

**YANG Schema Dispatching Language
draft-lhotka-netmod-ysdl-00**

Abstract

This document defines YANG Schema Dispatching Language (YSDL). It is a meta-schema language that allows for combining YANG modules into any number of schemas, and arranging these schemas in a hierarchical structure.

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[1.](#) Introduction

YANG data modelling language [[I-D.ietf-netmod-rfc6020bis](#)] assumes that data trees (configuration and state data) defined in YANG modules start at the common global root. This means that the global path of every data node is fixed as soon as the data node is defined (for a node defined in a grouping, the path is fixed when the grouping is used).

Recent data modeling efforts, such as [[I-D.rtgyangdt-rtgwg-device-model](#)] indicate that this arrangement may be too restrictive. A typical use case is a data model that was designed for a stand-alone device but later needs to be reused for logical or virtual devices, and the original data model has to be grafted as a submodel in a top-level schema describing the organization of logical/virtual devices.

This document proposes a new minilanguage named YANG Schema Dispatching Language (YSDL) as a solution to this problem. It is a meta-schema language that allows for defining multiple schemas comprising one or more YANG modules, and arrange the schemas in a hierarchical structure.

As a useful side-effect, it is also possible to use YSDL schemas to specify a data model for an "anydata" node at run time.

[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](#)].

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The following terms are defined in [[I-D.ietf-netmod-rfc6020bis](#)]:

- o action,
- o anydata,
- o augment,
- o container,
- o data node,
- o data tree,
- o identity,
- o instance identifier,
- o leaf,
- o leaf-list,
- o list,
- o module,
- o notification,
- o RPC operation,
- o schema node.

The term "server" denotes a server of a network management protocol such as NETCONF [[RFC6241](#)] or RESTCONF [[I-D.ietf-netconf-restconf](#)].

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 Curly braces "{" and "}" contain names of optional features that make the corresponding node conditional.
- o Abbreviations before data node names: "rw" means configuration (read-write), "ro" state data (read-only), "-x" RPC operations, and "-n" notifications.

- o Symbols after data node names: "?" means an optional node, "!" a container with presence, and "*" denotes a "list" or "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.

3. YANG Schema Dispatching Language

The YSDL syntax is defined in [Section 4](#) using YANG in the role of a schema language. YSDL meta-schemas can be serialized in any encoding supported by YANG, such as XML [[I-D.ietf-netmod-rfc6020bis](#)] or JSON [[I-D.ietf-netmod-yang-json](#)].

YSDL meta-schemas are intended to be used in conjunction with YANG Library [[I-D.ietf-netconf-yang-library](#)]: names and revisions of YANG modules appearing in a meta-schema SHALL be resolved from YANG Library data, and YANG Library specifications of supported features and deviations MUST also be taken into account.

A YSDL meta-schema only affects the main data tree (configuration and state data), including actions. RPC operations and notifications are handled exactly as specified in [[I-D.ietf-netmod-rfc6020bis](#)].

YANG tree diagram for a YSDL meta-schema is as follows:

```
module: ietf-ysdl
  +--rw schemas
    +--rw top-schema?   schema-ref
    +--rw schema* [name]
      +--rw name          string
      +--rw yang-modules* yang:yang-identifier
      +--rw subschema* [root]
        +--rw root        schema-node-path
        +--rw schemas*    schema-ref
```

3.1. YSDL Schemas

A YSDL meta-schema defines one or more schemas, each comprising one or more YANG modules and zero or more subschemas. The same YANG module can be part of multiple schemas.

Exactly one of the schemas MUST be the top-level schema which is identified by the "top-schema" leaf. The top-level schema defines the uppermost structure of the entire data model, and its root always coincides with the global root.

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Any schema can define other schemas as its subschema. For each subschema, the root node has to be specified. Any "container", "list", "case" or "anydata" schema node contained in one of the parent schema modules can act as the root node.

Note that the traditional arrangement of YANG modules in a data model can be achieved with a YSDL meta-schema in which all modules are listed in the top-level schema, and no subschemas are defined.

3.2. Validating Data with YSDL and YANG

The schema tree of a subschema is conceptually attached to the parent schema tree as a subtree of the root node. In other words, the first data node that is either the subschema root or its ancestor coincides with the conceptual root of the subschema data tree.

All paths (in leafrefs, instance-identifiers, XPath expressions and target nodes of augments) are interpreted within the subschema data or schema tree. Therefore, they cannot refer to nodes in the ancestor schemas or other subschemas.

4. YSDL YANG Module

The "ietf-ysdl" module below defines the YSDL meta-schema language using YANG. However, it is not meant to be implemented as datastore contents by a server.

```
<CODE BEGINS> file "ietf-ysdl@2015-11-30.yang"

module ietf-ysdl {

    namespace "urn:ietf:params:xml:ns:yang:ietf-ysdl";

    prefix "ysdl";

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

    organization
        "IETF NETMOD (NETCONF Data Modeling Language) Working Group";

    contact
        "WG Web:    <http://tools.ietf.org/wg/netmod/>
        WG List:    <mailto:netmod@ietf.org>

        WG Chair: Thomas Nadeau
                   <mailto:tnadeau@lucidvision.com>
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Editor: Ladislav Lhotka
<<mailto:lhotka@nic.cz>>;

description

"This module defines YANG Schema Dispatching Language (YSDL) - a meta-schema language for YANG-based data models.

A YSDL schema allows for embedding a YANG schema as a subschema in a specific location of another module.

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The key words 'MUST', 'MUST NOT', 'REQUIRED', 'SHALL', 'SHALL NOT', 'SHOULD', 'SHOULD NOT', 'RECOMMENDED', 'MAY', and 'OPTIONAL' in the module text are to be interpreted as described in [RFC 2119](#) (<http://tools.ietf.org/html/rfc2119>).

This version of this YANG module is part of RFC XXXX (<http://tools.ietf.org/html/rfcXXXX>); see the RFC itself for full legal notices.";

