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Use of SHA-256 in DNSSEC Delegation Signer (DS) Resource Records (RRs) draft-ietf-dnsext-ds-sha256-01.txt

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Abstract

This document specifies how to use the SHA-256 digest type in DNS Delegation Signer (DS) Resource Records (RRs). DS records, when stored in a parent zone, point to key signing DNSKEY key(s) in a child zone.

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1. Introduction

The DNSSEC [RFC4033] [RFC4034] [RFC4035] DS RR is published in parent zones to distribute a cryptographic digest of a child's Key Signing Key (KSK) DNSKEY RR. This DS RR is signed using the parent zone's private half of it's DNSKEY and the signature is published in a RRSIG record.

2. Implementing the SHA-256 algorithm for DS record support

This document specifies that the digest type code [XXX: To be assigned by IANA; likely 2] is to be assigned to SHA-256 [SHA256] for use within DS records. The results of the digest algorithm MUST NOT be truncated and the entire 32 byte digest result is to be published in the DS record.

2.1. DS record field values

Using the SHA-256 digest algorithm within a DS record will make use of the following DS-record fields:

Digest type: [XXX: To be assigned by IANA; likely 2]

Digest: A SHA-256 bit digest value calculated by using the following formula ("|" denotes concatenation). The resulting value is not truncated and the entire 32 byte result is to used in the resulting DS record and related calculations.

```
digest = SHA_256(DNSKEY owner name | DNSKEY RDATA)
```

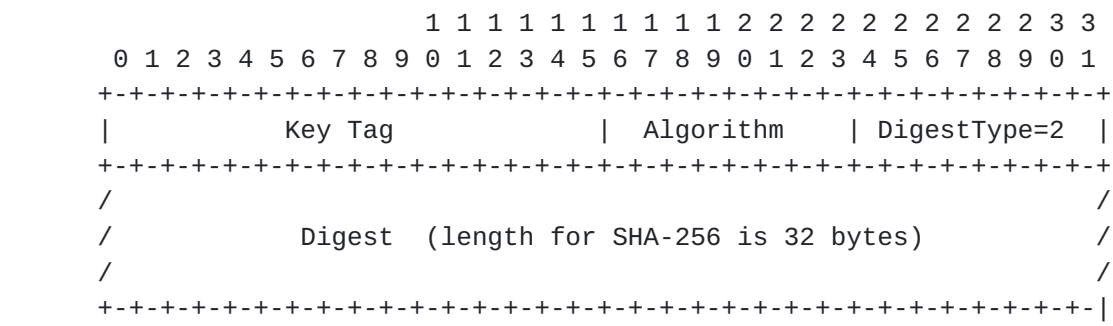
where DNSKEY RDATA is defined by [RFC4034] as:

```
DNSKEY RDATA = Flags | Protocol | Algorithm | Public Key
```

The Key Tag field and Algorithm fields remain unchanged by this document and are specified in the [RFC4034] specification.

2.2. DS Record with SHA-256 Wire Format

The resulting packet format for the resulting DS record will be [XXX: IANA assignment should replace the 2 below]:



2.3. Example DS Record Using SHA-256

The following is an example DSKEY and matching DS record. This DNSKEY record comes from the example DNSKEY/DS records found in section 5.4 of [RFC4034].

The DNSKEY record::

```
dskey.example.com. 86400 IN DNSKEY 256 3 5 ( AQOeiiR0GOMYkDshWoSKz9Xz
                                             fwJr1AYtsmx3TGkJaNXVbfi/
                                             2pHm822aJ5iI9BMzNXxeYCmZ
                                             DRD99WYwYqUSdjMmmAphXdvx
                                             egXd/M5+X7OrzKBaMbCVdFLU
                                             Uh6DhweJBjEVv5f2wwjM9Xzc
                                             nOf+EPbtG9DMBmADjFDc2w/r
                                             ljwvFw==
                                             ) ;  key id = 60485
```

The resulting DS record covering the above DNSKEY record using a SHA-256 digest: [RFC Editor: please replace XXX with the assigned digest type (likely 2):]

```
dskey.example.com. 86400 IN DS 60485 5 XXX ( D4B7D520E7BB5F0F67674A0C
                                             CEB1E3E0614B93C4F9E99B83
                                             83F6A1E4469DA50A )
```

3. Implementation Requirements

Implementations MUST support the use of the SHA-256 algorithm in DS RRs.

Validator implementations MUST be able to prefer DS records containing SHA-256 digests over those containing SHA-1 digests. This behavior SHOULD by the default. Validator implementations MAY provide configuration settings that allow network operators to specify preference policy when validating multiple DS records containing different digest types.

4. Deployment Considerations

If a validator does not support the SHA-256 digest type and no other DS RR exists in a zone's DS RRset with a supported digest type, then the validator has no supported authentication path leading from the parent to the child. The resolver should treat this case as it would the case of an authenticated NSEC RRset proving that no DS RRset exists, as described in [RFC4035], section 5.2.

Because zone administrators can not control the deployment support of SHA-256 in deployed validators that may referencing any given zone, deployments should consider publishing both SHA-1 and SHA-256 based DS records for a while. Whether to publish both digest types together and for how long is a policy decision that extends beyond the scope of this document.

5. IANA Considerations

The Digest Type to be used for supporting SHA-256 within DS records needs to be assigned by IANA. This document requests that the Digest Type value of 2 be assigned to the SHA-256 digest algorithm.

At the time of this writing, the current digest types assigned for use in DS records are as follows:

VALUE	Digest Type	Status
0	Reserved	-
1	SHA-1	MANDATORY
2	SHA-256	MANDATORY
3-255	Unassigned	-

6. Security Considerations

Because of the weaknesses recently discovered within the SHA-1 algorithm, users of DNSSEC are encouraged to deploy the use of SHA-256 as soon as the software implementations in use allow for it.

At the time of this publication, the SHA-256 digest algorithm is considered sufficiently strong for the immediate future. It is also considered sufficient for use in DNSSEC DS RRs for the immediate future. However, future published attacks may, of course, weaken the usability of this algorithm within the DS RRs. It is beyond the scope of this document to speculate extensively on the cryptographic strength of the SHA-256 digest algorithm.

Likewise, it is also beyond the scope of this document to specify

whether or for how long SHA-1 based DS records should be simultaneously published alongside SHA-256 based DS records.

7. Acknowledgments

This document is a minor extension to the existing DNSSEC documents and those authors are gratefully appreciated for the hard work that went into the base documents.

The following people contributed to valuable technical content of this document: Roy Arends, Olafur Gudmundsson, Olaf M. Kolkman, Scott Rose, Sam Weiler.

8. References

8.1. Normative References

[RFC4033] Arends, R., Austein, R., Larson, M., Massey, D., and S. Rose, "DNS Security Introduction and Requirements", RFC 4033, March 2005.

[RFC4034] Arends, R., Austein, R., Larson, M., Massey, D., and S. Rose, "Resource Records for the DNS Security Extensions", RFC 4034, March 2005.

[RFC4035] Arends, R., Austein, R., Larson, M., Massey, D., and S. Rose, "Protocol Modifications for the DNS Security Extensions", RFC 4035, March 2005.

[SHA256] National Institute of Standards and Technology, "Secure Hash Algorithm. NIST FIPS 180-2", August 2002.

8.2. Informative References

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