

Internet Engineering Task Force  
Internet-Draft  
Updates: [5246](#) (if approved)  
Intended status: Standards Track  
Expires: 7 March 2022

L.V. Velvindron  
cyberstorm.mu  
K.M. Moriarty  
CIS  
A.G. Ghedini  
Cloudflare Inc.  
3 September 2021

Deprecating MD5 and SHA-1 signature hashes in (D)TLS 1.2  
draft-ietf-tls-md5-sha1-deprecate-08

## 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](#).

## Status of This Memo

This Internet-Draft is submitted in full conformance with the provisions of [BCP 78](#) and [BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF). Note that other groups may also distribute working documents as Internet-Drafts. The list of current Internet-Drafts is at <https://datatracker.ietf.org/drafts/current/>.

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."

This Internet-Draft will expire on 7 March 2022.

## Copyright Notice

Copyright (c) 2021 IETF Trust and the persons identified as the document authors. All rights reserved.

Internet-Draft

[draft-ietf-tls-md5-sha1-deprecate](#)

September 2021

This document is subject to [BCP 78](#) and the IETF Trust's Legal Provisions Relating to IETF Documents (<https://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights and restrictions with respect to this document. Code Components extracted from this document must include Simplified BSD License text as described in Section 4.e of the [Trust Legal Provisions](#) and are provided without warranty as described in the Simplified BSD License.

## Table of Contents

<a href="#">1.</a>	Introduction . . . . .	<a href="#">2</a>
<a href="#">1.1.</a>	Requirements Language . . . . .	<a href="#">3</a>
<a href="#">2.</a>	Signature Algorithms . . . . .	<a href="#">3</a>
<a href="#">3.</a>	Certificate Request . . . . .	<a href="#">3</a>
<a href="#">4.</a>	Server Key Exchange . . . . .	<a href="#">3</a>
<a href="#">5.</a>	Certificate Verify . . . . .	<a href="#">3</a>
<a href="#">6.</a>	IANA Considerations . . . . .	<a href="#">3</a>
<a href="#">7.</a>	Security Considerations . . . . .	<a href="#">4</a>
<a href="#">8.</a>	Acknowledgement . . . . .	<a href="#">4</a>
<a href="#">9.</a>	References . . . . .	<a href="#">4</a>
<a href="#">9.1.</a>	Normative References . . . . .	<a href="#">4</a>
<a href="#">9.2.</a>	Informative References . . . . .	<a href="#">5</a>
	Authors' Addresses . . . . .	<a href="#">6</a>

## [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](#)] 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 include the `signature_algorithms` extension. Clients MUST NOT include MD5 and SHA-1 in this extension.

## [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 no other signature algorithms are available (for example, if the client does not send a `signature_algorithms` extension), the server MUST abort the handshake with a `handshake_failure` alert or select a different cipher suite.

## [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](#). 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]

Table 1

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]

## 7. 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.

## [8.](#) Acknowledgement

The authors would like to thank Hubert Kario for his help in writing the initial draft. We are also grateful to Daniel Migault, Martin Thomson, Sean Turner, Christopher Wood and David Cooper for their feedback.

## [9.](#) References

### [9.1.](#) 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>>.
- [RFC5246] Dierks, T. and E. Rescorla, "The Transport Layer Security (TLS) Protocol Version 1.2", [RFC 5246](#), DOI 10.17487/RFC5246, August 2008, <<https://www.rfc-editor.org/info/rfc5246>>.
- [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>>.
- [RFC8446] Rescorla, E., "The Transport Layer Security (TLS) Protocol Version 1.3", [RFC 8446](#), DOI 10.17487/RFC8446, August 2018, <<https://www.rfc-editor.org/info/rfc8446>>.
- [RFC8447] Salowey, J. and S. Turner, "IANA Registry Updates for TLS and DTLS", [RFC 8447](#), DOI 10.17487/RFC8447, August 2018, <<https://www.rfc-editor.org/info/rfc8447>>.

## 9.2. Informative References

- [CAB-Baseline] CA/Browser Forum, "Baseline Requirements for the Issuance and Management of Publicly-Trusted Certificates Version 1.1.6", 2013, <<https://www.cabforum.org/documents.html>>.
- [CABF] CA/Browser Forum, "Ballot 118 -- SHA-1 Sunset (passed)", 2014, <<https://cabforum.org/2014/10/16/ballot-118-sha-1-sunset/>>.
- [NISTSP800-131A-R2] Barker, E.B. and A.R. Roginsky, "Transitioning the Use of Cryptographic Algorithms and Key Lengths", March 2019, <<https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-131Ar2.pdf>>.
- [RFC6151] Turner, S. and L. Chen, "Updated Security Considerations for the MD5 Message-Digest and the HMAC-MD5 Algorithms", [RFC 6151](#), DOI 10.17487/RFC6151, March 2011, <<https://www.rfc-editor.org/info/rfc6151>>.
- [SHA-1-Collision] Stevens, M.S., Bursztein, E.B., Karpman, P.K., Albertini, A.A., and Y.M. Markov, "The first collision for full SHA-1", March 2019, <<https://eprint.iacr.org/2017/190>>.

- [Transcript-Collision] Bhargavan, K.B. and G.L. Leurent, "Transcript Collision Attacks: Breaking Authentication in TLS, IKE, and SSH", February 2016, <<https://hal.inria.fr/hal-01244855/document>>.
- [Wang] Wang, X.W., Yin, Y.Y., and H.Y. Yu, "Finding Collisions in the Full SHA-1", 2005, <<https://www.iacr.org/archive/crypto2005/36210017/36210017.pdf>>.

### Authors' Addresses

Loganaden Velvindron  
cyberstorm.mu  
Rose Hill

Mauritius

Phone: +230 59762817

Email: logan@cyberstorm.mu

Kathleen Moriarty  
Center for Internet Security  
East Greenbush, NY  
United States of America

Email: Kathleen.Moriarty.ietf@gmail.com

Alessandro Ghedini  
Cloudflare Inc.

Email: alessandro@cloudflare.com