

TLS Working Group  
Internet-Draft  
Expires: October 25, 2005

P. Eronen, Ed.  
Nokia  
H. Tschofenig, Ed.  
Siemens  
April 26, 2005

**Pre-Shared Key Ciphersuites for Transport Layer Security (TLS)**  
**draft-ietf-tls-psk-08.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 October 25, 2005.

Copyright Notice

Copyright (C) The Internet Society (2005).

Abstract

This document specifies three sets of new ciphersuites for the Transport Layer Security (TLS) protocol to support authentication based on pre-shared keys. These pre-shared keys are symmetric keys, shared in advance among the communicating parties. The first set of ciphersuites uses only symmetric key operations for authentication. The second set uses a Diffie-Hellman exchange authenticated with a pre-shared key; and the third set combines public key authentication of the server with pre-shared key authentication of the client.



## Table of Contents

<a href="#">1.</a>	<a href="#">Introduction . . . . .</a>	<a href="#">3</a>
<a href="#">1.1</a>	<a href="#">Applicability statement . . . . .</a>	<a href="#">4</a>
<a href="#">1.2</a>	<a href="#">Conventions used in this document . . . . .</a>	<a href="#">4</a>
<a href="#">2.</a>	<a href="#">PSK key exchange algorithm . . . . .</a>	<a href="#">5</a>
<a href="#">3.</a>	<a href="#">DHE_PSK key exchange algorithm . . . . .</a>	<a href="#">7</a>
<a href="#">4.</a>	<a href="#">RSA_PSK key exchange algorithm . . . . .</a>	<a href="#">8</a>
<a href="#">5.</a>	<a href="#">Conformance requirements . . . . .</a>	<a href="#">9</a>
<a href="#">5.1</a>	<a href="#">PSK identity encoding . . . . .</a>	<a href="#">9</a>
<a href="#">5.2</a>	<a href="#">Identity hint . . . . .</a>	<a href="#">9</a>
<a href="#">5.3</a>	<a href="#">Requirements for TLS implementations . . . . .</a>	<a href="#">10</a>
<a href="#">5.4</a>	<a href="#">Requirements for management interfaces . . . . .</a>	<a href="#">10</a>
<a href="#">6.</a>	<a href="#">IANA considerations . . . . .</a>	<a href="#">11</a>
<a href="#">7.</a>	<a href="#">Security Considerations . . . . .</a>	<a href="#">11</a>
<a href="#">7.1</a>	<a href="#">Perfect forward secrecy (PFS) . . . . .</a>	<a href="#">11</a>
<a href="#">7.2</a>	<a href="#">Brute-force and dictionary attacks . . . . .</a>	<a href="#">11</a>
<a href="#">7.3</a>	<a href="#">Identity privacy . . . . .</a>	<a href="#">12</a>
<a href="#">7.4</a>	<a href="#">Implementation notes . . . . .</a>	<a href="#">12</a>
<a href="#">8.</a>	<a href="#">Acknowledgments . . . . .</a>	<a href="#">12</a>
<a href="#">9.</a>	<a href="#">References . . . . .</a>	<a href="#">13</a>
<a href="#">9.1</a>	<a href="#">Normative References . . . . .</a>	<a href="#">13</a>
<a href="#">9.2</a>	<a href="#">Informative References . . . . .</a>	<a href="#">13</a>
	<a href="#">Authors' and Contributors' Addresses . . . . .</a>	<a href="#">15</a>
	<a href="#">Appendix A. Changelog . . . . .</a>	<a href="#">16</a>



## 1. Introduction

Usually TLS uses public key certificates [3] or Kerberos [12] for authentication. This document describes how to use symmetric keys (later called pre-shared keys or PSKs), shared in advance among the communicating parties, to establish a TLS connection.

