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M. Veillette, Ed.
Trilliant Networks Inc.
I. Petrov, Ed.
Acklio

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Constrained YANG Module Library
draft-veillette-core-yang-library-05

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 CORECONF server).

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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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 [RFC8525] section 2 and 3.

2. Terminology and Notation

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.

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

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

The following terms are defined in [RFC8525]: YANG library and YANG library checksum.

3. Overview

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

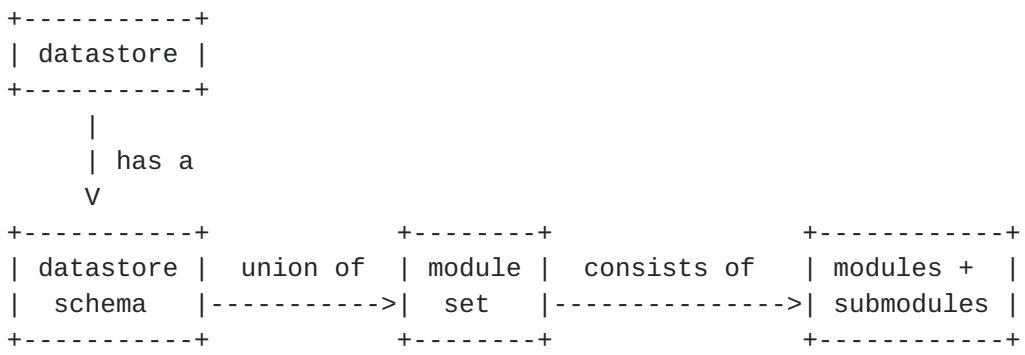

Figure 1: Conceptual model of the YANG library

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 provides:

- 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    sid:sid
     |  |  +--ro revision?     revision-identifier
     |  |  +--ro namespace?    inet:uri
     |  |  +--ro location*     inet:uri
     |  |  +--ro submodule* [identifier]
     |  |  |  +--ro identifier    sid:sid
     |  |  |  +--ro revision?     revision-identifier
     |  |  |  +--ro location*     inet:uri
     |  |  +--ro feature*      sid:sid
     |  |  +--ro deviation*    -> ../../module/identifier
     |  +--ro import-only-module* [identifier revision]
     |     +--ro identifier    sid:sid
     |     +--ro revision      union
     |     +--ro namespace?    inet:uri
     |     +--ro location*     inet:uri
     |     +--ro submodule* [identifier]
     |        +--ro identifier    sid: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:datastore-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 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 don'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@2019-03-28.yang"

```
module ietf-constrained-yang-library {
  yang-version 1.1;
  namespace
    "urn:ietf:params:xml:ns:yang:ietf-constrained-yang-library";
  prefix "yanglib";

  // RFC Ed.: update ietf-core-sid reference.

  import ietf-sid-file {
    prefix sid;
    reference "I-D.ietf-core-sid";
  }
  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/>

        WG List:  <mailto:core@ietf.org>

        WG Chair: Carsten Bormann
                  <mailto:cabo@tzi.org>

        WG Chair: Jaime Jimenez
                  <mailto:jaime.jimenez@ericsson.com>

        Editor:   Michel Veillette
                  <mailto:michel.veillette@trilliantinc.com>";

     description
       "This module provides information about the YANG modules,
        datastores, and datastore schemas implemented by a
        constrained network management server.

        Copyright (c) 2018 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 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 XXXX; see
        the RFC itself for full legal notices.";

     // RFC Ed.: update reference.

     revision 2019-03-28 {
       description
         "Second revision.";
       reference
         "[I-D.veillette-core-yang-library]";
     }

     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 of 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 sid: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 sid: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 sid: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;
          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 datstore 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
             implementedwith their associated features and
             deviations.";
        }
      }
    }

    /*
     * Top-level container
     */

    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.";
      }
    }

    /*
     * Notifications
     */

    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.";
        }
      }
    }
  }
  <CODE ENDS>
```

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

namespace: urn:ietf:params:xml:ns:yang:ietf-constrained-yang-library

prefix: lib

reference: RFC XXXX

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

6. Security Considerations

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 to identify server

implementations with such a defect, in order to launch a denial of service attack on these devices.

7. Acknowledgments

The YANG module defined by this memo have been derived from an already existing YANG module, ietf-yang-library [RFC8525], 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

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8.2. Informative References

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[RFC7228] Bormann, C., Ersue, M., and A. Keranen, "Terminology for Constrained-Node Networks", RFC 7228, DOI 10.17487/RFC7228, May 2014, <https://www.rfc-editor.org/info/rfc7228>.

Authors' Addresses

Michel Veillette (editor)
Trilliant Networks Inc.
610 Rue du Luxembourg
Granby, Quebec J2J 2V2
Canada

Email: michel.veillette@trilliantinc.com

Ivaylo Petrov (editor)
Acklio
1137A avenue des Champs Blancs
Cesson-Sevigne, Bretagne 35510
France

Email: ivaylo@ackl.io