

Workgroup: NETCONF Working Group  
Internet-Draft:  
draft-ietf-netconf-tls-client-server-32  
Published: 12 December 2022  
Intended Status: Standards Track  
Expires: 15 June 2023  
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## **YANG Groupings for TLS Clients and TLS Servers**

### **Abstract**

This document defines three YANG 1.1 modules: the first defines features and groupings common to both TLS clients and TLS servers, the second defines a grouping for a generic TLS client, and the third defines a grouping for a generic TLS server.

### **Editorial Note (To be removed by RFC Editor)**

This draft contains 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:

\*AAAA --> the assigned RFC value for draft-ietf-netconf-crypto-types

\*BBBB --> the assigned RFC value for draft-ietf-netconf-trust-anchors

\*CCCC --> the assigned RFC value for draft-ietf-netconf-keystore

\*DDDD --> the assigned RFC value for draft-ietf-netconf-tcp-client-server

\*FFFF --> the assigned RFC value for this draft

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

\*2022-12-12 --> the publication date of this draft

The "Relation to other RFCs" section [Section 1.1](#) contains the text "one or more YANG modules" and, later, "modules". This text is sourced from a file in a context where it is unknown how many

modules a draft defines. The text is not wrong as is, but it may be improved by stating more directly how many modules are defined.

The "Relation to other RFCs" section [Section 1.1](#) contains a self-reference to this draft, along with a corresponding Informative Reference in the Appendix.

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

\*[Appendix B](#). Change Log

## 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 15 June 2023.

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## Table of Contents

- [1. Introduction](#)
  - [1.1. Relation to other RFCs](#)
  - [1.2. Specification Language](#)
  - [1.3. Adherence to the NMDA](#)

1.4.	<a href="#">Conventions</a>
2.	<a href="#">The "ietf-tls-common" Module</a>
2.1.	<a href="#">Data Model Overview</a>
2.2.	<a href="#">Example Usage</a>
2.3.	<a href="#">YANG Module</a>
3.	<a href="#">The "ietf-tls-client" Module</a>
3.1.	<a href="#">Data Model Overview</a>
3.2.	<a href="#">Example Usage</a>
3.3.	<a href="#">YANG Module</a>
4.	<a href="#">The "ietf-tls-server" Module</a>
4.1.	<a href="#">Data Model Overview</a>
4.2.	<a href="#">Example Usage</a>
4.3.	<a href="#">YANG Module</a>
5.	<a href="#">Security Considerations</a>
5.1.	<a href="#">The "iana-tls-cipher-suite-algs" Module</a>
5.2.	<a href="#">The "ietf-tls-common" YANG Module</a>
5.3.	<a href="#">The "ietf-tls-client" YANG Module</a>
5.4.	<a href="#">The "ietf-tls-server" YANG Module</a>
6.	<a href="#">IANA Considerations</a>
6.1.	<a href="#">The "IETF XML" Registry</a>
6.2.	<a href="#">The "YANG Module Names" Registry</a>
6.3.	<a href="#">The "iana-tls-cipher-suite-algs" Module</a>
7.	<a href="#">References</a>
7.1.	<a href="#">Normative References</a>
7.2.	<a href="#">Informative References</a>
Appendix A.	<a href="#">YANG Modules for IANA</a>
A.1.	<a href="#">Initial Module for the "TLS Cipher Suites" Registry</a>
A.1.1.	<a href="#">Data Model Overview</a>
A.1.2.	<a href="#">Example Usage</a>
A.1.3.	<a href="#">YANG Module</a>
Appendix B.	<a href="#">Change Log</a>
B.1.	<a href="#">00 to 01</a>
B.2.	<a href="#">01 to 02</a>
B.3.	<a href="#">02 to 03</a>
B.4.	<a href="#">03 to 04</a>
B.5.	<a href="#">04 to 05</a>
B.6.	<a href="#">05 to 06</a>
B.7.	<a href="#">06 to 07</a>
B.8.	<a href="#">07 to 08</a>
B.9.	<a href="#">08 to 09</a>
B.10.	<a href="#">09 to 10</a>
B.11.	<a href="#">10 to 11</a>
B.12.	<a href="#">11 to 12</a>
B.13.	<a href="#">12 to 13</a>
B.14.	<a href="#">12 to 13</a>
B.15.	<a href="#">13 to 14</a>
B.16.	<a href="#">14 to 15</a>
B.17.	<a href="#">15 to 16</a>
B.18.	<a href="#">16 to 17</a>

<a href="#">B.19.</a>	<a href="#">17 to 18</a>
<a href="#">B.20.</a>	<a href="#">18 to 19</a>
<a href="#">B.21.</a>	<a href="#">19 to 20</a>
<a href="#">B.22.</a>	<a href="#">20 to 21</a>
<a href="#">B.23.</a>	<a href="#">21 to 22</a>
<a href="#">B.24.</a>	<a href="#">22 to 23</a>
<a href="#">B.25.</a>	<a href="#">23 to 24</a>
<a href="#">B.26.</a>	<a href="#">24 to 25</a>
<a href="#">B.27.</a>	<a href="#">25 to 26</a>
<a href="#">B.28.</a>	<a href="#">26 to 27</a>
<a href="#">B.29.</a>	<a href="#">27 to 28</a>
<a href="#">B.30.</a>	<a href="#">28 to 29</a>
<a href="#">B.31.</a>	<a href="#">29 to 30</a>
<a href="#">B.32.</a>	<a href="#">30 to 31</a>
<a href="#">B.33.</a>	<a href="#">31 to 32</a>
<a href="#">Acknowledgements</a>	
<a href="#">Contributors</a>	
<a href="#">Author's Address</a>	

## 1. Introduction

This document defines three YANG 1.1 [[RFC7950](#)] modules: the first defines features and groupings common to both TLS clients and TLS servers, the second defines a grouping for a generic TLS client, and the third defines a grouping for a generic TLS server.

Any version of TLS may be configured. TLS 1.0 [[RFC2246](#)] and TLS 1.1 [[RFC4346](#)] are historic and hence the YANG "feature" statements enabling them are marked "status obsolete". TLS 1.2 [[RFC5246](#)] is obsoleted by TLS 1.3 [[RFC8446](#)] but still in common use, and hence its "feature" statement is marked "status deprecated". All the feature statements for 1.0, 1.1, and 1.3 have "description" statements stating that it is NOT RECOMMENDED to enable obsolete protocol versions.

It is intended that the YANG groupings will be used by applications needing to configure TLS client and server protocol stacks. For instance, these groupings are used to help define the data model for HTTPS [[RFC2818](#)] and NETCONF over TLS [[RFC7589](#)] based clients and servers in [[I-D.ietf-netconf-http-client-server](#)] and [[I-D.ietf-netconf-netconf-client-server](#)] respectively.

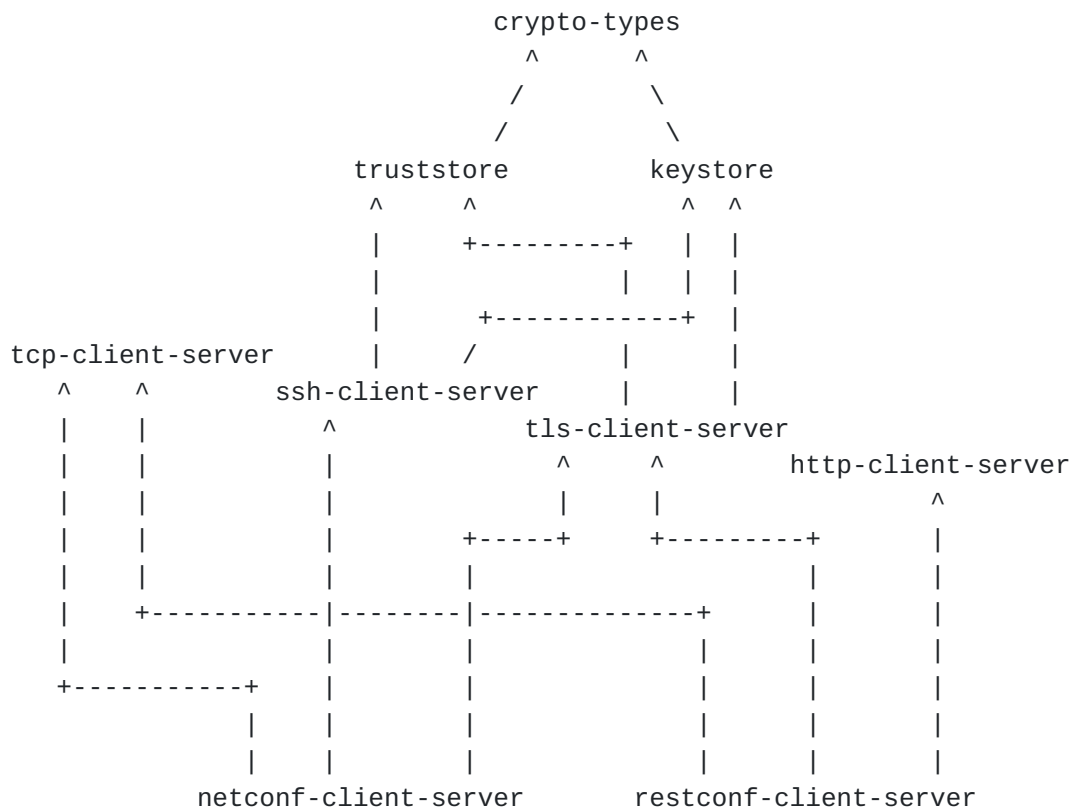
The client and server YANG modules in this document each define one grouping, which is focused on just TLS-specific configuration, and specifically avoids any transport-level configuration, such as what ports to listen-on or connect-to. This affords applications the opportunity to define their own strategy for how the underlying TCP connection is established. For instance, applications supporting NETCONF Call Home [[RFC8071](#)] could use the "tls-server-grouping"

grouping for the TLS parts it provides, while adding data nodes for the TCP-level call-home configuration.

### 1.1. Relation to other RFCs

This document presents one or more YANG modules [[RFC7950](#)] that are part of a collection of RFCs that work together to, ultimately, enable the configuration of both the clients and servers of both the NETCONF [[RFC6241](#)] and RESTCONF [[RFC8040](#)] protocols.

The normative dependency relationship between the various RFCs in this collection is presented in the below diagram. The labels in the diagram represent the primary purpose provided by each RFC. Hyperlinks to each RFC are provided below the diagram.



Label in Diagram	Originating RFC
crypto-types	<a href="#">[I-D.ietf-netconf-crypto-types]</a>
truststore	<a href="#">[I-D.ietf-netconf-trust-anchors]</a>
keystore	<a href="#">[I-D.ietf-netconf-keystore]</a>
tcp-client-server	<a href="#">[I-D.ietf-netconf-tcp-client-server]</a>
ssh-client-server	<a href="#">[I-D.ietf-netconf-ssh-client-server]</a>
tls-client-server	<a href="#">[I-D.ietf-netconf-tls-client-server]</a>
http-client-server	<a href="#">[I-D.ietf-netconf-http-client-server]</a>
netconf-client-server	<a href="#">[I-D.ietf-netconf-netconf-client-server]</a>

restconf-client-server	<a href="#">[I-D.ietf-netconf-restconf-client-server]</a>
------------------------	---

Table 1: Label to RFC Mapping

## 1.2. Specification 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.

## 1.3. Adherence to the NMDA

This document is compliant with the Network Management Datastore Architecture (NMDA) [[RFC8342](#)]. For instance, as described in [[I-D.ietf-netconf-trust-anchors](#)] and [[I-D.ietf-netconf-keystore](#)], trust anchors and keys installed during manufacturing are expected to appear in <operational>.

## 1.4. Conventions

Various examples used in this document use a placeholder value for binary data that has been base64 encoded (e.g., "BASE64VALUE="). This placeholder value is used as real base64 encoded structures are often many lines long and hence distracting to the example being presented.

## 2. The "ietf-tls-common" Module

The TLS common model presented in this section contains features and groupings common to both TLS clients and TLS servers. The "hello-params-grouping" grouping can be used to configure the list of TLS algorithms permitted by the TLS client or TLS server. The lists of algorithms are ordered such that, if multiple algorithms are permitted by the client, the algorithm that appears first in its list that is also permitted by the server is used for the TLS transport layer connection. The ability to restrict the algorithms allowed is provided in this grouping for TLS clients and TLS servers that are capable of doing so and may serve to make TLS clients and TLS servers compliant with local security policies. This model supports both TLS 1.2 [[RFC5246](#)] and TLS 1.3 [[RFC8446](#)].

Thus, in order to support both TLS1.2 and TLS1.3, the cipher-suites part of the "hello-params-grouping" grouping should include three parameters for configuring its permitted TLS algorithms, which are: TLS Cipher Suites, TLS SignatureScheme, TLS Supported Groups. Note that TLS1.2 only uses TLS Cipher Suites.

## 2.1. Data Model Overview

This section provides an overview of the "ietf-tls-common" module in terms of its features, identities, and groupings.

### 2.1.1. Features

The following diagram lists all the "feature" statements defined in the "ietf-tls-common" module:

Features:

```
+-- tls10
+-- tls11
+-- tls12
+-- tls13
+-- hello-params
+-- public-key-generation
```

The diagram above uses syntax that is similar to but not defined in [\[RFC8340\]](#).

### 2.1.2. Identities

The following diagram illustrates the relationship amongst the "identity" statements defined in the "ietf-tls-common" module:

Identities:

```
+-- tls-version-base
  +-- tls10
  +-- tls11
  +-- tls12
  +-- tls13
```

The diagram above uses syntax that is similar to but not defined in [\[RFC8340\]](#).

Comments:

- \*The diagram shows that there are two base identities.
- \*One base identity is used to specific TLS versions, while the other is used to specify cipher-suites.
- \*These base identities are "abstract", in the object oriented programming sense, in that they only define a "class" of things, rather than a specific thing.

### 2.1.3. Groupings

The "ietf-tls-common" module defines the following "grouping" statement:

```
*hello-params-grouping
```

This grouping is presented in the following subsection.

#### 2.1.3.1. The "hello-params-grouping" Grouping

The following tree diagram [[RFC8340](#)] illustrates the "hello-params-grouping" grouping:

```
grouping hello-params-grouping:
  +-- tls-versions
  |  +-- tls-version*   identityref
  +-- cipher-suites
     +-- cipher-suite*  identityref
```

Comments:

\*This grouping is used by both the "tls-client-grouping" and the "tls-server-grouping" groupings defined in [Section 3.1.2.1](#) and [Section 4.1.2.1](#), respectively.

\*This grouping enables client and server configurations to specify the TLS versions and cipher suites that are to be used when establishing TLS sessions.

\*The "cipher-suites" list is "ordered-by user".

#### 2.1.4. Protocol-accessible Nodes

The following tree diagram [[RFC8340](#)] lists all the protocol-accessible nodes defined in the "ietf-tls-common" module, without expanding the "grouping" statements:



```
module: ietf-tls-common
```

```
rpcs:
```

```
  +---x generate-public-key {public-key-generation}?
    +---w input
      | +---w algorithm
      | |          tlscsa:cipher-suite-algorithm-ref
      | +---w bits?          uint16
      | +---w (private-key-encoding)?
      |   +---:(cleartext)
      |   | +---w cleartext?          empty
      |   +---:(encrypt) {ct:private-key-encryption}?
      |   | +---w encrypt-with
      |   |   +---w ks:encrypted-by-choice-grouping
      |   +---:(hide) {ct:hidden-keys}?
      |   +---w hide?          empty
    +---ro output
      +---u ct:asymmetric-key-pair-grouping
```

The following tree diagram [[RFC8340](#)] lists all the protocol-accessible nodes defined in the "ietf-tls-common" module, with all "grouping" statements expanded, enabling the module's full structure to be seen:

===== NOTE: '\' line wrapping per RFC 8792 =====

module: ietf-tls-common

rpcs:

```
+---x generate-public-key {public-key-generation}?
+---w input
| +---w algorithm
| |      tlscsa:cipher-suite-algorithm-ref
| +---w bits?          uint16
| +---w (private-key-encoding)?
| |      +---:(cleartext)
| | |      +---w cleartext?      empty
| | +---:(encrypt) {ct:private-key-encryption}?
| | |      +---w encrypt-with
| | | |      +---w (encrypted-by-choice)
| | | |      +---:(symmetric-key-ref)
| | | |      {central-keystore-supported,symmetric\
- keys}?
| | | |      +---w symmetric-key-ref?
| | | |      ks:symmetric-key-ref
| | | +---:(asymmetric-key-ref)
| | | {central-keystore-supported,asymmetric\
c-keys}?
| | |      +---w asymmetric-key-ref?
| | |      ks:asymmetric-key-ref
| | +---:(hide) {ct:hidden-keys}?
| | +---w hide?      empty
+---ro output
+---ro public-key-format          identityref
+---ro public-key                 binary
+---ro private-key-format?        identityref
+---ro (private-key-type)
+---:(cleartext-private-key)
| +---ro cleartext-private-key?   binary
+---:(hidden-private-key) {hidden-keys}?
| +---ro hidden-private-key?      empty
+---:(encrypted-private-key) {private-key-encryption}?
+---ro encrypted-private-key
+---ro encrypted-by
+---ro encrypted-value-format     identityref
+---ro encrypted-value            binary
```

Comments:

\*Protocol-accessible nodes are those nodes that are accessible when the module is "implemented", as described in [Section 5.6.5](#) of [\[RFC7950\]](#).

\*The protocol-accessible nodes for the "ietf-tls-common" module are limited to the RPC "generate-public-key", which is additionally constrained by the feature "public-key-generation".

\*The "encrypted-by-choice-grouping" grouping is discussed in [Section 2.1.3.1](#) of [[I-D.ietf-netconf-keystore](#)].

\*The "asymmetric-key-pair-grouping" grouping is discussed in [Section 2.1.4.5](#) of [[I-D.ietf-netconf-crypto-types](#)].

## 2.2. Example Usage

The following example illustrates the "hello-params-grouping" grouping when populated with some data.

===== NOTE: '\' line wrapping per RFC 8792 =====

```
<!-- The outermost element below doesn't exist in the data model. -->
<!-- It simulates if the "grouping" were a "container" instead. -->
```

```
<hello-params
  xmlns="urn:ietf:params:xml:ns:yang:ietf-tls-common"
  xmlns:tlscmn="urn:ietf:params:xml:ns:yang:ietf-tls-common"
  xmlns:tlscsa="urn:ietf:params:xml:ns:yang:iana-tls-cipher-suite-a\
lgs">
  <tls-versions>
    <tls-version>tlscmn:tls11</tls-version>
    <tls-version>tlscmn:tls12</tls-version>
  </tls-versions>
  <cipher-suites>
    <cipher-suite>tlscsa:tls-ecdh-e-ecdsa-with-aes-256-cbc-sha</ciphe\
r-suite>
    <cipher-suite>tlscsa:tls-dhe-rsa-with-aes-128-cbc-sha256</cipher\
-suite>
    <cipher-suite>tlscsa:tls-rsa-with-3des-edc-cbc-sha</cipher-suite>
  </cipher-suites>
</hello-params>
```

The following example illustrates the "generate-public-key" RPC.

===== NOTE: '\\' line wrapping per RFC 8792 =====

```
<rpc message-id="101"
  xmlns="urn:ietf:params:xml:ns:netconf:base:1.0">
  <generate-public-key
    xmlns="urn:ietf:params:xml:ns:yang:ietf-tls-common"
    xmlns:tlscsa="urn:ietf:params:xml:ns:yang:iana-tls-cipher-suite-\
algs">
    <algorithm>tlscsa:tls-ecdhe-psk-with-aes-128-gcm-sha256</algorit\
hm>
    <bits>521</bits>
    <encrypt-with>
      <asymmetric-key-ref>hidden-asymmetric-key</asymmetric-key-ref>
    </encrypt-with>
  </generate-public-key>
</rpc>
```

### 2.3. YANG Module

This YANG module has a normative references to [[RFC4346](#)], [[RFC5288](#)], [[RFC5289](#)], [[RFC8422](#)], and FIPS PUB 180-4.

This YANG module has a informative references to [[RFC2246](#)], [[RFC4346](#)], [[RFC5246](#)], and [[RFC8446](#)].

<CODE BEGINS> file "ietf-tls-common@2022-12-12.yang"

```

module ietf-tls-common {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-tls-common";
  prefix tlscmn;

  import iana-tls-cipher-suite-algs {
    prefix tlscsa;
    reference
      "RFC FFFF: YANG Groupings for TLS Clients and SSH Servers";
  }

  import ietf-crypto-types {
    prefix ct;
    reference
      "RFC AAAA: YANG Data Types and Groupings for Cryptography";
  }

  import ietf-keystore {
    prefix ks;
    reference
      "RFC CCCC: A YANG Data Model for a Keystore";
  }

  organization
    "IETF NETCONF (Network Configuration) Working Group";

  contact
    "WG List:  NETCONF WG list <mailto:netconf@ietf.org>
    WG Web:    https://datatracker.ietf.org/wg/netconf
    Author:    Kent Watsen <mailto:kent+ietf@watsen.net>
    Author:    Jeff Hartley <mailto:jeff.hartley@commscope.com>
    Author:    Gary Wu <mailto:garywu@cisco.com>";

  description
    "This module defines a common features and groupings for
    Transport Layer Security (TLS).

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    as authors of the code. All rights reserved.

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    Legal Provisions Relating to IETF Documents
    (https://trustee.ietf.org/license-info).

    This version of this YANG module is part of RFC FFFF
    (https://www.rfc-editor.org/info/rfcFFFF); see the RFC
    itself for full legal notices.