There are basically two reasons why one might want to do this:

- o First, using pre-shared keys can, depending on the ciphersuite, avoid the need for public key operations. This is useful if TLS is used in performance-constrained environments with limited CPU power.
- o Second, pre-shared keys may be more convenient from a key management point of view. For instance, in closed environments where the connections are mostly configured manually in advance, it may be easier to configure a PSK than to use certificates. Another case is when the parties already have a mechanism for setting up a shared secret key, and that mechanism could be used to "bootstrap" a key for authenticating a TLS connection.

This document specifies three sets of new ciphersuites for TLS. These ciphersuites use new key exchange algorithms, and re-use existing cipher and MAC algorithms from [3] and [2]. A summary of these ciphersuites is shown below.

CipherSuite	Key Exchange	Cipher	Hash
TLS_PSK_WITH_RC4_128_SHA	PSK	RC4_128	SHA
TLS_PSK_WITH_3DES_EDE_CBC_SHA	PSK	3DES_EDE_CBC	SHA
TLS_PSK_WITH_AES_128_CBC_SHA	PSK	AES_128_CBC	SHA
TLS_PSK_WITH_AES_256_CBC_SHA	PSK	AES_256_CBC	SHA
TLS_DHE_PSK_WITH_RC4_128_SHA	DHE_PSK	RC4_128	SHA
TLS_DHE_PSK_WITH_3DES_EDE_CBC_SHA	DHE_PSK	3DES_EDE_CBC	SHA
TLS_DHE_PSK_WITH_AES_128_CBC_SHA	DHE_PSK	AES_128_CBC	SHA
TLS_DHE_PSK_WITH_AES_256_CBC_SHA	DHE_PSK	AES_256_CBC	SHA
TLS_RSA_PSK_WITH_RC4_128_SHA	RSA_PSK	RC4_128	SHA
TLS_RSA_PSK_WITH_3DES_EDE_CBC_SHA	RSA_PSK	3DES_EDE_CBC	SHA
TLS_RSA_PSK_WITH_AES_128_CBC_SHA	RSA_PSK	AES_128_CBC	SHA
TLS_RSA_PSK_WITH_AES_256_CBC_SHA	RSA_PSK	AES_256_CBC	SHA

The first set of ciphersuites (with PSK key exchange algorithm), defined in [Section 2](#) use only symmetric key algorithms, and are thus especially suitable for performance-constrained environments.

The ciphersuites in [Section 3](#) (with DHE\_PSK key exchange algorithm) use a PSK to authenticate a Diffie-Hellman exchange. These



ciphersuites protect against dictionary attacks by passive eavesdroppers (but not active attackers), and also provide Perfect Forward Secrecy (PFS).

The third set of ciphersuites (with RSA\_PSK key exchange algorithm), defined in [Section 4](#), combine public key based authentication of the server (using RSA and certificates) with mutual authentication using a PSK.

### **[1.1](#) Applicability statement**

The ciphersuites defined in this document are intended for a rather limited set of applications, usually involving only a very small number of clients and servers. Even in such environments, other alternatives may be more appropriate.

If the main goal is to avoid PKIs, another possibility worth considering is to use self-signed certificates with public key fingerprints. Instead of manually configuring a shared secret in, for instance, some configuration file, a fingerprint (hash) of the other party's public key (or certificate) could be placed there instead.

It is also possible to use the SRP (Secure Remote Password) ciphersuites for shared secret authentication [[14](#)]. SRP was designed to be used with passwords, and incorporates protection against dictionary attacks. However, it is computationally more expensive than the PSK ciphersuites in [Section 2](#).

### **[1.2](#) 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 [[1](#)].





## 2. PSK key exchange algorithm

This section defines the PSK key exchange algorithm and associated ciphersuites. These ciphersuites use only symmetric key algorithms.

It is assumed that the reader is familiar with ordinary TLS handshake, shown below. The elements in parenthesis are not included when PSK key exchange algorithm is used, and "\*" indicates a situation-dependent message that is not always sent.

