A YANG Data Model for a Truststore
draft-ietf-netconf-trust-anchors-07

Abstract

This document defines a YANG 1.1 data model for configuring global sets of X.509 certificates, SSH host-keys, raw public keys, and PSKs (pairwise-symmetric or pre-shared keys) that can be referenced by other data models for trust. While the SSH host-keys are uniquely for the SSH protocol, certificates, raw public keys, and PSKs may have multiple uses, including authenticating protocol peers and verifying signatures.

Editorial Note (To be removed by RFC Editor)

This draft contains many placeholder values that need to be replaced with finalized values at the time of publication. This note summarizes all of the substitutions that are needed. No other RFC Editor instructions are specified elsewhere in this document.

Artwork in this document contains shorthand references to drafts in progress. Please apply the following replacements:

- "XXXX" --> the assigned RFC value for this draft
- "YYYY" --> the assigned RFC value for draft-ietf-netconf-crypto-types

Artwork in this document contains placeholder values for the date of publication of this draft. Please apply the following replacement:

- "2019-11-02" --> the publication date of this draft

The following Appendix section is to be removed prior to publication:

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1. Introduction

This document defines a YANG 1.1 [RFC7950] data model for configuring global sets of X.509 certificates, SSH host-keys, raw public keys, and PSKs (pairwise-symmetric or pre-shared keys) that can be referenced by other data models for trust. While the SSH host-keys are uniquely for the SSH protocol, certificates, raw public keys, and PSKs may have multiple uses, including authenticating protocol peers and verifying signatures.

This document in compliant with Network Management Datastore Architecture (NMDA) [RFC8342]. For instance, to support trust anchors installed during manufacturing, it is expected that such data would appear only in <operational>.

1.1. 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.

1.2. Tree Diagram Notation

Tree diagrams used in this document follow the notation defined in [RFC8340].

2. The Trust Anchors Model

2.1. Tree Diagram

The following tree diagram provides an overview of the "ietf-truststore" module.

module: ietf-truststore
  +--rw truststore
```yang
++--rw certificates* [name] {x509-certificates}?
    +--rw name           string
    +--rw description?   string
    +--rw certificate* [name]
        +--rw name                      string
        +--rw cert                      trust-anchor-cert-cms
        +--n certificate-expiration
            +-- expiration-date    yang:date-and-time
++--rw host-keys* [name] {ssh-host-keys}?
    +--rw name           string
    +--rw description?   string
    +--rw host-key* [name]
        +--rw name        string
        +--rw host-key    ct:ssh-host-key
++--rw psks* [name] {psks}?
    +--rw name           string
    +--rw description?   string
    +--rw psk* [name]
        +--rw name    string
        +--rw psk     ct:psk
++--rw raw-public-keys* [name] {raw-public-keys}?
    +--rw name              string
    +--rw description?      string
    +--rw raw-public-key* [name]
        +--rw name              string
        +--rw raw-public-key    ct:raw-public-key

grouping local-or-truststore-certs-grouping
  +-- (local-or-truststore)
    +--:(local) {local-definitions-supported}?
        +-- local-definition
            +-- cert*                     trust-anchor-cert-cms
            +--n certificate-expiration
                +-- expiration-date    yang:date-and-time
    +--:(truststore) {truststore-supported,x509-certificates}?
        +-- truststore-reference?   ts:certificates-ref

grouping local-or-truststore-host-keys-grouping
  +-- (local-or-truststore)
    +--:(local) {local-definitions-supported}?
        +-- local-definition
            +-- host-key*   ct:ssh-host-key
    +--:(truststore) {truststore-supported,ssh-host-keys}?
        +-- truststore-reference?   ts:host-keys-ref

grouping local-or-truststore-psks-grouping
  +-- (local-or-truststore)
    +--:(local) {local-definitions-supported}?
        +-- local-definition
            +-- psk*     ct:psk
```

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2.2. Example Usage

The following example illustrates trust anchors in <operational> as described by Section 5.3 in [RFC8342]. This datastore view illustrates data set by the manufacturing process alongside conventional configuration. This trust anchors instance has six sets of pinned certificates and one set of pinned host keys.

