Network Inventory YANG
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A Network Data Model for Inventory Topology Mapping
draft-ietf-ivy-network-inventory-topology-03

Abstract

This document defines a YANG data model to map the network inventory data with the topology data to form a base underlay network. The data model facilitates the correlation between the layer (e.g., Layer 2 or Layer 3) topology information and the inventory data of the underlay network for better service provisioning, network maintenance operations, and other assessment scenarios.

Discussion Venues

This note is to be removed before publishing as an RFC.

Discussion of this document takes place on the Network Inventory YANG Working Group mailing list (inventory-yang@ietf.org), which is archived at https://mailarchive.ietf.org/arch/browse/inventory-yang/.

Source for this draft and an issue tracker can be found at https://github.com/ietf-ivy-wg/network-inventory-topology.

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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This Internet-Draft will expire on 9 April 2026.

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1. Introduction

[I-D.ietf-ivy-network-inventory-yang] defines the base network inventory model to aggregate the inventory data of Network Elements (NEs). This data includes identification of these NEs and their hardware, firmware, and software components. Examples of inventory hardware components could be rack, shelf, slot, board, or physical port. Examples of inventory software components could be platform Operating System (OS), software-patches, bios, or boot- loader [I-D.ietf-ivy-network-inventory-software].

In order to ease navigation from (or to) inventory and network topologies, this document extends the network topology data model [RFC8345] for network inventory mapping: "ietf-network-inventory-topology" (Section 5). This data model provides a mechanism for the correlation with existing network and topology data models, such as "A YANG Network Data Model for Service Attachment Points (SAPs)" [RFC9408], "A YANG Data Model for Layer 2 Network Topologies" [RFC8944], and "A YANG Data Model for Layer 3 Topologies" [RFC8346].

The network inventory topology mapping data model ("ietf-network-inventory-topology") also provides anchor points to mount specific device configuration and state information, e.g., Quality of Service (QoS) and Access Control List (ACL) policies, to support configuration verification of policies at the network level. Further sample uses are discussed in Section 3.

Similar to the base inventory data model [I-D.ietf-ivy-network-inventory-yang], the network inventory topology does not make any assumption about involved NEs and their roles in topologies. As such, the mapping model can be applied indepent of the network type (optical local loops, access network, core network, etc.) and application.

1.1. Editorial Note (To be removed by RFC Editor)

> Note to the RFC Editor: This section is to be removed prior to publication.

This document contains placeholder values that need to be replaced with finalized values at the time of publication. This note summarizes all of the substitutions that are needed.

Please apply the following replacements:

* XXXX --> the assigned RFC number for this I-D

* AAAA --> the assigned RFC number for [I-D.ietf-ivy-network-inventory-yang]

2. Conventions and Definitions

The meanings of the symbols in the YANG tree diagrams are defined in [RFC8340].

This document uses terms defined in [I-D.ietf-ivy-network-inventory-yang].

3. Sample Use Cases of the Data Model

3.1. Determine Available Resources of Service Attachment Points (SAPs)

The inventory topology data model can be used as a base to correlate underlay information, such as physical port components. Figure 1 exemplifies such a usage.

During service provisioning, to check available physical port resources, the SAPs information can be associated with the underlay inventory information and interface information associated with the inventory topology, e.g., "parent-termination-point" of SAP Model can be associated with the "port-component-ref" and "interface-name" of the inventory topology data model, which can be used to check the availability and capacity of physical ports.

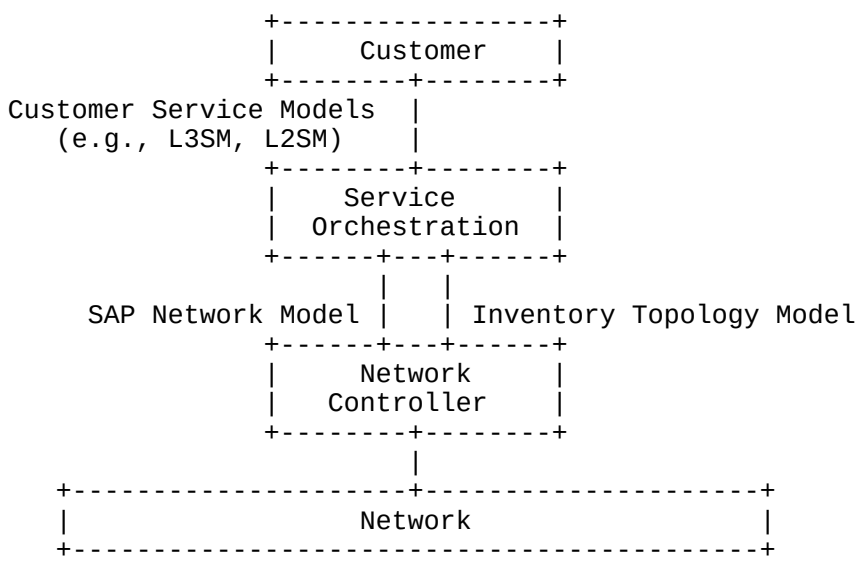

Figure 1: An Example Usage of Network Inventory Topology

3.2. "What-if" Scenarios

[I-D.irtf-nmrg-network-digital-twin-arch] defines Network Digital Twin (NDT) as a virtual representation of the physical network. Such representation is meant to be used to analyze, diagnose, emulate, and then manage the physical network based on data, models, and interfaces.