```

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 (RFC 2119) (RFC 8174) when, and only when, they appear in all capitals, as shown here.";

```
revision 2022-12-12 {  
  description  
    "Initial version";  
  reference  
    "RFC FFFF: YANG Groupings for TLS Clients and TLS Servers";  
}
```

// Features

```
feature tls10 {  
  status "obsolete";  
  description  
    "TLS Protocol Version 1.0 is supported. TLS 1.0 is obsolete  
    and thus it is NOT RECOMMENDED to enable this feature.";  
  reference  
    "RFC 2246: The TLS Protocol Version 1.0";  
}
```

```
feature tls11 {  
  status "obsolete";  
  description  
    "TLS Protocol Version 1.1 is supported. TLS 1.1 is obsolete  
    and thus it is NOT RECOMMENDED to enable this feature.";  
  reference  
    "RFC 4346: The Transport Layer Security (TLS) Protocol  
    Version 1.1";  
}
```

```
feature tls12 {  
  status "deprecated";  
  description  
    "TLS Protocol Version 1.2 is supported TLS 1.2 is obsolete  
    and thus it is NOT RECOMMENDED to enable this feature.";  
  reference  
    "RFC 5246: The Transport Layer Security (TLS) Protocol  
    Version 1.2";  
}
```

```
feature tls13 {  
  description  
    "TLS Protocol Version 1.3 is supported.";
```

```

    reference
        "RFC 8446: The Transport Layer Security (TLS)
            Protocol Version 1.3";
}

feature hello-params {
    description
        "TLS hello message parameters are configurable.";
}

feature public-key-generation {
    description
        "Indicates that the server implements the
            'generate-public-key' RPC.";
}

// Identities

identity tls-version-base {
    description
        "Base identity used to identify TLS protocol versions.";
}

identity tls10 {
    if-feature "tls10";
    base tls-version-base;
    status "obsolete";
    description
        "TLS Protocol Version 1.0.";
    reference
        "RFC 2246: The TLS Protocol Version 1.0";
}

identity tls11 {
    if-feature "tls11";
    base tls-version-base;
    status "obsolete";
    description
        "TLS Protocol Version 1.1.";
    reference
        "RFC 4346: The Transport Layer Security (TLS) Protocol
            Version 1.1";
}

identity tls12 {
    if-feature "tls12";
    base tls-version-base;
    status "deprecated";
    description

```

```

        "TLS Protocol Version 1.2.";
    reference
        "RFC 5246: The Transport Layer Security (TLS) Protocol
            Version 1.2";
}

identity tls13 {
    if-feature "tls13";
    base tls-version-base;
    description
        "TLS Protocol Version 1.3.";
    reference
        "RFC 8446: The Transport Layer Security (TLS)
            Protocol Version 1.3";
}

typedef epsk-supported-hash {
    type enumeration {
        enum sha-256 {
            description
                "The SHA-256 Hash.";
        }
        enum sha-384 {
            description
                "The SHA-384 Hash.";
        }
    }
}
description
    "As per Section 4.2.11 of RFC 8446, the hash algorithm
        supported by an instance of an External Pre-Shared
        Key (EPSK).";
reference
    "RFC 8446: The Transport Layer Security (TLS)
        Protocol Version 1.3
    I-D.ietf-tls-external-psk-importer: Importing
        External PSKs for TLS
    I-D.ietf-tls-external-psk-guidance: Guidance
        for External PSK Usage in TLS";
}

// Groupings

grouping hello-params-grouping {
    description
        "A reusable grouping for TLS hello message parameters.";
    reference
        "RFC 5246: The Transport Layer Security (TLS) Protocol
            Version 1.2

```



```

RFC 8446: The Transport Layer Security (TLS) Protocol
    Version 1.3";
container tls-versions {
    description
        "Parameters regarding TLS versions.";
    leaf-list tls-version {
        type identityref {
            base tls-version-base;
        }
        description
            "Acceptable TLS protocol versions.

            If this leaf-list is not configured (has zero elements)
            the acceptable TLS protocol versions are implementation-
            defined.";
    }
}
container cipher-suites {
    description
        "Parameters regarding cipher suites.";
    leaf-list cipher-suite {
        type identityref {
            base tlscsa:cipher-suite-alg-base;
        }
        ordered-by user;
        description
            "Acceptable cipher suites in order of descending
            preference. The configured host key algorithms should
            be compatible with the algorithm used by the configured
            private key. Please see Section 5 of RFC FFFF for
            valid combinations.

            If this leaf-list is not configured (has zero elements)
            the acceptable cipher suites are implementation-
            defined.";
        reference
            "RFC FFFF: YANG Groupings for TLS Clients and TLS Servers";
    }
}
} // hello-params-grouping

rpc generate-public-key {
    if-feature "public-key-generation";
    description
        "Requests the device to generate an public key using
        the specified key algorithm.";
    input {
        leaf algorithm {
            type tlscsa:cipher-suite-algorithm-ref;

```

```

mandatory true;
description
    "The cipher suite algorithm that the generated key is
    to work with. Implementations derive the public key
    algorithm from the cipher suite algorithm. Example:
    cipher suite 'tls-rsa-with-aes-256-cbc-sha256' maps
    to the RSA public key.";
}
leaf bits {
    type uint16;
    description
        "Specifies the number of bits in the key to create.
        For RSA keys, the minimum size is 1024 bits and
        the default is 3072 bits. Generally, 3072 bits is
        considered sufficient. DSA keys must be exactly 1024
        bits as specified by FIPS 186-2. For elliptical
        keys, the 'bits' value determines the key length
        of the curve (e.g., 256, 384 or 521), where valid
        values supported by the server are conveyed via an
        unspecified mechanism. For some public algorithms,
        the keys have a fixed length and the 'bits' value,
        if specified, will be ignored.";
}
choice private-key-encoding {
    default cleartext;
    description
        "A choice amongst optional private key handling.";
    case cleartext {
        leaf cleartext {
            type empty;
            description
                "Indicates that the private key is to be returned
                as a cleartext value.";
        }
    }
    case encrypt {
        if-feature "ct:private-key-encryption";
        container encrypt-with {
            description
                "Indicates that the key is to be encrypted using
                the specified symmetric or asymmetric key.";
            uses ks:encrypted-by-choice-grouping;
        }
    }
    case hide {
        if-feature "ct:hidden-keys";
        leaf hide {
            type empty;
            description

```

"Indicates that the private key is to be hidden.

Unlike the 'cleartext' and 'encrypt' options, the key returned is a placeholder for an internally stored key. See the 'Support for Built-in Keys' section in RFC CCCC for information about hidden keys.";

```
    }  
  }  
}  
}  
output {  
  uses ct:asymmetric-key-pair-grouping;  
}  
} // end generate-public-key  
  
}
```

<CODE ENDS>

### 3. The "ietf-tls-client" Module

This section defines a YANG 1.1 [[RFC7950](#)] module called "ietf-tls-client". A high-level overview of the module is provided in [Section 3.1](#). Examples illustrating the module's use are provided in [Examples \(Section 3.2\)](#). The YANG module itself is defined in [Section 3.3](#).

#### 3.1. Data Model Overview

This section provides an overview of the "ietf-tls-client" module in terms of its features and groupings.

##### 3.1.1. Features

The following diagram lists all the "feature" statements defined in the "ietf-tls-client" module:

Features:

```
+-- tls-client-keepalives
+-- client-ident-x509-cert
+-- client-ident-raw-public-key
+-- client-ident-psk
+-- server-auth-x509-cert
+-- server-auth-raw-public-key
+-- server-auth-psk
```

The diagram above uses syntax that is similar to but not defined in [[RFC8340](#)].

##### 3.1.2. Groupings

The "ietf-tls-client" module defines the following "grouping" statement:

```
*tls-client-grouping
```

This grouping is presented in the following subsection.

###### 3.1.2.1. The "tls-client-grouping" Grouping

The following tree diagram [[RFC8340](#)] illustrates the "tls-client-grouping" grouping:

===== NOTE: '\\' line wrapping per RFC 8792 =====

```
grouping tls-client-grouping:
  +-- client-identity!
  |   +-- (auth-type)
  |       +--:(certificate) {client-ident-x509-cert}?
  |           |   +-- certificate
  |           |       +---u ks:local-or-keystore-end-entity-cert-with-key-\\
grouping
  |       +--:(raw-public-key) {client-ident-raw-public-key}?
  |           |   +-- raw-private-key
  |           |       +---u ks:local-or-keystore-asymmetric-key-grouping
  |       +--:(tls12-psk) {client-ident-tls12-psk}?
  |           |   +-- tls12-psk
  |           |       +---u ks:local-or-keystore-symmetric-key-grouping
  |           |       +-- id?
  |           |           string
  |       +--:(tls13-epsk) {client-ident-tls13-epsk}?
  |           +-- tls13-epsk
  |               +---u ks:local-or-keystore-symmetric-key-grouping
  |               +-- external-identity
  |                   |       string
  |               +-- hash
  |                   |       tlscmn:epsk-supported-hash
  |               +-- context?
  |                   |       string
  |               +-- target-protocol?
  |                   |       uint16
  |               +-- target-kdf?
  |                   |       uint16
  +-- server-authentication
  |   +-- ca-certs! {server-auth-x509-cert}?
  |   |   +---u ts:local-or-truststore-certs-grouping
  |   +-- ee-certs! {server-auth-x509-cert}?
  |   |   +---u ts:local-or-truststore-certs-grouping
  |   +-- raw-public-keys! {server-auth-raw-public-key}?
  |   |   +---u ts:local-or-truststore-public-keys-grouping
  |   +-- tls12-psks?          empty {server-auth-tls12-psk}?
  |   +-- tls13-epsks?        empty {server-auth-tls13-epsk}?
  +-- hello-params {tlscmn:hello-params}?
  |   +---u tlscmn:hello-params-grouping
  +-- keepalives {tls-client-keepalives}?
  |   +-- peer-allowed-to-send?  empty
  |   +-- test-peer-aliveness!
  |       +-- max-wait?          uint16
  |       +-- max-attempts?      uint8
```

Comments:

\*The "client-identity" node, which is optionally configured (as client authentication MAY occur at a higher protocol layer), configures identity credentials, each enabled by a "feature" statement defined in [Section 3.1.1](#).

\*The "server-authentication" node configures trust anchors for authenticating the TLS server, with each option enabled by a "feature" statement.

\*The "hello-params" node, which must be enabled by a feature, configures parameters for the TLS sessions established by this configuration.

\*The "keepalives" node, which must be enabled by a feature, configures a "presence" container for testing the aliveness of the TLS server. The aliveness-test occurs at the TLS protocol layer.

\*For the referenced grouping statement(s):

- The "local-or-keystore-end-entity-cert-with-key-grouping" grouping is discussed in [Section 2.1.3.6](#) of [\[I-D.ietf-netconf-keystore\]](#).
- The "local-or-keystore-asymmetric-key-grouping" grouping is discussed in [Section 2.1.3.4](#) of [\[I-D.ietf-netconf-keystore\]](#).
- The "local-or-keystore-symmetric-key-grouping" grouping is discussed in [Section 2.1.3.3](#) of [\[I-D.ietf-netconf-keystore\]](#).
- The "local-or-truststore-certs-grouping" grouping is discussed in [Section 2.1.3.1](#) of [\[I-D.ietf-netconf-trust-anchors\]](#).
- The "local-or-truststore-public-keys-grouping" grouping is discussed in [Section 2.1.3.2](#) of [\[I-D.ietf-netconf-trust-anchors\]](#).
- The "hello-params-grouping" grouping is discussed in [Section 2.1.3.1](#) in this document.

### 3.1.3. Protocol-accessible Nodes

The "ietf-tls-client" module defines only "grouping" statements that are used by other modules to instantiate protocol-accessible nodes.

### 3.2. Example Usage

This section presents two examples showing the "tls-client-grouping" grouping populated with some data. These examples are effectively the same except the first configures the client identity using a local key while the second uses a key configured in a keystore. Both examples are consistent with the examples presented in Section 2 of

[[I-D.ietf-netconf-trust-anchors](#)] and Section 3.2 of [[I-D.ietf-netconf-keystore](#)].

The following configuration example uses local-definitions for the client identity and server authentication:

===== NOTE: '\\' line wrapping per RFC 8792 =====

<!-- The outermost element below doesn't exist in the data model. -->

<!-- It simulates if the "grouping" were a "container" instead. -->

```
<tls-client
  xmlns="urn:ietf:params:xml:ns:yang:ietf-tls-client"
  xmlns:ct="urn:ietf:params:xml:ns:yang:ietf-crypto-types">
  <!-- how this client will authenticate itself to the server -->
  <client-identity>
    <certificate>
      <local-definition>
        <public-key-format>ct:subject-public-key-info-format\
</public-key-format>
        <public-key>BASE64VALUE=</public-key>
        <private-key-format>ct:rsa-private-key-format</priva\
te-key-format>
        <cleartext-private-key>BASE64VALUE=</cleartext-priva\
te-key>
        <cert-data>BASE64VALUE=</cert-data>
      </local-definition>
    </certificate>
    <!-- TESTED, BUT COMMENTED OUT DUE TO ONLY ONE ALLOWED AT A \
TIME
    <raw-private-key>
      <local-definition>
        <public-key-format>ct:subject-public-key-info-format</pu\
blic-key-format>
        <public-key>BASE64VALUE=</public-key>
        <private-key-format>ct:rsa-private-key-format</private-k\
ey-format>
        <cleartext-private-key>BASE64VALUE=</cleartext-private-k\
ey>
      </local-definition>
    </raw-private-key>
    -->
    <!-- USE ONLY ONE AT A TIME
    <tls12-psk>
      <local-definition>
        <key-format>ct:octet-string-key-format</key-format>
        <cleartext-key>BASE64VALUE=</cleartext-key>
      </local-definition>
      <id>example_id_string</id>
    </tls12-psk>
    -->
    <!-- USE ONLY ONE AT A TIME
    <tls13-epsk>
      <local-definition>
        <key-format>ct:octet-string-key-format</key-format>
```



```

        <cleartext-key>BASE64VALUE=</cleartext-key>
    </local-definition>
    <external-identity>example_external_id</external-identity>
y>
    <hash>sha-256</hash>
    <context>example_context_string</context>
    <target-protocol>8443</target-protocol>
    <target-kdf>12345</target-kdf>
</tls13-epsk>
-->
</client-identity>
<!-- which certificates will this client trust -->
<server-authentication>
    <ca-certs>
        <local-definition>
            <certificate>
                <name>Server Cert Issuer #1</name>
                <cert-data>BASE64VALUE=</cert-data>
            </certificate>
            <certificate>
                <name>Server Cert Issuer #2</name>
                <cert-data>BASE64VALUE=</cert-data>
            </certificate>
        </local-definition>
    </ca-certs>
    <ee-certs>
        <local-definition>
            <certificate>
                <name>My Application #1</name>
                <cert-data>BASE64VALUE=</cert-data>
            </certificate>
            <certificate>
                <name>My Application #2</name>
                <cert-data>BASE64VALUE=</cert-data>
            </certificate>
        </local-definition>
    </ee-certs>
    <raw-public-keys>
        <local-definition>
            <public-key>
                <name>corp-fw1</name>
                <public-key-format>ct:subject-public-key-info-fo\
rmat</public-key-format>
                <public-key>BASE64VALUE=</public-key>
            </public-key>
            <public-key>
                <name>corp-fw2</name>
                <public-key-format>ct:subject-public-key-info-fo\
rmat</public-key-format>

```

```
        <public-key>BASE64VALUE=</public-key>
      </public-key>
    </local-definition>
  </raw-public-keys>
  <tls12-psks/>
  <tls13-epsks/>
</server-authentication>
<keepalives>
  <test-peer-aliveness>
    <max-wait>30</max-wait>
    <max-attempts>3</max-attempts>
  </test-peer-aliveness>
</keepalives>
</tls-client>
```

The following configuration example uses keystore-references for the client identity and truststore-references for server authentication:  
from the keystore:

===== NOTE: '\\' line wrapping per RFC 8792 =====

<!-- The outermost element below doesn't exist in the data model. -->  
<!-- It simulates if the "grouping" were a "container" instead. -->

```
<tls-client xmlns="urn:ietf:params:xml:ns:yang:ietf-tls-client">
  <!-- how this client will authenticate itself to the server -->
  <client-identity>
    <certificate>
      <keystore-reference>
        <asymmetric-key>rsa-asymmetric-key</asymmetric-key>
        <certificate>ex-rsa-cert</certificate>
      </keystore-reference>
    </certificate>
    <!-- TESTED, BUT COMMENTED OUT DUE TO ONLY ONE ALLOWED AT A \
TIME
    <raw-private-key>
      <keystore-reference>raw-private-key</keystore-reference>
    </raw-private-key>
    -->
    <!-- USE ONLY ONE AT A TIME
    <tls12-psk>
      <keystore-reference>encrypted-symmetric-key</keystore-re\
ference>
      <id>example_id_string</id>
    </tls12-psk>
    -->
    <!-- USE ONLY ONE AT A TIME
    <tls13-epsk>
      <keystore-reference>encrypted-symmetric-key</keystore-re\
ference>
      <external-identity>example_external_id</external-identit\
y>
      <hash>sha-256</hash>
      <context>example_context_string</context>
      <target-protocol>8443</target-protocol>
      <target-kdf>12345</target-kdf>
    </tls13-epsk>
    -->
  </client-identity>
  <!-- which certificates will this client trust -->
  <server-authentication>
    <ca-certs>
      <truststore-reference>trusted-server-ca-certs</truststor\
e-reference>
    </ca-certs>
    <ee-certs>
      <truststore-reference>trusted-server-ee-certs</truststor\
e-reference>
```

```
        </ee-certs>
        <raw-public-keys>
            <truststore-reference>Raw Public Keys for TLS Servers</t\
ruststore-reference>
        </raw-public-keys>
        <tls12-psks/>
        <tls13-epsks/>
    </server-authentication>
    <keepalives>
        <test-peer-aliveness>
            <max-wait>30</max-wait>
            <max-attempts>3</max-attempts>
        </test-peer-aliveness>
    </keepalives>
</tls-client>
```

### 3.3. YANG Module

This YANG module has normative references to [[I-D.ietf-netconf-trust-anchors](#)] and [[I-D.ietf-netconf-keystore](#)], and Informative references to [[RFC5246](#)], [[RFC8446](#)], [[I-D.ietf-tls-external-psk-importer](#)] and [[I-D.ietf-tls-external-psk-guidance](#)].

<CODE BEGINS> file "ietf-tls-client@2022-12-12.yang"

```

module ietf-tls-client {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-tls-client";
  prefix tlsc;

  import ietf-netconf-acm {
    prefix nacm;
    reference
      "RFC 8341: Network Configuration Access Control Model";
  }

  import ietf-crypto-types {
    prefix ct;
    reference
      "RFC AAAA: YANG Data Types and Groupings for Cryptography";
  }

  import ietf-truststore {
    prefix ts;
    reference
      "RFC BBBB: A YANG Data Model for a Truststore";
  }

  import ietf-keystore {
    prefix ks;
    reference
      "RFC CCCC: A YANG Data Model for a Keystore";
  }

  import ietf-tls-common {
    prefix tlscmn;
    reference
      "RFC FFFF: YANG Groupings for TLS Clients and TLS Servers";
  }

  organization
    "IETF NETCONF (Network Configuration) Working Group";

  contact
    "WG List:  NETCONF WG list <mailto:netconf@ietf.org>
     WG Web:   https://datatracker.ietf.org/wg/netconf
     Author:   Kent Watsen <mailto:kent+ietf@watsen.net>
     Author:   Jeff Hartley <mailto:jeff.hartley@commscope.com>";

  description
    "This module defines reusable groupings for TLS clients that
     can be used as a basis for specific TLS client instances.

     Copyright (c) 2022 IETF Trust and the persons identified
     as authors of the code. All rights reserved."

```

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This version of this YANG module is part of RFC FFFF (<https://www.rfc-editor.org/info/rfcFFFF>); see the RFC itself for full legal notices.

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 (RFC 2119) (RFC 8174) when, and only when, they appear in all capitals, as shown here.";

```
revision 2022-12-12 {
  description
    "Initial version";
  reference
    "RFC FFFF: YANG Groupings for TLS Clients and TLS Servers";
}

// Features

feature tls-client-keepalives {
  description
    "Per socket TLS keepalive parameters are configurable for
    TLS clients on the server implementing this feature.";
}

feature client-ident-x509-cert {
  description
    "Indicates that the client supports identifying itself
    using X.509 certificates.";
  reference
    "RFC 5280:
    Internet X.509 Public Key Infrastructure Certificate
    and Certificate Revocation List (CRL) Profile";
}

feature client-ident-raw-public-key {
  description
    "Indicates that the client supports identifying itself
    using raw public keys.";
  reference
    "RFC 7250:
```



```

        Using Raw Public Keys in Transport Layer Security (TLS)
        and Datagram Transport Layer Security (DTLS)";
    }

feature client-ident-tls12-psk {
    description
        "Indicates that the client supports identifying itself
        using TLS-1.2 PSKs (pre-shared or pairwise-symmetric keys).";
    reference
        "RFC 4279:
        Pre-Shared Key Ciphersuites for Transport Layer Security
        (TLS)";
}

feature client-ident-tls13-epsk {
    description
        "Indicates that the client supports identifying itself
        using TLS-1.3 External PSKs (pre-shared keys).";
    reference
        "RFC 8446:
        The Transport Layer Security (TLS) Protocol Version 1.3";
}

feature server-auth-x509-cert {
    description
        "Indicates that the client supports authenticating servers
        using X.509 certificates.";
    reference
        "RFC 5280:
        Internet X.509 Public Key Infrastructure Certificate
        and Certificate Revocation List (CRL) Profile";
}

feature server-auth-raw-public-key {
    description
        "Indicates that the client supports authenticating servers
        using raw public keys.";
    reference
        "RFC 7250:
        Using Raw Public Keys in Transport Layer Security (TLS)
        and Datagram Transport Layer Security (DTLS)";
}

feature server-auth-tls12-psk {
    description
        "Indicates that the client supports authenticating servers
        using PSKs (pre-shared or pairwise-symmetric keys).";
    reference
        "RFC 4279:

```

```

        Pre-Shared Key Ciphersuites for Transport Layer Security
        (TLS)";
    }

feature server-auth-tls13-epsk {
    description
        "Indicates that the client supports authenticating servers
        using TLS-1.3 External PSKs (pre-shared keys).";
    reference
        "RFC 8446:
        The Transport Layer Security (TLS) Protocol Version 1.3";
}

// Groupings

grouping tls-client-grouping {
    description
        "A reusable grouping for configuring a TLS client without
        any consideration for how an underlying TCP session is
        established.

        Note that this grouping uses fairly typical descendant
        node names such that a stack of 'uses' statements will
        have name conflicts. It is intended that the consuming
        data model will resolve the issue (e.g., by wrapping
        the 'uses' statement in a container called
        'tls-client-parameters'). This model purposely does
        not do this itself so as to provide maximum flexibility
        to consuming models.";

    container client-identity {
        nacm:default-deny-write;
        presence
            "Indicates that a TLS-level client identity has been
            configured. This statement is present so the mandatory
            descendant do not imply that this node must be configured.";
        description
            "Identity credentials the TLS client MAY present when
            establishing a connection to a TLS server. If not
            configured, then client authentication is presumed to
            occur a protocol layer above TLS. When configured,
            and requested by the TLS server when establishing a
            TLS session, these credentials are passed in the
            Certificate message defined in Section 7.4.2 of
            RFC 5246 and Section 4.4.2 in RFC 8446.";
        reference
            "RFC 5246: The Transport Layer Security (TLS)
            Protocol Version 1.2
            RFC 8446: The Transport Layer Security (TLS)

