\]](#) mode with an HMAC-based MAC.

[3.1. PSK Key Exchange Algorithm with SHA-256/384](#)

CipherSuite TLS_PSK_WITH_AES_128_CBC_SHA256	= {0xxx, 0xxx};
CipherSuite TLS_PSK_WITH_AES_256_CBC_SHA384	= {0xxx, 0xxx};
CipherSuite TLS_PSK_WITH_NULL_SHA256	= {0xxx, 0xxx};
CipherSuite TLS_PSK_WITH_NULL_SHA384	= {0xxx, 0xxx};

The above four cipher suites are the same as the corresponding cipher suites in [RFC 4279](#) and [RFC 4785](#) (with names ending in "_SHA" in place of "_SHA256" or "_SHA384"), except for the hash and PRF algorithms.

The PRF and MAC algorithms SHALL be as follows:

For cipher suites ending with _SHA256, the PRF is the TLS PRF [\[RFC5246\]](#) with SHA-256 as the hash function.

The MAC is HMAC [\[RFC2104\]](#) with SHA-256 as the hash function.

For cipher suites ending with _SHA384, the PRF is the TLS PRF [\[RFC5246\]](#) with SHA-384 as the hash function.

The MAC is HMAC [\[RFC2104\]](#) with SHA-384 as the hash function.

[3.2. DHE_PSK Key Exchange Algorithm with SHA-256/384](#)

CipherSuite TLS_DHE_PSK_WITH_AES_128_CBC_SHA256	= {0xxx, 0xxx};
CipherSuite TLS_DHE_PSK_WITH_AES_256_CBC_SHA384	= {0xxx, 0xxx};
CipherSuite TLS_DHE_PSK_WITH_NULL_SHA256	= {0xxx, 0xxx};
CipherSuite TLS_DHE_PSK_WITH_NULL_SHA384	= {0xxx, 0xxx};

The above four cipher suites are the same as the corresponding cipher suites in [RFC 4279](#) and [RFC 4785](#) (with names ending in "_SHA" in place of "_SHA256" or "_SHA384"), except for the hash and PRF algorithms, as explained in [section 3.1](#).

3.3. RSA_PSK Key Exchange Algorithm with SHA-256/384

```
CipherSuite TLS_RSA_PSK_WITH_AES_128_CBC_SHA256    = {0xXX,0xXX};
CipherSuite TLS_RSA_PSK_WITH_AES_256_CBC_SHA384     = {0xXX,0xXX};
```

The above two cipher suites are the same as the corresponding cipher suites in [RFC 4279](#) and [RFC 4785](#) (with names ending in "_SHA" in place of "_SHA256" or "_SHA384"), except for the hash and PRF algorithms, as explained in [section 3.1](#).

4. Security Considerations

The security considerations in [RFC 4279](#), [RFC 4758](#), and [\[RFC5288\]](#) apply to this document as well. In addition, as described in [\[RFC5288\]](#), these cipher suites may only be used with TLS 1.2 or greater.

5. IANA Considerations

IANA has assigned the following values for the cipher suites defined in this document:

```
CipherSuite TLS_PSK_WITH_AES_128_GCM_SHA256        = {0xXX,0xXX};
CipherSuite TLS_PSK_WITH_AES_256_GCM_SHA384        = {0xXX,0xXX};
CipherSuite TLS_DHE_PSK_WITH_AES_128_GCM_SHA256    = {0xXX,0xXX};
CipherSuite TLS_DHE_PSK_WITH_AES_256_GCM_SHA384    = {0xXX,0xXX};
CipherSuite TLS_RSA_PSK_WITH_AES_128_GCM_SHA256    = {0xXX,0xXX};
CipherSuite TLS_RSA_PSK_WITH_AES_256_GCM_SHA384    = {0xXX,0xXX};
CipherSuite TLS_PSK_WITH_AES_128_CBC_SHA256        = {0xXX,0xXX};
CipherSuite TLS_PSK_WITH_AES_256_CBC_SHA384        = {0xXX,0xXX};
CipherSuite TLS_PSK_WITH_NULL_SHA256               = {0xXX,0xXX};
CipherSuite TLS_PSK_WITH_NULL_SHA384              = {0xXX,0xXX};
CipherSuite TLS_DHE_PSK_WITH_AES_128_CBC_SHA256    = {0xXX,0xXX};
CipherSuite TLS_DHE_PSK_WITH_AES_256_CBC_SHA384    = {0xXX,0xXX};
CipherSuite TLS_DHE_PSK_WITH_NULL_SHA256          = {0xXX,0xXX};
CipherSuite TLS_DHE_PSK_WITH_NULL_SHA384          = {0xXX,0xXX};
CipherSuite TLS_RSA_PSK_WITH_AES_128_CBC_SHA256    = {0xXX,0xXX};
CipherSuite TLS_RSA_PSK_WITH_AES_256_CBC_SHA384    = {0xXX,0xXX};
```

6. Acknowledgments

This draft borrows heavily from [\[RFC5289\]](#) and [\[RFC5288\]](#).