Client		Server
-----		-----
ClientHello	----->	
		ServerHello
		(Certificate)
		ServerKeyExchange*
		(CertificateRequest)
	<-----	ServerHelloDone
(Certificate)		
ClientKeyExchange		
(CertificateVerify)		
ChangeCipherSpec		
Finished	----->	
		ChangeCipherSpec
	<-----	Finished
Application Data	<----->	Application Data

The client indicates its willingness to use pre-shared key authentication by including one or more PSK ciphersuites in the ClientHello message. If the TLS server also wants to use pre-shared keys, it selects one of the PSK ciphersuites, places the selected ciphersuite in the ServerHello message, and includes an appropriate ServerKeyExchange message (see below). The Certificate and CertificateRequest payloads are omitted from the response.

Both clients and servers may have pre-shared keys with several different parties. The client indicates which key to use by including a "PSK identity" in the ClientKeyExchange message (note that unlike in [7], the session\_id field in ClientHello message keeps its usual meaning). To help the client in selecting which identity to use, the server can provide a "PSK identity hint" in the ServerKeyExchange message. If no hint is provided, the ServerKeyExchange message is omitted. See [Section 5](#) for more detailed description of these fields.

The format of the ServerKeyExchange and ClientKeyExchange messages is shown below.



```
struct {
    select (KeyExchangeAlgorithm) {
        /* other cases for rsa, diffie_hellman, etc. */
        case psk: /* NEW */
            opaque psk_identity_hint<0..2^16-1>;
    };
} ServerKeyExchange;

struct {
    select (KeyExchangeAlgorithm) {
        /* other cases for rsa, diffie_hellman, etc. */
        case psk: /* NEW */
            opaque psk_identity<0..2^16-1>;
    } exchange_keys;
} ClientKeyExchange;
```

The premaster secret is formed as follows: if the PSK is N octets long, concatenate a uint16 with the value N, N zero octets, a second uint16 with the value N, and the PSK itself.

Note 1: All the ciphersuites in this document share the same general structure for the premaster secret, namely

```
struct {
    opaque other_secret<0..2^16-1>;
    opaque psk<0..2^16-1>;
};
```

Here "other\_secret" is either zeroes (plain PSK case), or comes from the Diffie-Hellman or RSA exchange (DHE\_PSK and RSA\_PSK, respectively). See Sections [3](#) and [4](#) for a more detailed description.

Note 2: Using zeroes for "other\_secret" effectively means that only the HMAC-SHA1 part (but not the HMAC-MD5 part) of the TLS PRF is used when constructing the master secret. This was considered more elegant from an analytical viewpoint than, for instance, using the same key for both the HMAC-MD5 and HMAC-SHA1 parts. See [\[8\]](#) for a more detailed rationale.

The TLS handshake is authenticated using the Finished messages as usual.

If the server does not recognize the PSK identity, it MAY respond with an "unknown\_psk\_identity" alert message. Alternatively, if the server wishes to hide the fact that the PSK identity was not known, it MAY continue the protocol as if the PSK identity existed but the key was incorrect: that is, respond with a "decrypt\_error" alert.



### 3. DHE\_PSK key exchange algorithm

This section defines additional ciphersuites that use a PSK to authenticate a Diffie-Hellman exchange. These ciphersuites give some additional protection against dictionary attacks, and also provide Perfect Forward Secrecy (PFS). See [Section 7](#) for discussion of related security considerations.

When these ciphersuites are used, the ServerKeyExchange and ClientKeyExchange messages also include the Diffie-Hellman parameters. The PSK identity and identity hint fields have the same meaning as in the previous section (note that the ServerKeyExchange message is always sent even if no PSK identity hint is provided).

The format of the ServerKeyExchange and ClientKeyExchange messages is shown below.

```
struct {
    select (KeyExchangeAlgorithm) {
        /* other cases for rsa, diffie_hellman, etc. */
        case diffie_hellman_psk: /* NEW */
            opaque psk_identity_hint<0..2^16-1>;
            ServerDHParams params;
    };
} ServerKeyExchange;

struct {
    select (KeyExchangeAlgorithm) {
        /* other cases for rsa, diffie_hellman, etc. */
        case diffie_hellman_psk: /* NEW */
            opaque psk_identity<0..2^16-1>;
            ClientDiffieHellmanPublic public;
    } exchange_keys;
} ClientKeyExchange;
```

The premaster secret is formed as follows. First, perform the Diffie-Hellman computation in the same way as for other Diffie-Hellman based ciphersuites in [\[3\]](#). Let Z be the value produced by this computation (with leading zero bytes stripped as in other Diffie-Hellman based ciphersuites). Concatenate a uint16 containing the length of Z (in octets), Z itself, a uint16 containing the length of the PSK (in octets), and the PSK itself.

