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YANG Instance Data File Format

Abstract

There is a need to document data defined in YANG models at design time, implementation time or when a live server is unavailable. This document specifies a standard file format for YANG instance data, which follows the syntax and semantics of existing YANG models, and annotates it with metadata.

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1. Introduction

There is a need to document data defined in YANG models when a live server is unavailable. Data is often needed at design, implementation time or even later when a live running server is unavailable. To facilitate this offline delivery of data, this document specifies a standard format for YANG instance data sets and YANG instance data files. The format of the instance data set is defined by the "ietf-yang-instance-data" YANG module, see Section 3. The YANG data model in this document conforms to the Network Management Datastore Architecture (NMDA) defined in [RFC8342]

The following is a list of already implemented and potential use cases.

UC1 Documentation of server capabilities

UC2 Preloading default configuration data

UC3 Documenting factory default settings

UC4 Storing the configuration of a device, e.g., for backup, archive or audit purposes

UC5 Storing diagnostics data

UC6 Allowing YANG instance data to potentially be carried within other IPC message formats

UC7 Default instance data used as part of a templating solution

UC8 Providing data examples in RFCs or internet drafts

Appendix C describes the first three use cases in detail.

There are many and varied use cases where YANG instance data could be used. This document does not limit future uses of instance data sets, so specifying how and when to use YANG instance data is out of scope for this document. It is anticipated that other documents will define specific use cases. Use cases are listed only as examples.

1.1. Terminology

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.

Instance Data: A collection of instantiated data nodes.

Instance Data Set: A named set of data items annotated with metadata that can be used as instance data in a YANG data tree.

Instance Data File: A file containing an instance data set formatted according to the rules described in this document.

Content-schema: A set of YANG modules with their revision, supported features, and deviations for which the instance data set contains instance data.

Content defining YANG module: an individual YANG module that is part of the content-schema.

The term "server" is used as defined in [RFC8342].

1.2. Principles

The following is a list of the basic principles of the instance data format:

P1 Two standard formats shall be defined based on the XML and JSON encodings.

P2 Instance data shall reuse existing encoding rules for YANG defined data.

P3 Metadata about the instance data set (Section 2, Paragraph 12) shall be defined.

P4 A YANG instance data set shall be allowed to contain data for multiple YANG modules.

P5 Instance data shall be allowed to contain configuration data, state data, or a mix of the two.

P6 Partial data sets shall be allowed.

P7 The YANG instance data format shall be usable for any data for which YANG module(s) are defined and available to the reader, independent of whether the module is implemented by a server.

P8 It shall be possible to report the identity of the datastore with which the instance data set is associated.

1.3. Delivery of Instance Data

Instance data sets that are produced as a result of some sort of specification or design effort may be available without the need for a live server e.g., via download from the vendor's website, or in any other way that product documentation is distributed.

Other instance data sets may be read from or produced by the YANG server itself e.g., UC5 documenting diagnostic data.

1.4. Data Life cycle

A YANG instance data set is created at a specific point of time. If the data changes afterwards, the instance data set will no longer represent the current data, unless it is updated. The current values may be retrieved at run-time via NETCONF/RESTCONF or received e.g., in YANG-Push notifications.

Whether the instance data changes and if so, when and how, should be described either in the instance data set's description statement or in some other implementation specific manner.

2. Instance Data File Format

A YANG instance data file MUST contain a single instance data set and no additional data.

The format of the instance data set is defined by the "ietf-yang-instance-data" YANG module. It is made up of a header part and content-data. The header part carries metadata for the instance data set. The content-data, defined as an anydata data node, carries the instance data that the user wants to document/provide. The syntax and semantics of content-data is defined by the content-schema.

Two formats are specified based on the XML and JSON YANG encodings. The file formats are achieved by applying the respective XML and JSON encoding rules for the YANG structure included in this document. Later, as other YANG encodings (e.g., CBOR) are defined, further instance data formats may be specified.