The author appreciates Alfred Hoenes for his detailed review and effort on issues resolving discussion. The author would like also to acknowledge Ibrahim Hajjeh, Simon Josefsson, Hassnaa Moustafa, Joseph Salowey and Pascal Urien for their reviews of the content of the document.

7. References

7.1. Normative References

- [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), March 1997.
- [RFC5246] Dierks, T. and E. Rescorla, "The Transport Layer Security (TLS) Protocol Version 1.2", [RFC 5246](#), August 2008.
- [RFC2104] Krawczyk, H., Bellare, M., and R. Canetti, "HMAC: Keyed-Hashing for Message Authentication", [RFC 2104](#), February 1997.
- [RFC5116] McGrew, D., "An Interface and Algorithms for Authenticated Encryption", [RFC 5116](#), January 2008.
- [RFC4279] Eronen, P. and H. Tschofenig, "Pre-Shared Key Ciphersuites for Transport Layer Security (TLS)", [RFC 4279](#), December 2005.
- [RFC4785] Blumenthal, U., Goel, P., "Pre-Shared Key (PSK) Ciphersuites with NULL Encryption for Transport Layer Security (TLS)", [RFC 4785](#), January 2007.
- [AES] National Institute of Standards and Technology, "Specification for the Advanced Encryption Standard (AES)", FIPS 197, November 2001.
- [SHS] National Institute of Standards and Technology, "Secure Hash Standard", FIPS 180-2, August 2002.
- [CBC] National Institute of Standards and Technology, "Recommendation for Block Cipher Modes of Operation - Methods and Techniques", SP 800-38A, December 2001.
- [GCM] National Institute of Standards and Technology, "Recommendation for Block Cipher Modes of Operation: Galois/Counter Mode (GCM) for Confidentiality and Authentication", SP 800-38D, November 2007.

[RFC5288] Salowey, J., A. Choudhury, and C. McGrew, "RSA based AES-GCM Cipher Suites for TLS", [RFC 5288](#), August 2008.

[7.2. Informative References](#)

[Wang05] Wang, X., Yin, Y., and H. Yu, "Finding Collisions in the Full SHA-1", CRYPTO 2005, August 2005.

[RFC5289] Rescorla, E., "TLS Elliptic Curve Cipher Suites with SHA-256/384 and AES Galois Counter Mode", [RFC 5289](#), August 2008.

Author's Addresses

Mohamad Badra
LIMOS Laboratory - UMR6158, CNRS
France

Email: badra@isima.fr

Intellectual Property Statement

The IETF takes no position regarding the validity or scope of any Intellectual Property Rights or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available; nor does it represent that it has made any independent effort to identify any such rights. Information on the procedures with respect to rights in RFC documents can be found in [BCP 78](#) and [BCP 79](#).

Copies of IPR disclosures made to the IETF Secretariat and any assurances of licenses to be made available, or the result of an attempt made to obtain a general license or permission for the use of such proprietary rights by implementers or users of this specification can be obtained from the IETF on-line IPR repository at <http://www.ietf.org/ipr>.

The IETF invites any interested party to bring to its attention any copyrights, patents or patent applications, or other proprietary rights that may cover technology that may be required to implement this standard. Please address the information to the IETF at ietf-ipr@ietf.org.

Disclaimer of Validity

This document and the information contained herein are provided on an "AS IS" basis and THE CONTRIBUTOR, THE ORGANIZATION HE/SHE REPRESENTS OR IS SPONSORED BY (IF ANY), THE INTERNET SOCIETY, THE IETF TRUST AND THE INTERNET ENGINEERING TASK FORCE DISCLAIM ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Copyright Statement

Copyright (C) The IETF Trust (2008).

This document is subject to the rights, licenses and restrictions contained in [BCP 78](#), and except as set forth therein, the authors retain all their rights.

Acknowledgment

Funding for the RFC Editor function is currently provided by the Internet Society.