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A Profile for Autonomous System Provider Authorization

Abstract

This document defines a standard profile for Autonomous System Provider Authorization in the Resource Public Key Infrastructure. An Autonomous System Provider Authorization is a digitally signed object that provides a means of verifying that a Customer Autonomous System holder has authorized members of Provider set to be its upstream providers and for the Providers to send prefixes received from the Customer Autonomous System in all directions including providers and peers.

Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [[RFC2119](#)] [[RFC8174](#)] when, and only when, they appear in all capitals, as shown here.

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1. Introduction

The primary purpose of the Resource Public Key Infrastructure (RPKI) is to improve routing security. (See [[RFC6480](#)] for more information.) As part of this infrastructure, a mechanism is needed to verify that a AS has permission from a Customer AS (CAS) holder to send routes in all directions. The digitally signed Autonomous System Provider Authorization (ASPA) object provides this verification mechanism.

The ASPA uses the template for RPKI digitally signed objects [[RFC6488](#)], which defines a Cryptographic Message Syntax (CMS) [[RFC5652](#)] wrapper for the ASPA content as well as a generic validation procedure for RPKI signed objects. As ASPAs need to be validated with RPKI certificates issued by the current

infrastructure, we assume the mandatory-to-implement algorithms in [[RFC6485](#)], or its successor.

To complete the specification of the ASPA (see Section 4 of [[RFC6488](#)]), this document defines:

1. The object identifier (OID) that identifies the ASPA signed object. This OID appears in the eContentType field of the encapContentInfo object as well as the content-type signed attribute within the signerInfo structure).
2. The ASN.1 syntax for the ASPA content, which is the payload signed by the CAS. The ASPA content is encoded using the ASN.1 [[X680](#)] Distinguished Encoding Rules (DER) [[X690](#)].
3. The steps required to validate an ASPA beyond the validation steps specified in [[RFC6488](#)]).

2. The ASPA Content Type

The content-type for an ASPA is defined as id-cct-ASPA, which has the numerical value of 1.2.840.113549.1.9.16.1.TBD. This OID MUST appear both within the eContentType in the encapContentInfo structure as well as the content-type signed attribute within the signerInfo structure (see [[RFC6488](#)]).

3. The ASPA eContent

The content of an ASPA identifies the Customer AS (CAS) as well as the Set of Provider ASes (SPAS) that are authorized to further propagate announcements received from the customer. If customer has multiple providers they MUST be registered in a single ASPA object. This rule is important to avoid possible race conditions during updates. An ASPA is formally defined as:

```
ct-ASPA CONTENT-TYPE ::=
  { ASProviderAttestation IDENTIFIED BY id-ct-ASPA }
```

```
id-ct-ASPA OBJECT IDENTIFIER ::= { id-ct TBD }
```

```
ASProviderAttestation ::= SEQUENCE {
  version [0] ASPAVersion DEFAULT v0,
  aFI AddressFamilyIdentifier,
  customerASID ASID,
  providerASSET SEQUENCE (SIZE(1..MAX)) OF ASID }
```

```
ASPAVersion ::= INTEGER { v0(0) }
```

```
AddressFamilyIdentifier ::= OCTET STRING (SIZE (2))
```

```
ASID ::= INTEGER
```

Note that this content appears as the eContent within the encapContentInfo as specified in [[RFC6488](#)].

3.1. version

The version number of the ASProviderAttestation MUST be v0.

3.2. AFI

The AFI field contains Address Family Identifier for which the relation between customer and provider ASes is authorized. Presently defined values for the Address Family Identifier field are specified in the IANA's Address Family Numbers registry [[IANA-AF](#)].

3.3. customerASID

The customerASID field contains the AS number of the Autonomous System that authorizes an upstream providers (listed in the providerASSET) to propagate prefixes in the specified address family other ASes.

3.4. providerASSET

The providerASSET contains the sequence (set) of AS numbers that are authorized to further propagate announcements in the specified address family received from the customer.

4. ASPA Validation

Before a relying party can use an ASPA to validate a routing announcement, the relying party MUST first validate the ASPA object itself. To validate an ASPA, the relying party MUST perform all the

validation checks specified in [[RFC6488](#)] as well as the following additional ASPA-specific validation step.

