Domain Name System Operations (dnsop)
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DNSSEC automation
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Abstract

This document describes an algorithm and a protocol to automate DNSSEC multi-signer [RFC8901] "Multi-Signer DNSSEC Models" setup, operations and decomissioning. It makes use of [RFC8078] "Managing DS Records from the Parent via CDS/CDNSKEY" and [RFC7477] "Child-to-Parent Synchronization in DNS" to accomplish this.

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 23 August 2021.

Table of Contents

1. Introduction

[RFC8901] describes the neccessary steps and API for a multi-signer DNSSEC configuration. In this document we will combine [RFC8901] with [RFC8078] and [RFC7477] to define a fully automatable algorithm for setting up, operating and decomissioning of a multi-signer DNSSEC configuration.

One of the special cases of multi-signer DNSSEC is actually the secure change of DNS operator.

1.1. Out-Of-Scope

In order for any multi-signer group to give consitent answers over all instances the contents of the zone have to be synchronized. The content synchronization is out-of-scope for this document.

1.2. Notation

Short definitions of expressions used in this document

signer An entity signing a zone

multi-signer group A group of signers that sign the same zone

1.3. 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. Use Cases

2.1. Running a multi-signer setup

As described in [RFC8901] a multi-signer DNSSEC configuration has some challenges that can be overcome with the right infrastructure and following a number of steps for setup and operation.

In this document we describe how all of the steps in the multi-signer DNSSEC setup can be automated. That is, all except the initial trust between involded signers.

2.2. Secure change of name server operator

Changing the name server operator of a DNSSEC signed zone can be quite a challenge. Currently the most used algorithm is "going insecure". This is a bad choice for security. And a bad choice for users relying on the security of the zone.

Changing name server operators is a special case of multi-signer DNSSEC operations. It simply comes down to the new operator joins the old operator in a multi-signer setup. And once that is completed the old operator leaves the multi-signer setup.

3. Algorithm

3.1. Setting up a new multi-signer group

The zone is already authoritatively served by one DNS operator and is DNSSEC signed. For full automation both the KSK and ZSK or CSK must be online.

This would be a special case, a multi-signer group with only one signer.

3.2. Configuration

The following configrations have to be made for any signer of the multi-signer group before joining the group. These steps are not automated by this draft.

1. The signers own keys (probably the keys the signer has the private part of)

2. The NS records in the zone that get update from the signer.

3. An established trust to the multi-signer group

3.3. A new signer joins the multi-signer group

3.3.1. Prerequisites

The new signer

1. has a working setup of the zone, including DNSSEC signing.

2. uses the same algorithm for DNSSEC signing as the multi-signer goup uses.

3.3.2. Steps for joining

1. a new signer joins the group

2. Exchange of keys, after this step all signers must have the dnskey set of all other signers of the group

3. Calculate CDS/CDNSKEY set

4. All signers put the ZSK of all other signers in their DNSKEY set.

5. All signers publish their CDS/CDNSKEY set

6. Wait for parent to pick up DS updates

7. Remove CDS/CDNSKEY set from all signers

8. Wait 2 time maximum TTL of DS at parent and DNSKEY at all children

9. Exchange of NS set, after this step all signers must have the ns set of all other signers

10. Compile new complete NS set with NS records from all signers

11. Compare to NS set at parent

12. If parent if different, publish CSYNC record with NS and A and AAAA bit set.

13. Wait for parent to pick up changes

14. Remove CSYNC record from all signers

3.4. A signer leaves the multi-signer group

1. Signal to all other signers to remove the leaving signes NS records

2. Compile new complete NS set with NS records from all signers

3. Compare to NS set at parent

4. If parent if different, publish CSYNC record with NS and A and AAAA bit set.

5. Wait for parent to pick up changes

6. Remove CSYNC record from all signers

7. Wait 2 times TTL of maximum NS TTL from parent and all signers

8. Signal all other signers leaving of multi-signer group

9. Stop answering queries

10. Remaining signers remove ZSK of leaving signer from their DNSKEY set

11. Remaining signers recalculat DNSKEY set

12. Calculate CDS/CDNSKEY set

13. All signers put the ZSK of all other signers in their DNSKEY set.

14. All signers publish their CDS/CDNSKEY set

15. Wait for parent to pick up DS updates

16. Remove CDS/CDNSKEY set from all signers

4. Automation

Automation of the neccessary steps described in the last section can be devided into two main models, centralized and decentralized. Both have pros and cons and any zone operator should chose wisely.

4.1. Centralized

In a centralized model the zone operator will run a software that executes all steps neccessary and controls all signers.

4.2. Decentralized

In the decentralized models all signers will comminucate with each other and execute the necessary steps on their instance only. For this signers need a specialised protocol to comminicate configuration details that are not part of the zone data.

5. Acknowledgements

6. IANA Considerations

7. Security Considerations

8. 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>.

[RFC7477] Hardaker, W., "Child-to-Parent Synchronization in DNS", RFC 7477, DOI 10.17487/RFC7477, March 2015, <https://www.rfc-editor.org/info/rfc7477>.

[RFC8078] Gudmundsson, O. and P. Wouters, "Managing DS Records from the Parent via CDS/CDNSKEY", RFC 8078, DOI 10.17487/RFC8078, March 2017, <https://www.rfc-editor.org/info/rfc8078>.

9. Informative References

[RFC8901] Huque, S., Aras, P., Dickinson, J., Vcelak, J., and D. Blacka, "Multi-Signer DNSSEC Models", RFC 8901, DOI 10.17487/RFC8901, September 2020, <https://www.rfc-editor.org/info/rfc8901>.

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