The content-data part MUST conform to the content-schema, while allowing for the exceptions listed below. The content-data part SHALL follow the encoding rules defined in [RFC7950] for XML and [RFC7951] for JSON and MUST use UTF-8 character encoding. Content-data MAY include:

* metadata, as defined by [RFC7952].

* origin metadata, as specified in [RFC8526] and [RFC8527]

* implementation specific metadata relevant to individual data nodes. Unknown metadata MUST be ignored by users of instance data, allowing it to be used later for other purposes.

An instance data set MAY contain data for any number of YANG modules; if needed it MAY carry the complete configuration and state data for a server. Default values should be excluded where they do not provide additional useful data.

Configuration ("config true") and operational state data ("config false") MAY be mixed in the instance data file.

Instance data files MAY contain partial data sets. This means "mandatory", "min-elements", "require-instance true", "must" and "when" constraints MAY be violated.

The name of the instance data file SHOULD be of the form (using ABNF notation [RFC5234]):

```
instance-data-set-name ["@" ( revision-date / timestamp ) ]
               ( ".xml" / ".json" )
```

E.g., acme-router-modules.xml
E.g., acme-router-modules@2018-01-25.xml
E.g., acme-router-modules@2018-01-25T15_06_34_3+01_00.json

If the leaf "name" is present in the instance data header, its value SHOULD be used for the "instance-data-set-name" in the filename. If the "revision-date" is present in the filename it MUST conform to the format of the revision-date leaf in the YANG model. If the "revision-date" is present in both the filename and in the instance data header, the revision date in the file name MUST be set to the latest revision date inside the instance data set. If the "timestamp" is present in the filename it MUST conform to the format of the timestamp leaf in the YANG model except for replacing colons as described below. If the "timestamp" is present both in the filename and in the instance data header, the timestamp in the file name SHOULD be set to the timestamp inside the instance data set; any colons, if present, shall be replaced by underscores.

Metadata, information about the data set itself MUST be included. Some metadata items are defined in the YANG module "ietf-yang-instance-data", but other items MAY be used.

Metadata MUST include:

- Version of the YANG Instance Data format (if not explicitly present the default value is used)

Metadata SHOULD include:

- Name of the data set

- Content-schema specification (i.e., the "content-schema" node)

- Description of the instance data set. The description SHOULD contain information whether and how the data can change during the lifetime of the server

- An indication whether default values are included. The default handling uses the concepts defined in [RFC6243], however as only concepts are re-used, users of instance data sets, do not need to support RFC 6243.

2.1. Specifying the Content Schema

To properly understand and use an instance data set, the user needs to know the content-schema. The content-schema can be either

specified in external documents or within the instance data set. In the latter case one of the following methods MUST be used:

Inline method: Include the needed information as part of the instance data set.

Simplified-Inline method: Include the needed information as part of the instance data set; short specification, only the module name and revision-date is used.

URI method: Include a URI that references another YANG instance data file. This instance data file will use the same content-schema as the referenced YANG instance data file. (if you don't want to repeat the info again and again)

Additional methods e.g., a YANG-package based solution may be added later.

Note, the specified content-schema only indicates the set of modules that were used to define this YANG instance data set. Sometimes instance data may be used for a server supporting a different YANG module set (e.g., for the "Preloading default configuration data" use-case, UC2 in Section 1, the instance data set may not be updated every time the YANG modules on the server are updated). Whether an instance data set originally defined using a specific content-schema is usable with a different other schema depends on many factors including the amount of differences and the compatibility between the original and the other schema, considering modules, revisions, features, deviations, the scope of the instance data, etc.

2.1.1. Inline Method

The inline-yang-library anydata data node carries instance data (conforming to ietf-yang-library@2019-01-04) [RFC8525] that specifies the content defining YANG modules including revision, supported features, deviations and any relevant additional data. An example of the "inline" method is provided in Section 2.2.1.

