NETMOD D. Bogdanovic
Internet-Draft
Intended status: Informational B. Claise
Expires: April 19, 2016 C. Moberg
Cisco Systems, Inc.
October 17, 2015

YANG Model Classification
draft-bogdanovic-netmod-yang-model-classification-05

Abstract

The YANG [RFC6020] data modeling language is currently being considered for a wide variety of applications throughout the networking industry at large. Many standards defining organizations, open source projects, and vendors are using YANG to develop and publish models of configuration, state data and operations for a wide variety of applications. At the same time, there is currently no well-known terminology to categorize various types of YANG models.

A consistent terminology would help with the categorization of models, assist in the analysis the YANG data modeling efforts in the IETF and other organizations, and bring clarity to the YANG-related discussions between the different groups.

This document describes a set of concepts and associated terms to support consistent classification of YANG models.

Status of This Memo

Copyright Notice

Table of Contents

1. Introduction

The Internet Engineering Steering Group (IESG) has been actively encouraging IETF working groups to use the NETCONF [RFC6241] and YANG standards for configuration management purposes, especially in new working group charters [Writable-MIB-Module-IESG-Statement].

YANG is also gaining wide acceptance as the de-facto standard modeling language in the broader industry. This extends beyond the IETF, including many standards development organizations, industry consortia, ad hoc groups, open source projects and vendors.

There are currently no clear guidelines on how to classify the layering of YANG models according to abstraction, or how to classify models along the continuum spanning formal standards publications and vendor-specific models.

This document presents a set of concepts and terms to form a useful taxonomy for consistent classification of YANG models in two dimensions:

- The layering of models based on their abstraction levels

- The type of model based on the nature and intent of the content

The two categories are covered in the next two sections.

2. First Dimension: YANG Model Abstraction Layers

Model developers have taken two approaches to developing YANG model: top-down and bottom-up. The top-down approach starts with high level abstractions modeling business or customer requirements and maps them to specific networking technologies. The bottom-up approach starts with fundamental networking technologies and maps them into more abstract constructs.

There are currently no specific requirements on, or well-defined best practices around the development of models. For the purpose of this document we assume that both approaches (bottom-up and top-down) will be used as they both provide benefits that appeals to different groups.

For layering purposes, this documents suggests the classification of data models into two distinct abstraction layers:

- Network Element YANG Models describe the configuration, state data and operations of a specific device-centric technology or feature.

- Network Service YANG Models describes the configuration, state data and operations of an abstract representation of a service implemented on one or multiple network elements

Figure 1 illustrates the application of YANG models at different layers of abstraction. Layering of models allow for reusability of existing lower layer models by higher level models while limiting duplication of features across layers.

For model developers, per-layer modeling allows for separation of concern across editing teams focusing on specific areas.

As an example, experience from the IETF shows that creating useful network element YANG models for e.g routing or switching protocols requires teams that include developers with experience from implementing those protocols.

On the other hand, network service models are best developed by people experienced in defining network services for consumption by programmers developing e.g. flow-through provisioning systems or self-service portals.

```
                       +-----------------------+
                       |                       |
                       |        OSS/BSS        |
                       |                       |
                       +-----------------------+

   - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
   Network Service YANG data models

        +------------+      +-------------+      +-------------+
        |            |      |             |      |             |
        |  - VPWS    |      |  - VPLS     |      |    L3VPN    |
        |  - L2VPN   |      |  - L2VPN    |      |             |
        |            |      |             |      |             |
        +------------+      +-------------+      +-------------+

   - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - - -
   Network Element YANG data models

   +------------+  +------------+  +-------------+  +------------+
   |            |  |            |  |             |  |            |
   |    MPLS    |  |    BGP     |  | IPv4 & IPv6 |  |  Ethernet  |
   |            |  |            |  |             |  |            |
   +------------+  +------------+  +-------------+  +------------+
```

Fig. 1 YANG Model Layers

2.1. Network Service YANG Data Models

Network Service YANG Data Models describe the characteristics of a service, as agreed upon with consumers of that service. That is, a service model does not expose the detailed configuration parameters of all participating network elements and features, but describes an abstract model that allows instances of the service to be decomposed into instance data according to the Network Element data models of the participating network elements. The service-to-element decomposition is a separate process with details depending on how the network operator chooses to realize the service.

As an example, the Network Service model included in [YANG-Data-Model-for-L3VPN-service-delivery] provides an abstracted model for Layer 3 IP VPN service configuration. An orchestrator receives operations on service instances according to the service model and decomposes the data into specific Network Element models to configure the participating network elements to perform the intent of the service.

Network Service YANG models defines services models to be consumed by external systems. These models are commonly designed, developed and deployed by network infrastructure teams.

YANG allows for different design patterns to describe network services, ranging from monolithic to component-based approaches.

The monolithic approach captures the entire service in a single model and does not put focus on reusability of internal data definitions and groupings. The monolithic approach has the advantages of single-purpose development including speed at the expense of reusability.

The component-based approach captures device-centric features (e.g. the definition of a VRF, routing protocols, or packet filtering) in a vendor-independent manner. The components are designed for reuse across many services. The set of components required for a specific service is then composed into the higher-level service. The component-based approach has the advantages of modular development including a higher degree of reusability at the expense of initial speed.

