Abstract

This document describes a constrained version of the YANG library that provides information about the YANG modules, datastores, and datastore schemas used by a constrained network management server (e.g., a CoMI server).

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1. Introduction

There is a need for a standard mechanism to expose which YANG modules, datastores and datastore schemas are in use by a constrained network management server. This document defines the YANG module ‘ietf-constrained-yang-library’ that provides this information.

YANG module ‘ietf-constrained-yang-library’ shares the same data model and objectives as ‘ietf-yang-library’, only datatypes and mandatory requirements have been updated to minimize its size to allow its implementation by Constrained Nodes and/or Constrained Networks as defined by [RFC7228]. To review the list of objectives and proposed data model, please refer to [I-D.ietf-netconf-rfc7895bis] section 2 and 3.

2. Terminology and Notation

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

The following terms are defined in [RFC7950]: client, deviation, feature, module, submodule and server.

The following term is defined in [I-D.ietf-core-yang-cbor]: YANG Schema Item iDentifier (SID).

The following terms are defined in [I-D.ietf-netconf-rfc7895bis]: YANG library and YANG library checksum.
3. Overview

The conceptual model of the YANG library is depicted in Figure 1.

```
+-----------+
| datastore |
+-----------+
  | has a V
+-----------+
  | datastore | union of | module | consists of | modules + |
  | schema    | ----------| set    | ------------| submodules |
+-----------+           +--------+                +------------+
```

Figure 1: Abstract CoMI architecture

It’s expected that most constrained network management servers have one datastore (e.g. a unified datastore). However, some servers may have multiples datastore as described by NMDA [RFC8342]. The YANG library data model supports both cases.

In this model, every datastore has an associated datastore schema, which is the union of module sets, which is a collection of modules. Multiple datastores may refer to the same datastore schema and individual datastore schemas may share module sets.

For each module, the YANG library provide:

- the YANG module identifier (i.e. SID)
- its revision
- its list of submodules
- its list of imported modules
- its set of features and deviations

YANG module namespace and location are also supported, but their implementation is not recommended for constrained servers.

3.1. Tree diagram

The tree diagram of YANG module ietf-constrained-yang-library is provided below. This graphical representation of a YANG module is defined in [RFC8340].
module: ietf-constrained-yang-library
    +--ro yang-library
        +--ro module-set* [index]
            +--ro index uint8
        +--ro module* [identifier]
            +--ro identifier comi:sid
            +--ro revision? revision-identifier
            +--ro namespace? inet:uri
            +--ro location* inet:uri
            +--ro submodule* [identifier]
                +--ro identifier comi:sid
                +--ro revision? revision-identifier
                +--ro location* inet:uri
                +--ro feature* comi:sid
                +--ro deviation* ../../../module/identifier
        +--ro import-only-module* [identifier revision]
            +--ro identifier comi:sid
            +--ro revision union
            +--ro namespace inet:uri
            +--ro location* inet:uri
            +--ro submodule* [identifier]
                +--ro identifier comi:sid
                +--ro revision? revision-identifier
                +--ro location* inet:uri
        +--ro schema* [index]
            +--ro index uint8
        +--ro module-set* ../../../module-set/index
        +--ro datastore* [identifier]
            +--ro identifier ds:datapath-ref
            +--ro schema ../../../schema/index
            +--ro checksum binary

notifications:
    +----n yang-library-update
        +--ro checksum ../../../yang-library/checksum

3.2. Major differences between ietf-constrained-yang-library and ietf-yang-library

The list of changes between the reference data model 'ietf-yang-library' and its constrained version 'ietf-constrained-yang-library' are listed below:

- module-set 'name' and schema 'name' are implemented using an 8 bits unsigned integer and renamed 'index'.
module 'name', submodule 'name' and datastore 'name' are implemented using a SID (i.e. an unsigned integer) and renamed 'identifier'.

'feature' and 'deviation' are implemented using a SID (i.e. an unsigned integer).