2.1.2. Simplified-Inline Method

The instance data set contains a list of content defining YANG modules including the revision date for each. Usage of this method implies that the modules are used without any deviations and with all features supported. YANG modules that are only required to satisfy import-only dependencies MAY be excluded from the leaf-list. If they are excluded then the consumer of the instance data set has to apply the YANG language rules to resolve the imports. An example of the "simplified-inline" method is provided in Section 2.2.2.

2.1.3. URI Method

The "same-schema-as-file" leaf SHALL contain a URI that references another YANG instance data file. The current instance data file will use the same content-schema as the referenced file.

The referenced instance data file MAY have no content-data if it is used solely for specifying the content-schema.

If a referenced instance data file is unavailable, content-schema is unknown.

The URI method is advantageous when the user wants to avoid the overhead of specifying the content-schema in each instance data file: E.g., In UC6, when the system creates a diagnostic file every minute to document the state of the server.

An example of the "URI" method is provided in Section 2.2.3.

2.2. Examples

2.2.1. Documentation of server capabilities

The example file acme-router-modules@2021-09-16.xml reflects UC1 in Section 1. It provides a list of supported YANG modules and NETCONF capabilities for a server. It uses the "inline" method to specify the content-schema.

The example uses artwork folding [RFC8792].

```
========== NOTE: '\' line wrapping per RFC 8792 ===========

<?xml version="1.0" encoding="UTF-8"?>
<instance-data-set xmlns=\
    "urn:ietf:params:xml:ns:yang:ietf-yang-instance-data">
  <name>acme-router-modules</name>
  <content-schema>
    <inline-yang-library>
      <modules-state \
        xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-library">
        <module>
          <name>ietf-yang-library</name>
          <revision>2019-01-04</revision>
        </module>
        <module>
          <name>ietf-netconf-monitoring</name>
          <revision>2010-10-04</revision>
        </module>
      </modules-state>
    </inline-yang-library>
  </content-schema>
  <revision>
    <date>2020-10-23</date>
    <description>Initial version</description>
  </revision>
  <description>Defines the minimal set of modules that any \
      acme-router will contain. This minimal set will \
      only change when a new SW release is \
      introduced.</description>
  <contact>info@acme.example.com</contact>
  <content-data>
    <modules-state \
        xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-library">
      <module>
        <name>ietf-yang-library</name>
        <revision>2019-01-04</revision>
        <namespace>\
          urn:ietf:params:xml:ns:yang:ietf-yang-library\
        </namespace>
        <conformance-type>implement</conformance-type>
      </module>
      <module>
        <name>ietf-system</name>
        <revision>2014-08-06</revision>
        <namespace>urn:ietf:params:xml:ns:yang:ietf-system</namespace>
        <feature>sys:authentication</feature>
        <feature>sys:local-users</feature>
        <deviation>
          <name>acme-system-ext</name>
```

```
          <revision>2018-08-06</revision>
        </deviation>
        <conformance-type>implement</conformance-type>
      </module>
      <module>
        <name>ietf-netconf-monitoring</name>
        <revision>2010-10-04</revision>
        <namespace>\
          urn:ietf:params:xml:ns:yang:ietf-netconf-monitoring\
        </namespace>
        <conformance-type>implement</conformance-type>
      </module>
      <module>
        <name>ietf-yang-types</name>
        <revision>2013-07-15</revision>
        <namespace>urn:ietf:params:xml:ns:yang:ietf-yang-types\
          </namespace>
        <conformance-type>import</conformance-type>
      </module>
      <module>
        <name>acme-system-ext</name>
        <revision>2018-08-06</revision>
        <namespace>\
          urn:rdns:acme.example.com:oammodel:acme-system-ext\
        </namespace>
        <conformance-type>implement</conformance-type>
      </module>
    </modules-state>
    <netconf-state \
        xmlns="urn:ietf:params:xml:ns:yang:ietf-netconf-monitoring">
      <capabilities>
        <capability>\
          urn:ietf:params:netconf:capability:validate:1.1\
        </capability>
      </capabilities>
    </netconf-state>
  </content-data>
</instance-data-set>
```

