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Signaling Cryptographic Algorithm Understanding in DNSSEC
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Abstract

The DNS Security Extensions (DNSSEC) were developed to provide origin authentication and integrity protection for DNS data by using digital signatures. These digital signatures can be generated using different algorithms. This draft sets out to specify a way for validating end-system resolvers to signal to a server which cryptographic algorithms they support.

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].

Status of this Memo

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1. Introduction

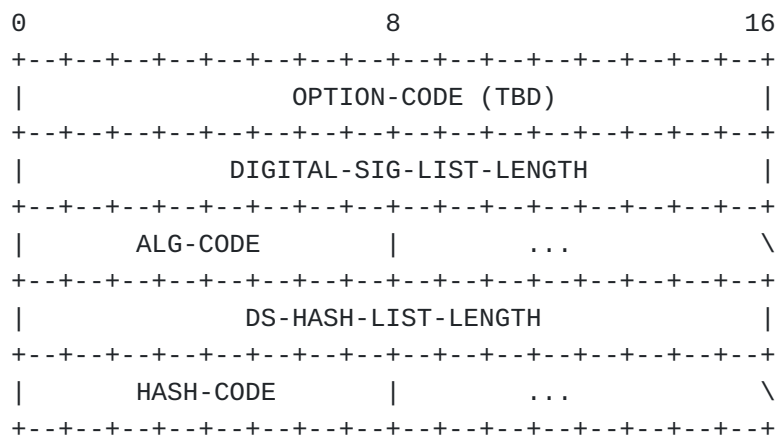
The DNS Security Extensions (DNSSEC) [\[RFC4033\]](#), [\[RFC4034\]](#) and [\[RFC4035\]](#) were developed to provide origin authentication and integrity protection for DNS data by using digital signatures. Each digital signature RR (RRSIG) contains an algorithm code number. These algorithm codes tells validators which cryptographic algorithm was used to generate the digital signature. Authentication across delegation boundaries is maintained by storing a hash of a subzone's key in the parent zone stored in a Delegation Signer (DS) RR. These DS RR's contain a second code number to identify the hash algorithm used to construct the DS RR.

This draft sets out to specify a way for validating end-system resolvers to tell a server which cryptographic and/or hash algorithms they support in a DNS query. This is done using the EDNS attribute values in the OPT meta-RR [\[RFC2671\]](#).

This proposed EDNS option serves to measure the acceptance and use of new digital signing and hash algorithms. This algorithm signaling option can be used by zone administrators as a gauge to measure the successful deployment of code that implements a newly deployed digital signature or hash algorithm used with DNSSEC. A zone administrator may be able to determine when to stop serving the old algorithm when the server sees that a significant number of its clients signal that they are able to accept the new algorithm. Note that this survey may be conducted over the period of years before a tipping point is seen. This draft does not seek to include another process for including new algorithms for use with DNSSEC. It also does not address the question of which algorithms are to be included in any official list of mandatory or recommended cryptographic algorithms for use with DNSSEC. Rather, this document specifies a means by which a client query can signal a set of algorithms it implements.

2. Signaling DNSSEC Algorithm Understood (DAU) Using EDNS

The EDNS0 specification outlined in [\[RFC2671\]](#) defines a way to include new options using a standardized mechanism. These options are contained in the RDATA of the OPT meta-RR. This document defines a new EDNS0 option for a client to signal which algorithms the client supports. The figure below shows how the signaling attribute is defined in the RDATA of the OPT RR specified in [\[RFC2671\]](#):



OPTION-CODE is the code for the DNSSEC Algorithm Understood (DAU) option. Its value is fixed at TBD.

DIGITAL-SIG-LIST-LENGTH is the length of the list of digital signature algorithms in octets. DNSSEC algorithm codes are 1 octet long so this value is the number of octets.

ALG-CODE is the list of assigned values of DNSSEC zone signing algorithms that the client indicates it understands. The values SHOULD be in descending order of preference, with the most preferred algorithm first. For example, if a validating client implements RSA/SHA-1, RSA/SHA-256 and prefers the latter, the value of ALG-CODE would be: 8 (RSA/SHA-256), 5 (RSA/SHA-1).

DS-HASH-LIST-LENGTH is the length of the list of hash algorithms in octets. DNSSEC DS hash codes are 1 octet long so this value is the number of octets.

HASH-CODE is the list of assigned values of DNSSEC DS hash algorithms that the client indicates as understood. Like the ALG-CODE above, the values SHOULD be in descending order of preference, with the most preferred algorithm first.