```

Protocol Version 1.3

```

RFC CCCC: A YANG Data Model for a Keystore";
choice auth-type {
  mandatory true;
  description
    "A choice amongst authentication types, of which one must
    be enabled (via its associated 'feature') and selected.";
  case certificate {
    if-feature "client-ident-x509-cert";
    container certificate {
      description
        "Specifies the client identity using a certificate.";
      uses
        ks:local-or-keystore-end-entity-cert-with-key-grouping{
          refine "local-or-keystore/local/local-definition" {
            must 'derived-from-or-self(public-key-format, '
              + ' "ct:subject-public-key-info-format")';
          }
          refine "local-or-keystore/keystore/keystore-reference"
            + "/asymmetric-key" {
            must 'derived-from-or-self(deref(..)/ks:public-'
              + 'key-format, "ct:subject-public-key-info-'
              + 'format")';
          }
        }
      }
    }
  case raw-public-key {
    if-feature "client-ident-raw-public-key";
    container raw-private-key {
      description
        "Specifies the client identity using a raw
        private key.";
      uses ks:local-or-keystore-asymmetric-key-grouping {
        refine "local-or-keystore/local/local-definition" {
          must 'derived-from-or-self(public-key-format, '
            + ' "ct:subject-public-key-info-format")';
        }
        refine "local-or-keystore/keystore/keystore-reference"{
          must 'derived-from-or-self(deref(..)/ks:public-'
            + 'key-format, "ct:subject-public-key-info-'
            + 'format")';
        }
      }
    }
  }
}
case tls12-psk {
  if-feature "client-ident-tls12-psk";
  container tls12-psk {
```

```

description
    "Specifies the client identity using a PSK (pre-shared
    or pairwise-symmetric key).";
uses ks:local-or-keystore-symmetric-key-grouping;
leaf id {
    type string;
    description
        "The key 'psk_identity' value used in the TLS
        'ClientKeyExchange' message.";
    reference
        "RFC 4279: Pre-Shared Key Ciphersuites for
        Transport Layer Security (TLS)";
}
}
}
case tls13-epsk {
    if-feature "client-ident-tls13-epsk";
    container tls13-epsk {
        description
            "An External Pre-Shared Key (EPSK) is established
            or provisioned out-of-band, i.e., not from a TLS
            connection. An EPSK is a tuple of (Base Key,
            External Identity, Hash). External PSKs MUST NOT
            be imported for (D)TLS 1.2 or prior versions. When
            PSKs are provisioned out of band, the PSK identity
            and the KDF hash algorithm to be used with the PSK
            MUST also be provisioned.

            The structure of this container is designed
            to satisfy the requirements of RFC 8446
            Section 4.2.11, the recommendations from I-D
            ietf-tls-external-psk-guidance Section 6,
            and the EPSK input fields detailed in I-D
            draft-ietf-tls-external-psk-importer
            Section 3.1. The base-key is based upon
            ks:local-or-keystore-symmetric-key-grouping
            in order to provide users with flexible and
            secure storage options.";
        reference
            "RFC 8446: The Transport Layer Security (TLS)
            Protocol Version 1.3
            I-D.ietf-tls-external-psk-importer:
            Importing External PSKs for TLS
            I-D.ietf-tls-external-psk-guidance:
            Guidance for External PSK Usage in TLS";
        uses ks:local-or-keystore-symmetric-key-grouping;
        leaf external-identity {
            type string;
            mandatory true;

```

```

description
    "As per Section 4.2.11 of RFC 8446, and Section 4.1
    of I-D. ietf-tls-external-psk-guidance:
    A sequence of bytes used to identify an EPSK. A
    label for a pre-shared key established externally.";
reference
    "RFC 8446: The Transport Layer Security (TLS)
    Protocol Version 1.3
    I-D.ietf-tls-external-psk-guidance:
    Guidance for External PSK Usage in TLS";
}
leaf hash {
    type tlscmn:epsk-supported-hash;
    mandatory true;
    description
        "As per Section 4.2.11 of RFC 8446, for externally
        established PSKs, the Hash algorithm MUST be set
        when the PSK is established or default to SHA-256
        if no such algorithm is defined. The server MUST
        ensure that it selects a compatible PSK (if any)
        and cipher suite. Each PSK MUST only be used with
        a single hash function.";
    reference
        "RFC 8446: The Transport Layer Security (TLS)
        Protocol Version 1.3";
}
leaf context {
    type string;
    description
        "As per Section 4.1 of I-D.
        ietf-tls-external-psk-guidance: Context may include
        information about peer roles or identities to
        mitigate Selfie-style reflection attacks [Selfie].
        If the EPSK is a key derived from some other
        protocol or sequence of protocols, context
        MUST include a channel binding for the deriving
        protocols [RFC5056]. The details of this binding
        are protocol specific.";
    reference
        "I-D.ietf-tls-external-psk-importer:
        Importing External PSKs for TLS
        I-D.ietf-tls-external-psk-guidance:
        Guidance for External PSK Usage in TLS";
}
leaf target-protocol {
    type uint16;
    description
        "As per Section 3.1 of I-D.
        ietf-tls-external-psk-guidance:

```

```

        The protocol for which a PSK is imported for use.";
    reference
        "I-D.ietf-tls-external-psk-importer:
            Importing External PSKs for TLS";
}
leaf target-kdf {
    type uint16;
    description
        "As per Section 3.1 of I-D.
        ietf-tls-external-psk-guidance:
        The specific Key Derivation Function (KDF) for which
        a PSK is imported for use.";
    reference
        "I-D.ietf-tls-external-psk-importer:
            Importing External PSKs for TLS";
}
}
}
} // container client-identity

container server-authentication {
    nacm:default-deny-write;
    must 'ca-certs or ee-certs or raw-public-keys or tls12-psks
        or tls13-epsks';
    description
        "Specifies how the TLS client can authenticate TLS servers.
        Any combination of credentials is additive and unordered.

        Note that no configuration is required for PSK (pre-shared
        or pairwise-symmetric key) based authentication as the key
        is necessarily the same as configured in the '../client-
        identity' node.";
    container ca-certs {
        if-feature "server-auth-x509-cert";
        presence
            "Indicates that CA certificates have been configured.
            This statement is present so the mandatory descendant
            nodes do not imply that this node must be configured.";
        description
            "A set of certificate authority (CA) certificates used by
            the TLS client to authenticate TLS server certificates.
            A server certificate is authenticated if it has a valid
            chain of trust to a configured CA certificate.";
        reference
            "RFC BBBB: A YANG Data Model for a Truststore";
        uses ts:local-or-truststore-certs-grouping;
    }
    container ee-certs {

```

```

if-feature "server-auth-x509-cert";
presence
  "Indicates that EE certificates have been configured.
  This statement is present so the mandatory descendant
  nodes do not imply that this node must be configured.";
description
  "A set of server certificates (i.e., end entity
  certificates) used by the TLS client to authenticate
  certificates presented by TLS servers. A server
  certificate is authenticated if it is an exact
  match to a configured server certificate.";
reference
  "RFC BBBB: A YANG Data Model for a Truststore";
uses ts:local-or-truststore-certs-grouping;
}
container raw-public-keys {
  if-feature "server-auth-raw-public-key";
  presence
    "Indicates that raw public keys have been configured.
    This statement is present so the mandatory descendant
    nodes do not imply that this node must be configured.";
  description
    "A set of raw public keys used by the TLS client to
    authenticate raw public keys presented by the TLS
    server. A raw public key is authenticated if it
    is an exact match to a configured raw public key.";
  reference
    "RFC BBBB: A YANG Data Model for a Truststore";
  uses ts:local-or-truststore-public-keys-grouping {
    refine "local-or-truststore/local/local-definition/"
      + "public-key" {
      must 'derived-from-or-self(public-key-format, '
      + ' "ct:subject-public-key-info-format")';
    }
    refine "local-or-truststore/truststore/truststore-"
      + "reference" {
      must 'not(deref(..)/../ts:public-key/ts:public-key-'
      + 'format[not(derived-from-or-self(., "ct:subject-'
      + 'public-key-info-format"))])';
    }
  }
}
}
leaf tls12-psks {
  if-feature "server-auth-tls12-psk";
  type empty;
  description
    "Indicates that the TLS client can authenticate TLS servers
    using configure PSKs (pre-shared or pairwise-symmetric
    keys).

```

```

        No configuration is required since the PSK value is the
        same as PSK value configured in the 'client-identity'
        node.";
    }
    leaf tls13-epsks {
        if-feature "server-auth-tls13-epsk";
        type empty;
        description
            "Indicates that the TLS client can authenticate TLS servers
            using configured external PSKs (pre-shared keys).

            No configuration is required since the PSK value is the
            same as PSK value configured in the 'client-identity'
            node.";
    }
} // container server-authentication

container hello-params {
    nacm:default-deny-write;
    if-feature "tlscmn:hello-params";
    uses tlscmn:hello-params-grouping;
    description
        "Configurable parameters for the TLS hello message.";
} // container hello-params

container keepalives {
    nacm:default-deny-write;
    if-feature "tls-client-keepalives";
    description
        "Configures the keepalive policy for the TLS client.";
    leaf peer-allowed-to-send {
        type empty;
        description
            "Indicates that the remote TLS server is allowed to send
            HeartbeatRequest messages, as defined by RFC 6520
            to this TLS client.";
        reference
            "RFC 6520: Transport Layer Security (TLS) and Datagram
            Transport Layer Security (DTLS) Heartbeat Extension";
    }
}
container test-peer-aliveness {
    presence
        "Indicates that the TLS client proactively tests the
        aliveness of the remote TLS server.";
    description
        "Configures the keep-alive policy to proactively test
        the aliveness of the TLS server. An unresponsive
        TLS server is dropped after approximately max-wait

```



```

        * max-attempts seconds. The TLS client MUST send
        HeartbeatRequest messages, as defined by RFC 6520.";
reference
    "RFC 6520: Transport Layer Security (TLS) and Datagram
    Transport Layer Security (DTLS) Heartbeat Extension";
leaf max-wait {
    type uint16 {
        range "1..max";
    }
    units "seconds";
    default "30";
    description
        "Sets the amount of time in seconds after which if
        no data has been received from the TLS server, a
        TLS-level message will be sent to test the
        aliveness of the TLS server.";
}
leaf max-attempts {
    type uint8;
    default "3";
    description
        "Sets the maximum number of sequential keep-alive
        messages that can fail to obtain a response from
        the TLS server before assuming the TLS server is
        no longer alive.";
}
}
}
} // grouping tls-client-grouping
}

```

<CODE ENDS>

## 4. The "ietf-tls-server" Module

This section defines a YANG 1.1 module called "ietf-tls-server". A high-level overview of the module is provided in [Section 4.1](#). Examples illustrating the module's use are provided in [Examples \(Section 4.2\)](#). The YANG module itself is defined in [Section 4.3](#).

### 4.1. Data Model Overview

This section provides an overview of the "ietf-tls-server" module in terms of its features and groupings.

#### 4.1.1. Features

The following diagram lists all the "feature" statements defined in the "ietf-tls-server" module:

Features:

```
+-- tls-server-keepalives
+-- server-ident-x509-cert
+-- server-ident-raw-public-key
+-- server-ident-psk
+-- client-auth-supported
+-- client-auth-x509-cert
+-- client-auth-raw-public-key
+-- client-auth-psk
```

The diagram above uses syntax that is similar to but not defined in [\[RFC8340\]](#).

#### 4.1.2. Groupings

The "ietf-tls-server" module defines the following "grouping" statement:

```
*tls-server-grouping
```

This grouping is presented in the following subsection.

##### 4.1.2.1. The "tls-server-grouping" Grouping

The following tree diagram [\[RFC8340\]](#) illustrates the "tls-server-grouping" grouping:

===== NOTE: '\' line wrapping per RFC 8792 =====

```
grouping tls-server-grouping:
  +-- server-identity
  |   +-- (auth-type)
  |       +--:(certificate) {server-ident-x509-cert}?
  |           |   +-- certificate
  |           |       +---u ks:local-or-keystore-end-entity-cert-with-key-\
grouping
  |       +--:(raw-private-key) {server-ident-raw-public-key}?
  |           |   +-- raw-private-key
  |           |       +---u ks:local-or-keystore-asymmetric-key-grouping
  |       +--:(tls12-psk) {server-ident-tls12-psk}?
  |           |   +-- tls12-psk
  |           |       +---u ks:local-or-keystore-symmetric-key-grouping
  |           |       +-- id_hint?
  |           |           string
  |       +--:(tls13-epsk) {server-ident-tls13-epsk}?
  |           +-- tls13-epsk
  |               +---u ks:local-or-keystore-symmetric-key-grouping
  |               +-- external-identity
  |                   |   string
  |               +-- hash
  |                   |   tlscmn:epsk-supported-hash
  |               +-- context?
  |                   |   string
  |               +-- target-protocol?
  |                   |   uint16
  |               +-- target-kdf?
  |                   |   uint16
  +-- client-authentication! {client-auth-supported}?
  |   +-- ca-certs! {client-auth-x509-cert}?
  |       |   +---u ts:local-or-truststore-certs-grouping
  |   +-- ee-certs! {client-auth-x509-cert}?
  |       |   +---u ts:local-or-truststore-certs-grouping
  |   +-- raw-public-keys! {client-auth-raw-public-key}?
  |       |   +---u ts:local-or-truststore-public-keys-grouping
  |   +-- tls12-psks?          empty {client-auth-tls12-psk}?
  |   +-- tls13-epsks?          empty {client-auth-tls13-epsk}?
  +-- hello-params {tlscmn:hello-params}?
  |   +---u tlscmn:hello-params-grouping
  +-- keepalives {tls-server-keepalives}?
  |   +-- peer-allowed-to-send?    empty
  |   +-- test-peer-aliveness!
  |       +-- max-wait?            uint16
  |       +-- max-attempts?        uint8
```

Comments:

\*The "server-identity" node configures identity credentials, each of which is enabled by a "feature".

\*The "client-authentication" node, which is optionally configured (as client authentication MAY occur at a higher protocol layer), configures trust anchors for authenticating the TLS client, with each option enabled by a "feature" statement.

\*The "hello-params" node, which must be enabled by a feature, configures parameters for the TLS sessions established by this configuration.

\*The "keepalives" node, which must be enabled by a feature, configures a flag enabling the TLS client to test the aliveness of the TLS server, as well as a "presence" container for testing the aliveness of the TLSi client. The aliveness-tests occurs at the TLS protocol layer.

\*For the referenced grouping statement(s):

- The "local-or-keystore-end-entity-cert-with-key-grouping" grouping is discussed in [Section 2.1.3.6](#) of [\[I-D.ietf-netconf-keystore\]](#).
- The "local-or-keystore-asymmetric-key-grouping" grouping is discussed in [Section 2.1.3.4](#) of [\[I-D.ietf-netconf-keystore\]](#).
- The "local-or-keystore-symmetric-key-grouping" grouping is discussed in [Section 2.1.3.3](#) of [\[I-D.ietf-netconf-keystore\]](#).
- The "local-or-truststore-public-keys-grouping" grouping is discussed in [Section 2.1.3.2](#) of [\[I-D.ietf-netconf-trust-anchors\]](#).
- The "local-or-truststore-certs-grouping" grouping is discussed in [Section 2.1.3.1](#) of [\[I-D.ietf-netconf-trust-anchors\]](#).
- The "hello-params-grouping" grouping is discussed in [Section 2.1.3.1](#) in this document.

#### 4.1.3. Protocol-accessible Nodes

The "ietf-tls-server" module defines only "grouping" statements that are used by other modules to instantiate protocol-accessible nodes.

#### 4.2. Example Usage

This section presents two examples showing the "tls-server-grouping" grouping populated with some data. These examples are effectively the same except the first configures the server identity using a local key while the second uses a key configured in a keystore. Both examples are consistent with the examples presented in Section 2 of

[[I-D.ietf-netconf-trust-anchors](#)] and Section 3.2 of [[I-D.ietf-netconf-keystore](#)].

The following configuration example uses local-definitions for the server identity and client authentication:

===== NOTE: '\\' line wrapping per RFC 8792 =====

<!-- The outermost element below doesn't exist in the data model. -->  
<!-- It simulates if the "grouping" were a "container" instead. -->

```
<tls-server
  xmlns="urn:ietf:params:xml:ns:yang:ietf-tls-server"
  xmlns:ct="urn:ietf:params:xml:ns:yang:ietf-crypto-types">
  <!-- how this server will authenticate itself to the client -->
  <server-identity>
    <certificate>
      <local-definition>
        <public-key-format>ct:subject-public-key-info-format\
</public-key-format>
        <public-key>BASE64VALUE=</public-key>
        <private-key-format>ct:rsa-private-key-format</priva\
te-key-format>
        <cleartext-private-key>BASE64VALUE=</cleartext-priva\
te-key>
        <cert-data>BASE64VALUE=</cert-data>
      </local-definition>
    </certificate>
    <!-- TESTED, BUT COMMENTED OUT DUE TO ONLY ONE ALLOWED AT A \
TIME
    <raw-private-key>
      <local-definition>
        <public-key-format>ct:subject-public-key-info-format</pu\
blic-key-format>
        <public-key>BASE64VALUE=</public-key>
        <private-key-format>ct:rsa-private-key-format</private-k\
ey-format>
        <cleartext-private-key>BASE64VALUE=</cleartext-private-k\
ey>
      </local-definition>
    </raw-private-key>
    -->
    <!-- USE ONLY ONE AT A TIME
    <tls12-psk>
      <local-definition>
        <key-format>ct:octet-string-key-format</key-format>
        <cleartext-key>BASE64VALUE=</cleartext-key>
      </local-definition>
      <id_hint>example_id_hint</id_hint>
    </tls12-psk>
    -->
    <!-- USE ONLY ONE AT A TIME
    <tls13-epsk>
      <local-definition>
        <key-format>ct:octet-string-key-format</key-format>
```

```

        <cleartext-key>BASE64VALUE=</cleartext-key>
    </local-definition>
    <external-identity>example_external_id</external-identity>
y>
    <hash>sha-256</hash>
    <context>example_context_string</context>
    <target-protocol>8443</target-protocol>
    <target-kdf>12345</target-kdf>
</tls13-epsk>
-->
</server-identity>
<!-- which certificates will this server trust -->
<client-authentication>
    <ca-certs>
        <local-definition>
            <certificate>
                <name>Identity Cert Issuer #1</name>
                <cert-data>BASE64VALUE=</cert-data>
            </certificate>
            <certificate>
                <name>Identity Cert Issuer #2</name>
                <cert-data>BASE64VALUE=</cert-data>
            </certificate>
        </local-definition>
    </ca-certs>
    <ee-certs>
        <local-definition>
            <certificate>
                <name>Application #1</name>
                <cert-data>BASE64VALUE=</cert-data>
            </certificate>
            <certificate>
                <name>Application #2</name>
                <cert-data>BASE64VALUE=</cert-data>
            </certificate>
        </local-definition>
    </ee-certs>
    <raw-public-keys>
        <local-definition>
            <public-key>
                <name>User A</name>
                <public-key-format>ct:subject-public-key-info-fo\
rmat</public-key-format>
                <public-key>BASE64VALUE=</public-key>
            </public-key>
            <public-key>
                <name>User B</name>
                <public-key-format>ct:subject-public-key-info-fo\
rmat</public-key-format>

```

```
        <public-key>BASE64VALUE=</public-key>
      </public-key>
    </local-definition>
  </raw-public-keys>
  <tls12-psks/>
  <tls13-epsks/>
</client-authentication>
<keepalives>
  <peer-allowed-to-send/>
</keepalives>
</tls-server>
```



The following configuration example uses keystore-references for the server identity and truststore-references for client authentication: from the keystore:

===== NOTE: '\\' line wrapping per RFC 8792 =====

<!-- The outermost element below doesn't exist in the data model. -->  
<!-- It simulates if the "grouping" were a "container" instead. -->

```
<tls-server xmlns="urn:ietf:params:xml:ns:yang:ietf-tls-server">
  <!-- how this server will authenticate itself to the client -->
  <server-identity>
    <certificate>
      <keystore-reference>
        <asymmetric-key>rsa-asymmetric-key</asymmetric-key>
        <certificate>ex-rsa-cert</certificate>
      </keystore-reference>
    </certificate>
    <!-- TESTED, BUT COMMENTED OUT DUE TO ONLY ONE ALLOWED AT A \
TIME
    <raw-private-key>
      <keystore-reference>raw-private-key</keystore-reference>
    </raw-private-key>
    -->
    <!-- USE ONLY ONE AT A TIME
    <tls12-psk>
      <keystore-reference>encrypted-symmetric-key</keystore-re\
ference>
      <id_hint>example_id_hint</id_hint>
    </tls12-psk>
    -->
    <!-- USE ONLY ONE AT A TIME
    <tls13-epsk>
      <keystore-reference>encrypted-symmetric-key</keystore-re\
ference>
      <external-identity>example_external_id</external-identit\
y>
      <hash>sha-256</hash>
      <context>example_context_string</context>
      <target-protocol>8443</target-protocol>
      <target-kdf>12345</target-kdf>
    </tls13-epsk>
    -->
  </server-identity>
  <!-- which certificates will this server trust -->
  <client-authentication>
    <ca-certs>
      <truststore-reference>trusted-client-ca-certs</truststor\
e-reference>
    </ca-certs>
    <ee-certs>
      <truststore-reference>trusted-client-ee-certs</truststor\
e-reference>
```

```
        </ee-certs>
        <raw-public-keys>
            <truststore-reference>Raw Public Keys for TLS Clients</t\
ruststore-reference>
        </raw-public-keys>
        <tls12-psks/>
        <tls13-epsks/>
    </client-authentication>
    <keepalives>
        <peer-allowed-to-send/>
    </keepalives>
</tls-server>
```

### 4.3. YANG Module

This YANG module has normative references to [[I-D.ietf-netconf-trust-anchors](#)] and [[I-D.ietf-netconf-keystore](#)], and Informative references to [[RFC5246](#)], [[RFC8446](#)], [[I-D.ietf-tls-external-psk-importer](#)] and [[I-D.ietf-tls-external-psk-guidance](#)].

<CODE BEGINS> file "ietf-tls-server@2022-12-12.yang"

```

module ietf-tls-server {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-tls-server";
  prefix tlss;

  import ietf-netconf-acm {
    prefix nacm;
    reference
      "RFC 8341: Network Configuration Access Control Model";
  }

  import ietf-crypto-types {
    prefix ct;
    reference
      "RFC AAAA: YANG Data Types and Groupings for Cryptography";
  }

  import ietf-truststore {
    prefix ts;
    reference
      "RFC BBBB: A YANG Data Model for a Truststore";
  }

  import ietf-keystore {
    prefix ks;
    reference
      "RFC CCCC: A YANG Data Model for a Keystore";
  }

  import ietf-tls-common {
    prefix tlscmn;
    reference
      "RFC FFFF: YANG Groupings for TLS Clients and TLS Servers";
  }

  organization
    "IETF NETCONF (Network Configuration) Working Group";

  contact
    "WG List:  NETCONF WG list <mailto:netconf@ietf.org>
     WG Web:   https://datatracker.ietf.org/wg/netconf
     Author:   Kent Watsen <mailto:kent+ietf@watsen.net>
     Author:   Jeff Hartley <mailto:jeff.hartley@commscope.com>";

  description
    "This module defines reusable groupings for TLS servers that
     can be used as a basis for specific TLS server instances.

     Copyright (c) 2022 IETF Trust and the persons identified
     as authors of the code. All rights reserved."

```

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This version of this YANG module is part of RFC FFFF (<https://www.rfc-editor.org/info/rfcFFFF>); see the RFC itself for full legal notices.