This corresponds to the general structure for the premaster secrets (see Note 1 in [Section 2](#)) in this document, with "other\_secret" containing Z.



#### 4. RSA\_PSK key exchange algorithm

The ciphersuites in this section use RSA and certificates to authenticate the server, in addition to using a PSK.

As in normal RSA ciphersuites, the server must send a Certificate message. The format of the ServerKeyExchange and ClientKeyExchange messages is shown below. If no PSK identity hint is provided, the ServerKeyExchange message is omitted.

```
struct {
    select (KeyExchangeAlgorithm) {
        /* other cases for rsa, diffie_hellman, etc. */
        case rsa_psk: /* NEW */
            opaque psk_identity_hint<0..2^16-1>;
    };
} ServerKeyExchange;

struct {
    select (KeyExchangeAlgorithm) {
        /* other cases for rsa, diffie_hellman, etc. */
        case rsa_psk: /* NEW */
            opaque psk_identity<0..2^16-1>;
            EncryptedPreMasterSecret;
    } exchange_keys;
} ClientKeyExchange;
```

The EncryptedPreMasterSecret field sent from the client to the server contains a 2-byte version number and a 46-byte random value, encrypted using the server's RSA public key as described in [Section 7.4.7.1](#) of [3]. The actual premaster secret is formed by both parties as follows: concatenate a uint16 with the value 48, the 2-byte version number and the 46-byte random value, a uint16 containing the length of the PSK (in octets), and the PSK itself. (The premaster secret is thus 52 octets longer than the PSK.)

This corresponds to the general structure for the premaster secrets (see Note 1 in [Section 2](#)) in this document, with "other\_secret" containing both the 2-byte version number and the 46-byte random value.

Neither the normal RSA ciphersuites nor these RSA\_PSK ciphersuites themselves specify what the certificates contain (in addition to the RSA public key), or how the certificates are to be validated. In particular, it is possible to use the RSA\_PSK ciphersuites with unvalidated self-signed certificates to provide somewhat similar protection against dictionary attacks as the DHE\_PSK ciphersuites defined in [Section 3](#).





## **5. Conformance requirements**

It is expected that different types of identities are useful for different applications running over TLS. This document does not therefore mandate the use of any particular type of identity (such as IPv4 address or FQDN).

However, the TLS client and server clearly have to agree on the identities and keys to be used. To improve interoperability, this document places requirements on how the identity is encoded in the protocol, and what kinds of identities and keys implementations have to support.

The requirements for implementations are divided to two categories, requirements for TLS implementations and management interfaces. In this context, "TLS implementation" refers to a TLS library or module that is intended to be used for several different purposes, while "management interface" would typically be implemented by a particular application that uses TLS.

### **5.1 PSK identity encoding**

The PSK identity MUST be first converted to a character string, and then encoded to octets using UTF-8 [5]. For instance,

- o IPv4 addresses are sent as dotted-decimal strings (e.g., "192.0.1.2"), not as 32-bit integers in network byte order.
- o Domain names are sent in their usual text form (e.g., "www.example.com" or "embedded.dot.example.net"), not in DNS protocol format.
- o X.500 Distinguished Names are sent in their string representation [9], not as BER-encoded ASN.1.

This encoding is clearly not optimal for many types of identities. It was chosen to avoid identity type specific parsing and encoding code in implementations where the identity is configured by a person using some kind of management interface. Requiring such identity type specific code would also increase the chances for interoperability problems resulting from different implementations supporting different identity types.

