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YANG Instance Data Files and their use for Documenting Server
Capabilities
draft-lengyel-netmod-yang-instance-data-00

Abstract

This document specifies a standard file format for YANG instance data, that is data that could be stored in a datastore and whose syntax and semantics is defined by YANG models. Instance data files can be used to provide information that is defined in design time. There is a need to document Server capabilities (which are often specified in design time), which should be done using instance data files.

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YANG Instance Data

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1. Terminology

Instance Data Set: A named set of data items 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.

2. Introduction

A YANG server has a number of server-capabilities that can be retrieved from the server using protocols like NETCONF or RESTCONF. YANG server capabilities include among other things

- o data defined in ietf-yang-library (YANG modules, submodules, features, deviations, schema-mounts)
- o datastores supported
- o alarms supported ([draft-vallin-ccamp-alarm-module](#))
- o data nodes, subtrees that support or do not support on-change notifications ([draft-ietf-netconf-yang-push](#))-
- o netconf-capabilities
- o etc.

While it is good practice to allow a client to query these capabilities from the live YANG server, that is often not enough. Many of these server-capabilities are relatively stable. They may change

1. only at upgrade, or
2. rarely (e.g. due to licensing), or
3. more frequently

Most capabilities belong to type 1), some to type 2) and a relatively small set to type 3). Many network nodes only have type 1) or type 1+2) capabilities. Stable capabilities are usually defined by a vendor in design time, before the product is released. While these

capabilities can be retrieved from the live server in run-time, there is a strong need to provide the same data already during design time. (Often only a part of all the server capabilities can be made available.)

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 YANG server. During NMS implementation the information about server capabilities is needed. If the information is not available early in some off-line document, but only as instance data from the network node, the NMS implementation will be delayed, because it has to wait for the network node to be ready. Also assuming that all NMS implementors will have a correctly configured network node available to retrieve data from, is a very expensive proposition. (An NMS may handle dozens of node types.)

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

This document specifies a file format for YANG instance data and proposes to use it to provide server capability information, allowing vendors to specify capabilities together with the YANG modules.

The same instance data file format can be used for other purposes, like providing initial data for any YANG module. E.g. a basic set of access control groups can be provided either by a device vendor or an operator using a network device.

[2.1.](#) Data Life cycle

Data defined or documented in YANG Instance Data Sets may be used for preloading a YANG server with this data, but the server may populate the data without using the actual file in which case the Instance Data File is only used as documentation.

While such data will usually not change, a data documented by Instance Data Files MAY be changed by the YANG server itself or by management operations. It is out of scope for this document to specify a method to prevent this.

Notifications about the change of data documented by Instance Data Sets may be supplied by e.g. the Yang-Push mechanism, but it is out of scope for this document.

[2.2.](#) Use Case 1: Early Documentation of Server Capabilities

An operator wants to integrate his own in-house built management system with the network node from ACME Systems. The management integration must be ready by the time the first AcmeRouter 9000 is installed in the network. To do the integration the operator needs the the list of supported YANG modules and features. While this list could be read from the ietf-yang-library via Netconf, in order to allow time for developing the management integration, the operator demands this information early. The operator will value that this information is available in a standard format, that is actually the same format he can later read from the node via Netconf.

[2.3.](#) Use Case 2: Preloading Data

Defining Access control data is a complex task. To help with this the device vendor pre-defines some of the data. Among others a set of default groups (/nacm:nacm/nacm:groups) are defined e.g. "read-only", "operator", "sys-admin". The operator will often use these default groups, but is also free to completely remove them and define his own set of groups.

[3.](#) Instance Data File Format

Two standard formats to represent YANG Instance Data are specified based on the XML and JSON serialization. The XML format is defined in [[RFC7950](#)] while the JSON format is defined in [[RFC7951](#)] with the additions below.

For both formats data is placed in a top level auxiliary container named "instance-data". The purpose of the container, which is not part of the real data itself, is to contain the potentially multiple top level XML elements and to carry meta-data for the complete instance-data-set.

The XML format SHALL follow the format returned for a NETCONF GET operation. The <instance-data> container SHALL contain all data that would be inside the <data> wrapper element. XML attributes SHOULD NOT be used, however if a SW receiving a YANG instance data file encounters XML attributes it MUST discard them silently, allowing them to be used later for other purposes.

The JSON format SHALL follow the format of the reply returned for a RESTCONF GET request directed at the datastore resource: {+restconf}/data. ETags and Timestamps SHOULD NOT be included.

A YANG Instance data file MUST contain a single instance data set. Instance data MUST conform to the corresponding YANG Modules.

Default values SHOULD NOT but MAY be included. Config=true and config=false data may be mixed in the instance data file. Instance data files MAY contain partial data sets. This means mandatory, min-elements or require-instance=true constrains MAY be violated.

Meta data, information about the data set itself SHALL be included in the instance data file. Metadata SHALL be formulated following [\[RFC7952\]](#) using the annotations defined in module ietf-yang-instance-data-annotations. All metadata SHOULD be connected to the top level "instance-data" container. Meta data SHALL include:

- o Name of the instance data set
- o Revision date of the instance data set (later a semantic version MAY also be included)
- o Description of the instance data set. The description SHOULD contain information whether and how the data can change during the lifetime of the network element.