*The autonomous system identifier delegation extension [[RFC3779](#)] is present in the end-entity (EE) certificate (contained within the ASPA), and the customer AS number in the ASPA is contained within the set of AS numbers specified by the EE certificate's autonomous system identifier delegation extension.

5. ASN.1 Module for the ASPA Content Type

```
RPKI-ASPA-2020
  { iso(1) member-body(2) us(840) rsadsi(113549) pkcs(1)
    pkcs-9(9) smime(16) modules(0) id-mod-rpki-aspa-2020(TBD2) }
DEFINITIONS IMPLICIT TAGS ::=
BEGIN
IMPORTS

CONTENT-TYPE
FROM CryptographicMessageSyntax-2010 -- RFC 6268
  { iso(1) member-body(2) us(840) rsadsi(113549) pkcs(1)
    pkcs-9(9) smime(16) modules(0) id-mod-cms-2009(58) } ;

ContentSet CONTENT-TYPE ::= { ct-ASPA, ... }

--
-- ASPA Content Type
--

id-smime OBJECT IDENTIFIER ::= { iso(1) member-body(2)
  us(840) rsadsi(113549) pkcs(1) pkcs-9(9) 16 }

id-ct OBJECT IDENTIFIER ::= { id-smime 1 }

id-ct-ASPA OBJECT IDENTIFIER ::= { id-ct TBD }

ct-ASPA CONTENT-TYPE ::=
  { TYPE ASPProviderAttestation IDENTIFIED BY id-ct-ASPA }

ASPProviderAttestation ::= SEQUENCE {
  version [0] ASPAVersion DEFAULT v0,
  aFI AddressFamilyIdentifier,
  customerASID ASID,
  providerASSET SEQUENCE (SIZE(1..MAX)) OF ASID OPTIONAL }

ASPAVersion ::= INTEGER { v0(0) }

AddressFamilyIdentifier ::= OCTET STRING (SIZE (2))

ASID ::= INTEGER

END
```

6. IANA Considerations

Please add the id-mod-rpki-aspa-2018 to the SMI Security for S/MIME Module Identifier (1.2.840.113549.1.9.16.0) registry (<https://www.iana.org/assignments/smi-numbers/smi-numbers.xml#security-smime-0>) as follows:

Decimal	Description	Specification
TBD2	id-mod-rpki-aspa-2020	[ThisRFC]

Please add the ASPA to the SMI Security for S/MIME CMS Content Type (1.2.840.113549.1.9.16.1) registry (<https://www.iana.org/assignments/smi-numbers/smi-numbers.xml#security-smime-1>) as follows:

Decimal	Description	Specification
TBD	id-ct-ASPA	[ThisRFC]

Please add Autonomous System Provider Authorization to the RPKI Signed Object registry (<https://www.iana.org/assignments/rpki/rpki.xhtml#signed-objects>) as follows:

Name	OID
Autonomous System Provider Authorization	1.2.840.113549.1.9.16.1.T

Please add an item for the Autonomous System Provider Authorization file extension to the "RPKI Repository Name Scheme" registry created by [\[RFC6481\]](#) as follows:

Filename Extension	RPKI Object	Reference
.asa	Autonomous System Provider Authorization	[draft-ietf-sidr

7. Security Considerations

While it's not restricted, but it's highly recommended maintaining for selected Customer AS a single ASPA object that covers all its providers. Such policy should prevent race conditions during ASPA updates that might affect prefix propagation. The software that provides hosting for ASPA records SHOULD support enforcement of this rule. In the case of the transition process between different CA registries, the ASPA records SHOULD be kept identical in all registries.

8. Acknowledgments

9. References

9.1. Normative References

[IANA-AF]

IANA, "Address Family Numbers", <<https://www.iana.org/assignments/address-family-numbers/address-family-numbers.xhtml>>.

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9.2. Informative References

[RFC6480]

Lepinski, M. and S. Kent, "An Infrastructure to Support Secure Internet Routing", RFC 6480, DOI 10.17487/RFC6480, February 2012, <<https://www.rfc-editor.org/info/rfc6480>>.

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