### **5.2 Identity hint**

In the absence of an application profile specification specifying otherwise, servers SHOULD NOT provide an identity hint and clients MUST ignore the identity hint field. Applications that do use this



field MUST specify its contents, how the value is chosen by the TLS server, and what the TLS client is expected to do with the value.

### **[5.3](#) Requirements for TLS implementations**

TLS implementations supporting these ciphersuites MUST support arbitrary PSK identities up to 128 octets in length, and arbitrary PSKs up to 64 octets in length. Supporting longer identities and keys is RECOMMENDED.

### **[5.4](#) Requirements for management interfaces**

In the absence of an application profile specification specifying otherwise, a management interface for entering the PSK and/or PSK identity MUST support the following:

- o Entering PSK identities consisting of up to 128 printable Unicode characters. Supporting as wide character repertoire and as long identities as feasible is RECOMMENDED, as is processing the character string with an appropriate stringprep [[10](#)] profile.
- o Entering PSKs up to 64 octets in length as ASCII strings and in hexadecimal encoding.



## **6. IANA considerations**

IANA does not currently have a registry for TLS-related numbers, so there are no IANA actions associated with this document.

For easier reference in the future, the ciphersuite numbers defined in this document are summarized below.

```
CipherSuite TLS_PSK_WITH_RC4_128_SHA      = { 0x00, 0x8A };
CipherSuite TLS_PSK_WITH_3DES_EDE_CBC_SHA = { 0x00, 0x8B };
CipherSuite TLS_PSK_WITH_AES_128_CBC_SHA   = { 0x00, 0x8C };
CipherSuite TLS_PSK_WITH_AES_256_CBC_SHA   = { 0x00, 0x8D };
CipherSuite TLS_DHE_PSK_WITH_RC4_128_SHA   = { 0x00, 0x8E };
CipherSuite TLS_DHE_PSK_WITH_3DES_EDE_CBC_SHA = { 0x00, 0x8F };
CipherSuite TLS_DHE_PSK_WITH_AES_128_CBC_SHA = { 0x00, 0x90 };
CipherSuite TLS_DHE_PSK_WITH_AES_256_CBC_SHA = { 0x00, 0x91 };
CipherSuite TLS_RSA_PSK_WITH_RC4_128_SHA   = { 0x00, 0x92 };
CipherSuite TLS_RSA_PSK_WITH_3DES_EDE_CBC_SHA = { 0x00, 0x93 };
CipherSuite TLS_RSA_PSK_WITH_AES_128_CBC_SHA = { 0x00, 0x94 };
CipherSuite TLS_RSA_PSK_WITH_AES_256_CBC_SHA = { 0x00, 0x95 };
```

This document also defines a new TLS alert message, `unknown_psk_identity(115)`.

## **7. Security Considerations**

As with all schemes involving shared keys, special care should be taken to protect the shared values and to limit their exposure over time.

### **7.1 Perfect forward secrecy (PFS)**

The PSK and RSA\_PSK ciphersuites defined in this document do not provide Perfect Forward Secrecy (PFS). That is, if the shared secret key (in PSK ciphersuites), or both the shared secret key and the RSA private key (in RSA\_PSK ciphersuites), is somehow compromised, an attacker can decrypt old conversations.

The DHE\_PSK ciphersuites provide Perfect Forward Secrecy if a fresh DH private key is generated for each handshake.

### **7.2 Brute-force and dictionary attacks**

Use of a fixed shared secret of limited entropy (for example, a PSK that is relatively short, or was chosen by a human and thus may contain less entropy than its length would imply) may allow an attacker to perform a brute-force or dictionary attack to recover the secret. This may be either an off-line attack (against a captured



TLS handshake messages), or an on-line attack where the attacker attempts to connect to the server and tries different keys.

For the PSK ciphersuites, an attacker can get the information required for an off-line attack by eavesdropping a TLS handshake, or by getting a valid client to attempt connection with the attacker (by tricking the client to connect to wrong address, or intercepting a connection attempt to the correct address, for instance).

