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A new cryptographic signature method for DKIM
draft-ietf-dcrup-dkim-crypto-08

Abstract

This document adds a new signing algorithm to DKIM.

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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This Internet-Draft will expire on July 26, 2018.

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1. Introduction

Discussion Venue: Discussion about this draft is directed to the dcrup@ietf.org [1] mailing list.

DKIM [RFC6376] signs e-mail messages, by creating hashes of the message headers and body and signing the header hash with a digital signature. Message recipients fetch the signature verification key from the DNS. The defining documents specify a single signing algorithm, RSA [RFC3447].

This document adds a new stronger signing algorithm, Edwards-Curve Digital Signature Algorithm using the Curve25519 curve (ed25519), which has much shorter keys than RSA for similar levels of security.

2. Conventions Used in This Document

The capitalized 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].

Syntax descriptions use Augmented BNF (ABNF) [RFC5234]. The ABNF tokens sig-a-tag-k and key-k-tag-type are imported from [RFC6376].

3. Ed25519-SHA256 Signing Algorithm

The ed25519-sha256 signing algorithm computes a message hash as defined in section 3 of [RFC6376], and signs it with the Hash variant of Ed25519, as defined in in RFC 8032 section 5.1 [RFC8032]. The signing algorithm is HashEdDSA.

Even though the input to the signing algorithm has already been hashed, the PureEdDSA version of the algorithm is not widely implemented, and the extra hash causes no problems beyond a minor computational slowdown.

The DNS record for the verification public key has a "k=ed25519" tag to indicate that the key is an Ed25519 rather than RSA key.

Note: since Ed25519 keys are 256 bits long, the base64 encoded key is only 44 octets, so DNS key record data will generally fit in a single 255 byte TXT string, and will work even with DNS provisioning software that doesn't handle multi-string TXT records.

4. Signature and key syntax

The syntax of DKIM signatures and DKIM keys are updated as follows.

4.1. Signature syntax

The syntax of DKIM algorithm tags in section 3.5 of [RFC6376] is updated by adding this rule to the existing rule for sig-a-tag-k:

ABNF:

```
sig-a-tag-k =/ "ed25519"
```

4.2. Key syntax

The syntax of DKIM key tags in section 3.6.1 of [RFC6376] is updated

by adding this rule to the existing rule for key-k-tag-type:

ABNF:

key-k-tag-type =/ "ed25519"

The p= value in the key record is the ed25519 public key encoded in base64. Since the key is 256 bits long, the base64 text is 44 octets long. For example, a key record using the public key in [RFC8032] Section 7.1, Test 1, mignt be:


```
s._domainkey.example TXT (
   "v=DKIM1; k=ed25519; p=11qYAYKxCrfVS/7TyWQHOg7hcvPapiMlrwIaaPcHURo="
   )
```

5. Key and algorithm choice and strength

Section 3.3 of [RFC6376] describes DKIM's hash and signature algorithms. It is updated as follows:

Signers SHOULD implement and verifiers MUST implement the ed25519-sha256 algorithm.

6. Transition Considerations

For backward compatibility, signers MAY add multiple signatures that use old and new signing algorithms. Since there can only be a single key record in the DNS for each selector, the signatures will have to use different selectors, although they can use the same d= and i= identifiers.

7. Security Considerations

Ed25519 is a widely used cryptographic technique, so the security of DKIM signatures using new signing algorithms should be at least as good as those using old algorithms.

8. IANA Considerations

IANA is requested to update registries as follows.

8.1. DKIM Key Type registry

The following value is added to the DKIM Key Type Registry

TYPE	REFERENCE	STATUS
ed25519	[RFC8032]	active

Table 1: DKIM Key Type Registry Added Values

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>.

[RFC3447] Jonsson, J. and B. Kaliski, "Public-Key Cryptography Standards (PKCS) #1: RSA Cryptography Specifications Version 2.1", RFC 3447, DOI 10.17487/RFC3447, February 2003, <https://www.rfc-editor.org/info/rfc3447>.

[RFC5234] Crocker, D., Ed. and P. Overell, "Augmented BNF for Syntax Specifications: ABNF", STD 68, RFC 5234, DOI 10.17487/RFC5234, January 2008, <https://www.rfc-editor.org/info/rfc5234>.

[RFC6376] Crocker, D., Ed., Hansen, T., Ed., and M. Kucherawy, Ed., "DomainKeys Identified Mail (DKIM) Signatures", STD 76, RFC 6376, DOI 10.17487/RFC6376, September 2011, <https://www.rfc-editor.org/info/rfc6376>.

[RFC8032] Josefsson, S. and I. Liusvaara, "Edwards-Curve Digital Signature Algorithm (EdDSA)", RFC 8032, DOI 10.17487/RFC8032, January 2017, <https://www.rfc-editor.org/info/rfc8032>.

9.2. URIs

[1] mailto:dcrup@ietf.org

Appendix A. Change log

07 to 08 Specify base64 key records. Style edits per Dave C.

06 to 07: Remove RSA fingerprints. Change Pure to hashed eddsa.

05 to 06: Editorial changes only.

04 to 05: Remove deprecation cruft and inconsistent key advice. Fix p= and k= text.

03 to 04: Change eddsa to ed25519. Add Martin's key regeneration issue. Remove hashed ed25519 keys. Fix typos and clarify text. Move syntax updates to separate section. Take out SHA-1 stuff.

01 to 02: Clarify EdDSA algorithm is ed25519 with Pure version of the signing. Make references to tags and fields consistent.

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