'revision' fields are implemented using a 4 bytes binary string.

the mandatory requirement of the 'namespace' fields is removed, and implementation is not recommended. SIDs used by constrained devices and protocols doesn’t require namespaces.

the implementation of the 'location' fields are not recommended, the use of the module SID as the handle to retrieve the associated YANG module is proposed instead.

4. YANG Module "ietf-constrained-yang-library"

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

<CODE BEGINS> file "ietf-constrained-yang-library@2018-01-20.yang"
module ietf-constrained-yang-library {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-constrained-yang-library";
  prefix "yanglib";

  import ietf-comi {
    prefix comi;
    reference "I-D.ietf-core-comi";
  }
  import ietf-inet-types {
    prefix inet;
    reference "RFC 6991: Common YANG Data Types.";
  }
  import ietf-datastores {
    prefix ds;
    reference "RFC 8342: Network Management Datastore Architecture (NMDA).";
  }

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

  contact
    "WG Web: <http://datatracker.ietf.org/wg/core/>"
This module provides information about the YANG modules, datastores, and datastore schemas implemented by a constrained network management server.

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


revision 2018-09-21 {
    description
        "Initial revision.";
    reference
        "I-D.veillette-core-yang-library"
}

/*
 * typedefs
 */

typedef revision-identifier {
    type binary {
        length "4";
    }
    description
        "Revision date encoded as a binary string, each nibble representing
a digit of the revision date. For example, revision 2018-09-21 is encoded as 0x20 0x18 0x09 0x21.
}
/*
 * Groupings
 */
grouping module-identification-leafs {
    description
    "Parameters for identifying YANG modules and submodules."
    leaf identifier {
        type comi:sid;
        mandatory true;
        description
        "SID assigned to this module or submodule.";
    }
    leaf revision {
        type revision-identifier;
        description
        "The YANG module or submodule revision date. If no revision statement is present in the YANG module or submodule, this leaf is not instantiated.";
    }
}

grouping location-leaf-list {
    description
    "Common location leaf list parameter for modules and submodules.";
    leaf-list location {
        type inet:uri;
        description
        "Contains a URL that represents the YANG schema resource for this module or submodule.

        This leaf is present in the model to keep the alignment with 'ietf-yang-library'. Support of this leaf in constrained devices is not necessarily required, nor expected. It is recommended that clients used the module or sub-module SID as the handle used to retrieve the corresponding YANG module";
    }
}

grouping implementation-parameters {
    description

"Parameters for describing the implementation of a module."

leaf-list feature {
    type comir:sid;
    description
        "List of all YANG feature names from this module that are
        supported by the server, regardless whether they are defined
        in the module or any included submodule.";
}

leaf-list deviation {
    type leafref {
        path "../../module/identifier";
    }
    description
        "List of all YANG deviation modules 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.

        This reference MUST NOT (directly or indirectly)
        refer to the module being deviated.

        Robust clients may want to make sure that they handle a
        situation where a module deviates itself (directly or
        indirectly) gracefully.";
}

grouping module-set-parameters {
    description
        "A set of parameters that describe a module set.";

    leaf index {
        type uint8;
        description
            "An arbitrary number assigned of the module set.";
    }

    list module {
        key "identifier";
        description
            "An entry in this list represents a module implemented by the
            server, as per RFC 7950 section 5.6.5, with a particular set
            of supported features and deviations.";
        reference
            "RFC 7950: The YANG 1.1 Data Modeling Language.";

        uses module-identification-leafs;
    }
}
leaf namespace {
  type inet:uri;
  description
    "The XML namespace identifier for this module. This leaf is present in the model to keep the alignment with 'ietf-yang-library'. Support of this leaf in constrained devices is not required, nor expected.";
}

uses location-leaf-list;

list submodule {
  key "identifier";
  description
    "Each entry represents one submodule within the parent module.";
  uses module-identification-leafs;
  uses location-leaf-list;
}