For the DHE\_PSK ciphersuites, an attacker can obtain the information by getting a valid client to attempt connection with the attacker. Passive eavesdropping alone is not sufficient.

For the RSA\_PSK ciphersuites, only the server (authenticated using RSA and certificates) can obtain sufficient information for an off-line attack.

It is RECOMMENDED that implementations that allow the administrator to manually configure the PSK also provide a functionality for generating a new random PSK, taking [\[4\]](#) into account.

### **[7.3](#) Identity privacy**

The PSK identity is sent in cleartext. While using a user name or other similar string as the PSK identity is the most straightforward option, it may lead to problems in some environments since an eavesdropper is able to identify the communicating parties. Even when the identity does not reveal any information itself, reusing the same identity over time may eventually allow an attacker to perform traffic analysis to identify the parties. It should be noted that this is no worse than client certificates, since they are also sent in cleartext.

### **[7.4](#) Implementation notes**

The implementation notes in [\[11\]](#) about correct implementation and use of RSA (including [Section 7.4.7.1](#)) and Diffie-Hellman (including [Appendix F.1.1.3](#)) apply to the DHE\_PSK and RSA\_PSK ciphersuites as well.

## **[8](#). Acknowledgments**

The protocol defined in this document is heavily based on work by Tim Dierks and Peter Gutmann, and borrows some text from [\[7\]](#) and [\[2\]](#). The DHE\_PSK and RSA\_PSK ciphersuites are based on earlier work in [\[6\]](#).

Valuable feedback was also provided by Bernard Aboba, Lakshminath





Dondeti, Philip Ginzboorg, Peter Gutmann, Russ Housley, David Jablon, Nikos Mavroyanopoulos, Bodo Moeller, Eric Rescorla, and Mika Tervonen.

When the first version of this draft was almost ready, the authors learned that something similar had been proposed already in 1996 [13]. However, this draft is not intended for web password authentication, but rather for other uses of TLS.

## 9. References

### 9.1 Normative References

- [1] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [RFC 2119](#), March 1997.
- [2] Chown, P., "Advanced Encryption Standard (AES) Ciphersuites for Transport Layer Security (TLS)", [RFC 3268](#), June 2002.
- [3] Dierks, T. and C. Allen, "The TLS Protocol Version 1.0", [RFC 2246](#), January 1999.
- [4] Eastlake, D., Crocker, S. and J. Schiller, "Randomness Recommendations for Security", [RFC 1750](#), December 1994.
- [5] Yergeau, F., "UTF-8, a transformation format of ISO 10646", [RFC 3629](#), November 2003.

### 9.2 Informative References

- [6] Badra, M., Cherkaoui, O., Hajjeh, I. and A. Serhrouchni, "Pre-Shared-Key key Exchange methods for TLS", [draft-badra-tls-key-exchange-00](#) (work in progress), August 2004.
- [7] Gutmann, P., "Use of Shared Keys in the TLS Protocol", [draft-ietf-tls-sharedkeys-02](#) (expired), October 2003.
- [8] Krawczyk, H., "Re: TLS shared keys PRF", message on [ietf-tls@lists.certicom.com](mailto:ietf-tls@lists.certicom.com) mailing list 2004-01-13, <http://www.imc.org/ietf-tls/mail-archive/msg04098.html>.
- [9] Zeilenga, K., "LDAP: String Representation of Distinguished Names", [draft-ietf-ldapbis-dn-15](#) (work in progress), October 2004.
- [10] Hoffman, P. and M. Blanchet, "Preparation of Internationalized Strings ("stringprep")", [RFC 3454](#), December 2002.



- [11] Dierks, T. and E. Rescorla, "The TLS Protocol Version 1.1", [draft-ietf-tls-rfc2246-bis-10](#) (work in progress), April 2005.
- [12] Medvinsky, A. and M. Hur, "Addition of Kerberos Cipher Suites to Transport Layer Security (TLS)", [RFC 2712](#), October 1999.
- [13] Simon, D., "Addition of Shared Key Authentication to Transport Layer Security (TLS)", [draft-ietf-tls-passauth-00](#) (expired), November 1996.
- [14] Taylor, D., Wu, T., Mavroyanopoulos, N. and T. Perrin, "Using SRP for TLS Authentication", [draft-ietf-tls-srp-09](#) (work in progress), March 2005.



