                          YANG Module Library

Abstract

   This document describes a YANG library that provides information
   about all the YANG modules used by a network management server (e.g.,
   a Network Configuration Protocol (NETCONF) server). Simple caching
   mechanisms are provided to allow clients to minimize retrieval of
   this information.

Status of This Memo

   This is an Internet Standards Track document.

   This document is a product of the Internet Engineering Task Force
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   Internet Engineering Steering Group (IESG). Further information on
   Internet Standards is available in Section 2 of RFC 7841.

   Information about the current status of this document, any errata,
   and how to provide feedback on it may be obtained at
   http://www.rfc-editor.org/info/rfc7895.

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1. Introduction

   There is a need for standard mechanisms to identify the YANG modules
   and submodules that are in use by a server that implements YANG data
   models. If a large number of YANG modules are utilized by the
   server, then the YANG library contents needed can be relatively
   large. This information changes very infrequently, so it is
   important that clients be able to cache the YANG library contents and
   easily identify whether their cache is out of date.

   YANG library information can be different on every server and can
   change at runtime or across a server reboot.

   If the server implements multiple protocols to access the YANG-
   defined data, each such protocol has its own conceptual instantiation
   of the YANG library.

   The following information is needed by a client application (for each
   YANG module in the library) to fully utilize the YANG data modeling
   language:

   o name: The name of the YANG module.

   o revision: Each YANG module and submodule within the library has a
      revision. This is derived from the most recent revision statement
      within the module or submodule. If no such revision statement
      exists, the module's or submodule's revision is the zero-length
      string.

   o submodule list: The name and revision of each submodule used by
      the module MUST be identified.

   o feature list: The name of each YANG feature supported by the
      server MUST be identified.

   o deviation list: The name of each YANG module used for deviation
      statements MUST be identified.

1.1. Terminology

   The keywords "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].

   The following terms are defined in [RFC6241]:

   o client

   o server

   The following terms are defined in [YANG1.1]:

   o module

   o submodule

   The following terms are used within this document:

   o YANG library: A collection of YANG modules and submodules used by
      a server.

1.2. Tree Diagrams

   A simplified graphical representation of the data model is used in
   this document. The meaning of the symbols in these diagrams is as
   follows:

   o Brackets "[" and "]" enclose list keys.

   o Abbreviations before data node names: "rw" means configuration
      data (read-write) and "ro" state data (read-only).

   o Symbols after data node names: "?" means an optional node, "!"
      means a presence container, and "*" denotes a list and leaf-list.

   o Parentheses enclose choice and case nodes, and case nodes are also
      marked with a colon (":").

   o Ellipsis ("...") stands for contents of subtrees that are not
      shown.

2. YANG Module Library

   The "ietf-yang-library" module provides information about the YANG
   library used by a server. This module is defined using YANG version
   1, but it supports the description of YANG modules written in any
   revision of YANG.

   Following is the YANG Tree Diagram for the "ietf-yang-library"
   module:

```
+--ro modules-state
   +--ro module-set-id    string
   +--ro module* [name revision]
      +--ro name                 yang:yang-identifier
      +--ro revision             union
      +--ro schema?              inet:uri
      +--ro namespace            inet:uri
      +--ro feature*             yang:yang-identifier
      +--ro deviation* [name revision]
      |  +--ro name        yang:yang-identifier
      |  +--ro revision    union
      +--ro conformance-type     enumeration
      +--ro submodule* [name revision]
         +--ro name        yang:yang-identifier
         +--ro revision    union
         +--ro schema?     inet:uri
```

2.1. modules-state

   This mandatory container holds the identifiers for the YANG data
   model modules supported by the server.

2.1.1. modules-state/module-set-id

   This mandatory leaf contains a unique implementation-specific
   identifier representing the current set of modules and submodules on
   a specific server. The value of this leaf MUST change whenever the
   set of modules and submodules in the YANG library changes. There is
   no requirement that the same set always results in the same "module-
   set-id" value.

This leaf allows a client to fetch the module list once, cache it, and only refetch it if the value of this leaf has been changed.

If the value of this leaf changes, the server also generates a "yang-library-change" notification, with the new value of "module-set-id".