Figure 1

2.2.2. Preloading default configuration data

The example file read-only-acm-rules@2021-09-16.xml reflects UC2 in Section 1. It provides a default rule set for a read-only operator role. It uses the "simplified-inline" method for specifying the content-schema.

```
========== NOTE: '\' line wrapping per RFC 8792 ===========

<?xml version="1.0" encoding="UTF-8"?>
<instance-data-set
    xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-instance-data">
  <name>read-only-acm-rules</name>
  <content-schema>
    <module>ietf-netconf-acm@2018-02-14</module>
  </content-schema>
  <revision>
    <date>2018-07-04</date>
    <description>Initial version</description>
  </revision>
  <description>Default access control rules for a read-only \
      role. This set of rules will only change when a new  \
      SW release is introduced.</description>
  <content-data>
    <nacm xmlns="urn:ietf:params:xml:ns:yang:ietf-netconf-acm">
      <enable-nacm>true</enable-nacm>
      <read-default>deny</read-default>
      <exec-default>deny</exec-default>
      <rule-list>
        <name>read-only-role</name>
        <group>read-only-group</group>
        <rule>
          <name>read-all</name>
          <module-name>*</module-name>
          <access-operation>read</access-operation>
          <action>permit</action>
        </rule>
      </rule-list>
    </nacm>
  </content-data>
</instance-data-set>
```

Figure 2

2.2.3. Storing diagnostics data

The example file acme-router-netconf-diagnostics@2018-01-25T17_00_38Z.json reflects UC5 in Section 1. An instance data set is produced by the server every 15 minutes that contains statistics about the NETCONF server. As a new set is produced periodically many times a day a revision-date would be useless; instead a timestamp is included.

```
========== NOTE: '\' line wrapping per RFC 8792 ===========

{
  "ietf-yang-instance-data:instance-data-set": {
    "name": "acme-router-netconf-diagnostics",
    "content-schema": {
      "same-schema-as-file": "file:///acme-diagnostics-schema.json"
    },
    "timestamp": "2018-01-25T17:00:38Z",
    "description":  ["NETCONF statistics, \
        The data may change at any time."],
    "content-data": {
      "ietf-netconf-monitoring:netconf-state": {
        "statistics": {
          "netconf-start-time ": "2018-12-05T17:45:00Z",
          "in-bad-hellos ": "32",
          "in-sessions ": "397",
          "dropped-sessions ": "87",
          "in-rpcs ": "8711",
          "in-bad-rpcs ": "408",
          "out-rpc-errors ": "408",
          "out-notifications": "39007"
        }
      }
    }
  }
}
```

Figure 3

3. YANG Instance Data Model

3.1. Tree Diagram

The following tree diagram [RFC8340] provides an overview of the data model.

```
module: ietf-yang-instance-data

  structure instance-data-set:
    +-- name?                string
    +-- format-version?      string
    +-- includes-defaults?   enumeration
    +-- content-schema
    |  +-- (content-schema-spec)?
    |     +--:(simplified-inline)
    |     |  +-- module*                module-with-revision-date
    |     +--:(inline)
    |     |  +-- inline-yang-library    <anydata>
    |     +--:(uri)
    |        +-- same-schema-as-file?   inet:uri
    +-- description*         string
    +-- contact?             string
    +-- organization?        string
    +-- datastore?           ds:datastore-ref
    +-- revision* [date]
    |  +-- date           string
    |  +-- description?   string
    +-- timestamp?           yang:date-and-time
    +-- content-data?        <anydata>
```