<truststore
 xmlns="urn:ietf:params:xml:ns:yang:ietf-truststore"
 xmlns:or="urn:ietf:params:xml:ns:yang:ietf-origin">
<!-- Manufacturer’s trusted root CA certs -->
<certificates or:origin="or:system">
  <name>manufacturers-root-ca-certs</name>
  <description>
    Certificates built into the device for authenticating
    manufacturer-signed objects, such as TLS server certificates,
    vouchers, etc. Note, though listed here, these are not
    configurable; any attempt to do so will be denied.
  </description>
  <certificate>
    <name>Manufacturer Root CA cert 1</name>
    <cert>base64encodedvalue==</cert>
  </certificate>
  <certificate>
    <name>Manufacturer Root CA cert 2</name>
    <cert>base64encodedvalue==</cert>
  </certificate>
</certificates>

<!-- specific end-entity certs for authenticating servers -->
<certificates or:origin="or:intended">
  <name>explicitly-trusted-server-certs</name>
  <description>
    Specific server authentication certificates for explicitly
    trusted servers. These are needed for server certificates
    that are not signed by a CA.
  </description>
  <certificate>
    <name>Fred Flintstone</name>
    <cert>base64encodedvalue==</cert>
  </certificate>
</certificates>

<!-- trusted CA certs for authenticating servers -->
<certificates or:origin="or:intended">
  <name>explicitly-trusted-server-ca-certs</name>
  <description>
    Trust anchors (i.e. CA certs) that are used to authenticate
    server connections. Servers are authenticated if their
    certificate has a chain of trust to one of these CA
    certificates.
  </description>
  <certificate>
    <name>ca.example.com</name>
    <cert>base64encodedvalue==</cert>
  </certificate>
</certificates>
<!-- specific end-entity certs for authenticating clients -->
<certificates or:origin="or:intended">
  <name>explicitly-trusted-client-certs</name>
  <description>
  Specific client authentication certificates for explicitly trusted clients. These are needed for client certificates that are not signed by a CA.
  </description>
  <certificate>
    <name>George Jetson</name>
    <cert>base64encodedvalue==</cert>
  </certificate>
</certificates>

<!-- trusted CA certs for authenticating clients -->
<certificates or:origin="or:intended">
  <name>explicitly-trusted-client-ca-certs</name>
  <description>
  Trust anchors (i.e. CA certs) that are used to authenticate client connections. Clients are authenticated if their certificate has a chain of trust to one of these CA certificates.
  </description>
  <certificate>
    <name>ca.example.com</name>
    <cert>base64encodedvalue==</cert>
  </certificate>
</certificates>

<!-- trusted CA certs for random HTTPS servers on Internet -->
<certificates or:origin="or:system">
  <name>common-ca-certs</name>
  <description>
  Trusted certificates to authenticate common HTTPS servers. These certificates are similar to those that might be shipped with a web browser.
  </description>
  <certificate>
    <name>ex-certificate-authority</name>
    <cert>base64encodedvalue==</cert>
  </certificate>
</certificates>

<!-- specific SSH host keys for authenticating clients -->
<host-keys or:origin="or:intended">
  <name>explicitly-trusted-ssh-host-keys</name>
  <description>
  Trusted SSH host keys used to authenticate SSH servers.
These host keys would be analogous to those stored in a known_hosts file in OpenSSH.

```xml
<host-key>
  <name>corp-fw1</name>
  <host-key>base64encodedvalue==</host-key>
</host-key>
</host-keys>
```