Note that for a NETCONF server that implements YANG 1.1 [YANG1.1], a change of the "module-set-id" value results in a new value for the :yang-library capability defined in [YANG1.1]. Thus, if such a server implements NETCONF notifications [RFC5277], and the notification "netconf-capability-change" [RFC6470], a "netconf-capability-change" notification is generated whenever the "module-set-id" changes.

2.1.2. modules-state/module

This mandatory list contains one entry for each YANG data model module supported by the server. There MUST be an entry in this list for each revision of each YANG module that is used by the server. It is possible for multiple revisions of the same module to be imported, in addition to an entry for the revision that is implemented by the server.

2.2. YANG Library Module

The "ietf-yang-library" module defines monitoring information for the YANG modules used by a server.

The "ietf-yang-types" and "ietf-inet-types" modules from [RFC6991] are used by this module for some type definitions.

<CODE BEGINS> file "ietf-yang-library@2016-06-21.yang"

```
module ietf-yang-library {
  namespace "urn:ietf:params:xml:ns:yang:ietf-yang-library";
  prefix "yanglib";

  import ietf-yang-types {
    prefix yang;
  }
  import ietf-inet-types {
    prefix inet;
  }
```

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

   contact
     "WG Web:   <https://datatracker.ietf.org/wg/netconf/>
      WG List:  <mailto:netconf@ietf.org>

      WG Chair: Mehmet Ersue
                <mailto:mehmet.ersue@nsn.com>

      WG Chair: Mahesh Jethanandani
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      Editor:   Martin Bjorklund
                <mailto:mbj@tail-f.com>

      Editor:   Kent Watsen
                <mailto:kwatsen@juniper.net>";

   description
     "This module contains monitoring information about the YANG
      modules and submodules that are used within a YANG-based
      server.

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      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 Simplified BSD License
      set forth in Section 4.c of the IETF Trust's Legal Provisions
      Relating to IETF Documents
      (http://trustee.ietf.org/license-info).

      This version of this YANG module is part of RFC 7895; see
      the RFC itself for full legal notices.";

   revision 2016-06-21 {
     description
       "Initial revision.";
     reference
       "RFC 7895: YANG Module Library.";
   }
```

```
      /*
       * Typedefs
       */

      typedef revision-identifier {
        type string {
          pattern '\d{4}-\d{2}-\d{2}';
        }
        description
          "Represents a specific date in YYYY-MM-DD format.";
      }

      /*
       * Groupings
       */

      grouping module-list {
        description
          "The module data structure is represented as a grouping
           so it can be reused in configuration or another monitoring
           data structure.";

        grouping common-leafs {
          description
            "Common parameters for YANG modules and submodules.";

          leaf name {
            type yang:yang-identifier;
            description
              "The YANG module or submodule name.";
          }
          leaf revision {
            type union {
              type revision-identifier;
              type string { length 0; }
            }
            description
              "The YANG module or submodule revision date.
               A zero-length string is used if no revision statement
               is present in the YANG module or submodule.";
          }
        }

        grouping schema-leaf {
          description
            "Common schema leaf parameter for modules and submodules.";
```

```
      leaf schema {
        type inet:uri;
        description
          "Contains a URL that represents the YANG schema
           resource for this module or submodule.

           This leaf will only be present if there is a URL
           available for retrieval of the schema for this entry.";
      }
    }

    list module {
      key "name revision";
      description
        "Each entry represents one revision of one module
         currently supported by the server.";

      uses common-leafs;
      uses schema-leaf;

      leaf namespace {
        type inet:uri;
        mandatory true;
        description
          "The XML namespace identifier for this module.";
      }
      leaf-list feature {
        type yang:yang-identifier;
        description
          "List of YANG feature names from this module that are
           supported by the server, regardless of whether they are
           defined in the module or any included submodule.";
      }
      list deviation {
        key "name revision";
        description
          "List of YANG deviation module names and revisions
           used by this server to modify the conformance of
           the module associated with this entry.  Note that
           the same module can be used for deviations for
           multiple modules, so the same entry MAY appear
           within multiple 'module' entries.