As an example, an L2VPN service can be built on many different types of transport network technologies, including e.g. MPLS or carrier ethernet. A component-based approach would allow for reuse of e.g. UNI-interface definitions independent of the underlying transport network (e.g. MEF UNI interface or MPLS interface). The monolithic approach would assume a specific set of transport technologies and interface definitions.

2.2. Network Element YANG Data models

Network Element YANG Data Models describe the configuration, state data and operations of a network device as defined by the vendor of that device. The models are commonly structured around features of the device, e.g. interface configuration [RFC7223], OSPF configuration [I-D.ietf-ospf-yang], and firewall rules definitions [I-D.ietf-netmod-acl-model]. The model provides a coherent data model representation of what is commonly a very mixed software environment consisting of the operating system and applications running on the device.

The decomposition, ordering and execution of changes to the operating system, and application configuration is the task of the management framework that implements the YANG model.

3. Second Dimension: Model Types

This document suggests classifying YANG model types as either standard YANG models, vendor-specific YANG models, or vendor-specific extensions.

The suggested classification applies to both Network Element YANG Data Models and to Network Service YANG Data Models.

It is to be expected that real-world implementations of both Network Service and Network Element models will include a mix of all three types of models.

3.1. Standard YANG Models

Standard YANG models are published by standards defining organizations (SDOs). While there is no formal definition of what construes an SDO, a common feature is that they publish specifications along specific processes with content that reflects some sort of membership consensus. The specifications are developed for wide use among the membership or for audiences beyond that.

The lifecycle of these models are driven by the editing cycle of the specification and not tied to a specific implementation.

Examples of SDOs in the networking industry are the IETF, the IEEE and the MEF.

3.2. Vendor-specific YANG Models

Vendor-specific YANG models are developed by organizations with the intent to support a specific set of implementations under control of that organization. The intent of these models range from providing openly published YANG models that may eventually be contributed back to, or adopted by an SDO, to strictly internal YANG models not intended for external consumption.

The lifecycle of these models are generally aligned with the release cycle of the product or open source software project deliverables.

It is worth noting that there is an increasing amount of interaction between OSS projects and SDOs in the networking industry. This includes OSS projects implementing published standards as well as OSS projects contributing content to standards defining organization processes.

3.3. Vendor-specific Extensions

Vendors develop Vendor-specific Extensions to standard models using YANG constructs for extending data definitions of previously published models. This is done using the 'augment' statement that allows locally defined data trees to be augmented into locations in externally defined data trees.

Vendors use this to extend standard data models to cover the full scope of features in implementations, which commonly is broader than what is covered by the standard model.

4. Security Considerations

At this stage, authors of the draft didn't look into security considerations.

5. IANA Considerations

This document requests no action by IANA.

6. Acknowledgements

Thanks to David Ball for his enlightenments on Metro Ethernet Forum service aspects.

7. Change log [RFC Editor: Please remove]

version 1: restructure the document, add the two dimensions, add the interaction with the different SDOs and opensource projects, add the definitions.

version 2: added definitions for config and service models clarified second dimension of model classification. fixed typos

version 3: restructure and partial rewrite of section 2.

version 4: Language fixes

8. References

8.1. Normative References

[RFC6020] Bjorklund, M., Ed., "YANG - A Data Modeling Language for the Network Configuration Protocol (NETCONF)", RFC 6020, DOI 10.17487/RFC6020, October 2010, <http://www.rfc-editor.org/info/rfc6020>.

8.2. Informative References

[I-D.ietf-netmod-acl-model]
Bogdanovic, D., Sreenivasa, K., Huang, L., and D. Blair, "Network Access Control List (ACL) YANG Data Model", draft-ietf-netmod-acl-model-03 (work in progress), June 2015.

[I-D.ietf-ospf-yang]
Yeung, D., Qu, Y., Zhang, J., Bogdanovic, D., and K. Koushik, "Yang Data Model for OSPF Protocol", draft-ietf-ospf-yang-02 (work in progress), September 2015.

[RFC6241] Enns, R., Ed., Bjorklund, M., Ed., Schoenwaelder, J., Ed., and A. Bierman, Ed., "Network Configuration Protocol (NETCONF)", RFC 6241, DOI 10.17487/RFC6241, June 2011, <http://www.rfc-editor.org/info/rfc6241>.

[RFC7223] Bjorklund, M., "A YANG Data Model for Interface Management", RFC 7223, DOI 10.17487/RFC7223, May 2014, <http://www.rfc-editor.org/info/rfc7223>.

[Writable-MIB-Module-IESG-Statement]
"Writable MIB Module IESG Statement", <https://www.ietf.org/iesg/statement/writable-mib-module.html>.

[YANG-Data-Model-for-L3VPN-service-delivery]
"YANG Data Model for L3VPN service delivery", <https://tools.ietf.org/id/draft-l3vpn-service-yang>.

Authors’ Addresses

Dean Bogdanovic

Email: ivandean@gmail.com

Benoit Claise
Cisco Systems, Inc.

Email: bclaise@cisco.com

Carl Moberg
Cisco Systems, Inc.

Email: camoberg@cisco.com