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 (RFC 2119) (RFC 8174) when, and only when, they appear in all capitals, as shown here.";

```
revision 2022-12-12 {
  description
    "Initial version";
  reference
    "RFC FFFF: YANG Groupings for TLS Clients and TLS Servers";
}

// Features

feature tls-server-keepalives {
  description
    "Per socket TLS keepalive parameters are configurable for
    TLS servers on the server implementing this feature.";
}

feature server-ident-x509-cert {
  description
    "Indicates that the server supports identifying itself
    using X.509 certificates.";
  reference
    "RFC 5280:
    Internet X.509 Public Key Infrastructure Certificate
    and Certificate Revocation List (CRL) Profile";
}

feature server-ident-raw-public-key {
  description
    "Indicates that the server supports identifying itself
    using raw public keys.";
  reference
    "RFC 7250:
```

```

        Using Raw Public Keys in Transport Layer Security (TLS)
        and Datagram Transport Layer Security (DTLS)";
    }

feature server-ident-tls12-psk {
    description
        "Indicates that the server supports identifying itself
        using TLS-1.2 PSKs (pre-shared or pairwise-symmetric keys).";
    reference
        "RFC 4279:
        Pre-Shared Key Ciphersuites for Transport Layer Security
        (TLS)";
}

feature server-ident-tls13-epsk {
    description
        "Indicates that the server supports identifying itself
        using TLS-1.3 External PSKs (pre-shared keys).";
    reference
        "RFC 8446:
        The Transport Layer Security (TLS) Protocol Version 1.3";
}

feature client-auth-supported {
    description
        "Indicates that the configuration for how to authenticate
        clients can be configured herein. TLS-level client
        authentication may not be needed when client authentication
        is expected to occur only at another protocol layer.";
}

feature client-auth-x509-cert {
    description
        "Indicates that the server supports authenticating clients
        using X.509 certificates.";
    reference
        "RFC 5280:
        Internet X.509 Public Key Infrastructure Certificate
        and Certificate Revocation List (CRL) Profile";
}

feature client-auth-raw-public-key {
    description
        "Indicates that the server supports authenticating clients
        using raw public keys.";
    reference
        "RFC 7250:
        Using Raw Public Keys in Transport Layer Security (TLS)
        and Datagram Transport Layer Security (DTLS)";
}

```

```

}

feature client-auth-tls12-psk {
    description
        "Indicates that the server supports authenticating clients
        using PSKs (pre-shared or pairwise-symmetric keys).";
    reference
        "RFC 4279:
        Pre-Shared Key Ciphersuites for Transport Layer Security
        (TLS)";
}

feature client-auth-tls13-epsk {
    description
        "Indicates that the server supports authenticating clients
        using TLS-1.3 External PSKs (pre-shared keys).";
    reference
        "RFC 8446:
        The Transport Layer Security (TLS) Protocol Version 1.3";
}

// Groupings

grouping tls-server-grouping {
    description
        "A reusable grouping for configuring a TLS server without
        any consideration for how underlying TCP sessions are
        established.

        Note that this grouping uses fairly typical descendant
        node names such that a stack of 'uses' statements will
        have name conflicts. It is intended that the consuming
        data model will resolve the issue (e.g., by wrapping
        the 'uses' statement in a container called
        'tls-server-parameters'). This model purposely does
        not do this itself so as to provide maximum flexibility
        to consuming models.";

    container server-identity {
        nacm:default-deny-write;
        description
            "A locally-defined or referenced end-entity certificate,
            including any configured intermediate certificates, the
            TLS server will present when establishing a TLS connection
            in its Certificate message, as defined in Section 7.4.2
            in RFC 5246 and Section 4.4.2 in RFC 8446.";
        reference
            "RFC 5246: The Transport Layer Security (TLS) Protocol
            Version 1.2

```



RFC 8446: The Transport Layer Security (TLS) Protocol  
Version 1.3

RFC CCCC: A YANG Data Model for a Keystore";

```
choice auth-type {
  mandatory true;
  description
    "A choice amongst authentication types, of which one must
    be enabled (via its associated 'feature') and selected.";
  case certificate {
    if-feature "server-ident-x509-cert";
    container certificate {
      description
        "Specifies the server identity using a certificate.";
      uses
        ks:local-or-keystore-end-entity-cert-with-key-grouping{
          refine "local-or-keystore/local/local-definition" {
            must 'derived-from-or-self(public-key-format, '
              + ' "ct:subject-public-key-info-format")';
          }
          refine "local-or-keystore/keystore/keystore-reference"
            + "/asymmetric-key" {
            must 'derived-from-or-self(deref(..)/ks:public-'
              + 'key-format, "ct:subject-public-key-info-'
              + 'format")';
          }
        }
    }
  }
  case raw-private-key {
    if-feature "server-ident-raw-public-key";
    container raw-private-key {
      description
        "Specifies the server identity using a raw
        private key.";
      uses ks:local-or-keystore-asymmetric-key-grouping {
        refine "local-or-keystore/local/local-definition" {
          must 'derived-from-or-self(public-key-format, '
            + ' "ct:subject-public-key-info-format")';
        }
        refine "local-or-keystore/keystore/keystore-reference"{
          must 'derived-from-or-self(deref(..)/ks:public-'
            + 'key-format, "ct:subject-public-key-info-'
            + 'format")';
        }
      }
    }
  }
}
case tls12-psk {
  if-feature "server-ident-tls12-psk";
```

```

container tls12-psk {
  description
    "Specifies the server identity using a PSK (pre-shared
    or pairwise-symmetric key).";
  uses ks:local-or-keystore-symmetric-key-grouping;
  leaf id_hint {
    type string;
    description
      "The key 'psk_identity_hint' value used in the TLS
      'ServerKeyExchange' message.";
    reference
      "RFC 4279: Pre-Shared Key Ciphersuites for
      Transport Layer Security (TLS)";
  }
}

case tls13-epsk {
  if-feature "server-ident-tls13-epsk";
  container tls13-epsk {
    description
      "An External Pre-Shared Key (EPSK) is established
      or provisioned out-of-band, i.e., not from a TLS
      connection. An EPSK is a tuple of (Base Key,
      External Identity, Hash). External PSKs MUST
      NOT be imported for (D)TLS 1.2 or prior versions.
      When PSKs are provisioned out of band, the PSK
      identity and the KDF hash algorithm to be used
      with the PSK MUST also be provisioned.

      The structure of this container is designed
      to satisfy the requirements of RFC 8446
      Section 4.2.11, the recommendations from
      I-D ietf-tls-external-psk-guidance Section 6,
      and the EPSK input fields detailed in
      I-D draft-ietf-tls-external-psk-importer
      Section 3.1. The base-key is based upon
      ks:local-or-keystore-symmetric-key-grouping
      in order to provide users with flexible and
      secure storage options.";
    reference
      "RFC 8446: The Transport Layer Security (TLS)
      Protocol Version 1.3
      I-D.ietf-tls-external-psk-importer: Importing
      External PSKs for TLS
      I-D.ietf-tls-external-psk-guidance: Guidance
      for External PSK Usage in TLS";
    uses ks:local-or-keystore-symmetric-key-grouping;
    leaf external-identity {
      type string;
    }
  }
}

```

```

mandatory true;
description
    "As per Section 4.2.11 of RFC 8446, and Section 4.1
    of I-D. ietf-tls-external-psk-guidance: A sequence
    of bytes used to identify an EPSK. A label for a
    pre-shared key established externally.";
reference
    "RFC 8446: The Transport Layer Security (TLS)
    Protocol Version 1.3
    I-D.ietf-tls-external-psk-guidance:
    Guidance for External PSK Usage in TLS";
}
leaf hash {
    type tlscmn:epsk-supported-hash;
    mandatory true;
    description
        "As per Section 4.2.11 of RFC 8446, for externally
        established PSKs, the Hash algorithm MUST be set
        when the PSK is established or default to SHA-256
        if no such algorithm is defined. The server MUST
        ensure that it selects a compatible PSK (if any)
        and cipher suite. Each PSK MUST only be used
        with a single hash function.";
    reference
        "RFC 8446: The Transport Layer Security (TLS)
        Protocol Version 1.3";
}
leaf context {
    type string;
    description
        "As per Section 4.1 of I-D.
        ietf-tls-external-psk-guidance: Context
        may include information about peer roles or
        identities to mitigate Selfie-style reflection
        attacks [Selfie]. If the EPSK is a key derived
        from some other protocol or sequence of protocols,
        context MUST include a channel binding for the
        deriving protocols [RFC5056]. The details of
        this binding are protocol specific.";
    reference
        "I-D.ietf-tls-external-psk-importer:
        Importing External PSKs for TLS
        I-D.ietf-tls-external-psk-guidance:
        Guidance for External PSK Usage in TLS";
}
leaf target-protocol {
    type uint16;
    description
        "As per Section 3.1 of I-D.

```

```

        ietf-tls-external-psk-guidance: The protocol
        for which a PSK is imported for use.";
    reference
        "I-D.ietf-tls-external-psk-importer:
            Importing External PSKs for TLS";
}
leaf target-kdf {
    type uint16;
    description
        "As per Section 3.1 of I-D.
        ietf-tls-external-psk-guidance: The specific Key
        Derivation Function (KDF) for which a PSK is
        imported for use.";
    reference
        "I-D.ietf-tls-external-psk-importer:
            Importing External PSKs for TLS";
}
}
}
} // container server-identity

container client-authentication {
    if-feature "client-auth-supported";
    nacm:default-deny-write;
    must 'ca-certs or ee-certs or raw-public-keys or tls12-psks
        or tls13-epsks';
    presence
        "Indicates that client authentication is supported (i.e.,
        that the server will request clients send certificates).
        If not configured, the TLS server SHOULD NOT request the
        TLS clients provide authentication credentials.";
    description
        "Specifies how the TLS server can authenticate TLS clients.
        Any combination of credentials is additive and unordered.

        Note that no configuration is required for PSK (pre-shared
        or pairwise-symmetric key) based authentication as the key
        is necessarily the same as configured in the '../server-
        identity' node.";
    container ca-certs {
        if-feature "client-auth-x509-cert";
        presence
            "Indicates that CA certificates have been configured.
            This statement is present so the mandatory descendant
            nodes do not imply that this node must be configured.";
        description
            "A set of certificate authority (CA) certificates used by
            the TLS server to authenticate TLS client certificates.

```

```

        A client certificate is authenticated if it has a valid
        chain of trust to a configured CA certificate.";
reference
    "RFC BBBB: A YANG Data Model for a Truststore";
uses ts:local-or-truststore-certs-grouping;
}
container ee-certs {
    if-feature "client-auth-x509-cert";
    presence
        "Indicates that EE certificates have been configured.
        This statement is present so the mandatory descendant
        nodes do not imply that this node must be configured.";
    description
        "A set of client certificates (i.e., end entity
        certificates) used by the TLS server to authenticate
        certificates presented by TLS clients. A client
        certificate is authenticated if it is an exact
        match to a configured client certificate.";
    reference
        "RFC BBBB: A YANG Data Model for a Truststore";
    uses ts:local-or-truststore-certs-grouping;
}
container raw-public-keys {
    if-feature "client-auth-raw-public-key";
    presence
        "Indicates that raw public keys have been configured.
        This statement is present so the mandatory descendant
        nodes do not imply that this node must be configured.";
    description
        "A set of raw public keys used by the TLS server to
        authenticate raw public keys presented by the TLS
        client. A raw public key is authenticated if it
        is an exact match to a configured raw public key.";
    reference
        "RFC BBBB: A YANG Data Model for a Truststore";
    uses ts:local-or-truststore-public-keys-grouping {
        refine "local-or-truststore/local/local-definition/"
            + "public-key" {
            must 'derived-from-or-self(public-key-format, '
            + ' "ct:subject-public-key-info-format")';
        }
        refine "local-or-truststore/truststore/truststore-"
            + "reference" {
            must 'not(deref(..)/../ts:public-key/ts:public-key-'
            + 'format[not(derived-from-or-self(., "ct:subject-'
            + 'public-key-info-format"))])';
        }
    }
}
}
}

```

```

leaf tls12-psks {
  if-feature "client-auth-tls12-psk";
  type empty;
  description
    "Indicates that the TLS server can authenticate TLS clients
    using configured PSKs (pre-shared or pairwise-symmetric
    keys).

    No configuration is required since the PSK value is the
    same as PSK value configured in the 'server-identity'
    node.";
}
leaf tls13-epsks {
  if-feature "client-auth-tls13-epsk";
  type empty;
  description
    "Indicates that the TLS 1.3 server can authenticate TLS
    clients using configured external PSKs (pre-shared keys).

    No configuration is required since the PSK value is the
    same as PSK value configured in the 'server-identity'
    node.";
}
} // container client-authentication

container hello-params {
  nacm:default-deny-write;
  if-feature "tlscmn:hello-params";
  uses tlscmn:hello-params-grouping;
  description
    "Configurable parameters for the TLS hello message.";
} // container hello-params

container keepalives {
  nacm:default-deny-write;
  if-feature "tls-server-keepalives";
  description
    "Configures the keepalive policy for the TLS server.";
  leaf peer-allowed-to-send {
    type empty;
    description
      "Indicates that the remote TLS client is allowed to send
      HeartbeatRequest messages, as defined by RFC 6520
      to this TLS server.";
    reference
      "RFC 6520: Transport Layer Security (TLS) and Datagram
      Transport Layer Security (DTLS) Heartbeat Extension";
  }
}
container test-peer-aliveness {

```

```

presence
    "Indicates that the TLS server proactively tests the
    aliveness of the remote TLS client.";
description
    "Configures the keep-alive policy to proactively test
    the aliveness of the TLS client. An unresponsive
    TLS client is dropped after approximately max-wait
    * max-attempts seconds.";
leaf max-wait {
    type uint16 {
        range "1..max";
    }
    units "seconds";
    default "30";
    description
        "Sets the amount of time in seconds after which if
        no data has been received from the TLS client, a
        TLS-level message will be sent to test the
        aliveness of the TLS client.";
}
leaf max-attempts {
    type uint8;
    default "3";
    description
        "Sets the maximum number of sequential keep-alive
        messages that can fail to obtain a response from
        the TLS client before assuming the TLS client is
        no longer alive.";
}
}
} // container keepalives
} // grouping tls-server-grouping
}

```

<CODE ENDS>

## 5. Security Considerations

### 5.1. The "iana-tls-cipher-suite-algs" Module

The "iana-tls-cipher-suite-algs" YANG module defines a data model that 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 Network 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.

This YANG module defines YANG identities, for a public IANA-maintained registry, and a single protocol-accessible read-only node for the subset of those identities supported by a server.

YANG identities are not security-sensitive, as they are statically defined in the publicly-accessible YANG module.

The protocol-accessible read-only node for the algorithms supported by a server is mildly sensitive, but not to the extent that special NACM annotations are needed to prevent read-access to regular authenticated administrators.

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

### 5.2. The "ietf-tls-common" YANG Module

The "ietf-tls-common" YANG module defines "grouping" statements that are 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 Network 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.

Since the module in this document only define groupings, these considerations are primarily for the designers of other modules that use these groupings.

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



"default-deny-all" extension has not been set for any data nodes defined in this module.

None of the writable data nodes defined in this YANG module are considered sensitive or vulnerable in network environments. The NACM "default-deny-write" extension has not been set for any data nodes defined in this module.

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

### 5.3. The "ietf-tls-client" YANG Module

The "ietf-tls-client" YANG module defines "grouping" statements that are 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 Network 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.

Since the module in this document only define groupings, these considerations are primarily for the designers of other modules that use these groupings.

None of the readable data nodes defined in this YANG module are considered sensitive or vulnerable in network environments. The NACM "default-deny-all" extension has not been set for any data nodes defined in this module.

Please be aware that this module uses the "key" and "private-key" nodes from the "ietf-crypto-types" module [[I-D.ietf-netconf-crypto-types](#)], where said nodes have the NACM extension "default-deny-all" set, thus preventing unrestricted read-access to the cleartext key values.

All the writable data nodes defined by this module may be considered sensitive or vulnerable in some network environments. For instance, any modification to a key or reference to a key may dramatically alter the implemented security policy. For this reason, the NACM extension "default-deny-write" has been set for all data nodes defined in this module.

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

## 5.4. The "ietf-tls-server" YANG Module

The "ietf-tls-server" YANG module defines "grouping" statements that are 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 Network 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.

Since the module in this document only define groupings, these considerations are primarily for the designers of other modules that use these groupings.

None of the readable data nodes defined in this YANG module are considered sensitive or vulnerable in network environments. The NACM "default-deny-all" extension has not been set for any data nodes defined in this module.

Please be aware that this module uses the "key" and "private-key" nodes from the "ietf-crypto-types" module [[I-D.ietf-netconf-crypto-types](#)], where said nodes have the NACM extension "default-deny-all" set, thus preventing unrestricted read-access to the cleartext key values.

All the writable data nodes defined by this module may be considered sensitive or vulnerable in some network environments. For instance, any modification to a key or reference to a key may dramatically alter the implemented security policy. For this reason, the NACM extension "default-deny-write" has been set for all data nodes defined in this module.

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

## 6. IANA Considerations

### 6.1. The "IETF XML" Registry

This document registers four URIs in the "ns" subregistry of the IETF XML Registry [[RFC3688](#)]. Following the format in [[RFC3688](#)], the following registrations are requested:

URI: urn:ietf:params:xml:ns:yang:iana-tls-cipher-suite-algs  
Registrant Contact: IANA  
XML: N/A, the requested URI is an XML namespace.

URI: urn:ietf:params:xml:ns:yang:ietf-tls-common  
Registrant Contact: The IESG  
XML: N/A, the requested URI is an XML namespace.

URI: urn:ietf:params:xml:ns:yang:ietf-tls-client  
Registrant Contact: The IESG  
XML: N/A, the requested URI is an XML namespace.

URI: urn:ietf:params:xml:ns:yang:ietf-tls-server  
Registrant Contact: The IESG  
XML: N/A, the requested URI is an XML namespace.

## 6.2. The "YANG Module Names" Registry

This document registers four YANG modules in the YANG Module Names registry [[RFC6020](#)]. Following the format in [[RFC6020](#)], the following registrations are requested:

name: iana-tls-cipher-suite-algs  
namespace: urn:ietf:params:xml:ns:yang:iana-tls-cipher-suite-algs  
prefix: tlscsa  
reference: RFC FFFF

name: ietf-tls-common  
namespace: urn:ietf:params:xml:ns:yang:ietf-tls-common  
prefix: tlscmn  
reference: RFC FFFF

name: ietf-tls-client  
namespace: urn:ietf:params:xml:ns:yang:ietf-tls-client  
prefix: tlsc  
reference: RFC FFFF

name: ietf-tls-server  
namespace: urn:ietf:params:xml:ns:yang:ietf-tls-server  
prefix: tlss  
reference: RFC FFFF

## 6.3. The "iana-tls-cipher-suite-algs" Module

IANA is requested to maintain a YANG module called "iana-tls-cipher-suite-algs" that shadows the "TLS Cipher Suites" sub-registry of the "Transport Layer Security (TLS) Parameters" registry [[IANA-CIPHER-ALGS](#)].

This registry defines a YANG identity for each cipher suite algorithm, and a "base" identity from which all of the other identities are derived. Identities are chosen over enumerations for extensibility reasons.

An initial version of this module can be found in [Appendix A.1](#).

\*Please note that this module was created on June 16th, 2022, and that additional entries may have been added in the interim before this document's publication. If this is that case, IANA may either publish just an updated module containing the new entries, or publish the initial module as is immediately followed by a "revision" containing the additional algorithm names.

\*Please also note that the "status" statement has been set to "deprecated", if the "RECOMMENDED" column in the registry had the value 'N', and to "obsolete", if the "References" column included [Moving single-DES and IDEA TLS ciphersuites to Historic](#) reference.

## 7. References

### 7.1. Normative References

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#### [I-D.ietf-netconf-trust-anchors]

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## Appendix A. YANG Modules for IANA

The module contained in this section was generated by scripts using the contents of the associated sub-registry as they existed on June 16th, 2022.

### A.1. Initial Module for the "TLS Cipher Suites" Registry

#### A.1.1. Data Model Overview

This section provides an overview of the "iana-tls-cipher-suite-algs" module in terms of its identities and protocol-accessible nodes.

##### A.1.1.1. Identities

The following diagram lists the base "identity" statements defined in the module, of which there is just one, and illustrates that all the derived identity statements are generated from the associated IANA-maintained registry [[IANA-CIPHER-ALGS](#)].

Identities:

```
+-- cipher-suite-alg-base
   +-- <identity-name from IANA registry>
```

The diagram above uses syntax that is similar to but not defined in [[RFC8340](#)].

##### A.1.1.2. Typedefs

The following diagram illustrates the "typedef" statements defined in the "iana-tls-cipher-suite-algs" module:

Typedefs:

```
identityref
+-- cipher-suite-algorithm-ref
```

The diagram above uses syntax that is similar to but not defined in [[RFC8340](#)].

Comments:

\*The typedef defined in the "iana-tls-cipher-suite-algs" module extends the "identityref" type defined in [[RFC7950](#)].

#### **A.1.1.3. Protocol-accessible Nodes**

The following tree diagram [[RFC8340](#)] lists all the protocol-accessible nodes defined in the "iana-tls-cipher-suite-alg" module:

```
module: iana-tls-cipher-suite-algs
+--ro supported-algorithms
   +--ro supported-algorithm*   cipher-suite-algorithm-ref
```

Comments:

\*Protocol-accessible nodes are those nodes that are accessible when the module is "implemented", as described in [Section 5.6.5](#) of [[RFC7950](#)].

#### **A.1.2. Example Usage**

The following example illustrates operational state data indicating the TLS cipher suite algorithms supported by the server:

===== NOTE: '\\' line wrapping per RFC 8792 =====

```
<supported-algorithms
  xmlns="urn:ietf:params:xml:ns:yang:iana-tls-cipher-suite-algs"
  xmlns:tlscsa="urn:ietf:params:xml:ns:yang:iana-tls-cipher-suite-algs">
  <supported-algorithm>tlscsa:tls-ecdhe-ecdsa-with-aes-256-cbc-sha</supported-algorithm>
  <supported-algorithm>tlscsa:tls-dhe-rsa-with-aes-128-cbc-sha256</supported-algorithm>
  <supported-algorithm>tlscsa:tls-rsa-with-3des-edc-cbc-sha</supported-algorithm>
  <supported-algorithm>tlscsa:tls-ecdhe-psk-with-aes-256-gcm-sha384</supported-algorithm>
  <supported-algorithm>tlscsa:tls-dhe-psk-with-chacha20-poly1305-sha256</supported-algorithm>
  <supported-algorithm>tlscsa:tls-eccpwr-with-aes-256-gcm-sha384</supported-algorithm>
  <supported-algorithm>tlscsa:tls-psk-with-aes-256-ccm</supported-algorithm>
  <supported-algorithm>tlscsa:tls-dhe-psk-with-camellia-256-cbc-sha384</supported-algorithm>
  <supported-algorithm>tlscsa:tls-ecdh-rsa-with-aes-256-cbc-sha384</supported-algorithm>
  <supported-algorithm>tlscsa:tls-ecdh-rsa-with-3des-edc-cbc-sha</supported-algorithm>
  <supported-algorithm>tlscsa:tls-dh-dss-with-aes-128-gcm-sha256</supported-algorithm>
</supported-algorithms>
```

### A.1.3. YANG Module

Following are the complete contents to the initial IANA-maintained YANG module. Please note that the date "2022-06-16" reflects the day on which the extraction occurred.

This YANG module has normative references to [\[RFC2712\]](#), [\[RFC4162\]](#), [\[RFC4279\]](#), [\[RFC4346\]](#), [\[RFC4785\]](#), [\[RFC5054\]](#), [\[RFC5246\]](#), [\[RFC5288\]](#), [\[RFC5289\]](#), [\[RFC5469\]](#), [\[RFC5487\]](#), [\[RFC5489\]](#), [\[RFC5746\]](#), [\[RFC5932\]](#), [\[RFC6209\]](#), [\[RFC6367\]](#), [\[RFC6655\]](#), [\[RFC7251\]](#), [\[RFC7507\]](#), [\[RFC7905\]](#), [\[RFC8422\]](#), [\[RFC8442\]](#), [\[RFC8446\]](#), [\[RFC8492\]](#), [\[RFC8998\]](#), [\[RFC9150\]](#), [\[RFC9189\]](#), and [\[RFC8340\]](#).