3.2. YANG Model

This YANG module imports typedefs from [RFC6991], [RFC6243], identities from [RFC8342] and the "structure" extension from [RFC8791]. It also references [RFC8525].

```
<CODE BEGINS> file "ietf-yang-instance-data@2021-09-16.yang"

// RFC Ed.: replace the date above if the module gets changed in
//any way during reviews or RFC editor process and remove this note
module ietf-yang-instance-data {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-yang-instance-data";
  prefix yid;

  import ietf-yang-structure-ext {
    prefix sx;
    reference
      "YANG Data Structure Extensions:
       draft-ietf-netmod-yang-data-ext-05";
  }
  import ietf-datastores {
    prefix ds;
    reference
      "RFC 8342: Network Management Datastore Architecture (NMDA)";
  }
  import ietf-inet-types {
    prefix inet;
    reference
      "RFC 6991: Common YANG Data Types";
  }
  import ietf-yang-types {
    prefix yang;
    reference
      "RFC 6991: Common YANG Data Types";
  }

  import ietf-netconf-with-defaults {
    prefix ncwd;
    reference
      "RFC 6243: With-defaults Capability for NETCONF";
  }

  organization
    "IETF NETMOD Working Group";
  contact
    "WG Web:   <https://datatracker.ietf.org/wg/netmod/>
     WG List:  <mailto:netmod@ietf.org>

     Author:  Balazs Lengyel
        <mailto:balazs.lengyel@ericsson.com>

     Author:  Benoit Claise
        <mailto:benoit.claise@huawei.com>";
  description
```

```
  "The module defines the structure and content of YANG
   instance data sets.

   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 (RFC 2119)
   (RFC 8174) when, and only when, they appear in all
   capitals, as shown here.

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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 XXXX; see
   the RFC itself for full legal notices.";
// RFC Ed.: replace XXXX with RFC number and remove this note

revision 2021-09-16 {
  // RFC Ed.: replace the date above if the module gets changed in
  // anyway during reviews or RFC editor process and remove
  //this note
  description
    "Initial revision.";
  reference
    "RFC XXXX: YANG Instance Data Format";
  // RFC Ed.: replace XXXX with RFC number and remove this note
}

typedef module-with-revision-date {
  type string {
    pattern '[a-zA-Z_][a-zA-Z0-9\-_.]*'
          + '(@\d{4}-(1[0-2]|0[1-9])-(0[1-9]|[1|2][0-9]|3[0-1]))?';
    pattern '.|..|[^xX].*|.[^mM].*|..[^lL].*';
  }
  description
    "A type defining a module name and an optional revision
     date, e.g. ietf-yang-library@2019-01-04";
}

sx:structure "instance-data-set" {
  description
    "A data structure to define a format for YANG instance
```

```
   data. The majority of the YANG nodes provide meta-data
   about the instance data; the instance data itself is
   contained only in the 'content-data' node.";
leaf name {
  type string;
  description
    "An arbitrary name for the YANG instance data set.  This
     value is primarily used for descriptive purposes.  However,
     when the instance data set is saved to a file, then the
     filename MUST encode the name's value, per Section 2
     of RFC XXXX.";
  // RFC Ed.: replace XXXX with RFC number and remove this note
}
leaf format-version {
  type string {
    pattern '\d{4}-(1[0-2]|0[1-9])-(0[1-9]|[1|2][0-9]|3[0-1])';
  }
  default "2021-09-16";
  // RFC Ed.: replace the date above if the module gets changed
  // in anyway during reviews or RFC editor process and remove
  // this note
  description
    "The 'revision' of the 'ietf-yang-instance-data' module
     used to encode this 'instance-data-set'.";
}
leaf includes-defaults {
  type ncwd:with-defaults-mode;
  default report-all;
  description "
    Indicates how data nodes with default values are
    represented for all data nodes contained in the
    instance-data-set.

    It uses the same definitions as per section 3 of RFC 6243,
    but applied in the context of an instance data file rather
    than a NETCONF request using the <with-defaults>
    parameter.

    For JSON files, the encoding of the 'report-all-tagged'
    option is as defined in section 4.8.9 of RFC 8040.";
  reference "With-defaults Capability for NETCONF, RFC 6243.";
}
container content-schema {
  description
    "The content schema (i.e., YANG modules) used to create