The following example illustrates the "certificate-expiration" notification in use with the NETCONF protocol.

```xml
<notification
  xmlns="urn:ietf:params:xml:ns:netconf:notification:1.0">
  <eventTime>2018-05-25T00:01:00Z</eventTime>
  <truststore xmlns="urn:ietf:params:xml:ns:yang:ietf-truststore">
    <certificates>
      <name>explicitly-trusted-client-certs</name>
      <certificate>
        <name>George Jetson</name>
        <certificate-expiration>
          <expiration-date>2018-08-05T14:18:53-05:00</expiration-date>
        </certificate-expiration>
      </certificate>
    </certificates>
  </truststore>
</notification>
```

### 2.3. YANG Module

This YANG module imports modules from [RFC8341] and [I-D.ietf-netconf-crypto-types].

```xml
<CODE BEGINS> file "ietf-truststore@2019-11-02.yang"

<CODE ENDS>
```
3. Security Considerations

The YANG module defined in this document is designed to be accessed via YANG based management protocols, such as NETCONF [RFC6241] and RESTCONF [RFC8040]. Both of these protocols have mandatory-to-implement secure transport layers (e.g., SSH, TLS) with mutual authentication.

The NETCONF access control model (NACM) [RFC8341] provides the means to restrict access for particular users to a pre-configured subset of all available protocol operations and content.

There are a number of data nodes defined in this YANG module that are writable/creatable/deletable (i.e., config true, which is the default). These data nodes may be considered sensitive or vulnerable in some network environments. Write operations (e.g., edit-config) to these data nodes without proper protection can have a negative effect on network operations. These are the subtrees and data nodes and their sensitivity/vulnerability:

/: The entire data tree defined by this module is sensitive to write operations. For instance, the addition or removal of any trust anchor may dramatically alter the implemented security policy. For this reason, the NACM extension "default-deny-write" has been set for the entire data tree.

None of the readable data nodes in this YANG module are considered sensitive or vulnerable in network environments.

This module does not define any RPCs, actions, or notifications, and thus the security consideration for such is not provided here.

4. IANA Considerations

4.1. The IETF XML Registry

This document registers one URI in the "ns" subregistry of the IETF XML Registry [RFC3688]. Following the format in [RFC3688], the following registration is requested:

Registrant Contact: The NETCONF WG of the IETF.
XML: N/A, the requested URI is an XML namespace.
4.2. The YANG Module Names Registry

This document registers one YANG module in the YANG Module Names registry [RFC6020]. Following the format in [RFC6020], the following registration is requested:

- name: ietf-truststore
- prefix: ta
- reference: RFC XXXX

5. References

5.1. Normative References


5.2. Informative References


Appendix A. Change Log

A.1. 00 to 01

- Added features "x509-certificates" and "ssh-host-keys".
- Added nacm:default-deny-write to "trust-anchors" container.

A.2. 01 to 02

- Switched "list pinned-certificate" to use the "trust-anchor-cert-grouping" from crypto-types. Effectively the same definition as before.

A.3. 02 to 03

- Updated copyright date, boilerplate template, affiliation, folding algorithm, and reformatted the YANG module.

A.4. 03 to 04

- Added groupings 'local-or-truststore-certs-grouping' and 'local-or-truststore-host-keys-grouping', matching similar definitions in the keystore draft. Note new (and incomplete) "truststore" usage!
- Related to above, also added features 'truststore-supported' and 'local-trust-anchors-supported'.

A.5. 04 to 05

- Renamed "trust-anchors" to "truststore"
- Removed "pinned." prefix everywhere, to match truststore rename
- Moved everything under a top-level 'grouping' to enable use in other contexts.
- Renamed feature from 'local-trust-anchors-supported' to 'local-definitions-supported' (same name used in keystore)
- Removed the "require-instance false" statement from the "*-ref" typedefs.
- Added missing "ssh-host-keys" and "x509-certificates" if-feature statements
A.6. 05 to 06
   o Editorial changes only.

A.7. 06 to 07
   o Added Henk Birkholz as a co-author (thanks Henk!)
   o Added PSKs and raw public keys to Truststore.

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