<CODE BEGINS> file "iana-tls-cipher-suite-algs@2022-06-16.yang"

```

module iana-tls-cipher-suite-algs {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:iana-tls-cipher-suite-algs";
  prefix tlscsa;

  organization
    "Internet Assigned Numbers Authority (IANA)";

  contact
    "Postal: ICANN
      12025 Waterfront Drive, Suite 300
      Los Angeles, CA 90094-2536
      United States of America
    Tel: +1 310 301 5800
    Email: iana@iana.org";

  description
    "This module defines identities for the Cipher Suite
    algorithms defined in the 'TLS Cipher Suites' sub-registry
    of the 'Transport Layer Security (TLS) Parameters' registry
    maintained by IANA.

    Copyright (c) 2022 IETF Trust and the persons identified as
    authors of the code. All rights reserved.

    Redistribution and use in source and binary forms, with
    or without modification, is permitted pursuant to, and
    subject to the license terms contained in, the Revised
    BSD License set forth in Section 4.c of the IETF Trust's
    Legal Provisions Relating to IETF Documents
    (https://trustee.ietf.org/license-info).

    The initial version of this YANG module is part of RFC FFFF
    (https://www.rfc-editor.org/info/rfcFFFF); see the RFC
    itself for full legal notices.";

  revision 2022-06-16 {
    description
      "Reflect contents of the public key algorithms registry
      on June 16, 2022.";
    reference
      "RFC FFFF: YANG Groupings for TLS Clients and TLS Servers";
  }

  // Typedefs

  typedef cipher-suite-algorithm-ref {
    type identityref {
      base "cipher-suite-alg-base";
    }
  }

```

```

    description
        "A reference to a TLS cipher suite algorithm identifier.";
}

// Identities

identity cipher-suite-alg-base {
    description
        "Base identity used to identify TLS cipher suites.";
}

identity tls-null-with-null-null {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-NULL-WITH-NULL-NULL";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-rsa-with-null-md5 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-WITH-NULL-MD5";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-rsa-with-null-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-WITH-NULL-SHA";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-rsa-export-with-rc4-40-md5 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-EXPORT-WITH-RC4-40-MD5";
    reference
        "RFC 4346:

```

```

        The TLS Protocol Version 1.1
    RFC 6347:
        Datagram Transport Layer Security version 1.2";
}

identity tls-rsa-with-rc4-128-md5 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-WITH-RC4-128-MD5";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2
        RFC 6347:
            Datagram Transport Layer Security version 1.2";
}

identity tls-rsa-with-rc4-128-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-WITH-RC4-128-SHA";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2
        RFC 6347:
            Datagram Transport Layer Security version 1.2";
}

identity tls-rsa-export-with-rc2-cbc-40-md5 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-EXPORT-WITH-RC2-CBC-40-MD5";
    reference
        "RFC 4346:
            The TLS Protocol Version 1.1";
}

identity tls-rsa-with-idea-cbc-sha {
    base cipher-suite-alg-base;
    status obsolete;
    description
        "TLS-RSA-WITH-IDEA-CBC-SHA";
    reference
        "RFC 5469:
            DES and IDEA Cipher Suites for
            Transport Layer Security (TLS)
        RFC 5469:

```

```

        DES and IDEA Cipher Suites for
        Transport Layer Security (TLS)";
}

identity tls-rsa-export-with-des40-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-EXPORT-WITH-DES40-CBC-SHA";
    reference
        "RFC 4346:
            The TLS Protocol Version 1.1";
}

identity tls-rsa-with-des-cbc-sha {
    base cipher-suite-alg-base;
    status obsolete;
    description
        "TLS-RSA-WITH-DES-CBC-SHA";
    reference
        "RFC 5469:
            DES and IDEA Cipher Suites for
            Transport Layer Security (TLS)
            RFC 5469:
            DES and IDEA Cipher Suites for
            Transport Layer Security (TLS)";
}

identity tls-rsa-with-3des-ede-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-WITH-3DES-EDE-CBC-SHA";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-dh-dss-export-with-des40-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-DSS-EXPORT-WITH-DES40-CBC-SHA";
    reference
        "RFC 4346:
            The TLS Protocol Version 1.1";
}

identity tls-dh-dss-with-des-cbc-sha {

```



```

base cipher-suite-alg-base;
status obsolete;
description
    "TLS-DH-DSS-WITH-DES-CBC-SHA";
reference
    "RFC 5469:
        DES and IDEA Cipher Suites for
        Transport Layer Security (TLS)
    RFC 5469:
        DES and IDEA Cipher Suites for
        Transport Layer Security (TLS)";
}

identity tls-dh-dss-with-3des-ede-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-DSS-WITH-3DES-EDE-CBC-SHA";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-dh-rsa-export-with-des40-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-RSA-EXPORT-WITH-DES40-CBC-SHA";
    reference
        "RFC 4346:
            The TLS Protocol Version 1.1";
}

identity tls-dh-rsa-with-des-cbc-sha {
    base cipher-suite-alg-base;
    status obsolete;
    description
        "TLS-DH-RSA-WITH-DES-CBC-SHA";
    reference
        "RFC 5469:
            DES and IDEA Cipher Suites for
            Transport Layer Security (TLS)
        RFC 5469:
            DES and IDEA Cipher Suites for
            Transport Layer Security (TLS)";
}

identity tls-dh-rsa-with-3des-ede-cbc-sha {
    base cipher-suite-alg-base;

```

```
status deprecated;
description
    "TLS-DH-RSA-WITH-3DES-EDE-CBC-SHA";
reference
    "RFC 5246:
        The Transport Layer Security (TLS) Protocol Version 1.2";
}
```

```
identity tls-dhe-dss-export-with-des40-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-DSS-EXPORT-WITH-DES40-CBC-SHA";
    reference
        "RFC 4346:
            The TLS Protocol Version 1.1";
}
```

```
identity tls-dhe-dss-with-des-cbc-sha {
    base cipher-suite-alg-base;
    status obsolete;
    description
        "TLS-DHE-DSS-WITH-DES-CBC-SHA";
    reference
        "RFC 5469:
            DES and IDEA Cipher Suites for
            Transport Layer Security (TLS)
            RFC 5469:
            DES and IDEA Cipher Suites for
            Transport Layer Security (TLS)";
}
```

```
identity tls-dhe-dss-with-3des-edc-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-DSS-WITH-3DES-EDE-CBC-SHA";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}
```

```
identity tls-dhe-rsa-export-with-des40-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-RSA-EXPORT-WITH-DES40-CBC-SHA";
    reference
        "RFC 4346:
```

```

        The TLS Protocol Version 1.1";
    }

identity tls-dhe-rsa-with-des-cbc-sha {
    base cipher-suite-alg-base;
    status obsolete;
    description
        "TLS-DHE-RSA-WITH-DES-CBC-SHA";
    reference
        "RFC 5469:
            DES and IDEA Cipher Suites for
            Transport Layer Security (TLS)
        RFC 5469:
            DES and IDEA Cipher Suites for
            Transport Layer Security (TLS)";
}

identity tls-dhe-rsa-with-3des-ede-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-RSA-WITH-3DES-EDE-CBC-SHA";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-dh-anon-export-with-rc4-40-md5 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-ANON-EXPORT-WITH-RC4-40-MD5";
    reference
        "RFC 4346:
            The TLS Protocol Version 1.1
        RFC 6347:
            Datagram Transport Layer Security version 1.2";
}

identity tls-dh-anon-with-rc4-128-md5 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-ANON-WITH-RC4-128-MD5";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2
        RFC 6347:
            Datagram Transport Layer Security version 1.2";
}

```

```
}
```

```
identity tls-dh-anon-export-with-des40-cbc-sha {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-DH-ANON-EXPORT-WITH-DES40-CBC-SHA";  
    reference  
        "RFC 4346:  
        The TLS Protocol Version 1.1";  
}
```

```
identity tls-dh-anon-with-des-cbc-sha {  
    base cipher-suite-alg-base;  
    status obsolete;  
    description  
        "TLS-DH-ANON-WITH-DES-CBC-SHA";  
    reference  
        "RFC 5469:  
        DES and IDEA Cipher Suites for  
        Transport Layer Security (TLS)  
        RFC 5469:  
        DES and IDEA Cipher Suites for  
        Transport Layer Security (TLS)";  
}
```

```
identity tls-dh-anon-with-3des-ede-cbc-sha {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-DH-ANON-WITH-3DES-EDE-CBC-SHA";  
    reference  
        "RFC 5246:  
        The Transport Layer Security (TLS) Protocol Version 1.2";  
}
```

```
identity tls-krb5-with-des-cbc-sha {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-KRB5-WITH-DES-CBC-SHA";  
    reference  
        "RFC 2712:  
        Addition of Kerberos Cipher Suites to  
        Transport Layer Security (TLS)";  
}
```

```
identity tls-krb5-with-3des-ede-cbc-sha {  
    base cipher-suite-alg-base;
```

```

    status deprecated;
    description
        "TLS-KRB5-WITH-3DES-EDE-CBC-SHA";
    reference
        "RFC 2712:
        Addition of Kerberos Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-krb5-with-rc4-128-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-KRB5-WITH-RC4-128-SHA";
    reference
        "RFC 2712:
        Addition of Kerberos Cipher Suites to
        Transport Layer Security (TLS)
        RFC 6347:
        Datagram Transport Layer Security version 1.2";
}

identity tls-krb5-with-idea-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-KRB5-WITH-IDEA-CBC-SHA";
    reference
        "RFC 2712:
        Addition of Kerberos Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-krb5-with-des-cbc-md5 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-KRB5-WITH-DES-CBC-MD5";
    reference
        "RFC 2712:
        Addition of Kerberos Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-krb5-with-3des-edc-cbc-md5 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-KRB5-WITH-3DES-EDE-CBC-MD5";
}

```

```

reference
  "RFC 2712:
    Addition of Kerberos Cipher Suites to
    Transport Layer Security (TLS)";
}

identity tls-krb5-with-rc4-128-md5 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-KRB5-WITH-RC4-128-MD5";
  reference
    "RFC 2712:
      Addition of Kerberos Cipher Suites to
      Transport Layer Security (TLS)
      RFC 6347:
      Datagram Transport Layer Security version 1.2";
}

identity tls-krb5-with-idea-cbc-md5 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-KRB5-WITH-IDEA-CBC-MD5";
  reference
    "RFC 2712:
      Addition of Kerberos Cipher Suites to
      Transport Layer Security (TLS)";
}

identity tls-krb5-export-with-des-cbc-40-sha {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-KRB5-EXPORT-WITH-DES-CBC-40-SHA";
  reference
    "RFC 2712:
      Addition of Kerberos Cipher Suites to
      Transport Layer Security (TLS)";
}

identity tls-krb5-export-with-rc2-cbc-40-sha {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-KRB5-EXPORT-WITH-RC2-CBC-40-SHA";
  reference
    "RFC 2712:
      Addition of Kerberos Cipher Suites to

```

```

        Transport Layer Security (TLS)";
    }

identity tls-krb5-export-with-rc4-40-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-KRB5-EXPORT-WITH-RC4-40-SHA";
    reference
        "RFC 2712:
            Addition of Kerberos Cipher Suites to
            Transport Layer Security (TLS)
        RFC 6347:
            Datagram Transport Layer Security version 1.2";
}

identity tls-krb5-export-with-des-cbc-40-md5 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-KRB5-EXPORT-WITH-DES-CBC-40-MD5";
    reference
        "RFC 2712:
            Addition of Kerberos Cipher Suites to
            Transport Layer Security (TLS)";
}

identity tls-krb5-export-with-rc2-cbc-40-md5 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-KRB5-EXPORT-WITH-RC2-CBC-40-MD5";
    reference
        "RFC 2712:
            Addition of Kerberos Cipher Suites to
            Transport Layer Security (TLS)";
}

identity tls-krb5-export-with-rc4-40-md5 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-KRB5-EXPORT-WITH-RC4-40-MD5";
    reference
        "RFC 2712:
            Addition of Kerberos Cipher Suites to
            Transport Layer Security (TLS)
        RFC 6347:
            Datagram Transport Layer Security version 1.2";
}

```

```
}
```

```
identity tls-psk-with-null-sha {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-PSK-WITH-NULL-SHA";  
    reference  
        "RFC 4785:  
        Pre-Shared Key Cipher Suites with NULL Encryption for  
        Transport Layer Security (TLS)";  
}
```

```
identity tls-dhe-psk-with-null-sha {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-DHE-PSK-WITH-NULL-SHA";  
    reference  
        "RFC 4785:  
        Pre-Shared Key Cipher Suites with NULL Encryption for  
        Transport Layer Security (TLS)";  
}
```

```
identity tls-rsa-psk-with-null-sha {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-RSA-PSK-WITH-NULL-SHA";  
    reference  
        "RFC 4785:  
        Pre-Shared Key Cipher Suites with NULL Encryption for  
        Transport Layer Security (TLS)";  
}
```

```
identity tls-rsa-with-aes-128-cbc-sha {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-RSA-WITH-AES-128-CBC-SHA";  
    reference  
        "RFC 5246:  
        The Transport Layer Security (TLS) Protocol Version 1.2";  
}
```

```
identity tls-dh-dss-with-aes-128-cbc-sha {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description
```



```

        "TLS-DH-DSS-WITH-AES-128-CBC-SHA";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-dh-rsa-with-aes-128-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-RSA-WITH-AES-128-CBC-SHA";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-dhe-dss-with-aes-128-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-DSS-WITH-AES-128-CBC-SHA";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-dhe-rsa-with-aes-128-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-RSA-WITH-AES-128-CBC-SHA";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-dh-anon-with-aes-128-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-ANON-WITH-AES-128-CBC-SHA";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-rsa-with-aes-256-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;

```

```

    description
        "TLS-RSA-WITH-AES-256-CBC-SHA";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-dh-dss-with-aes-256-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-DSS-WITH-AES-256-CBC-SHA";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-dh-rsa-with-aes-256-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-RSA-WITH-AES-256-CBC-SHA";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-dhe-dss-with-aes-256-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-DSS-WITH-AES-256-CBC-SHA";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-dhe-rsa-with-aes-256-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-RSA-WITH-AES-256-CBC-SHA";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-dh-anon-with-aes-256-cbc-sha {
    base cipher-suite-alg-base;

```

```

    status deprecated;
    description
        "TLS-DH-ANON-WITH-AES-256-CBC-SHA";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-rsa-with-null-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-WITH-NULL-SHA256";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-rsa-with-aes-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-WITH-AES-128-CBC-SHA256";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-rsa-with-aes-256-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-WITH-AES-256-CBC-SHA256";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-dh-dss-with-aes-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-DSS-WITH-AES-128-CBC-SHA256";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-dh-rsa-with-aes-128-cbc-sha256 {

```

```
base cipher-suite-alg-base;
status deprecated;
description
    "TLS-DH-RSA-WITH-AES-128-CBC-SHA256";
reference
    "RFC 5246:
        The Transport Layer Security (TLS) Protocol Version 1.2";
}
```

```
identity tls-dhe-dss-with-aes-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-DSS-WITH-AES-128-CBC-SHA256";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}
```

```
identity tls-rsa-with-camellia-128-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-WITH-CAMELLIA-128-CBC-SHA";
    reference
        "RFC 5932:
            Camellia Cipher Suites for TLS";
}
```

```
identity tls-dh-dss-with-camellia-128-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-DSS-WITH-CAMELLIA-128-CBC-SHA";
    reference
        "RFC 5932:
            Camellia Cipher Suites for TLS";
}
```

```
identity tls-dh-rsa-with-camellia-128-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-RSA-WITH-CAMELLIA-128-CBC-SHA";
    reference
        "RFC 5932:
            Camellia Cipher Suites for TLS";
}
```

```

identity tls-dhe-dss-with-camellia-128-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-DSS-WITH-CAMELLIA-128-CBC-SHA";
    reference
        "RFC 5932:
            Camellia Cipher Suites for TLS";
}

identity tls-dhe-rsa-with-camellia-128-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-RSA-WITH-CAMELLIA-128-CBC-SHA";
    reference
        "RFC 5932:
            Camellia Cipher Suites for TLS";
}

identity tls-dh-anon-with-camellia-128-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-ANON-WITH-CAMELLIA-128-CBC-SHA";
    reference
        "RFC 5932:
            Camellia Cipher Suites for TLS";
}

identity tls-dhe-rsa-with-aes-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-RSA-WITH-AES-128-CBC-SHA256";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-dh-dss-with-aes-256-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-DSS-WITH-AES-256-CBC-SHA256";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

```

```

identity tls-dh-rsa-with-aes-256-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-RSA-WITH-AES-256-CBC-SHA256";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-dhe-dss-with-aes-256-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-DSS-WITH-AES-256-CBC-SHA256";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-dhe-rsa-with-aes-256-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-RSA-WITH-AES-256-CBC-SHA256";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-dh-anon-with-aes-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-ANON-WITH-AES-128-CBC-SHA256";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

identity tls-dh-anon-with-aes-256-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-ANON-WITH-AES-256-CBC-SHA256";
    reference
        "RFC 5246:
            The Transport Layer Security (TLS) Protocol Version 1.2";
}

```

```
}
```

```
identity tls-rsa-with-camellia-256-cbc-sha {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-RSA-WITH-CAMELLIA-256-CBC-SHA";  
    reference  
        "RFC 5932:  
        Camellia Cipher Suites for TLS";  
}
```

```
identity tls-dh-dss-with-camellia-256-cbc-sha {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-DH-DSS-WITH-CAMELLIA-256-CBC-SHA";  
    reference  
        "RFC 5932:  
        Camellia Cipher Suites for TLS";  
}
```

```
identity tls-dh-rsa-with-camellia-256-cbc-sha {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-DH-RSA-WITH-CAMELLIA-256-CBC-SHA";  
    reference  
        "RFC 5932:  
        Camellia Cipher Suites for TLS";  
}
```

```
identity tls-dhe-dss-with-camellia-256-cbc-sha {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-DHE-DSS-WITH-CAMELLIA-256-CBC-SHA";  
    reference  
        "RFC 5932:  
        Camellia Cipher Suites for TLS";  
}
```

```
identity tls-dhe-rsa-with-camellia-256-cbc-sha {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-DHE-RSA-WITH-CAMELLIA-256-CBC-SHA";  
    reference  
        "RFC 5932:
```

```

        Camellia Cipher Suites for TLS";
    }

identity tls-dh-anon-with-camellia-256-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-ANON-WITH-CAMELLIA-256-CBC-SHA";
    reference
        "RFC 5932:
        Camellia Cipher Suites for TLS";
}

identity tls-psk-with-rc4-128-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-PSK-WITH-RC4-128-SHA";
    reference
        "RFC 4279:
        Pre-Shared Key Ciphersuites for
        Transport Layer Security (TLS)
        RFC 6347:
        Datagram Transport Layer Security version 1.2";
}

identity tls-psk-with-3des-ede-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-PSK-WITH-3DES-EDE-CBC-SHA";
    reference
        "RFC 4279:
        Pre-Shared Key Ciphersuites for
        Transport Layer Security (TLS)";
}

identity tls-psk-with-aes-128-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-PSK-WITH-AES-128-CBC-SHA";
    reference
        "RFC 4279:
        Pre-Shared Key Ciphersuites for
        Transport Layer Security (TLS)";
}

identity tls-psk-with-aes-256-cbc-sha {

```



```

base cipher-suite-alg-base;
status deprecated;
description
    "TLS-PSK-WITH-AES-256-CBC-SHA";
reference
    "RFC 4279:
        Pre-Shared Key Ciphersuites for
        Transport Layer Security (TLS)";
}

identity tls-dhe-psk-with-rc4-128-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-PSK-WITH-RC4-128-SHA";
    reference
        "RFC 4279:
            Pre-Shared Key Ciphersuites for
            Transport Layer Security (TLS)
        RFC 6347:
            Datagram Transport Layer Security version 1.2";
}

identity tls-dhe-psk-with-3des-ede-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-PSK-WITH-3DES-EDE-CBC-SHA";
    reference
        "RFC 4279:
            Pre-Shared Key Ciphersuites for
            Transport Layer Security (TLS)";
}

identity tls-dhe-psk-with-aes-128-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-PSK-WITH-AES-128-CBC-SHA";
    reference
        "RFC 4279:
            Pre-Shared Key Ciphersuites for
            Transport Layer Security (TLS)";
}

identity tls-dhe-psk-with-aes-256-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description

```

```

        "TLS-DHE-PSK-WITH-AES-256-CBC-SHA";
reference
    "RFC 4279:
        Pre-Shared Key Ciphersuites for
        Transport Layer Security (TLS)";
}

identity tls-rsa-psk-with-rc4-128-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-PSK-WITH-RC4-128-SHA";
    reference
        "RFC 4279:
            Pre-Shared Key Ciphersuites for
            Transport Layer Security (TLS)
        RFC 6347:
            Datagram Transport Layer Security version 1.2";
}

identity tls-rsa-psk-with-3des-ede-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-PSK-WITH-3DES-EDE-CBC-SHA";
    reference
        "RFC 4279:
            Pre-Shared Key Ciphersuites for
            Transport Layer Security (TLS)";
}

identity tls-rsa-psk-with-aes-128-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-PSK-WITH-AES-128-CBC-SHA";
    reference
        "RFC 4279:
            Pre-Shared Key Ciphersuites for
            Transport Layer Security (TLS)";
}

identity tls-rsa-psk-with-aes-256-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-PSK-WITH-AES-256-CBC-SHA";
    reference
        "RFC 4279:

```

```

        Pre-Shared Key Ciphersuites for
        Transport Layer Security (TLS)";
}

identity tls-rsa-with-seed-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-WITH-SEED-CBC-SHA";
    reference
        "RFC 4162:
        Addition of SEED Ciphersuites to
        Transport Layer Security (TLS)";
}

identity tls-dh-dss-with-seed-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-DSS-WITH-SEED-CBC-SHA";
    reference
        "RFC 4162:
        Addition of SEED Ciphersuites to
        Transport Layer Security (TLS)";
}

identity tls-dh-rsa-with-seed-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-RSA-WITH-SEED-CBC-SHA";
    reference
        "RFC 4162:
        Addition of SEED Ciphersuites to
        Transport Layer Security (TLS)";
}

identity tls-dhe-dss-with-seed-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-DSS-WITH-SEED-CBC-SHA";
    reference
        "RFC 4162:
        Addition of SEED Ciphersuites to
        Transport Layer Security (TLS)";
}

identity tls-dhe-rsa-with-seed-cbc-sha {

```

```

base cipher-suite-alg-base;
status deprecated;
description
    "TLS-DHE-RSA-WITH-SEED-CBC-SHA";
reference
    "RFC 4162:
        Addition of SEED Ciphersuites to
        Transport Layer Security (TLS)";
}

identity tls-dh-anon-with-seed-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-ANON-WITH-SEED-CBC-SHA";
    reference
        "RFC 4162:
            Addition of SEED Ciphersuites to
            Transport Layer Security (TLS)";
}

identity tls-rsa-with-aes-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-WITH-AES-128-GCM-SHA256";
    reference
        "RFC 5288:
            AES-GCM Cipher Suites for TLS";
}

identity tls-rsa-with-aes-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-WITH-AES-256-GCM-SHA384";
    reference
        "RFC 5288:
            AES-GCM Cipher Suites for TLS";
}

identity tls-dhe-rsa-with-aes-128-gcm-sha256 {
    base cipher-suite-alg-base;
    description
        "TLS-DHE-RSA-WITH-AES-128-GCM-SHA256";
    reference
        "RFC 5288:
            AES-GCM Cipher Suites for TLS";
}

