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L. Velvindron
cyberstorm.mu
K. Moriarty
Dell Technologies
A. Ghedini
Cloudflare Inc.
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Deprecating MD5 and SHA-1 signature hashes in TLS 1.2
draft-ietf-tls-md5-sha1-deprecate-07

Abstract

The MD5 and SHA-1 hashing algorithms are increasingly vulnerable to attack and this document deprecates their use in TLS 1.2 digital signatures. However, this document does not deprecate SHA-1 in HMAC for record protection. This document updates RFC 5246 and RFC 7525.

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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1. Introduction

The usage of MD5 and SHA-1 for signature hashing in TLS 1.2 is specified in [RFC5246]. MD5 and SHA-1 have been proven to be insecure, subject to collision attacks [Wang]. In 2011, [RFC6151] detailed the security considerations, including collision attacks for MD5. NIST formally deprecated use of SHA-1 in 2011 [NISTSP800-131A-R2] and disallowed its use for digital signatures at the end of 2013, based on both the Wang, et. al, attack and the potential for brute-force attack. In 2016, researchers from INRIA identified a new class of transcript collision attacks on TLS (and other protocols) that rely on efficient collision-finding algorithms on the underlying hash constructions [Transcript-Collision]. Further, in 2017, researchers from Google and CWI Amsterdam [SHA-1-Collision] proved SHA-1 collision attacks were practical. This document updates [RFC5246] and [RFC7525] in such a way that MD5 and SHA-1 MUST NOT be used for digital signatures. However, this document does not deprecate SHA-1 in HMAC for record protection. Note that the CABF has also deprecated use of SHA-1 [CABF].

1.1. Requirements Language

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

2. Signature Algorithms

Clients MUST NOT include MD5 and SHA-1 in the signature_algorithms extension. If a client does not send a signature_algorithms extension, then the server MUST abort the handshake and send a handshake_failure alert, except when digital signatures are not used (for example, when using PSK ciphers).

3. Certificate Request

Servers SHOULD NOT include MD5 and SHA-1 in CertificateRequest messages.

4. Server Key Exchange

Servers MUST NOT include MD5 and SHA-1 in ServerKeyExchange messages. If a client receives a MD5 or SHA-1 signature in a ServerKeyExchange message it MUST abort the connection with the illegal_parameter alert.

5. Certificate Verify

Clients MUST NOT include MD5 and SHA-1 in CertificateVerify messages. If a server receives a CertificateVerify message with MD5 or SHA-1 it MUST abort the connection with handshake_failure or insufficient_security alert.

6. Updates to RFC5246

[RFC5246], The Transport Layer Security (TLS) Protocol Version 1.2, suggests that implementations can assume support for MD5 and SHA-1 by their peer. This update changes the suggestion to assume support for SHA-256 instead, due to MD5 and SHA-1 being deprecated.

In Section 7.4.1.4.1: the text should be revised from:

OLD:

"Note: this is a change from TLS 1.1 where there are no explicit rules, but as a practical matter one can assume that the peer supports MD5 and SHA- 1."

NEW:

"Note: This is a change from TLS 1.1 where there are no explicit rules, but as a practical matter one can assume that the peer supports SHA-256."

7. Updates to RFC7525

[RFC7525], Recommendations for Secure Use of Transport Layer Security (TLS) and Datagram Transport Layer Security (DTLS), recommends use of SHA-256 as a minimum requirement. This update moves the minimum recommendation to use stronger language deprecating use of both SHA-1 and MD5. The prior text did not explicitly include MD5 or SHA-1; and this text adds guidance to ensure that these algorithms have been deprecated.

Section 4.3:

OLD:

When using RSA, servers SHOULD authenticate using certificates with at least a 2048-bit modulus for the public key. In addition, the use of the SHA-256 hash algorithm is RECOMMENDED (see [CAB-Baseline] for more details). Clients SHOULD indicate to servers that they request SHA-256, by using the "Signature Algorithms" extension defined in TLS 1.2.

NEW:

Servers SHOULD authenticate using certificates with at least a 2048-bit modulus for the public key.

In addition, the use of the SHA-256 hash algorithm is RECOMMENDED; and SHA-1 or MD5 MUST NOT be used (see [CAB-Baseline] for more details). Clients MUST indicate to servers that they request SHA-

256, by using the "Signature Algorithms" extension defined in TLS 1.2.

8. IANA Considerations

The document updates the "TLS SignatureScheme" registry to change the recommended status of SHA-1 based signature schemes to N (not recommended) as defined by [RFC8447]. The following entries are to be updated:

Value	Description	Recommended	Reference
0x0201	rsa_pkcs1_sha1	N	[RFC8446] [RFCTBD]
0x0203	ecdsa_sha1	N	[RFC8446] [RFCTBD]

Other entries of the registry remain the same.

IANA is also requested to update the Reference for the TLS SignatureAlgorithm and TLS HashAlgorithm registries to refer to this RFC:

OLD:

Reference

[RFC5246][RFC8447]

NEW:

Reference

[RFC5246][RFC8447][RFC-to-be]

9. Security Considerations

Concerns with TLS 1.2 implementations falling back to SHA-1 is an issue. This document updates the TLS 1.2 specification to deprecate support for MD5 and SHA-1 for digital signatures. However, this document does not deprecate SHA-1 in HMAC for record protection.

10. Acknowledgement

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11. References

11.1. Normative References

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11.2. Informative References

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Authors' Addresses

Loganaden Velvindron
cyberstorm.mu
Rose Hill
MU

Phone: +230 59762817
Email: logan@cyberstorm.mu

Kathleen Moriarty
Dell Technologies

Email: Kathleen.Moriarty.ietf@gmail.com

Alessandro Ghedini
Cloudflare Inc.

Email: alessandro@cloudflare.com