     the instance data set.
     If not present the user needs to obtain the information
     through external documents.";
  choice content-schema-spec {
```

```
description
  "Specification of the content-schema.";
case simplified-inline {
  leaf-list module {
    type module-with-revision-date;
    min-elements 1;
    description
      "The list of content defining YANG modules.

       The value SHALL start with the module name.
       If the module contains a revision statement the
       revision date SHALL be included in the leaf-list
       entry.

       E.g., ietf-yang-library@2019-01-04

       Usage of this leaf-list implies the modules are
       used without any deviations and with all features
       supported. Multiple revisions of the same module
       MUST NOT be specified.";
  }
}
case inline {
  anydata inline-yang-library {
    mandatory true;
    description
      "Instance data corresponding to the
       ietf-yang-library@2019-01-04 defining
       the set of content defining YANG modules for
       this instance-data-set.";
  }
}
case uri {
  leaf same-schema-as-file {
    type inet:uri;
    description
      "A reference to another YANG instance data file.
       This instance data file uses the same
       content schema as the referenced file.

       Referenced files using the 'inline' or the
       'simplified-inline' methods MUST be supported.
       Referenced files using the 'URI Method' MAY be
       supported.

       The URL schemes 'file://' and 'https://' MUST
       be supported, other schemes MAY also be
       supported.";
  }
```

```
    }
  }
}
leaf-list description {
  type string;
  description
    "Description of the instance data set.";
}
leaf contact {
  type string;
  description
    "Contact information for the person or
     organization to whom queries concerning this
     instance data set should be sent.";
}
leaf organization {
  type string;
  description
    "Organization responsible for the instance
     data set.";
}
leaf datastore {
  type ds:datastore-ref;
  description
    "The identity of the datastore with which the
     instance data set is associated, e.g., the datastore from
     where the data was read or the datastore into which the data
     may be loaded or the datastore which is being documented.
     If a single specific datastore cannot be specified, the
     leaf MUST be absent.

     If this leaf is absent, then the datastore to which the
     instance data belongs is unspecified.";
}
list revision {
  key "date";
  description
    "Instance data sets that are produced as
     a result of some sort of specification or design effort
     SHOULD have at least one revision entry.  For every
     published editorial change, a new unique revision SHOULD
     be added in front of the revisions sequence so that all
     revisions are in reverse chronological order.

     In case of instance data sets that are read from
     or produced by a server or otherwise subject to
     frequent updates or changes, revision
     SHOULD NOT be present";
  leaf date {
```

```
        type string {
          pattern '\d{4}-(1[0-2]|0[1-9])-(0[1-9]|[1|2][0-9]|3[0-1])';
        }
        description
          "Specifies the date the instance data set
           was last modified. Formatted as YYYY-MM-DD";
      }
      leaf description {
        type string;
        description
          "Description of this revision of the instance data set.";
      }
    }
    leaf timestamp {
      type yang:date-and-time;
      description
        "The date and time when the instance data set
         was last modified.

         In case of instance data sets that are read from or
         produced by a server or otherwise subject to frequent
         updates or changes, timestamp SHOULD be present.

         If both a revision list entry and timestamp are present
         the timestamp SHOULD contain the same date as the
         latest revision statement.";
    }
    anydata content-data {
      description
        "Contains the real instance data.
         The data MUST conform to the relevant YANG modules
         specified either in the content-schema or in some other
         implementation specific manner.";
    }
  }
}

<CODE ENDS>
```

