

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

Status of this Memo

By submitting this Internet-Draft, each author represents that any applicable patent or other IPR claims of which he or she is aware have been or will be disclosed, and any of which he or she becomes aware will be disclosed, in accordance with [Section 6 of BCP 79](#).

Internet-Drafts are working documents of the Internet Engineering Task Force (IETF), its areas, and its working groups. Note that other groups may also distribute working documents as Internet-Drafts.

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."

The list of current Internet-Drafts can be accessed at <http://www.ietf.org/ietf/1id-abstracts.txt>.

The list of Internet-Draft Shadow Directories can be accessed at <http://www.ietf.org/shadow.html>.

This Internet-Draft will expire on June 2, 2006.

Copyright Notice

Copyright (C) The Internet Society (2005).

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.

Table of Contents

1.	Introduction	3
2.	Implementing the SHA-256 algorithm for DS record support . . .	3
2.1.	DS record field values	3
2.2.	DS Record with SHA-256 Wire Format	3
2.3.	Example DS Record Using SHA-256	4
3.	Implementation Requirements	4
4.	Deployment Considerations	5
5.	IANA Considerations	5
6.	Security Considerations	5
7.	Acknowledgments	6
8.	References	6
8.1.	Normative References	6
8.2.	Informative References	6
	Author's Address	7
	Intellectual Property and Copyright Statements	8

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 its 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 be 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]:


```

          1 1 1 1 1 1 1 1 1 1 2 2 2 2 2 2 2 2 2 2 3 3
0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
|          Key Tag          | Algorithm | DigestType=2 |
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+
/
/          Digest (length for SHA-256 is 32 bytes)
/
+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+--+

```

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 ( AQ0eiiR0G0MYkDshWoSKz9Xz
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 be 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 be 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

Author's Address

Wes Hardaker
Sparta
P.O. Box 382
Davis 95617
US

Email: hardaker@tislabs.com

Intellectual Property Statement

The IETF takes no position regarding the validity or scope of any Intellectual Property Rights or other rights that might be claimed to pertain to the implementation or use of the technology described in this document or the extent to which any license under such rights might or might not be available; nor does it represent that it has made any independent effort to identify any such rights. Information on the procedures with respect to rights in RFC documents can be found in [BCP 78](#) and [BCP 79](#).

Copies of IPR disclosures made to the IETF Secretariat and any assurances of licenses to be made available, or the result of an attempt made to obtain a general license or permission for the use of such proprietary rights by implementers or users of this specification can be obtained from the IETF on-line IPR repository at <http://www.ietf.org/ipr>.

The IETF invites any interested party to bring to its attention any copyrights, patents or patent applications, or other proprietary rights that may cover technology that may be required to implement this standard. Please address the information to the IETF at ietf-ipr@ietf.org.

Disclaimer of Validity

This document and the information contained herein are provided on an "AS IS" basis and THE CONTRIBUTOR, THE ORGANIZATION HE/SHE REPRESENTS OR IS SPONSORED BY (IF ANY), THE INTERNET SOCIETY AND THE INTERNET ENGINEERING TASK FORCE DISCLAIM ALL WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO ANY WARRANTY THAT THE USE OF THE INFORMATION HEREIN WILL NOT INFRINGE ANY RIGHTS OR ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

Copyright Statement

Copyright (C) The Internet Society (2005). This document is subject to the rights, licenses and restrictions contained in [BCP 78](#), and except as set forth therein, the authors retain all their rights.

Acknowledgment

Funding for the RFC Editor function is currently provided by the Internet Society.

