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February 3, 2016

**YANG Module Library**  
**draft-ietf-netconf-yang-library-04**

## Abstract

This document describes a YANG library, which 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so it is important that clients be able to cache the YANG library contents and easily identify whether their cache is out-of-date.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 run-time 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.

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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 [[RFC6020](#)]:

- 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.

YANG Tree Diagram for "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 submodules
            +-ro submodule* [name revision]
                +-ro name      yang:yang-identifier
                +-ro revision  union
                +-ro schema?   inet:uri
```

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## **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. 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 re-fetch it if the value of this leaf has been changed.

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

Note that for a NETCONF server that implements YANG 1.1 [[I-D.ietf-netmod-rfc6020bis](#)], a change of the "module-set-id" value results in a new value for the :yang-library capability defined in [[I-D.ietf-netmod-rfc6020bis](#)]. 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 every YANG module that is used 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.

RFC Ed.: update the date below with the date of RFC publication and remove this note.

```
<CODE BEGINS> file "ietf-yang-library@2016-02-01.yang"
```

```
module ietf-yang-library {
```

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```
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: <http://tools.ietf.org/wg/netconf/>
     WG List: <mailto:netconf@ietf.org>

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

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    Editor: Andy Bierman
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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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```

This version of this YANG module is part of RFC XXXX; see

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```
the RFC itself for full legal notices.";

// RFC Ed.: replace XXXX with actual RFC number and remove this
// note.

// RFC Ed.: remove this note
// Note: extracted from draft-ietf-netconf-yang-library-04.txt

// RFC Ed.: update the date below with the date of RFC publication
// and remove this note.
revision 2016-02-01 {
    description
        "Initial revision.";
    reference
        "RFC XXXX: 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.";
}
```

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```
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 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 whether they are
            defined in the module or any included submodule.';
```

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```
}

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;
```

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```
description
  "Indicates the type of conformance the server is claiming
   for the YANG module identified by this entry.";
}
container submodules {
  description
  "Contains information about all the submodules used
   by the parent module 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
*/
```

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```
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 is requested to be made.

URI: urn:ietf:params:xml:ns:yang:ietf-yang-library  
Registrant Contact: The NETMOD 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
// RFC Ed.: replace XXXX with RFC number and remove this note
reference:    RFC XXXX
```

### **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](#)]. Authorization for access to specific

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portions of conceptual data and operations within this module is provided by the NETCONF access control model (NACM) [[RFC6536](#)].

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. 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. Acknowledgements**

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## **6. References**

### **6.1. Normative References**

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", [BCP 14](#), [RFC 2119](#), DOI 10.17487/RFC2119, March 1997, <<http://www.rfc-editor.org/info/rfc2119>>.

[RFC3688] Mealling, M., "The IETF XML Registry", [BCP 81](#), [RFC 3688](#), DOI 10.17487/RFC3688, January 2004, <<http://www.rfc-editor.org/info/rfc3688>>.

[RFC6020] Bjorklund, M., Ed., "YANG - A Data Modeling Language for the Network Configuration Protocol (NETCONF)", [RFC 6020](#), DOI 10.17487/RFC6020, October 2010, <<http://www.rfc-editor.org/info/rfc6020>>.

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- [RFC6241] Enns, R., Ed., Bjorklund, M., Ed., Schoenwaelder, J., Ed., and A. Bierman, Ed., "Network Configuration Protocol (NETCONF)", [RFC 6241](#), DOI 10.17487/RFC6241, June 2011, <<http://www.rfc-editor.org/info/rfc6241>>.
- [RFC6242] Wasserman, M., "Using the NETCONF Protocol over Secure Shell (SSH)", [RFC 6242](#), DOI 10.17487/RFC6242, June 2011, <<http://www.rfc-editor.org/info/rfc6242>>.
- [RFC6536] Bierman, A. and M. Bjorklund, "Network Configuration Protocol (NETCONF) Access Control Model", [RFC 6536](#), DOI 10.17487/RFC6536, March 2012, <<http://www.rfc-editor.org/info/rfc6536>>.
- [RFC6991] Schoenwaelder, J., Ed., "Common YANG Data Types", [RFC 6991](#), DOI 10.17487/RFC6991, July 2013, <<http://www.rfc-editor.org/info/rfc6991>>.

## **6.2. Informative References**

- [I-D.ietf-netmod-rfc6020bis]  
Bjorklund, M., "The YANG 1.1 Data Modeling Language", [draft-ietf-netmod-rfc6020bis-09](#) (work in progress), December 2015.
- [RFC5277] Chisholm, S. and H. Trevino, "NETCONF Event Notifications", [RFC 5277](#), DOI 10.17487/RFC5277, July 2008, <<http://www.rfc-editor.org/info/rfc5277>>.
- [RFC6470] Bierman, A., "Network Configuration Protocol (NETCONF) Base Notifications", [RFC 6470](#), DOI 10.17487/RFC6470, February 2012, <<http://www.rfc-editor.org/info/rfc6470>>.

## **Appendix A. Change Log**

-- RFC Ed.: remove this section before publication.

### **A.1. v03 to v04**

- o editorial changes after WGLC
- o one library instance per management protocol
- o removed protocol definitions
- o removed requirements on YANG 1.1 modules (text is moved to [draft-ietf-netmod-rfc6020bis](#))

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- o added notification yang-library-change
- o changed top-level node name from "modules" to "modules-state"
- o changed leaf "conformance" to "conformance-type"

#### A.2. v02 to v03

- o added yang-protocol identity
- o added identities for NETCONF and RESTCONF protocols
- o added yang-protocol leaf-list to /modules
- o added restricted-protocol leaf-list to /modules/module

#### A.3. v01 to v02

- o clarify 'implement' conformance for YANG 1.1 modules

#### A.4. v00 to v01

- o change conformance leaf to enumeration
- o filled in security considerations section

#### A.5. draft-ietf-netconf-restconf-03 to v00

- o moved ietf-yang-library from RESTCONF draft to new draft

### Appendix B. Open Issues

-- RFC Ed.: remove this section before publication.

The YANG Library issue tracker can be found here:

<https://github.com/netconf-wg/yang-library/issues>

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