```

```
identity tls-dhe-rsa-with-aes-256-gcm-sha384 {
    base cipher-suite-alg-base;
    description
        "TLS-DHE-RSA-WITH-AES-256-GCM-SHA384";
    reference
        "RFC 5288:
            AES-GCM Cipher Suites for TLS";
}
```

```
identity tls-dh-rsa-with-aes-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-RSA-WITH-AES-128-GCM-SHA256";
    reference
        "RFC 5288:
            AES-GCM Cipher Suites for TLS";
}
```

```
identity tls-dh-rsa-with-aes-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-RSA-WITH-AES-256-GCM-SHA384";
    reference
        "RFC 5288:
            AES-GCM Cipher Suites for TLS";
}
```

```
identity tls-dhe-dss-with-aes-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-DSS-WITH-AES-128-GCM-SHA256";
    reference
        "RFC 5288:
            AES-GCM Cipher Suites for TLS";
}
```

```
identity tls-dhe-dss-with-aes-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-DSS-WITH-AES-256-GCM-SHA384";
    reference
        "RFC 5288:
            AES-GCM Cipher Suites for TLS";
}
```

```

identity tls-dh-dss-with-aes-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-DSS-WITH-AES-128-GCM-SHA256";
    reference
        "RFC 5288:
            AES-GCM Cipher Suites for TLS";
}

identity tls-dh-dss-with-aes-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-DSS-WITH-AES-256-GCM-SHA384";
    reference
        "RFC 5288:
            AES-GCM Cipher Suites for TLS";
}

identity tls-dh-anon-with-aes-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-ANON-WITH-AES-128-GCM-SHA256";
    reference
        "RFC 5288:
            AES-GCM Cipher Suites for TLS";
}

identity tls-dh-anon-with-aes-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-ANON-WITH-AES-256-GCM-SHA384";
    reference
        "RFC 5288:
            AES-GCM Cipher Suites for TLS";
}

identity tls-psk-with-aes-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-PSK-WITH-AES-128-GCM-SHA256";
    reference
        "RFC 5487:
            Pre-Shared Key Cipher Suites for Transport Layer Security

```

```

        (TLS) with SHA-256/384 and AES Galois Counter Mode";
    }

identity tls-psk-with-aes-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-PSK-WITH-AES-256-GCM-SHA384";
    reference
        "RFC 5487:
        Pre-Shared Key Cipher Suites for Transport Layer Security
        (TLS) with SHA-256/384 and AES Galois Counter Mode";
}

identity tls-dhe-psk-with-aes-128-gcm-sha256 {
    base cipher-suite-alg-base;
    description
        "TLS-DHE-PSK-WITH-AES-128-GCM-SHA256";
    reference
        "RFC 5487:
        Pre-Shared Key Cipher Suites for Transport Layer Security
        (TLS) with SHA-256/384 and AES Galois Counter Mode";
}

identity tls-dhe-psk-with-aes-256-gcm-sha384 {
    base cipher-suite-alg-base;
    description
        "TLS-DHE-PSK-WITH-AES-256-GCM-SHA384";
    reference
        "RFC 5487:
        Pre-Shared Key Cipher Suites for Transport Layer Security
        (TLS) with SHA-256/384 and AES Galois Counter Mode";
}

identity tls-rsa-psk-with-aes-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-PSK-WITH-AES-128-GCM-SHA256";
    reference
        "RFC 5487:
        Pre-Shared Key Cipher Suites for Transport Layer Security
        (TLS) with SHA-256/384 and AES Galois Counter Mode";
}

identity tls-rsa-psk-with-aes-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description

```

```

        "TLS-RSA-PSK-WITH-AES-256-GCM-SHA384";
reference
    "RFC 5487:
        Pre-Shared Key Cipher Suites for Transport Layer Security
        (TLS) with SHA-256/384 and AES Galois Counter Mode";
}

identity tls-psk-with-aes-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-PSK-WITH-AES-128-CBC-SHA256";
    reference
        "RFC 5487:
            Pre-Shared Key Cipher Suites for Transport Layer Security
            (TLS) with SHA-256/384 and AES Galois Counter Mode";
}

identity tls-psk-with-aes-256-cbc-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-PSK-WITH-AES-256-CBC-SHA384";
    reference
        "RFC 5487:
            Pre-Shared Key Cipher Suites for Transport Layer Security
            (TLS) with SHA-256/384 and AES Galois Counter Mode";
}

identity tls-psk-with-null-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-PSK-WITH-NULL-SHA256";
    reference
        "RFC 5487:
            Pre-Shared Key Cipher Suites for Transport Layer Security
            (TLS) with SHA-256/384 and AES Galois Counter Mode";
}

identity tls-psk-with-null-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-PSK-WITH-NULL-SHA384";
    reference
        "RFC 5487:
            Pre-Shared Key Cipher Suites for Transport Layer Security
            (TLS) with SHA-256/384 and AES Galois Counter Mode";
}

```



```
}
```

```
identity tls-dhe-psk-with-aes-128-cbc-sha256 {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-DHE-PSK-WITH-AES-128-CBC-SHA256";  
    reference  
        "RFC 5487:  
        Pre-Shared Key Cipher Suites for Transport Layer Security  
        (TLS) with SHA-256/384 and AES Galois Counter Mode";  
}
```

```
identity tls-dhe-psk-with-aes-256-cbc-sha384 {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-DHE-PSK-WITH-AES-256-CBC-SHA384";  
    reference  
        "RFC 5487:  
        Pre-Shared Key Cipher Suites for Transport Layer Security  
        (TLS) with SHA-256/384 and AES Galois Counter Mode";  
}
```

```
identity tls-dhe-psk-with-null-sha256 {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-DHE-PSK-WITH-NULL-SHA256";  
    reference  
        "RFC 5487:  
        Pre-Shared Key Cipher Suites for Transport Layer Security  
        (TLS) with SHA-256/384 and AES Galois Counter Mode";  
}
```

```
identity tls-dhe-psk-with-null-sha384 {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-DHE-PSK-WITH-NULL-SHA384";  
    reference  
        "RFC 5487:  
        Pre-Shared Key Cipher Suites for Transport Layer Security  
        (TLS) with SHA-256/384 and AES Galois Counter Mode";  
}
```

```
identity tls-rsa-psk-with-aes-128-cbc-sha256 {  
    base cipher-suite-alg-base;  
    status deprecated;
```

```

description
  "TLS-RSA-PSK-WITH-AES-128-CBC-SHA256";
reference
  "RFC 5487:
    Pre-Shared Key Cipher Suites for Transport Layer Security
    (TLS) with SHA-256/384 and AES Galois Counter Mode";
}

identity tls-rsa-psk-with-aes-256-cbc-sha384 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-RSA-PSK-WITH-AES-256-CBC-SHA384";
  reference
    "RFC 5487:
      Pre-Shared Key Cipher Suites for Transport Layer Security
      (TLS) with SHA-256/384 and AES Galois Counter Mode";
}

identity tls-rsa-psk-with-null-sha256 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-RSA-PSK-WITH-NULL-SHA256";
  reference
    "RFC 5487:
      Pre-Shared Key Cipher Suites for Transport Layer Security
      (TLS) with SHA-256/384 and AES Galois Counter Mode";
}

identity tls-rsa-psk-with-null-sha384 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-RSA-PSK-WITH-NULL-SHA384";
  reference
    "RFC 5487:
      Pre-Shared Key Cipher Suites for Transport Layer Security
      (TLS) with SHA-256/384 and AES Galois Counter Mode";
}

identity tls-rsa-with-camellia-128-cbc-sha256 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-RSA-WITH-CAMELLIA-128-CBC-SHA256";
  reference
    "RFC 5932:
      Camellia Cipher Suites for TLS";
}

```

```
}
```

```
identity tls-dh-dss-with-camellia-128-cbc-sha256 {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-DH-DSS-WITH-CAMELLIA-128-CBC-SHA256";  
    reference  
        "RFC 5932:  
        Camellia Cipher Suites for TLS";  
}
```

```
identity tls-dh-rsa-with-camellia-128-cbc-sha256 {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-DH-RSA-WITH-CAMELLIA-128-CBC-SHA256";  
    reference  
        "RFC 5932:  
        Camellia Cipher Suites for TLS";  
}
```

```
identity tls-dhe-dss-with-camellia-128-cbc-sha256 {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-DHE-DSS-WITH-CAMELLIA-128-CBC-SHA256";  
    reference  
        "RFC 5932:  
        Camellia Cipher Suites for TLS";  
}
```

```
identity tls-dhe-rsa-with-camellia-128-cbc-sha256 {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-DHE-RSA-WITH-CAMELLIA-128-CBC-SHA256";  
    reference  
        "RFC 5932:  
        Camellia Cipher Suites for TLS";  
}
```

```
identity tls-dh-anon-with-camellia-128-cbc-sha256 {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-DH-ANON-WITH-CAMELLIA-128-CBC-SHA256";  
    reference  
        "RFC 5932:
```

```

        Camellia Cipher Suites for TLS";
    }

identity tls-rsa-with-camellia-256-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-WITH-CAMELLIA-256-CBC-SHA256";
    reference
        "RFC 5932:
        Camellia Cipher Suites for TLS";
}

identity tls-dh-dss-with-camellia-256-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-DSS-WITH-CAMELLIA-256-CBC-SHA256";
    reference
        "RFC 5932:
        Camellia Cipher Suites for TLS";
}

identity tls-dh-rsa-with-camellia-256-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-RSA-WITH-CAMELLIA-256-CBC-SHA256";
    reference
        "RFC 5932:
        Camellia Cipher Suites for TLS";
}

identity tls-dhe-dss-with-camellia-256-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-DSS-WITH-CAMELLIA-256-CBC-SHA256";
    reference
        "RFC 5932:
        Camellia Cipher Suites for TLS";
}

identity tls-dhe-rsa-with-camellia-256-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-RSA-WITH-CAMELLIA-256-CBC-SHA256";
    reference

```

```

        "RFC 5932:
          Camellia Cipher Suites for TLS";
    }

identity tls-dh-anon-with-camellia-256-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-ANON-WITH-CAMELLIA-256-CBC-SHA256";
    reference
        "RFC 5932:
          Camellia Cipher Suites for TLS";
}

identity tls-sm4-gcm-sm3 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-SM4-GCM-SM3";
    reference
        "RFC 8998:
          ShangMi (SM) Cipher Suites for Transport Layer Security
          (TLS) Protocol Version 1.3";
}

identity tls-sm4-ccm-sm3 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-SM4-CCM-SM3";
    reference
        "RFC 8998:
          ShangMi (SM) Cipher Suites for Transport Layer Security
          (TLS) Protocol Version 1.3";
}

identity tls-empty-renegotiation-info-scsv {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-EMPTY-RENEGOTIATION-INFO-SCSV";
    reference
        "RFC 5746:
          Transport Layer Security (TLS)
          Renegotiation Indication Extension";
}

identity tls-aes-128-gcm-sha256 {
    base cipher-suite-alg-base;

```

```

description
  "TLS-AES-128-GCM-SHA256";
reference
  "RFC 8446:
    The Transport Layer Security (TLS) Protocol Version 1.3";
}

identity tls-aes-256-gcm-sha384 {
  base cipher-suite-alg-base;
  description
    "TLS-AES-256-GCM-SHA384";
  reference
    "RFC 8446:
      The Transport Layer Security (TLS) Protocol Version 1.3";
}

identity tls-chacha20-poly1305-sha256 {
  base cipher-suite-alg-base;
  description
    "TLS-CHACHA20-POLY1305-SHA256";
  reference
    "RFC 8446:
      The Transport Layer Security (TLS) Protocol Version 1.3";
}

identity tls-aes-128-ccm-sha256 {
  base cipher-suite-alg-base;
  description
    "TLS-AES-128-CCM-SHA256";
  reference
    "RFC 8446:
      The Transport Layer Security (TLS) Protocol Version 1.3";
}

identity tls-aes-128-ccm-8-sha256 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-AES-128-CCM-8-SHA256";
  reference
    "RFC 8446:
      The Transport Layer Security (TLS) Protocol Version 1.3";
}

identity tls-fallback-scsv {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-FALLBACK-SCSV";
}

```

```

reference
  "RFC 7507:
    TLS Fallback Signaling Cipher Suite Value (SCSV)
    for Preventing Protocol Downgrade Attacks";
}

identity tls-ecdh-ecdsa-with-null-sha {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECDH-ECDSA-WITH-NULL-SHA";
  reference
    "RFC 8422:
      Elliptic Curve Cryptography (ECC) Cipher Suites for
      Transport Layer Security (TLS) Versions 1.2 and Earlier";
}

identity tls-ecdh-ecdsa-with-rc4-128-sha {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECDH-ECDSA-WITH-RC4-128-SHA";
  reference
    "RFC 8422:
      Elliptic Curve Cryptography (ECC) Cipher Suites for
      Transport Layer Security (TLS) Versions 1.2 and Earlier
    RFC 6347:
      Datagram Transport Layer Security version 1.2";
}

identity tls-ecdh-ecdsa-with-3des-ede-cbc-sha {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECDH-ECDSA-WITH-3DES-EDE-CBC-SHA";
  reference
    "RFC 8422:
      Elliptic Curve Cryptography (ECC) Cipher Suites for
      Transport Layer Security (TLS) Versions 1.2 and Earlier";
}

identity tls-ecdh-ecdsa-with-aes-128-cbc-sha {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECDH-ECDSA-WITH-AES-128-CBC-SHA";
  reference
    "RFC 8422:
      Elliptic Curve Cryptography (ECC) Cipher Suites for

```

```
        Transport Layer Security (TLS) Versions 1.2 and Earlier";
    }
```

```
identity tls-ecdh-ecdsa-with-aes-256-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-ECDSA-WITH-AES-256-CBC-SHA";
    reference
        "RFC 8422:
        Elliptic Curve Cryptography (ECC) Cipher Suites for
        Transport Layer Security (TLS) Versions 1.2 and Earlier";
}
```

```
identity tls-ecdhe-ecdsa-with-null-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDHE-ECDSA-WITH-NULL-SHA";
    reference
        "RFC 8422:
        Elliptic Curve Cryptography (ECC) Cipher Suites for
        Transport Layer Security (TLS) Versions 1.2 and Earlier";
}
```

```
identity tls-ecdhe-ecdsa-with-rc4-128-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDHE-ECDSA-WITH-RC4-128-SHA";
    reference
        "RFC 8422:
        Elliptic Curve Cryptography (ECC) Cipher Suites for
        Transport Layer Security (TLS) Versions 1.2 and Earlier
        RFC 6347:
        Datagram Transport Layer Security version 1.2";
}
```

```
identity tls-ecdhe-ecdsa-with-3des-ede-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDHE-ECDSA-WITH-3DES-EDE-CBC-SHA";
    reference
        "RFC 8422:
        Elliptic Curve Cryptography (ECC) Cipher Suites for
        Transport Layer Security (TLS) Versions 1.2 and Earlier";
}
```



```
identity tls-ecdh-rsa-with-null-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-RSA-WITH-NULL-SHA";
    reference
        "RFC 8422:
        Elliptic Curve Cryptography (ECC) Cipher Suites for
        Transport Layer Security (TLS) Versions 1.2 and Earlier";
}
```

```
identity tls-ecdh-rsa-with-rc4-128-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-RSA-WITH-RC4-128-SHA";
    reference
        "RFC 8422:
        Elliptic Curve Cryptography (ECC) Cipher Suites for
        Transport Layer Security (TLS) Versions 1.2 and Earlier";
}
```

```
identity tls-ecdh-rsa-with-3des-ede-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-RSA-WITH-3DES-EDE-CBC-SHA";
    reference
        "RFC 8422:
        Elliptic Curve Cryptography (ECC) Cipher Suites for
        Transport Layer Security (TLS) Versions 1.2 and Earlier";
}
```

```
identity tls-ecdh-rsa-with-aes-128-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-RSA-WITH-AES-128-CBC-SHA";
    reference
        "RFC 8422:
        Elliptic Curve Cryptography (ECC) Cipher Suites for
        Transport Layer Security (TLS) Versions 1.2 and Earlier";
}
```

```
identity tls-ecdh-rsa-with-aes-256-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
```

```

description
  "TLS-ECDH-RSA-WITH-3DES-EDE-CBC-SHA";
reference
  "RFC 8422:
    Elliptic Curve Cryptography (ECC) Cipher Suites for
    Transport Layer Security (TLS) Versions 1.2 and Earlier";
}

identity tls-ecdh-rsa-with-aes-128-cbc-sha {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECDH-RSA-WITH-AES-128-CBC-SHA";
  reference
    "RFC 8422:
      Elliptic Curve Cryptography (ECC) Cipher Suites for
      Transport Layer Security (TLS) Versions 1.2 and Earlier";
}

identity tls-ecdh-rsa-with-aes-256-cbc-sha {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECDH-RSA-WITH-AES-256-CBC-SHA";
  reference
    "RFC 8422:
      Elliptic Curve Cryptography (ECC) Cipher Suites for
      Transport Layer Security (TLS) Versions 1.2 and Earlier";
}

identity tls-ecdhe-rsa-with-null-sha {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECDHE-RSA-WITH-NULL-SHA";
  reference
    "RFC 8422:
      Elliptic Curve Cryptography (ECC) Cipher Suites for
      Transport Layer Security (TLS) Versions 1.2 and Earlier";
}

identity tls-ecdhe-rsa-with-rc4-128-sha {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECDHE-RSA-WITH-RC4-128-SHA";
  reference
    "RFC 8422:
      Elliptic Curve Cryptography (ECC) Cipher Suites for

```

```

        Transport Layer Security (TLS) Versions 1.2 and Earlier
    RFC 6347:
        Datagram Transport Layer Security version 1.2";
}

identity tls-ecdh-rsa-with-3des-ede-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDHE-RSA-WITH-3DES-EDE-CBC-SHA";
    reference
        "RFC 8422:
            Elliptic Curve Cryptography (ECC) Cipher Suites for
            Transport Layer Security (TLS) Versions 1.2 and Earlier";
}

identity tls-ecdh-rsa-with-aes-128-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDHE-RSA-WITH-AES-128-CBC-SHA";
    reference
        "RFC 8422:
            Elliptic Curve Cryptography (ECC) Cipher Suites for
            Transport Layer Security (TLS) Versions 1.2 and Earlier";
}

identity tls-ecdh-rsa-with-aes-256-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDHE-RSA-WITH-AES-256-CBC-SHA";
    reference
        "RFC 8422:
            Elliptic Curve Cryptography (ECC) Cipher Suites for
            Transport Layer Security (TLS) Versions 1.2 and Earlier";
}

identity tls-ecdh-anon-with-null-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-ANON-WITH-NUL-SHA";
    reference
        "RFC 8422:
            Elliptic Curve Cryptography (ECC) Cipher Suites for
            Transport Layer Security (TLS) Versions 1.2 and Earlier";
}

```

```

identity tls-ecdh-anon-with-rc4-128-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-ANON-WITH-RC4-128-SHA";
    reference
        "RFC 8422:
            Elliptic Curve Cryptography (ECC) Cipher Suites for
            Transport Layer Security (TLS) Versions 1.2 and Earlier
        RFC 6347:
            Datagram Transport Layer Security version 1.2";
}

identity tls-ecdh-anon-with-3des-ede-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-ANON-WITH-3DES-EDE-CBC-SHA";
    reference
        "RFC 8422:
            Elliptic Curve Cryptography (ECC) Cipher Suites for
            Transport Layer Security (TLS) Versions 1.2 and Earlier";
}

identity tls-ecdh-anon-with-aes-128-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-ANON-WITH-AES-128-CBC-SHA";
    reference
        "RFC 8422:
            Elliptic Curve Cryptography (ECC) Cipher Suites for
            Transport Layer Security (TLS) Versions 1.2 and Earlier";
}

identity tls-ecdh-anon-with-aes-256-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-ANON-WITH-AES-256-CBC-SHA";
    reference
        "RFC 8422:
            Elliptic Curve Cryptography (ECC) Cipher Suites for
            Transport Layer Security (TLS) Versions 1.2 and Earlier";
}

identity tls-srp-sha-with-3des-ede-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;

```

```

    description
        "TLS-SRP-SHA-WITH-3DES-EDE-CBC-SHA";
    reference
        "RFC 5054:
            Using SRP for TLS Authentication";
}

identity tls-srp-sha-rsa-with-3des-edc-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-SRP-SHA-RSA-WITH-3DES-EDE-CBC-SHA";
    reference
        "RFC 5054:
            Using SRP for TLS Authentication";
}

identity tls-srp-sha-dss-with-3des-edc-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-SRP-SHA-DSS-WITH-3DES-EDE-CBC-SHA";
    reference
        "RFC 5054:
            Using SRP for TLS Authentication";
}

identity tls-srp-sha-with-aes-128-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-SRP-SHA-WITH-AES-128-CBC-SHA";
    reference
        "RFC 5054:
            Using SRP for TLS Authentication";
}

identity tls-srp-sha-rsa-with-aes-128-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-SRP-SHA-RSA-WITH-AES-128-CBC-SHA";
    reference
        "RFC 5054:
            Using SRP for TLS Authentication";
}

identity tls-srp-sha-dss-with-aes-128-cbc-sha {
    base cipher-suite-alg-base;

```

```

    status deprecated;
    description
        "TLS-SRP-SHA-DSS-WITH-AES-128-CBC-SHA";
    reference
        "RFC 5054:
        Using SRP for TLS Authentication";
}

identity tls-srp-sha-with-aes-256-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-SRP-SHA-WITH-AES-256-CBC-SHA";
    reference
        "RFC 5054:
        Using SRP for TLS Authentication";
}

identity tls-srp-sha-rsa-with-aes-256-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-SRP-SHA-RSA-WITH-AES-256-CBC-SHA";
    reference
        "RFC 5054:
        Using SRP for TLS Authentication";
}

identity tls-srp-sha-dss-with-aes-256-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-SRP-SHA-DSS-WITH-AES-256-CBC-SHA";
    reference
        "RFC 5054:
        Using SRP for TLS Authentication";
}

identity tls-ecdhc-ecdsa-with-aes-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-ECDSA-WITH-AES-128-CBC-SHA256";
    reference
        "RFC 5289:
        TLS Elliptic Curve Cipher Suites with SHA-256/384
        and AES Galois Counter Mode";
}

```

```

identity tls-ecdh-eccsa-with-aes-256-cbc-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDHE-ECDSA-WITH-AES-256-CBC-SHA384";
    reference
        "RFC 5289:
        TLS Elliptic Curve Cipher Suites with SHA-256/384
        and AES Galois Counter Mode";
}

identity tls-ecdh-eccsa-with-aes-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-ECDSA-WITH-AES-128-CBC-SHA256";
    reference
        "RFC 5289:
        TLS Elliptic Curve Cipher Suites with SHA-256/384
        and AES Galois Counter Mode";
}

identity tls-ecdh-eccsa-with-aes-256-cbc-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-ECDSA-WITH-AES-256-CBC-SHA384";
    reference
        "RFC 5289:
        TLS Elliptic Curve Cipher Suites with SHA-256/384
        and AES Galois Counter Mode";
}

identity tls-ecdh-rsa-with-aes-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDHE-RSA-WITH-AES-128-CBC-SHA256";
    reference
        "RFC 5289:
        TLS Elliptic Curve Cipher Suites with SHA-256/384
        and AES Galois Counter Mode";
}

identity tls-ecdh-rsa-with-aes-256-cbc-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDHE-RSA-WITH-AES-256-CBC-SHA384";
}