## Authors' and Contributors' Addresses

Pasi Eronen  
Nokia Research Center  
P.O. Box 407  
FIN-00045 Nokia Group  
Finland  
Email: pasi.eronen@nokia.com

Hannes Tschofenig  
Siemens  
Otto-Hahn-Ring 6  
Munich, Bayern 81739  
Germany  
Email: Hannes.Tschofenig@siemens.com

Mohamad Badra  
ENST Telecom  
46 rue Barrault  
75634 Paris  
France  
Email: Mohamad.Badra@enst.fr

Omar Cherkaoui  
UQAM University  
Montreal (Quebec)  
Canada  
Email: cherkaoui.omar@uqam.ca

Ibrahim Hajjeh  
ENST Telecom  
46 rue Barrault  
75634 Paris  
France  
Email: Ibrahim.Hajjeh@enst.fr

Ahmed Serhrouchni  
ENST Telecom  
46 rue Barrault  
75634 Paris  
France  
Email: Ahmed.Serhrouchni@enst.fr



## [Appendix A](#). Changelog

(This section should be removed by the RFC Editor before publication.)

Changes from -07 to -08:

- o Added table of contents and updated I-D boilerplate.
- o Small clarification to motivation in [Section 1](#).
- o Small clarification to note 2 in [Section 2](#).
- o Corrected all instances of "an uint16" to "a uint16".
- o Updated references to latest versions.

Changes from -06 to -07:

- o Small clarifications to management interface requirements.

Changes from -05 to -06:

- o Small clarifications to how the premaster secret is formed.
- o Added a section about conformance requirements, and moved existing text about identity formats there.

Changes from -04 to -05:

- o Omit ServerKeyExchange message (in PSK/RSA\_PSK versions) if no identity hint is provided.

Changes from -03 to -04:

- o Added a note about premaster secret "general structure" in Sections [3](#) and [4](#).
- o Something in the I-D submission procedure had removed all circumflexes from -03 version, turning e.g. "2<sup>16</sup>" (two-to-the sixteenth power) to "216" (two hundred and sixteen). Let's try again.

Changes from -02 to -03:

- o Aligned the way the premaster secret is derived.
- o Specified that identities must be sent as human-readable UTF-8





strings, not in binary formats. Changed reference to [RFC 3629](#) from informative to normative.

- o Selected ciphersuite and alert numbers, and updated IANA considerations section to match this.
- o Reworded some text about dictionary attacks in [Section 6.2](#).

Changes from -01 to -02:

- o Clarified text about DHE\_PSK ciphersuites in [Section 1](#).
- o Clarified explanation of HMAC-SHA1/MD5 use of PRF in [Section 2](#).
- o Added note about certificate validation and self-signed certificates in [Section 4](#).
- o Added Mohamad Badra et al. as contributors.

Changes from [draft-ietf-tls-psk-00](#) to -01:

- o Added DHE\_PSK and RSA\_PSK key exchange algorithms, and updated other text accordingly
- o Removed SHA-1 hash from PSK key exchange premaster secret construction (since premaster secret doesn't need to be 48 bytes).
- o Added unknown\_psk\_identity alert message.
- o Updated IANA considerations section.

Changes from [draft-eronen-tls-psk-00](#) to [draft-ietf-tls-psk-00](#):

- o Updated dictionary attack considerations based on comments from David Jablon.
- o Added a recommendation about using UTF-8 in the identity field.
- o Removed [Appendix A](#) comparing this document with [draft-ietf-tls-sharedkeys-02](#).
- o Removed IPR comment about SPR.
- o Minor editorial changes.



## 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](mailto: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 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 Internet Society (2005). 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.

