Internet Engineering Task Force (IETF)
Request for Comments: 6490
Category: Standards Track
ISSN: 2070-1721

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February 2012

Resource Public Key Infrastructure (RPKI) Trust Anchor Locator

Abstract

This document defines a Trust Anchor Locator (TAL) for the Resource Public Key Infrastructure (RPKI).

Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 5741.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at http://www.rfc-editor.org/info/rfc6490.

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1. Introduction

This document defines a Trust Anchor Locator (TAL) for the Resource Public Key Infrastructure (RPKI) [RFC6480]. This format may be used to distribute trust anchor material using a mix of out-of-band and online means. Procedures used by Relying Parties (RPs) to verify RPKI signed objects SHOULD support this format to facilitate interoperability between creators of trust anchor material and RPs.

1.1. Terminology

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 [RFC2119].

2. Trust Anchor Locator

2.1. Trust Anchor Locator Format

This document does not propose a new format for trust anchor material. A trust anchor in the RPKI is represented by a self-signed X.509 Certification Authority (CA) certificate, a format commonly used in PKIs and widely supported by RP software. This document specifies a format for data used to retrieve and verify the authenticity of a trust anchor in a very simple fashion. That data is referred to as the TAL.

The motivation for defining the TAL is to enable selected data in the trust anchor to change, without needing to effect redistribution of the trust anchor per se. In the RPKI, certificates contain extensions that represent Internet Number Resources (INRs) [RFC3779]. The set of INRs associated with an entity likely will change over time. Thus, if one were to use the common PKI convention of

distributing a trust anchor to RPs in a secure fashion, this procedure would need to be repeated whenever the INR set for the trust anchor changed. By distributing the TAL (in a secure fashion) instead of the trust anchor, this problem is avoided, i.e., the TAL is constant so long as the trust anchor's public key and its location do not change.

The TAL is analogous to the TrustAnchorInfo data structure [RFC5914] adopted as a PKIX standard. That standard could be used to represent the TAL, if one defined an rsync URI extension for that data structure. However, the TAL format was adopted by RPKI implementors prior to the PKIX trust anchor work, and the RPKI implementer community has elected to utilize the TAL format, rather than define the requisite extension. The community also prefers the simplicity of the ASCII encoding of the TAL versus the binary (ASN.1) encoding for TrustAnchorInfo.

The TAL is an ordered sequence of:

1) An rsync URI [RFC5781],
2) A <CRLF> or <LF> line break, and
3) A subjectPublicKeyInfo [RFC5280] in DER format [X.509], encoded in Base64 (see Section 4 of [RFC4648]).

2.2. TAL and Trust Anchor Certificate Considerations

The rsync URI in the TAL MUST reference a single object. It MUST NOT reference a directory or any other form of collection of objects.

The referenced object MUST be a self-signed CA certificate that conforms to the RPKI certificate profile [RFC6487]. This certificate is the trust anchor in certification path discovery [RFC4158] and validation [RFC5280] [RFC3779].

The validity interval of this trust anchor SHOULD reflect the anticipated period of stability for the particular set of INRs that are associated with the putative trust anchor.

The INR extension(s) of this trust anchor MUST contain a non-empty set of number resources. It MUST NOT use the "inherit" form of the INR extension(s). The INR set described in this certificate is the set of number resources for which the issuing entity is offering itself as a putative trust anchor in the RPKI [RFC6480].

The public key used to verify the trust anchor MUST be the same as the subjectPublicKeyInfo in the CA certificate and in the TAL.

The trust anchor MUST contain a stable key. This key MUST NOT change when the certificate is reissued due to changes in the INR extension(s), when the certificate is renewed prior to expiration or for any reason other than a key change.

Because the public key in the TAL and the trust anchor MUST be stable, this motivates operation of that CA in an off-line mode. Thus the entity that issues the trust anchor SHOULD issue a subordinate CA certificate that contains the same INRs (via the use of the "inherit" option in the INR extensions of the subordinate certificate). This allows the entity that issues the trust anchor to keep the corresponding private key of this certificate off-line, while issuing all relevant child certificates under the immediate subordinate CA. This measure also allows the Certificate Revocation List (CRL) issued by that entity to be used to revoke the subordinate CA certificate in the event of suspected key compromise of this potentially more vulnerable online operational key pair.

The trust anchor MUST be published at a stable URI. When the trust anchor is reissued for any reason, the replacement CA certificate MUST be accessible using the same URI.

Because the trust anchor is a self-signed certificate, there is no corresponding CRL that can be used to revoke it, nor is there a manifest [RFC6486] that lists this certificate.

If an entity wishes to withdraw a self-signed CA certificate as a putative trust anchor for any reason, including key rollover, the entity MUST remove the object from the location referenced in the TAL.

2.3. Example

```
rsync://rpki.example.org/rpki/hedgehog/root.cer
MIIBIjANBgkqhkiG9w0BAQEFAAOCAQ8AMIIBCgKCAQEAovWQL2lh6knDx
GUG5hbtCXvvh4AOzjhDkSHlj22gn/1oiM9IeDATIwP44vhQ6L/xvuk7W6
Kfa5ygmqQ+xOZOwTWPcrUbqaQyPNxokuivzyvqVZVDecOEqs78q58mSp9
nbtxmLRW7B67SJCBSzfa5XpVyXYEgYAjkk3fpmefU+AcxtxvvHB5OVPIa
BfPcs80ICMgHQX+fphvute9XLxjfJKJWkhZqZ0v7pZm2uhkcPx1PMGcrG
ee0WSDC3fr3erLueagpiLsFjwwpX6F+Ms8vqz45H+DKmYKvPSstZjCCq9
aJ0qANT9OtnfSDOS+aLRPjZryCNyvvBHxZXqj5YCGKtwIDAQAB
```

3. Relying Party Use

In order to use the TAL to retrieve and validate a (putative) trust anchor, an RP SHOULD:

1. Retrieve the object referenced by the URI contained in the TAL.

2. Confirm that the retrieved object is a current, self-signed RPKI CA certificate that conforms to the profile as specified in [RFC6487].

3. Confirm that the public key in the TAL matches the public key in the retrieved object.

4. Perform other checks, as deemed appropriate (locally), to ensure that the RP is willing to accept the entity publishing this self-signed CA certificate to be a trust anchor. These checks apply to the validity of attestations made in the context of the RPKI, relating to all resources described in the INR extension of this certificate.

An RP SHOULD perform these functions for each instance of TAL that it is holding for this purpose every time the RP performs a re-synchronization across the local repository cache. In any case, an RP also SHOULD perform these functions prior to the expiration of the locally cached copy of the retrieved trust anchor referenced by the TAL.

4. Security Considerations

Compromise of a trust anchor private key permits unauthorized parties to masquerade as a trust anchor, with potentially severe consequences. Reliance on an inappropriate or incorrect trust anchor has similar potentially severe consequences.

This TAL does not directly provide a list of resources covered by the referenced self-signed CA certificate. Instead, the RP is referred to the trust anchor itself and the INR extension(s) within this certificate. This provides necessary operational flexibility, but it also allows the certificate issuer to claim to be authoritative for any resource. Relying parties should either have great confidence in the issuers of such certificates that they are configuring as trust anchors, or they should issue their own self-signed certificate as a trust anchor and, in doing so, impose constraints on the subordinate certificates. For more information on this approach, see [TA-MGMT].

5. Acknowledgments

This approach to trust anchor material was originally described by Robert Kisteleki.

The authors acknowledge the contributions of Rob Austein and Randy Bush, who assisted with earlier draft versions of this document and with helpful review comments.

6. References

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