```

```

    reference
      "RFC 5289:
        TLS Elliptic Curve Cipher Suites with SHA-256/384
        and AES Galois Counter Mode";
  }

identity tls-ecdh-rsa-with-aes-128-cbc-sha256 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECDH-RSA-WITH-AES-128-CBC-SHA256";
  reference
    "RFC 5289:
      TLS Elliptic Curve Cipher Suites with SHA-256/384
      and AES Galois Counter Mode";
}

identity tls-ecdh-rsa-with-aes-256-cbc-sha384 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECDH-RSA-WITH-AES-256-CBC-SHA384";
  reference
    "RFC 5289:
      TLS Elliptic Curve Cipher Suites with SHA-256/384
      and AES Galois Counter Mode";
}

identity tls-ecdhe-ecdsa-with-aes-128-gcm-sha256 {
  base cipher-suite-alg-base;
  description
    "TLS-ECDHE-ECDSA-WITH-AES-128-GCM-SHA256";
  reference
    "RFC 5289:
      TLS Elliptic Curve Cipher Suites with SHA-256/384
      and AES Galois Counter Mode";
}

identity tls-ecdhe-ecdsa-with-aes-256-gcm-sha384 {
  base cipher-suite-alg-base;
  description
    "TLS-ECDHE-ECDSA-WITH-AES-256-GCM-SHA384";
  reference
    "RFC 5289:
      TLS Elliptic Curve Cipher Suites with SHA-256/384
      and AES Galois Counter Mode";
}

identity tls-ecdh-ecdsa-with-aes-128-gcm-sha256 {

```



```

base cipher-suite-alg-base;
status deprecated;
description
    "TLS-ECDH-ECDSA-WITH-AES-128-GCM-SHA256";
reference
    "RFC 5289:
        TLS Elliptic Curve Cipher Suites with SHA-256/384
        and AES Galois Counter Mode";
}

identity tls-ecdh-ecdsa-with-aes-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-ECDSA-WITH-AES-256-GCM-SHA384";
    reference
        "RFC 5289:
            TLS Elliptic Curve Cipher Suites with SHA-256/384
            and AES Galois Counter Mode";
}

identity tls-ecdhe-rsa-with-aes-128-gcm-sha256 {
    base cipher-suite-alg-base;
    description
        "TLS-ECDHE-RSA-WITH-AES-128-GCM-SHA256";
    reference
        "RFC 5289:
            TLS Elliptic Curve Cipher Suites with SHA-256/384
            and AES Galois Counter Mode";
}

identity tls-ecdhe-rsa-with-aes-256-gcm-sha384 {
    base cipher-suite-alg-base;
    description
        "TLS-ECDHE-RSA-WITH-AES-256-GCM-SHA384";
    reference
        "RFC 5289:
            TLS Elliptic Curve Cipher Suites with SHA-256/384
            and AES Galois Counter Mode";
}

identity tls-ecdh-rsa-with-aes-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-RSA-WITH-AES-128-GCM-SHA256";
    reference
        "RFC 5289:
            TLS Elliptic Curve Cipher Suites with SHA-256/384

```

```

        and AES Galois Counter Mode";
    }

identity tls-ecdh-rsa-with-aes-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-RSA-WITH-AES-256-GCM-SHA384";
    reference
        "RFC 5289:
        TLS Elliptic Curve Cipher Suites with SHA-256/384
        and AES Galois Counter Mode";
}

identity tls-ecdhe-psk-with-rc4-128-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDHE-PSK-WITH-RC4-128-SHA";
    reference
        "RFC 5489:
        ECDHE_PSK Ciphersuites for Transport Layer Security (TLS)
        RFC 6347:
        Datagram Transport Layer Security version 1.2";
}

identity tls-ecdhe-psk-with-3des-ede-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDHE-PSK-WITH-3DES-EDE-CBC-SHA";
    reference
        "RFC 5489:
        ECDHE_PSK Ciphersuites for Transport Layer Security (TLS)";
}

identity tls-ecdhe-psk-with-aes-128-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDHE-PSK-WITH-AES-128-CBC-SHA";
    reference
        "RFC 5489:
        ECDHE_PSK Ciphersuites for Transport Layer Security (TLS)";
}

identity tls-ecdhe-psk-with-aes-256-cbc-sha {
    base cipher-suite-alg-base;
    status deprecated;

```

```

description
  "TLS-ECDHE-PSK-WITH-AES-256-CBC-SHA";
reference
  "RFC 5489:
    ECDHE_PSK Ciphersuites for Transport Layer Security (TLS)";
}

identity tls-ecdhe-psk-with-aes-128-cbc-sha256 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECDHE-PSK-WITH-AES-128-CBC-SHA256";
  reference
    "RFC 5489:
      ECDHE_PSK Ciphersuites for Transport Layer Security (TLS)";
}

identity tls-ecdhe-psk-with-aes-256-cbc-sha384 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECDHE-PSK-WITH-AES-256-CBC-SHA384";
  reference
    "RFC 5489:
      ECDHE_PSK Ciphersuites for Transport Layer Security (TLS)";
}

identity tls-ecdhe-psk-with-null-sha {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECDHE-PSK-WITH-NULL-SHA";
  reference
    "RFC 5489:
      ECDHE_PSK Ciphersuites for Transport Layer Security (TLS)";
}

identity tls-ecdhe-psk-with-null-sha256 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECDHE-PSK-WITH-NULL-SHA256";
  reference
    "RFC 5489:
      ECDHE_PSK Ciphersuites for Transport Layer Security (TLS)";
}

identity tls-ecdhe-psk-with-null-sha384 {
  base cipher-suite-alg-base;

```

```

    status deprecated;
    description
        "TLS-ECDHE-PSK-WITH-NULL-SHA384";
    reference
        "RFC 5489:
        ECDHE_PSK Ciphersuites for Transport Layer Security (TLS)";
}

identity tls-rsa-with-aria-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-WITH-ARIA-128-CBC-SHA256";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-rsa-with-aria-256-cbc-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-WITH-ARIA-256-CBC-SHA384";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-dh-dss-with-aria-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-DSS-WITH-ARIA-128-CBC-SHA256";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-dh-dss-with-aria-256-cbc-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-DSS-WITH-ARIA-256-CBC-SHA384";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to

```

```

        Transport Layer Security (TLS)";
    }

identity tls-dh-rsa-with-aria-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-RSA-WITH-ARIA-128-CBC-SHA256";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-dh-rsa-with-aria-256-cbc-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-RSA-WITH-ARIA-256-CBC-SHA384";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-dhe-dss-with-aria-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-DSS-WITH-ARIA-128-CBC-SHA256";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-dhe-dss-with-aria-256-cbc-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-DSS-WITH-ARIA-256-CBC-SHA384";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-dhe-rsa-with-aria-128-cbc-sha256 {
    base cipher-suite-alg-base;

```

```

    status deprecated;
    description
        "TLS-DHE-RSA-WITH-ARIA-128-CBC-SHA256";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-dhe-rsa-with-aria-256-cbc-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-RSA-WITH-ARIA-256-CBC-SHA384";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-dh-anon-with-aria-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-ANON-WITH-ARIA-128-CBC-SHA256";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-dh-anon-with-aria-256-cbc-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-ANON-WITH-ARIA-256-CBC-SHA384";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-ecdhc-ecdsa-with-aria-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDHE-ECDSA-WITH-ARIA-128-CBC-SHA256";
    reference
        "RFC 6209:

```

```

        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
    }

identity tls-ecdh-eccsa-with-aria-256-cbc-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDHE-ECDSA-WITH-ARIA-256-CBC-SHA384";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-ecdh-eccsa-with-aria-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-ECDSA-WITH-ARIA-128-CBC-SHA256";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-ecdh-eccsa-with-aria-256-cbc-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-ECDSA-WITH-ARIA-256-CBC-SHA384";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-ecdh-eccsa-with-aria-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDHE-RSA-WITH-ARIA-128-CBC-SHA256";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-ecdh-eccsa-with-aria-256-cbc-sha384 {

```

```

base cipher-suite-alg-base;
status deprecated;
description
    "TLS-ECDHE-RSA-WITH-ARIA-256-CBC-SHA384";
reference
    "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-ecdh-rsa-with-aria-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-RSA-WITH-ARIA-128-CBC-SHA256";
    reference
        "RFC 6209:
            Addition of the ARIA Cipher Suites to
            Transport Layer Security (TLS)";
}

identity tls-ecdh-rsa-with-aria-256-cbc-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-RSA-WITH-ARIA-256-CBC-SHA384";
    reference
        "RFC 6209:
            Addition of the ARIA Cipher Suites to
            Transport Layer Security (TLS)";
}

identity tls-rsa-with-aria-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-WITH-ARIA-128-GCM-SHA256";
    reference
        "RFC 6209:
            Addition of the ARIA Cipher Suites to
            Transport Layer Security (TLS)";
}

identity tls-rsa-with-aria-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-WITH-ARIA-256-GCM-SHA384";
    reference

```



```

    "RFC 6209:
      Addition of the ARIA Cipher Suites to
      Transport Layer Security (TLS)";
}

identity tls-dhe-rsa-with-aria-128-gcm-sha256 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-DHE-RSA-WITH-ARIA-128-GCM-SHA256";
  reference
    "RFC 6209:
      Addition of the ARIA Cipher Suites to
      Transport Layer Security (TLS)";
}

identity tls-dhe-rsa-with-aria-256-gcm-sha384 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-DHE-RSA-WITH-ARIA-256-GCM-SHA384";
  reference
    "RFC 6209:
      Addition of the ARIA Cipher Suites to
      Transport Layer Security (TLS)";
}

identity tls-dh-rsa-with-aria-128-gcm-sha256 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-DH-RSA-WITH-ARIA-128-GCM-SHA256";
  reference
    "RFC 6209:
      Addition of the ARIA Cipher Suites to
      Transport Layer Security (TLS)";
}

identity tls-dh-rsa-with-aria-256-gcm-sha384 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-DH-RSA-WITH-ARIA-256-GCM-SHA384";
  reference
    "RFC 6209:
      Addition of the ARIA Cipher Suites to
      Transport Layer Security (TLS)";
}

```

```
identity tls-dhe-dss-with-aria-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-DSS-WITH-ARIA-128-GCM-SHA256";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}
```

```
identity tls-dhe-dss-with-aria-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-DSS-WITH-ARIA-256-GCM-SHA384";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}
```

```
identity tls-dh-dss-with-aria-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-DSS-WITH-ARIA-128-GCM-SHA256";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}
```

```
identity tls-dh-dss-with-aria-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-DSS-WITH-ARIA-256-GCM-SHA384";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}
```

```
identity tls-dh-anon-with-aria-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-ANON-WITH-ARIA-128-GCM-SHA256";
}
```

```

reference
  "RFC 6209:
    Addition of the ARIA Cipher Suites to
    Transport Layer Security (TLS)";
}

identity tls-dh-anon-with-aria-256-gcm-sha384 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-DH-ANON-WITH-ARIA-256-GCM-SHA384";
  reference
    "RFC 6209:
      Addition of the ARIA Cipher Suites to
      Transport Layer Security (TLS)";
}

identity tls-ecdh-ecdsa-with-aria-128-gcm-sha256 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECDH-ECDSA-WITH-ARIA-128-GCM-SHA256";
  reference
    "RFC 6209:
      Addition of the ARIA Cipher Suites to
      Transport Layer Security (TLS)";
}

identity tls-ecdh-ecdsa-with-aria-256-gcm-sha384 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECDH-ECDSA-WITH-ARIA-256-GCM-SHA384";
  reference
    "RFC 6209:
      Addition of the ARIA Cipher Suites to
      Transport Layer Security (TLS)";
}

identity tls-ecdh-ecdsa-with-aria-128-gcm-sha256 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECDH-ECDSA-WITH-ARIA-128-GCM-SHA256";
  reference
    "RFC 6209:
      Addition of the ARIA Cipher Suites to
      Transport Layer Security (TLS)";
}

```

```
identity tls-ecdh-ecdsa-with-aria-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-ECDSA-WITH-ARIA-256-GCM-SHA384";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}
```

```
identity tls-ecdhe-rsa-with-aria-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDHE-RSA-WITH-ARIA-128-GCM-SHA256";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}
```

```
identity tls-ecdhe-rsa-with-aria-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDHE-RSA-WITH-ARIA-256-GCM-SHA384";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}
```

```
identity tls-ecdh-rsa-with-aria-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-RSA-WITH-ARIA-128-GCM-SHA256";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}
```

```
identity tls-ecdh-rsa-with-aria-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
```

```

        "TLS-ECDH-RSA-WITH-ARIA-256-GCM-SHA384";
reference
    "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-psk-with-aria-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-PSK-WITH-ARIA-128-CBC-SHA256";
    reference
        "RFC 6209:
            Addition of the ARIA Cipher Suites to
            Transport Layer Security (TLS)";
}

identity tls-psk-with-aria-256-cbc-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-PSK-WITH-ARIA-256-CBC-SHA384";
    reference
        "RFC 6209:
            Addition of the ARIA Cipher Suites to
            Transport Layer Security (TLS)";
}

identity tls-dhe-psk-with-aria-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-PSK-WITH-ARIA-128-CBC-SHA256";
    reference
        "RFC 6209:
            Addition of the ARIA Cipher Suites to
            Transport Layer Security (TLS)";
}

identity tls-dhe-psk-with-aria-256-cbc-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-PSK-WITH-ARIA-256-CBC-SHA384";
    reference
        "RFC 6209:
            Addition of the ARIA Cipher Suites to
            Transport Layer Security (TLS)";
}

```

```

}

identity tls-rsa-psk-with-aria-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-PSK-WITH-ARIA-128-CBC-SHA256";
    reference
        "RFC 6209:
            Addition of the ARIA Cipher Suites to
            Transport Layer Security (TLS)";
}

identity tls-rsa-psk-with-aria-256-cbc-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-PSK-WITH-ARIA-256-CBC-SHA384";
    reference
        "RFC 6209:
            Addition of the ARIA Cipher Suites to
            Transport Layer Security (TLS)";
}

identity tls-psk-with-aria-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-PSK-WITH-ARIA-128-GCM-SHA256";
    reference
        "RFC 6209:
            Addition of the ARIA Cipher Suites to
            Transport Layer Security (TLS)";
}

identity tls-psk-with-aria-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-PSK-WITH-ARIA-256-GCM-SHA384";
    reference
        "RFC 6209:
            Addition of the ARIA Cipher Suites to
            Transport Layer Security (TLS)";
}

identity tls-dhe-psk-with-aria-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;

```

```

description
  "TLS-DHE-PSK-WITH-ARIA-128-GCM-SHA256";
reference
  "RFC 6209:
    Addition of the ARIA Cipher Suites to
    Transport Layer Security (TLS)";
}

identity tls-dhe-psk-with-aria-256-gcm-sha384 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-DHE-PSK-WITH-ARIA-256-GCM-SHA384";
  reference
    "RFC 6209:
      Addition of the ARIA Cipher Suites to
      Transport Layer Security (TLS)";
}

identity tls-rsa-psk-with-aria-128-gcm-sha256 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-RSA-PSK-WITH-ARIA-128-GCM-SHA256";
  reference
    "RFC 6209:
      Addition of the ARIA Cipher Suites to
      Transport Layer Security (TLS)";
}

identity tls-rsa-psk-with-aria-256-gcm-sha384 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-RSA-PSK-WITH-ARIA-256-GCM-SHA384";
  reference
    "RFC 6209:
      Addition of the ARIA Cipher Suites to
      Transport Layer Security (TLS)";
}

identity tls-ecdhe-psk-with-aria-128-cbc-sha256 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECDHE-PSK-WITH-ARIA-128-CBC-SHA256";
  reference
    "RFC 6209:
      Addition of the ARIA Cipher Suites to

```

```

        Transport Layer Security (TLS)";
    }

identity tls-ecdh-psk-with-aria-256-cbc-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-PSK-WITH-ARIA-256-CBC-SHA384";
    reference
        "RFC 6209:
        Addition of the ARIA Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-ecdh-ecdsa-with-camellia-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-ECDSA-WITH-CAMELLIA-128-CBC-SHA256";
    reference
        "RFC 6367:
        Addition of the Camellia Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-ecdh-ecdsa-with-camellia-256-cbc-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-ECDSA-WITH-CAMELLIA-256-CBC-SHA384";
    reference
        "RFC 6367:
        Addition of the Camellia Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-ecdh-ecdsa-with-camellia-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-ECDSA-WITH-CAMELLIA-128-CBC-SHA256";
    reference
        "RFC 6367:
        Addition of the Camellia Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-ecdh-ecdsa-with-camellia-256-cbc-sha384 {
    base cipher-suite-alg-base;

```



```

    status deprecated;
    description
        "TLS-ECDH-ECDSA-WITH-CAMELLIA-256-CBC-SHA384";
    reference
        "RFC 6367:
        Addition of the Camellia Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-ecdh-rsa-with-camellia-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-RSA-WITH-CAMELLIA-128-CBC-SHA256";
    reference
        "RFC 6367:
        Addition of the Camellia Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-ecdh-rsa-with-camellia-256-cbc-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-RSA-WITH-CAMELLIA-256-CBC-SHA384";
    reference
        "RFC 6367:
        Addition of the Camellia Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-ecdh-rsa-with-camellia-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-RSA-WITH-CAMELLIA-128-CBC-SHA256";
    reference
        "RFC 6367:
        Addition of the Camellia Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-ecdh-rsa-with-camellia-256-cbc-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-RSA-WITH-CAMELLIA-256-CBC-SHA384";
    reference
        "RFC 6367:

```

```

        Addition of the Camellia Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-rsa-with-camellia-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-WITH-CAMELLIA-128-GCM-SHA256";
    reference
        "RFC 6367:
        Addition of the Camellia Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-rsa-with-camellia-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-WITH-CAMELLIA-256-GCM-SHA384";
    reference
        "RFC 6367:
        Addition of the Camellia Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-dhe-rsa-with-camellia-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-RSA-WITH-CAMELLIA-128-GCM-SHA256";
    reference
        "RFC 6367:
        Addition of the Camellia Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-dhe-rsa-with-camellia-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-RSA-WITH-CAMELLIA-256-GCM-SHA384";
    reference
        "RFC 6367:
        Addition of the Camellia Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-dh-rsa-with-camellia-128-gcm-sha256 {

```

```

base cipher-suite-alg-base;
status deprecated;
description
    "TLS-DH-RSA-WITH-CAMELLIA-128-GCM-SHA256";
reference
    "RFC 6367:
        Addition of the Camellia Cipher Suites to
        Transport Layer Security (TLS)";
}

identity tls-dh-rsa-with-camellia-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-RSA-WITH-CAMELLIA-256-GCM-SHA384";
    reference
        "RFC 6367:
            Addition of the Camellia Cipher Suites to
            Transport Layer Security (TLS)";
}

identity tls-dhe-dss-with-camellia-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-DSS-WITH-CAMELLIA-128-GCM-SHA256";
    reference
        "RFC 6367:
            Addition of the Camellia Cipher Suites to
            Transport Layer Security (TLS)";
}

identity tls-dhe-dss-with-camellia-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-DSS-WITH-CAMELLIA-256-GCM-SHA384";
    reference
        "RFC 6367:
            Addition of the Camellia Cipher Suites to
            Transport Layer Security (TLS)";
}

identity tls-dh-dss-with-camellia-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DH-DSS-WITH-CAMELLIA-128-GCM-SHA256";
    reference

```

```

    "RFC 6367:
      Addition of the Camellia Cipher Suites to
      Transport Layer Security (TLS)";
}

identity tls-dh-dss-with-camellia-256-gcm-sha384 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-DH-DSS-WITH-CAMELLIA-256-GCM-SHA384";
  reference
    "RFC 6367:
      Addition of the Camellia Cipher Suites to
      Transport Layer Security (TLS)";
}

identity tls-dh-anon-with-camellia-128-gcm-sha256 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-DH-ANON-WITH-CAMELLIA-128-GCM-SHA256";
  reference
    "RFC 6367:
      Addition of the Camellia Cipher Suites to
      Transport Layer Security (TLS)";
}

identity tls-dh-anon-with-camellia-256-gcm-sha384 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-DH-ANON-WITH-CAMELLIA-256-GCM-SHA384";
  reference
    "RFC 6367:
      Addition of the Camellia Cipher Suites to
      Transport Layer Security (TLS)";
}

identity tls-ecdh-ecc-with-camellia-128-gcm-sha256 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECDH-ECC-WITH-CAMELLIA-128-GCM-SHA256";
  reference
    "RFC 6367:
      Addition of the Camellia Cipher Suites to
      Transport Layer Security (TLS)";
}

```

```
identity tls-ecdh-eccsa-with-camellia-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDHE-ECDSA-WITH-CAMELLIA-256-GCM-SHA384";
    reference
        "RFC 6367:
        Addition of the Camellia Cipher Suites to
        Transport Layer Security (TLS)";
}
```

```
identity tls-ecdh-eccsa-with-camellia-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-ECDSA-WITH-CAMELLIA-128-GCM-SHA256";
    reference
        "RFC 6367:
        Addition of the Camellia Cipher Suites to
        Transport Layer Security (TLS)";
}
```

```
identity tls-ecdh-eccsa-with-camellia-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDH-ECDSA-WITH-CAMELLIA-256-GCM-SHA384";
    reference
        "RFC 6367:
        Addition of the Camellia Cipher Suites to
        Transport Layer Security (TLS)";
}
```

```
identity tls-ecdh-rsa-with-camellia-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDHE-RSA-WITH-CAMELLIA-128-GCM-SHA256";
    reference
        "RFC 6367:
        Addition of the Camellia Cipher Suites to
        Transport Layer Security (TLS)";
}
```

```
identity tls-ecdh-rsa-with-camellia-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDHE-RSA-WITH-CAMELLIA-256-GCM-SHA384";
}
```

```

reference
  "RFC 6367:
    Addition of the Camellia Cipher Suites to
    Transport Layer Security (TLS)";
}

identity tls-ecdh-rsa-with-camellia-128-gcm-sha256 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECDH-RSA-WITH-CAMELLIA-128-GCM-SHA256";
  reference
    "RFC 6367:
      Addition of the Camellia Cipher Suites to
      Transport Layer Security (TLS)";
}

identity tls-ecdh-rsa-with-camellia-256-gcm-sha384 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECDH-RSA-WITH-CAMELLIA-256-GCM-SHA384";
  reference
    "RFC 6367:
      Addition of the Camellia Cipher Suites to
      Transport Layer Security (TLS)";
}

identity tls-psk-with-camellia-128-gcm-sha256 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-PSK-WITH-CAMELLIA-128-GCM-SHA256";
  reference
    "RFC 6367:
      Addition of the Camellia Cipher Suites to
      Transport Layer Security (TLS)";
}

identity tls-psk-with-camellia-256-gcm-sha384 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-PSK-WITH-CAMELLIA-256-GCM-SHA384";
  reference
    "RFC 6367:
      Addition of the Camellia Cipher Suites to
      Transport Layer Security (TLS)";
}

