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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

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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so it is important that clients be able to cache the YANG library contents and easily identify whether their cache is out of date.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";

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description

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

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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

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