```
revision 2015-11-30 {  
  description  
    "Initial revision."  
  reference  
    "RFC XXXX: YANG Schema Dispatching Language";  
}
```

```
/* Typedefs */
```

```
typedef schema-node-path {  
  type string {  
    pattern "[a-zA-Z_][a-zA-Z0-9\\-\\.]*:[a-zA-Z_][a-zA-Z0-9\\-\\.]*"  
    + "(/[a-zA-Z_][a-zA-Z0-9\\-\\.]*")"
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```
        + ":[a-zA-Z_][a-zA-Z0-9\\-\\.]*)";
    }
    description
        "Intra-schema path to a YANG schema node.

        The value is a sequence of schema node names separated by the
        slash character ('/'). The first (leftmost) component is
        prefixed with the name of the YANG module in which the schema
        node is defined. A subsequent component has the module prefix
        if and only if the preceding schema node is defined in another
        module.";
}

typedef schema-ref {
    type leafref {
        path "/ysdl:schemas/ysdl:schema/ysdl:name";
    }
    description
        "Reference to a schema.";
}

/* YSDL */

container schemas {
    description
        "Container for YSDL schemas.";
    leaf top-schema {
        type schema-ref;
        description
            "Reference to the top-level schema.";
    }
    list schema {
        key "name";
        min-elements "1";
        description
            "Each entry is a named schema. Exactly one entry must be the
            top-level schema, other (optional) entries can be used as
            subschemas.";
        leaf name {
            type string;
            description
                "Name of the schema.";
        }
    }
    leaf-list yang-modules {
        type yang:yang-identifier;
        min-elements "1";
        description
            "Each entry is the name of a YANG module contributing to
```

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```

    the schema.";
}
list subschema {
    key "root";
    description
        "Each entry is a subschema attached to the parent
        schema.";
    leaf root {
        type schema-node-path;
        description
            "Each entry specifies the relative (intra-schema) path to
            the root node where the subschema is attached. The
            schema node MUST be one of: container, list, case or
            anydata.

            The absolute path of the root node depends on the
            structure of schemas:

            - For the top-level schema, the root is always '/'.

            - For other schemas, the root path is formed by
              concatenation of the corresponding root paths of all
              ancestor schemas.";
    }
    leaf-list schemas {
        type schema-ref;
        description
            "References to schemas that comprise the subschema.";
    }
}
}
}
}
<CODE ENDS>
```

5. Example YSDL Meta-Schema

The following YANG module will be used for the top-level schema. It is a simplified analogy of the "network-device" module from [\[I-D.rtgyangdt-rtgwq-device-model\]](#).


```
module example-device {  
    namespace "http://www.example.net/example-device";  
    prefix "exdev";  
    container device {  
        container logical-NEs {  
            list logical-NE {  
                key "name";  
                leaf name {  
                    type string;  
                }  
            }  
        }  
    }  
}
```

The YSDL meta-schema is as follows:


```
{
  "ietf-ysdl:schemas": {
    "top-schema": "device",
    "schema": [
      {
        "name": "device",
        "yang-modules": [
          "example-device"
        ],
        "subschema": [
          {
            "root": "example-device:device",
            "schemas": [
              "if-ip",
              "system"
            ]
          },
          {
            "root": "example-device:device/logical-NEs/logical-NE",
            "schemas": [
              "if-ip"
            ]
          }
        ]
      },
      {
        "name": "if-ip",
        "yang-modules": [
          "ietf-interfaces",
          "ietf-ip"
        ]
      },
      {
        "name": "system",
        "yang-modules": [
          "ietf-system"
        ]
      }
    ]
  }
}
```

Apart from the top-level schema, "device", the meta-schema defines two other schemas:

- o "if-ip" schema consists of "ietf-interfaces" and "ietf-ip" modules;

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- o "system" schema consist of "ietf-system" module.

Two subschemas of the top-level schema defined with the following root nodes:

- o "example-device:device",
- o "example-device:device/logical-NEs/logical-NE".

The former one uses both "if-ip" and "system" schemas whereas the latter uses only "system".

The entire schema tree consisting of the top-level schema and the two subschemas is shown schematically in the following tree diagram:

```
module: example-device
  +--rw device
    +--rw if:interfaces
      | ...
    +--ro if:interfaces-state
      | ...
    +--rw sys:system
      | ...
    +--rw sys:system-state
    +--rw logical-NEs
      +--rw logical-NE* [name]
        +--rw name      string
        +--rw if:interfaces
          | ...
        +--ro if:interfaces-state
          | ...
```

6. IANA Considerations

RFC Editor: In this section, replace all occurrences of 'XXXX' with the actual RFC number and all occurrences of the revision date below with the date of RFC publication (and remove this note).

This document registers a URI in the "IETF XML registry" [[RFC3688](#)]. Following the format in [RFC 3688](#), the following registration has been made.

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URI: urn:ietf:params:xml:ns:yang:ietf-ysdl

Registrant Contact: The NETMOD WG of the IETF.

XML: N/A, the requested URI is an XML namespace.

This document registers a YANG module in the "YANG Module Names" registry [[RFC6020](#)].

name: ietf-ysdl
namespace: urn:ietf:params:xml:ns:yang:ietf-ysdl
prefix: ysd1
reference: RFC XXXX

7. Security Considerations

TBD

8. Acknowledgements

YSDL was loosely inspired by Namespace-based Validation Dispatching Language (NVDL) [[ISO.19757-4](#)].

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9.1. Normative References

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