           The deviation module MUST be present in the 'module'
           list, with the same name and revision values.
           The 'conformance-type' value will be 'implement' for
           the deviation module.";
        uses common-leafs;
```

```
      }
    leaf conformance-type {
      type enumeration {
        enum implement {
          description
            "Indicates that the server implements one or more
             protocol-accessible objects defined in the YANG module
             identified in this entry.  This includes deviation
             statements defined in the module.

             For YANG version 1.1 modules, there is at most one
             module entry with conformance type 'implement' for a
             particular module name, since YANG 1.1 requires that,
             at most, one revision of a module is implemented.

             For YANG version 1 modules, there SHOULD NOT be more
             than one module entry for a particular module name.";
        }
        enum import {
          description
            "Indicates that the server imports reusable definitions
             from the specified revision of the module but does
             not implement any protocol-accessible objects from
             this revision.

             Multiple module entries for the same module name MAY
             exist.  This can occur if multiple modules import the
             same module but specify different revision dates in
             the import statements.";
        }
      }
      mandatory true;
      description
        "Indicates the type of conformance the server is claiming
         for the YANG module identified by this entry.";
    }
    list submodule {
      key "name revision";
      description
        "Each entry represents one submodule within the
         parent module.";
      uses common-leafs;
      uses schema-leaf;
    }
  }
}
```

```
   /*
    * Operational state data nodes
    */

   container modules-state {
     config false;
     description
       "Contains YANG module monitoring information.";

     leaf module-set-id {
       type string;
       mandatory true;
       description
         "Contains a server-specific identifier representing
          the current set of modules and submodules.  The
          server MUST change the value of this leaf if the
          information represented by the 'module' list instances
          has changed.";
     }

     uses module-list;
   }

   /*
    * Notifications
    */

   notification yang-library-change {
     description
       "Generated when the set of modules and submodules supported
        by the server has changed.";
     leaf module-set-id {
       type leafref {
         path "/yanglib:modules-state/yanglib:module-set-id";
       }
       mandatory true;
       description
         "Contains the module-set-id value representing the
          set of modules and submodules supported at the server at
          the time the notification is generated.";
     }
   }

 }

 <CODE ENDS>
```

3. IANA Considerations

3.1. YANG Module Registry

   This document registers one URI in the "IETF XML Registry" [RFC3688].
   Following the format in RFC 3688, the following registration has been
   made.

      URI: urn:ietf:params:xml:ns:yang:ietf-yang-library
      Registrant Contact: The NETCONF WG of the IETF.
      XML: N/A, the requested URI is an XML namespace.

   This document registers one YANG module in the "YANG Module Names"
   registry [RFC6020].

      name: ietf-yang-library
      namespace: urn:ietf:params:xml:ns:yang:ietf-yang-library
      prefix: yanglib
      reference: RFC 7895

4. Security Considerations

   The YANG module defined in this memo is designed to be accessed via
   the NETCONF protocol [RFC6241]. The lowest NETCONF layer is the
   secure transport layer and the mandatory-to-implement secure
   transport is SSH [RFC6242]. The NETCONF access control model
   [RFC6536] provides the means to restrict access for particular
   NETCONF users to a pre-configured subset of all available NETCONF
   protocol operations and content.

   Some of the readable data nodes in this YANG module may be considered
   sensitive or vulnerable in some network environments. It is thus
   important to control read access (e.g., via get, get-config, or
   notification) to these data nodes. These are the subtrees and data
   nodes and their sensitivity/vulnerability:

   o /modules-state/module: The module list used in a server
      implementation may help an attacker identify the server
      capabilities and server implementations with known bugs. Although
      some of this information may be available to all users via the
      NETCONF <hello> message (or similar messages in other management
      protocols), this YANG module potentially exposes additional
      details that could be of some assistance to an attacker. Server
      vulnerabilities may be specific to particular modules, module
      revisions, module features, or even module deviations. This
      information is included in each module entry. For example, if a
      particular operation on a particular data node is known to cause a
      server to crash or significantly degrade device performance, then

the module list information will help an attacker identify server
      implementations with such a defect, in order to launch a denial-
      of-service attack on the device.

5. References

5.1. Normative References

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