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Deprecating MD5 and SHA1 in TLS 1.2
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Abstract

The MD5 and SHA1 hashing algorithms are steadily weakening in strength and their deprecation process should begin for their use in TLS 1.2 digital signatures.

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[1.](#) Introduction

The usage of MD5 and SHA1 for TLS 1.2 is specified [RFC 5246](#) [[RFC5246](#)]. MD5 and SHA-1 have been proven to be insecure, subject to collision attacks. [RFC 6151](#) [[RFC6151](#)] details the security considerations, including collision attacks for MD5, published in 2011. MD5 has been deprecated by NIST and is no longer mentioned in publications such as [[NISTSP800-131A-R2](#)]. 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. Further, in 2017, researchers from Google and CWI Amsterdam [[SHA-1-Collision](#)] proved SHA-1 collision attacks were practical. This document updates [RFC 5246](#) [[RFC5246](#)] and [RFC7525](#) [[RFC7525](#)] in such as way that MD5 and SHA1 MUST NOT be used for digital signatures.

[1.1.](#) Requirements Language

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 [RFC 2119](#) [[RFC2119](#)].

[2.](#) Signature Algorithms

Clients SHOULD NOT include md5 and SHA-1 in 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.

[3.](#) Certificate Requests

Servers SHOULD NOT include md5 and SHA-1 in CertificateRequest message.

[4.](#) Server Key Exchange

Servers MUST NOT include md5 and SHA-1 in ServerKeyExchange message. If client does receive a MD5 or SHA-1 signature in the ServerKeyExchange message it MUST abort the connection with handshake_failure or insufficient_security alert.

[5.](#) Certificate Verify

Clients MUST NOT include md5 and SHA-1 in CertificateVerify message.

[6.](#) Updates to [RFC5246](#)

OLD:

In [Section 7.4.1.4.1](#): the text should be revised from " enum { none(0), md5(1), sha1(2), sha224(3), sha256(4), sha384(5), sha512(6), (255) } HashAlgorithm;"

NEW:

enum { none(0), sha224(3), sha256(4), sha384(5), sha512(6), (255) } HashAlgorithm;

OLD:

In [Section 7.4.1.4.1](#): the text should be revised from " 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](#) [[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 and this text adds it to ensure it is understood as having 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:

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, SHA-1 or MD5 MUST not be used (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.

8. Security Considerations

Concerns with TLS 1.2 implementations falling back to SHA-1 is an issue. This draft updates the TLS 1.2 specification to deprecate support for MD5 and SHA-1 for digital signatures.

9. Acknowledgement

The authors would like to thank Hubert Kario for his help in writing the initial draft.

10. References

10.1. 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>>.

- [RFC7525] Sheffer, Y., Holz, R., and P. Saint-Andre, "Recommendations for Secure Use of Transport Layer Security (TLS) and Datagram Transport Layer Security (DTLS)", [BCP 195](#), [RFC 7525](#), DOI 10.17487/RFC7525, May 2015, <<https://www.rfc-editor.org/info/rfc7525>>.

10.2. 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>>.
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- [RFC5246] Dierks, T. and E. Rescorla, "The Transport Layer Security (TLS) Protocol Version 1.2", [RFC 5246](#), DOI 10.17487/RFC5246, August 2008,

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[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., Bursztein, E., Karpman, P., Albertini, A., and Y. Markov, "The first collision for full SHA-1", March 2019, <<http://shattered.io/static/shattered.pdf>>.

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