4. Security Considerations

The YANG module defined in this document only defines a wrapper structure specifying a format and a metadata header for YANG instance data defined by the content-schema. Because of this the security considerations template for YANG models in section 3.7.1 in [RFC8407] is not followed. The instance data is designed to be

accessed as a stored file or over any file access method or protocol.

The document does not specify any method to influence the behavior of a server.

The header part is usually not security sensitive, however sensitive information may be included, in which case it needs to be handled securely as mentioned below. Information to consider includes:

*If the URI method is used for specification of the content-schema and the URI includes a userinfo subcomponent

*Any description text

The content part may contain sensitive data. The security sensitivity of this data is completely dependent on the content-schema. Depending on the nature of the instance data, instance data files MAY need to be handled securely. The same kind of handling should be applied to this file at-rest and in-transit that would be needed for the result of a read operation returning the same data. These in-transit protection mechanisms will also mitigate integrity issues when transporting the file.

Instance data files should be protected against modification or unauthorized access using normal file handling mechanisms. Care should be taken, when copying the original files or providing file access for additional users, not to reveal information unintentionally.

If the URI method is used for specification of the content-schema, there is a risk that the config schema section in the referenced YANG instance data file may be altered maliciously or even as part of its normal handling. In this case the content-schema might differ from the one expected. Protecting the integrity and stability of the referenced file should be ensured.

5. IANA Considerations

This document registers one URI and one YANG module.

5.1. URI Registration

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-instance-data
Registrant Contact: The IESG.
XML: N/A, the requested URI is an XML namespace.

5.2. YANG Module Name Registration

This document registers one YANG module in the YANG Module Names registry [RFC6020]. Following the format in [RFC6020], the following registrations are requested:

```
name: ietf-yang-instance-data
namespace: urn:ietf:params:xml:ns:yang:ietf-yang-instance-data
prefix: yid
reference: RFC XXXX
// RFC Ed.: replace XXXX with RFC number and remove this note
```

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Appendix A. Changes between revisions

RFC Ed.: Remove section "Changes between revisions"

v20 - v21

- *Minor updates for IESG comments
- *Added ABNF as a normative reference for the filename's definition.
- *Enhanced security considerations
- *Added data change information to the description of the examples.

v19 - v20

* Minor updates for IESG comments

v18 - v19

* Updated leaf includes-defaults

v17 - v18

* Added the report-all-tagged mode to the leaf includes-defaults

v16 - v17

* Removed default statement from includes-default

v15 - v16

* Editorial changes

v14 - v15

* Removed reference to revision-label

* For the inline method made the usage of ietf-yang-library@2019-01-04 mandatory. Simplified the case "inline" in the YANG module.

* Removed the "inline-module" leaf as it does not carry useful information anymore.

* Removed YANG feature

v13 - v14

* Added leaf includes-defaults

* Many small changes based on AD review

v09 - v13

* Editorial updates

v08 - v09

* Removed statement "the format will be similar to the response of a NETCONF get operation"

* Introduced artwork folding in the examples

v07 - v08

* Moved compatibility into appendix

* Renamed yid-version to format-version. Changed format to date of the YANG module

* Made support of ietf-yang-library mandatory if inline-content-schema is supported

* Many small changes based on WGLC

v06 - v07

* Updated terminology, use-cases

* Many small changes based on WGLC

v05 - v06

* Modified module name format, removed .yin or .yang extension

* Removed pattern for module and inline-module. The usage of revision-label should also be allowed.

v04 - v05

* Updated according to YANG-Doctor review

* Updated security considerations

* Added a wrapping container for the schema, and renamed the data nodes in the inline and uri cases.

* Allowed .yin for simplified-inline schema naming. Made date optional if it is unavailable in the YANG module.

* Added a mandatory yid-version to the header metadata to allow later updates of the module.

v03 - v04

* removed entity-tag and last-modified timestamp

* Added simplified-inline method of content-schema specification

v02 - v03

* target renamed to "content-schema" and "content defining YANG module(s)"

*Made name of instance data set optional

*Updated according to draft-ietf-netmod-yang-data-ext-03

*Clarified that entity-tag and last-modified timestamp are encoded as metadata. While they contain useful data, the HTTP-header based encoding from Restconf is not suitable.

v01 - v02

*Removed design time from terminology

*Defined the format of the content-data part by referencing various RFCs and drafts instead of the result of the get-data and get operations.