```

```
identity tls-dhe-psk-with-camellia-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-PSK-WITH-CAMELLIA-128-GCM-SHA256";
    reference
        "RFC 6367:
        Addition of the Camellia Cipher Suites to
        Transport Layer Security (TLS)";
}
```

```
identity tls-dhe-psk-with-camellia-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-PSK-WITH-CAMELLIA-256-GCM-SHA384";
    reference
        "RFC 6367:
        Addition of the Camellia Cipher Suites to
        Transport Layer Security (TLS)";
}
```

```
identity tls-rsa-psk-with-camellia-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-PSK-WITH-CAMELLIA-128-GCM-SHA256";
    reference
        "RFC 6367:
        Addition of the Camellia Cipher Suites to
        Transport Layer Security (TLS)";
}
```

```
identity tls-rsa-psk-with-camellia-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-PSK-WITH-CAMELLIA-256-GCM-SHA384";
    reference
        "RFC 6367:
        Addition of the Camellia Cipher Suites to
        Transport Layer Security (TLS)";
}
```

```
identity tls-psk-with-camellia-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
```

```

        "TLS-PSK-WITH-CAMELLIA-128-CBC-SHA256";
    reference
        "RFC 6367:
            Addition of the Camellia Cipher Suites to
            Transport Layer Security (TLS)";
}

identity tls-psk-with-camellia-256-cbc-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-PSK-WITH-CAMELLIA-256-CBC-SHA384";
    reference
        "RFC 6367:
            Addition of the Camellia Cipher Suites to
            Transport Layer Security (TLS)";
}

identity tls-dhe-psk-with-camellia-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-PSK-WITH-CAMELLIA-128-CBC-SHA256";
    reference
        "RFC 6367:
            Addition of the Camellia Cipher Suites to
            Transport Layer Security (TLS)";
}

identity tls-dhe-psk-with-camellia-256-cbc-sha384 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-PSK-WITH-CAMELLIA-256-CBC-SHA384";
    reference
        "RFC 6367:
            Addition of the Camellia Cipher Suites to
            Transport Layer Security (TLS)";
}

identity tls-rsa-psk-with-camellia-128-cbc-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-PSK-WITH-CAMELLIA-128-CBC-SHA256";
    reference
        "RFC 6367:
            Addition of the Camellia Cipher Suites to
            Transport Layer Security (TLS)";
}

```



```
}
```

```
identity tls-rsa-psk-with-camellia-256-cbc-sha384 {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-RSA-PSK-WITH-CAMELLIA-256-CBC-SHA384";  
    reference  
        "RFC 6367:  
        Addition of the Camellia Cipher Suites to  
        Transport Layer Security (TLS)";  
}
```

```
identity tls-ecdhe-psk-with-camellia-128-cbc-sha256 {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-ECDHE-PSK-WITH-CAMELLIA-128-CBC-SHA256";  
    reference  
        "RFC 6367:  
        Addition of the Camellia Cipher Suites to  
        Transport Layer Security (TLS)";  
}
```

```
identity tls-ecdhe-psk-with-camellia-256-cbc-sha384 {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-ECDHE-PSK-WITH-CAMELLIA-256-CBC-SHA384";  
    reference  
        "RFC 6367:  
        Addition of the Camellia Cipher Suites to  
        Transport Layer Security (TLS)";  
}
```

```
identity tls-rsa-with-aes-128-ccm {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description  
        "TLS-RSA-WITH-AES-128-CCM";  
    reference  
        "RFC 6655:  
        AES-CCM Cipher Suites for TLS";  
}
```

```
identity tls-rsa-with-aes-256-ccm {  
    base cipher-suite-alg-base;  
    status deprecated;  
    description
```

```

        "TLS-RSA-WITH-AES-256-CCM";
    reference
        "RFC 6655:
            AES-CCM Cipher Suites for TLS";
}

identity tls-dhe-rsa-with-aes-128-ccm {
    base cipher-suite-alg-base;
    description
        "TLS-DHE-RSA-WITH-AES-128-CCM";
    reference
        "RFC 6655:
            AES-CCM Cipher Suites for TLS";
}

identity tls-dhe-rsa-with-aes-256-ccm {
    base cipher-suite-alg-base;
    description
        "TLS-DHE-RSA-WITH-AES-256-CCM";
    reference
        "RFC 6655:
            AES-CCM Cipher Suites for TLS";
}

identity tls-rsa-with-aes-128-ccm-8 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-WITH-AES-128-CCM-8";
    reference
        "RFC 6655:
            AES-CCM Cipher Suites for TLS";
}

identity tls-rsa-with-aes-256-ccm-8 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-RSA-WITH-AES-256-CCM-8";
    reference
        "RFC 6655:
            AES-CCM Cipher Suites for TLS";
}

identity tls-dhe-rsa-with-aes-128-ccm-8 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-DHE-RSA-WITH-AES-128-CCM-8";

```

```

    reference
      "RFC 6655:
        AES-CCM Cipher Suites for TLS";
  }

identity tls-dhe-rsa-with-aes-256-ccm-8 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-DHE-RSA-WITH-AES-256-CCM-8";
  reference
    "RFC 6655:
      AES-CCM Cipher Suites for TLS";
}

identity tls-psk-with-aes-128-ccm {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-PSK-WITH-AES-128-CCM";
  reference
    "RFC 6655:
      AES-CCM Cipher Suites for TLS";
}

identity tls-psk-with-aes-256-ccm {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-PSK-WITH-AES-256-CCM";
  reference
    "RFC 6655:
      AES-CCM Cipher Suites for TLS";
}

identity tls-dhe-psk-with-aes-128-ccm {
  base cipher-suite-alg-base;
  description
    "TLS-DHE-PSK-WITH-AES-128-CCM";
  reference
    "RFC 6655:
      AES-CCM Cipher Suites for TLS";
}

identity tls-dhe-psk-with-aes-256-ccm {
  base cipher-suite-alg-base;
  description
    "TLS-DHE-PSK-WITH-AES-256-CCM";
  reference

```

```

        "RFC 6655:
          AES-CCM Cipher Suites for TLS";
    }

identity tls-psk-with-aes-128-ccm-8 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-PSK-WITH-AES-128-CCM-8";
    reference
        "RFC 6655:
          AES-CCM Cipher Suites for TLS";
}

identity tls-psk-with-aes-256-ccm-8 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-PSK-WITH-AES-256-CCM-8";
    reference
        "RFC 6655:
          AES-CCM Cipher Suites for TLS";
}

identity tls-psk-dhe-with-aes-128-ccm-8 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-PSK-DHE-WITH-AES-128-CCM-8";
    reference
        "RFC 6655:
          AES-CCM Cipher Suites for TLS";
}

identity tls-psk-dhe-with-aes-256-ccm-8 {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-PSK-DHE-WITH-AES-256-CCM-8";
    reference
        "RFC 6655:
          AES-CCM Cipher Suites for TLS";
}

identity tls-ecdhc-ecdsa-with-aes-128-ccm {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-ECDHc-ECDSA-WITH-AES-128-CCM";
}

```

```

    reference
      "RFC 7251:
        AES-CCM ECC Cipher Suites for TLS";
  }

  identity tls-ecdhe-ecdsa-with-aes-256-ccm {
    base cipher-suite-alg-base;
    status deprecated;
    description
      "TLS-ECDHE-ECDSA-WITH-AES-256-CCM";
    reference
      "RFC 7251:
        AES-CCM ECC Cipher Suites for TLS";
  }

  identity tls-ecdhe-ecdsa-with-aes-128-ccm-8 {
    base cipher-suite-alg-base;
    status deprecated;
    description
      "TLS-ECDHE-ECDSA-WITH-AES-128-CCM-8";
    reference
      "RFC 7251:
        AES-CCM ECC Cipher Suites for TLS";
  }

  identity tls-ecdhe-ecdsa-with-aes-256-ccm-8 {
    base cipher-suite-alg-base;
    status deprecated;
    description
      "TLS-ECDHE-ECDSA-WITH-AES-256-CCM-8";
    reference
      "RFC 7251:
        AES-CCM ECC Cipher Suites for TLS";
  }

  identity tls-eccpwd-with-aes-128-gcm-sha256 {
    base cipher-suite-alg-base;
    status deprecated;
    description
      "TLS-ECCPWD-WITH-AES-128-GCM-SHA256";
    reference
      "RFC 8492:
        Secure Password Ciphersuites for
        Transport Layer Security (TLS)";
  }

  identity tls-eccpwd-with-aes-256-gcm-sha384 {
    base cipher-suite-alg-base;
    status deprecated;

```

```

description
  "TLS-ECCPWD-WITH-AES-256-GCM-SHA384";
reference
  "RFC 8492:
    Secure Password Ciphersuites for
    Transport Layer Security (TLS)";
}

identity tls-eccpwd-with-aes-128-ccm-sha256 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECCPWD-WITH-AES-128-CCM-SHA256";
  reference
    "RFC 8492:
      Secure Password Ciphersuites for
      Transport Layer Security (TLS)";
}

identity tls-eccpwd-with-aes-256-ccm-sha384 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECCPWD-WITH-AES-256-CCM-SHA384";
  reference
    "RFC 8492:
      Secure Password Ciphersuites for
      Transport Layer Security (TLS)";
}

identity tls-sha256-sha256 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-SHA256-SHA256";
  reference
    "RFC 9150:
      TLS 1.3 Authentication and Integrity-Only Cipher Suites";
}

identity tls-sha384-sha384 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-SHA384-SHA384";
  reference
    "RFC 9150:
      TLS 1.3 Authentication and Integrity-Only Cipher Suites";
}

```

```
identity tls-gostr341112-256-with-kuznyechik-ctr-omac {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-GOSTR341112-256-WITH-KUZNYECHIK-CTR-OMAC";
    reference
        "RFC 9189:
        GOST Cipher Suites for Transport Layer Security (TLS)
        Protocol Version 1.2";
}
```

```
identity tls-gostr341112-256-with-magma-ctr-omac {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-GOSTR341112-256-WITH-MAGMA-CTR-OMAC";
    reference
        "RFC 9189:
        GOST Cipher Suites for Transport Layer Security (TLS)
        Protocol Version 1.2";
}
```

```
identity tls-gostr341112-256-with-28147-cnt-imit {
    base cipher-suite-alg-base;
    status deprecated;
    description
        "TLS-GOSTR341112-256-WITH-28147-CNT-IMIT";
    reference
        "RFC 9189:
        GOST Cipher Suites for Transport Layer Security (TLS)
        Protocol Version 1.2";
}
```

```
identity tls-ecdhe-rsa-with-chacha20-poly1305-sha256 {
    base cipher-suite-alg-base;
    description
        "TLS-ECDHE-RSA-WITH-CHACHA20-POLY1305-SHA256";
    reference
        "RFC 7905:
        ChaCha20-Poly1305 Cipher Suites for
        Transport Layer Security (TLS)";
}
```

```
identity tls-ecdhe-ecdsa-with-chacha20-poly1305-sha256 {
    base cipher-suite-alg-base;
    description
        "TLS-ECDHE-ECDSA-WITH-CHACHA20-POLY1305-SHA256";
    reference
```

```

    "RFC 7905:
      ChaCha20-Poly1305 Cipher Suites for
      Transport Layer Security (TLS)";
  }

identity tls-dhe-rsa-with-chacha20-poly1305-sha256 {
  base cipher-suite-alg-base;
  description
    "TLS-DHE-RSA-WITH-CHACHA20-POLY1305-SHA256";
  reference
    "RFC 7905:
      ChaCha20-Poly1305 Cipher Suites for
      Transport Layer Security (TLS)";
}

identity tls-psk-with-chacha20-poly1305-sha256 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-PSK-WITH-CHACHA20-POLY1305-SHA256";
  reference
    "RFC 7905:
      ChaCha20-Poly1305 Cipher Suites for
      Transport Layer Security (TLS)";
}

identity tls-ecdhe-psk-with-chacha20-poly1305-sha256 {
  base cipher-suite-alg-base;
  description
    "TLS-ECDHE-PSK-WITH-CHACHA20-POLY1305-SHA256";
  reference
    "RFC 7905:
      ChaCha20-Poly1305 Cipher Suites for
      Transport Layer Security (TLS)";
}

identity tls-dhe-psk-with-chacha20-poly1305-sha256 {
  base cipher-suite-alg-base;
  description
    "TLS-DHE-PSK-WITH-CHACHA20-POLY1305-SHA256";
  reference
    "RFC 7905:
      ChaCha20-Poly1305 Cipher Suites for
      Transport Layer Security (TLS)";
}

identity tls-rsa-psk-with-chacha20-poly1305-sha256 {
  base cipher-suite-alg-base;
  status deprecated;

```



```

description
  "TLS-RSA-PSK-WITH-CHACHA20-POLY1305-SHA256";
reference
  "RFC 7905:
    ChaCha20-Poly1305 Cipher Suites for
    Transport Layer Security (TLS)";
}

identity tls-ecdhe-psk-with-aes-128-gcm-sha256 {
  base cipher-suite-alg-base;
  description
    "TLS-ECDHE-PSK-WITH-AES-128-GCM-SHA256";
  reference
    "RFC 8442:
      ECDHE_PSK with AES-GCM and AES-CCM Cipher Suites";
}

identity tls-ecdhe-psk-with-aes-256-gcm-sha384 {
  base cipher-suite-alg-base;
  description
    "TLS-ECDHE-PSK-WITH-AES-256-GCM-SHA384";
  reference
    "RFC 8442:
      ECDHE_PSK with AES-GCM and AES-CCM Cipher Suites";
}

identity tls-ecdhe-psk-with-aes-128-ccm-8-sha256 {
  base cipher-suite-alg-base;
  status deprecated;
  description
    "TLS-ECDHE-PSK-WITH-AES-128-CCM-8-SHA256";
  reference
    "RFC 8442:
      ECDHE_PSK with AES-GCM and AES-CCM Cipher Suites";
}

identity tls-ecdhe-psk-with-aes-128-ccm-sha256 {
  base cipher-suite-alg-base;
  description
    "TLS-ECDHE-PSK-WITH-AES-128-CCM-SHA256";
  reference
    "RFC 8442:
      ECDHE_PSK with AES-GCM and AES-CCM Cipher Suites";
}

// Protocol-accessible Nodes

container supported-algorithms {

```

```
config false;
description
  "A container for a list of cipher suite algorithms supported
  by the server.";
leaf-list supported-algorithm {
  type cipher-suite-algorithm-ref;
  description
    "A cipher suite algorithm supported by the server.";
}
}
}
```

<CODE ENDS>

## **Appendix B. Change Log**

This section is to be removed before publishing as an RFC.

### **B.1. 00 to 01**

\*Noted that '0.0.0.0' and ':::' might have special meanings.

\*Renamed "keychain" to "keystore".

### **B.2. 01 to 02**

\*Removed the groupings containing transport-level configuration.  
Now modules contain only the transport-independent groupings.

\*Filled in previously incomplete 'ietf-tls-client' module.

\*Added cipher suites for various algorithms into new 'ietf-tls-common' module.

### **B.3. 02 to 03**

\*Added a 'must' statement to container 'server-auth' asserting that at least one of the various auth mechanisms must be specified.

\*Fixed description statement for leaf 'trusted-ca-certs'.

### **B.4. 03 to 04**

\*Updated title to "YANG Groupings for TLS Clients and TLS Servers"

\*Updated leafref paths to point to new keystore path

\*Changed the YANG prefix for ietf-tls-common from 'tlscom' to 'tlscmn'.

\*Added TLS protocol versions 1.0 and 1.1.

\*Made author lists consistent

\*Now tree diagrams reference ietf-netmod-yang-tree-diagrams

\*Updated YANG to use typedefs around leafrefs to common keystore paths

\*Now inlines key and certificates (no longer a leafref to keystore)

#### **B.5. 04 to 05**

\*Merged changes from co-author.

#### **B.6. 05 to 06**

\*Updated to use trust anchors from trust-anchors draft (was keystore draft)

\*Now Uses new keystore grouping enabling asymmetric key to be either locally defined or a reference to the keystore.

#### **B.7. 06 to 07**

\*factored the tls-[client|server]-groupings into more reusable groupings.

\*added if-feature statements for the new "x509-certificates" feature defined in draft-ietf-netconf-trust-anchors.

#### **B.8. 07 to 08**

\*Added a number of compatibility matrices to Section 5 (thanks Frank!)

\*Clarified that any configured "cipher-suite" values need to be compatible with the configured private key.

#### **B.9. 08 to 09**

\*Updated examples to reflect update to groupings defined in the keystore draft.

\*Add TLS keepalives features and groupings.

\*Prefixed top-level TLS grouping nodes with 'tls-' and support mashups.

\*Updated copyright date, boilerplate template, affiliation, and folding algorithm.

#### **B.10. 09 to 10**

\*Reformatted the YANG modules.

#### **B.11. 10 to 11**

\*Collapsed all the inner groupings into the top-level grouping.

\*Added a top-level "demux container" inside the top-level grouping.

\*Added NACM statements and updated the Security Considerations section.

\*Added "presence" statements on the "keepalive" containers, as was needed to address a validation error that appeared after adding the "must" statements into the NETCONF/RESTCONF client/server modules.

\*Updated the boilerplate text in module-level "description" statement to match copyeditor convention.

#### **B.12. 11 to 12**

\*In server model, made 'client-authentication' a 'presence' node indicating that the server supports client authentication.

\*In the server model, added a 'required-or-optional' choice to 'client-authentication' to better support protocols such as RESTCONF.

\*In the server model, added a 'local-or-external' choice to 'client-authentication' to better support consuming data models that prefer to keep client auth with client definitions than in a model principally concerned with the "transport".

\*In both models, removed the "demux containers", floating the nacm:default-deny-write to each descendant node, and adding a note to model designers regarding the potential need to add their own demux containers.

\*Fixed a couple references (section 2 --> section 3)

#### **B.13. 12 to 13**

\*Updated to reflect changes in trust-anchors drafts (e.g., s/trust-anchors/truststore/g + s/pinned.//)

#### **B.14. 12 to 13**

\*Removed 'container' under 'client-identity' to match server model.

\*Updated examples to reflect change grouping in keystore module.

#### **B.15. 13 to 14**

\*Removed the "certificate" container from "client-identity" in the ietf-tls-client module.

\*Updated examples to reflect ietf-crypto-types change (e.g., identities --> enumerations)

#### **B.16. 14 to 15**

\*Updated "server-authentication" and "client-authentication" nodes from being a leaf of type "ts:certificates-ref" to a container that uses "ts:local-or-truststore-certs-grouping".

#### **B.17. 15 to 16**

\*Removed unnecessary if-feature statements in the -client and -server modules.

\*Cleaned up some description statements in the -client and -server modules.

\*Fixed a canonical ordering issue in ietf-tls-common detected by new pyang.

#### **B.18. 16 to 17**

\*Removed choice local-or-external by removing the 'external' case and flattening the 'local' case and adding a "client-auth-supported" feature.

\*Removed choice required-or-optional.

\*Updated examples to include the "-key-format" nodes.

\*Augmented-in "must" expressions ensuring that locally-defined public-key-format are "ct:tls-public-key-format" (must expr for ref'ed keys are TBD).

#### **B.19. 17 to 18**

\*Removed the unused "external-client-auth-supported" feature.

\*Made client-identity optional, as there may be over-the-top auth instead.

\*Added augment to uses of local-or-keystore-symmetric-key-grouping for a psk "id" node.

\*Added missing presence container "psks" to ietf-tls-server's "client-authentication" container.

\*Updated examples to reflect new "bag" addition to truststore.

- \*Removed feature-limited caseless 'case' statements to improve tree diagram rendering.
- \*Refined truststore/keystore groupings to ensure the key formats "must" be particular values.
- \*Switched to using truststore's new "public-key" bag (instead of separate "ssh-public-key" and "raw-public-key" bags).
- \*Updated client/server examples to cover ALL cases (local/ref x cert/raw-key/psk).

#### **B.20. 18 to 19**

- \*Updated the "keepalives" containers in part to address Michal Vasko's request to align with RFC 8071, and in part to better align to RFC 6520.
- \*Removed algorithm-mapping tables from the "TLS Common Model" section
- \*Removed the 'algorithm' node from the examples.
- \*Renamed both "client-certs" and "server-certs" to "ee-certs"
- \*Added a "Note to Reviewers" note to first page.

#### **B.21. 19 to 20**

- \*Modified the 'must' expression in the "ietf-tls-client:server-authentication" node to cover the "raw-public-keys" and "psks" nodes also.
- \*Added a "must 'ca-certs or ee-certs or raw-public-keys or psks'" statement to the ietf-tls-server:client-authentication" node.
- \*Added "mandatory true" to "choice auth-type" and a "presence" statement to its ancestor.
- \*Expanded "Data Model Overview section(s) [remove "wall" of tree diagrams].
- \*Moved the "ietf-tls-common" module section to proceed the other two module sections.
- \*Updated the Security Considerations section.

#### **B.22. 20 to 21**

\*Updated examples to reflect new "cleartext-" prefix in the crypto-types draft.

#### **B.23. 21 to 22**

\*In both the "client-authentication" and "server-authentication" subtrees, replaced the "psks" node from being a P-container to a leaf of type "empty".

\*Cleaned up examples (e.g., removed FIXMEs)

\*Fixed issues found by the SecDir review of the "keystore" draft.

\*Updated the "psk" sections in the "ietf-tls-client" and "ietf-tls-server" modules to more correctly reflect RFC 4279.

#### **B.24. 22 to 23**

\*Addressed comments raised by YANG Doctor in the ct/ts/ks drafts.

#### **B.25. 23 to 24**

\*Added missing reference to "FIPS PUB 180-4".

\*Added identity "tls-1.3" and updated description statement in other identities indicating that the protocol version is obsolete and enabling the feature is NOT RECOMMENDED.

\*Added XML-comment above examples explaining the reason for the unexpected top-most element's presence.

\*Added missing "client-ident-raw-public-key" and "client-ident-psk" features.

\*Aligned modules with `pyang -f` formatting.

\*Fixed nits found by YANG Doctor reviews.

\*Added a 'Contributors' section.

#### **B.26. 24 to 25**

\*Added TLS 1.3 references.

\*Clarified support for various TLS protocol versions.

\*Moved algorithms in ietf-tls-common (plus more) to IANA-maintained modules



\*Added "config false" lists for algorithms supported by the server.

\*Fixed issues found during YANG Doctor review.

#### **B.27. 25 to 26**

\*Replaced "base64encodedvalue==" with "BASE64VALUE=" in examples.

\*Minor editorial nits

#### **B.28. 26 to 27**

\*Fixed up the 'WG Web' and 'WG List' lines in YANG module(s)

\*Fixed up copyright (i.e., s/Simplified/Revised/) in YANG module(s)

\*Created identityref-based typedef for the IANA alg identity base.

\*Major update to support TLS 1.3.

#### **B.29. 27 to 28**

\*Fixed draft text to refer to new "identity" values (e.g., s/tls-1.3/tls13).

\*Added ietf-tls-common:generate-public-key() RPC.

#### **B.30. 28 to 29**

\*Updated modules to IANA-maintained module in Appendix A to 2022-06-16.

#### **B.31. 29 to 30**

\*Fixed 'must' expressions.

\*Added missing 'revision' statement.

#### **B.32. 30 to 31**

\*Updated per Shepherd reviews impacting the suite of drafts.

#### **B.33. 31 to 32**

\*Updated per Shepherd reviews impacting the suite of drafts.

## **Acknowledgements**

The authors would like to thank for following for lively discussions on list and in the halls (ordered by first name): Alan Luchuk, Andy Bierman, Balazs Kovacs, Benoit Claise, Bert Wijnen, David Lamparter, Dhruv Dhody, Gary Wu, Henk Birkholz, Jeff Hartley, Juergen Schoenwaelder, Ladislav Lhotka, Liang Xia, Martin Bjoerklund, Mehmet Ersue, Michal Vasko, Phil Shafer, Radek Krejci, Sean Turner, and Tom Petch.

## **Contributors**

Special acknowledgement goes to Gary Wu who contributed the "ietf-tls-common" module, and Tom Petch who carefully ensured that references were set correctly throughout.

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