3. Client Considerations

A validating end-system resolver sets the DAU option in the OPT meta-RR when sending a query. The validating end-system resolver sets the value(s) in the order of preference, with the most preferred algorithm(s) first as described in section 2. The end-system resolver SHOULD also set the DNSSEC-OK bit [\[RFC4035\]](#) to indicate that it wishes to receive DNSSEC RRs in the response.

Note that the PRIVATEDNS (253) and/or the PRIVATEOID (254) codes cover a potentially wide range of algorithms and are likely not useful to a server. There is no compelling reason for a client to include these codes in its list of understood algorithms.

3.1. Stub Resolvers

Typically, stub resolvers rely on an upstream recursive server (or cache) to provide a response; any algorithm support on the stub resolver's side SHOULD be honored (if possible) by an upstream recursive cache.

3.2. Validating Stub Resolvers

A validating stub resolver MUST set the DO bit [\[RFC4035\]](#) to indicate that it wishes to receive DNSSEC RRs in the response. Such validating resolvers SHOULD include the DAU option in the OPT RR when sending a query. This way the validating stub resolver indicates which cryptographic algorithm(s) it supports by setting the values(s) in the order of preference, with the most preferred algorithm(s) first as described in Section 2.

3.3. Non-Validating Stub Resolvers

The DAU EDNS option is NOT RECOMMENDED for non-validating stub resolvers.

3.4. Recursive Resolvers

3.4.1. Validating Recursive Resolvers

A validating recursive resolver MUST set the DO bit [\[RFC4035\]](#) to indicate that it wishes to receive DNSSEC RRs in the response. If the client of the recursive resolver did not include the DO bit in the query the recursive resolver SHOULD include the DAU option according to its own local policy.

If the client did include the DO and CD bits, but did not include the DAU option in the query, the validating recursive resolver SHOULD NOT include the DAU option to avoid conflicts.

If the client did set the DO bit and the DAU option in the query, the validating recursive resolver SHOULD include the DAU option based on the setting of the CD bit. If the CD bit is set, the validating recursive resolver SHOULD include the DAU option based on the client query or a superset of the client DAU option list and the validator's own list (if different). If the CD bit is not set, the validating recursive resolver MAY copy the client DAU option or substitute its own DAU option list.

3.4.2. Non-validating Recursive Resolvers

Recursive resolvers that do not do validation or caching SHOULD copy the DAU option seen in received queries as they represent the wishes of the validating downstream resolver that issued the original query.

4. Intermediate Middlebox Considerations

Intermediate middleboxes SHOULD behave like a comparable recursive resolver when dealing with the DAU option [\[RFC5625\]](#).

5. Server Considerations

When an authoritative server sees the DAU option in the OPT meta-RR in a request the normal algorithm for servicing requests is followed. The DAU option does not trigger any special processing on the server side. If the DAU option is present but the DNSSEC-OK (OK) bit is not set, the server does not do any DNSSEC processing, including any recording of the DAU option.

6. Traffic Analysis Considerations

Zone administrators that are planning or are in the process of a cryptographic algorithm rollover operation should monitor DNS query traffic and record the values of the DAU option in queries. This monitoring can measure the deployment of client code that implements (and signals) certain algorithms. Exactly how to capture DNS traffic and measure new algorithm adoption is beyond the scope of this document.

Zone administrators can use this data to set plans for starting an algorithm rollover and determine when older algorithms can be phased out without disrupting a significant number of clients. In order to keep this disruption to a minimum, zone administrators should wait to complete an algorithm rollover until a large majority of clients signal that they understand the new algorithm. This may be in the order of years rather than months. Note that clients that do not implement the DAU option are likely to be older implementations which would also not implement any newly deployed algorithm.

7. IANA Considerations

The algorithm codes used to identify DNSSEC algorithms has already been established by IANA. This document does not seek to alter that registry in any way.

This draft seeks to update the "DNS EDNS0 Options" registry by adding the DAU option and referencing this document. The code for the option should be TBD.

8. Security Considerations

This document specifies a way for a client to signal its digital signature algorithm preference to a cache or server. It is not meant to be a discussion on algorithm superiority. The signal is an optional code contained in the OPT meta-RR used with EDNS0. The goal of this option is to signal new algorithm uptake in client code to allow zone administrators to know when it is possible to complete an algorithm rollover in a DNSSEC signed zone.

9. References

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