Any other metadata may also be included after these items.

```

<instance-data xmlns:ida=
  "urn:ietf:params:xml:ns:yang:ietf-yang-instance-data-annotations"
  ida:instance-data-set="acme-router-modules"
  ida:revision="2108-01-25"
  ida:description="Defines the minimal set of modules that any acme
    will contain. These modules will always be present."
  ida:contact="info@acme.com">
<modules xmlns="urn:ietf:params:xml:ns:yang:ietf-yang-library">
  <module>
    <name>ietf-system</>
    <revision>2014-08-06</revision>
    <!-- description "A later revision may be used."; -->
    <namespace>urn:ietf:params:xml:ns:yang:ietf-system</namespace>
    <conformance-type>implement</conformance-type>
    <feature>authentication</feature>
    <feature>radius-authentication</feature>
  </module>
</modules>
</instance-data>

```

Figure 1: XML Instance Data File example

```

{
  "instance-data": {
    "@": {
      "ietf-yang-instance-data-annotations:instance-data-set":
        "acme-router-modules",
      "ietf-yang-instance-data-annotations:revision": "2108-01-25",
      "ietf-yang-instance-data-annotations:contact":
        "info@acme.com",
      "ietf-yang-instance-data-annotations:description":
        "Defines the set of modules that an acme-router will contain."
    },
    "ietf-yang-library:modules-state": {
      "module": [
        {
          "name": "ietf-system",

```

```

    "revision": "2014-08-06",
    "namespace": "urn:ietf:params:xml:ns:yang:ietf-system",
    "conformance-type": "implement",
    "feature": ["authentication", "radius-authentication"]
  }
]
}
}
}

```

Figure 2: JSON Instance Data File example

4. Providing Initial Data

YANG instance data files SHOULD be used to provide design time information about server capabilities. The content of the instance data file SHOULD describe the capabilities of the server, however there is no general guarantee that the capabilities will not change over time. Whether capabilities change and if so, when and how SHOULD be described either in the instance data file description statements or some other implementation specific manner. The set of server capabilities to be documented will be defined by other standards and specifications, and is out of scope for this document. Whether and how the instance data files are used by SW implementing a YANG server is out of scope for this specification.

5. YANG Model

<CODE BEGINS> file "ietf-yang-instance-data-annotations.yang"

```

module ietf-yang-instance-data-annotations {
  yang-version 1.1;
  namespace

```

```

    "urn:ietf:params:xml:ns:yang:ietf-yang-instance-data-annotations";
  prefix ida ;

  import ietf-yang-types { prefix "yang"; }
  import ietf-yang-metadata { prefix "md"; }

  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>>;

description "The module defines annotations to allow defining metadata for YANG Instance Data files.";

reference "[RFC 7950](#), [RFC 7962](#)";

```
revision 2017-08-24 {  
  description "Initial revision.";  
  reference "RFC XXXX: YANG Instance Data";  
}
```

```
md:annotation instance-data-set {  
  type yang:yang-identifier;  
  description "Defines the name of a YANG instance data set.
```

```
    The annotation SHALL only be used on the top level  
    <data> element in RFC XXXX defined YANG Instance Data files.  
    Exactly one instance-data-set annotation SHALL be used per  
    <data> element.";
```

```
}
```

```
md:annotation contact {  
  type string;  
  description "Contains the same information the ontact statement  
    carries for a YANG module.
```

```
    The annotation SHALL only be used on the top level  
    <data> element in RFC XXXX defined YANG Instance Data files.  
    Zero or one contact annotation SHALL be used per  
    <data> element.";
```

```
}
```

```
md:annotation organization {  
  type string;
```

```
description "Contains the same information the organization
```

statement carries for a YANG module.

The annotation SHALL only be used on the top level <data> element in RFC XXXX defined YANG instance data files. Zero or one organization annotation SHALL be used per <data> element.";

}

```
md:annotation revision {
  type string {
    pattern '\d{4}-\d{2}-\d{2}';
  }
  description "Specifies the data the instance-data-set was
    modified for this release.
```

The annotation SHALL only be used on the top level <data> element in RFC XXXX defined YANG Instance Data files. One or more revision annotations SHALL be used per <data> element.

A separate annotation SHOULD be added each time the instance-data-set is released.";

}

```
md:annotation description {
  type string;
  description "Defines the name of a YANG instance data set.
```

The annotation SHALL be used on the top level <data> element in RFC XXXX defined YANG Instance Data files, and MAY be used on other data elements of an instance data file. Zero one description annotation SHALL be used per element, but exactly one description annotation SHALL be used on the top level <data> element.";

}

}

<CODE ENDS>

6. Security Considerations

To be completed

7. IANA Considerations

No IANA action is requested.

[8.](#) References

[8.1.](#) Normative References

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[8.2.](#) Informative References

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