uses implementation-parameters;
}

list import-only-module {
  key "identifier revision";
  description
    "An entry in this list 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 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.";

leaf identifier {
  type comi:sid;
  description
    "The YANG module name.";
}

leaf revision {
  type union {
    type revision-identifier;
    type string {
      length 0;
    }
  }
  description
    "The YANG module revision date.";
}
leaf namespace {
    type inet:uri;
    mandatory true;
    description "The XML namespace identifier for this module. This leaf is present in the model to keep the alignment with 'ietf-yang-library'. Support of this leaf in constrained devices is not required, nor expected.";
}

uses location-leaf-list;

list submodule {
    key "identifier";
    description "Each entry represents one submodule within the parent module."
    uses module-identification-leafs;
    uses location-leaf-list;
}

}  

grouping yang-library-parameters {
    description "The YANG library data structure is represented as a grouping so it can be reused in configuration or another monitoring data structure."

    list module-set {
        key index;
        description "A set of modules that may be used by one or more schemas. A module set does not have to be referentially complete, i.e., it may define modules that contain import statements for other modules not included in the module set."

        uses module-set-parameters;
    }

    list schema {
        key "index";
        description "A datastore schema that may be used by one or more datastores."
The schema must be valid and referentially complete, i.e., it must contain modules to satisfy all used import statements for all modules specified in the schema.

leaf index {
    type uint8;
    description
        "An arbitrary reference number assigned to the schema.";
}

leaf-list module-set {
    type leafref {
        path "../../module-set/index";
    }
    description
        "A set of module-sets that are included in this schema.
        If a non import-only module appears in multiple module sets, then the module revision and the associated features and deviations must be identical.";
}

list datastore {
    key "identifier";
    description
        "A datastore supported by this server.
        Each datastore indicates which schema it supports.
        The server MUST instantiate one entry in this list per specific datastore it supports.
        Each datastore entry with the same datastore schema SHOULD reference the same schema.";

    leaf identifier {
        type ds:datastore-ref;
        description
            "The identity of the datastore.";
    }

    leaf schema {
        type leafref {
            path "../../schema/index";
        }
        mandatory true;
        description
            "A reference to the schema supported by this datastore.
            All non import-only modules of the schema are implemented with their associated features and deviations.";
    }
}
container yang-library {
  config false;
  description
    "Container holding the entire YANG library of this server."
  uses yang-library-parameters;

  leaf checksum {
    type binary;
    mandatory true;
    description
      "A server-generated checksum or digest of the contents of the
      'yang-library' tree. The server MUST change the value of
      this leaf if the information represented by the
      'yang-library' tree, except 'yang-library/checksum', has
      changed.";
  }
}

notification yang-library-update {
  description
    "Generated when any YANG library information on the
    server has changed."

  leaf checksum {
    type leafref {
      path "/yanglib:yang-library/yanglib:checksum";
    }
    mandatory true;
    description
      "Contains the YANG library checksum or digest for the updated
      YANG library at the time the notification is generated.";
  }
}
5. IANA Considerations

5.1. YANG Module Registry

This document registers one YANG module in the YANG Module Names registry [RFC7950].

name: ietf-constrained-yang-library


prefix: lib

reference: RFC XXXX

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

6. Security Considerations

This YANG module is designed to be accessed via the CoMI protocol [I-D.ietf-core-comi]. 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 to these data nodes.

Specifically, the ‘module’ list may help an attacker to 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.

7. Acknowledgments

The YANG module defined by this memo have been derived from an already existing YANG module, ietf-yang-library [I-D.ietf-netconf-rfc7895bis], we will like to thanks to the authors of this YANG module. A special thank also to Andy Bierman for his initial recommendations for the creation of this YANG module.
8. References

8.1. Normative References

[I-D.ietf-core-yang-cbor]

[I-D.ietf-netconf-rfc7895bis]


8.2. Informative References

[I-D.ietf-core-comi]