*Changed target-ptr to a choice

*Inline target-ptr may include augmenting modules and alternatives to ietf-yang-library

*Moved list of target modules into a separate <target-modules> element.

*Added backwards compatibility considerations

v00 - v01

*Added the target-ptr metadata with 3 methods

*Added timestamp metadata

*Removed usage of dedicated .yid file extension

*Added list of use cases

*Added list of principles

*Updated examples

*Moved detailed use case descriptions to appendix

Appendix B. Backwards Compatibility

The concept of backwards compatibility and what changes are backwards compatible are not defined for "instance data sets" as it is highly dependent on the specific use case and the content-schema.

In case of "instance data sets" that are the result of design or specification activity, some changes that may be good to avoid are listed below.

YANG uses the concept of managed entities identified by key values; if the connection between the represented entity and the key value is not preserved during an update, this may lead to the following problems.

- If the key value of a list entry that represents the same managed entity as before is changed, the user may mistakenly identify the list entry as new.

- If the meaning of a list entry is changed, but the key values are not (e.g., redefining an alarm-type but not changing its alarm-type-id) the change may not be noticed.

- If the key value of a previously removed list entry is reused for a different entity, the change may be misinterpreted as reintroducing the previous entity.

Appendix C. Detailed Use Cases

This section is non-normative.

C.1. Use Case 1: Early Documentation of Server Capabilities

A server has a number of server-capabilities that are defined in YANG modules and can be retrieved from the server using protocols like NETCONF or RESTCONF. Server capabilities include:

- data defined in "ietf-yang-library": YANG modules, submodules, features, deviations, schema-mounts, and datastores supported ([RFC8525])

- alarms supported ([RFC8632])

- data nodes and subtrees that support or do not support on-change notifications ([RFC8641])

- netconf-capabilities in ietf-netconf-monitoring.

While it is good practice to allow a client to query these capabilities from the live server, that is often not possible.

Often when a network node is released, an associated NMS (network management system) is also released with it. The NMS depends on the capabilities of the server. During NMS implementation, information about server capabilities is needed. If the information is unavailable early in some offline document, but only as instance data from the live network node, the NMS implementation will be delayed, because it has to wait until the network node is ready. Also assuming that all NMS implementors will have a correctly

configured network nodes from which data can be retrieved, is a very expensive proposition. (An NMS may handle dozens of node types.)

Network operators often build their own home-grown NMS systems that need to be integrated with a vendor's network node. The operator needs to know the network node's server capabilities in order to do this. Moreover, the network operator's decision to buy a vendor's product may even be influenced by the network node's OAM feature set documented as the server's capabilities.

Beside NMS implementors, system integrators and many others also need the same information early. Examples could be model driven testing, generating documentation, etc.

Most server-capabilities are relatively stable and change only during upgrade or due to licensing or the addition or removal of hardware. They are usually defined by a vendor at design time, before the product is released. It is feasible and advantageous to define/document them early e.g., in a YANG instance data File.

It is anticipated that a separate IETF document will define in detail how and which set of server capabilities should be documented.

C.2. Use Case 2: Preloading Data

There are parts of the configuration that must be fully configurable by the operator. However, often a simple default configuration will be sufficient.

One example is access control groups/roles and related rules. While a sophisticated operator may define dozens of different groups, often a basic (read-only operator, read-write system administrator, security-administrator) triplet will be enough. Vendors will often provide such default configuration data to make device configuration easier for an operator.

The device vendor may define a set of default groups (/nacm:nacm/groups) and rules for these groups to access specific parts of the common models (/nacm:nacm/rule-list/rule).

YANG instance data files can be used to document and/or preload the default configuration.

C.3. Use Case 3: Documenting Factory Default Settings

Nearly every server has a factory default configuration. If the system is really badly misconfigured or if the current configuration is to be abandoned, the system can be reset to the default factory configuration.

YANG instance data can be used to document the factory default configuration. See [RFC8808].

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