The management system can use NDT to build multi-layer topology maps for networks and endpoints with relationship types and dependencies, and identify potential impacts on configuration management information from incidents, problems, and changes. More generally, the inventory topology data model can be used as part of the Service & Infrastructure Maps (SIMAP) [I-D.ietf-nmop-simap-concept].

The inventory topology data model can, for example, be used to emulate several "what-if" scenarios such as the impact of End of Life (EOL) or depletion of a hardware component (chipset) on the network resilience and service availability.

4. Module Tree Structure

An overview of the structure of the "ietf-network-inventory-topology" module is shown in Figure 2.

```
 module: ietf-network-inventory-topology
   augment /nw:networks/nw:network/nw:node:
     +--rw inventory-mapping-attributes
             {topology-to-inventory-navigate}?
        +--ro ne-ref?   nwi:ne-ref
   augment /nw:networks/nw:network/nt:link:
     +--rw inventory-mapping-attributes
             {topology-to-inventory-navigate}?
        +--ro cable-name?   string
        +--ro link-type?    string
   augment /nw:networks/nw:network/nw:node/nt:termination-point:
     +--rw inventory-mapping-attributes
             {topology-to-inventory-navigate}?
        +--rw ne-ref?                   nwi:ne-ref
        +--rw port-ref?                 leafref
        +--ro physical-interface-name?  string
   augment /nwi:network-inventory/nwi:network-elements
             /nwi:network-element:
     +--rw node-ref?      leafref {inventory-to-topology-navigate}?
     +--rw network-ref?   -> /nw:networks/network/network-id
             {inventory-to-topology-navigate}?
```

Figure 2: The Structure of the Network Inventory Mapping Data Model

The module defines two features "inventory-to-topology-navigate" and "topology-to-inventory-navigate" to control the navigation direction (from topology to inventory and vice versa).

The module augments the "ietf-network-topology" module as follows:

* A new network topology type: "network-inventory-mapping". The corresponding container augments the "network-types" of the "ietf-network" module.

* Inventory mapping attributes for nodes, links, and termination points: The corresponding containers augments the topology module with the references to the base network inventory, references to interface management, and policy mount points

  The inventory topology model associates inventory data with overlay topologies. It can be used as the "supporting-networks" of SAP, Layer 2, or Layer 3 topologies.

Also, the "ietf-network-inventory-topology" module augments the "ietf-network-inventory" to add required references to navigate from the inventory to topologies (’node-ref’ and ’network-ref’).

5. Network Inventory Topology YANG Module

This module augments the Network Topology [RFC8345].

This module imports the base network inventory [I-D.ietf-ivy-network-inventory-yang].

<CODE BEGINS> file "ietf-network-inventory-topology@2025-02-04.yang"

```
module ietf-network-inventory-topology {
  yang-version 1.1;
  namespace
    "urn:ietf:params:xml:ns:yang:ietf-network-inventory-topology";
  prefix nwit;

  import ietf-network {
    prefix nw;
    reference
      "RFC 8345: A YANG Data Model for Network Topologies,
                 Section 4.1";
  }
  import ietf-network-topology {
    prefix nt;
    reference
      "RFC 8345: A YANG Data Model for Network Topologies,
                 Section 4.2";
  }
  import ietf-network-inventory {
    prefix nwi;
    reference
      "RFC AAAA: A YANG Data Model for Network Inventory";
  }
```

```
     organization
       "IETF Network Inventory YANG (ivy) Working Group";
     contact
       "WG Web:   <https://datatracker.ietf.org/wg/ivy>
        WG List:  <mailto:inventory-yang@ietf.org>

        Editor: Bo Wu
                <lana.wubo@huawei.com>
        Editor: Mohamed Boucadair
                <mohamed.boucadair@orange.com>
        Author: Cheng Zhou
                <zhouchengyjy@chinamobile.com>
        Author: Qin Wu
                <bill.wu@huawei.com>";
     description
       "This YANG module defines a YANG module for network
        topology and inventory mapping.

        Copyright (c) 2025 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 Revised
        BSD License set forth in Section 4.c of the IETF Trust's
        Legal Provisions Relating to IETF Documents
        (https://trustee.ietf.org/license-info).

        All revisions of IETF and IANA published modules can be found
        at the YANG Parameters registry group
        (https://www.iana.org/assignments/yang-parameters).

        This version of this YANG module is part of RFC XXXX; see
        the RFC itself for full legal notices.";

     revision 2025-03-03 {
       description
         "Initial revision.";
       reference
         "RFC XXXX: A Network Data Model for Inventory Topology
                    Mapping";
     }

     /* features */

     feature inventory-to-topology-navigate {
       description
         "Indicates support for navigating from inventory to topology.";
```

```
}

feature topology-to-inventory-navigate {
  description
    "Indicates support for navigating from topology to inventory.";
}

/* Groupings */
/* Node Grouping Feature with 1:1 mapping to NE*/

grouping node-inventory-feature-attributes {
  description
    "Network Inventory mapping node scope attributes";
  container inventory-mapping-attributes {
    if-feature "topology-to-inventory-navigate";
    description
      "The container node attributes of Network Inventory
       mapping.";
    leaf ne-ref {
      type nwi:ne-ref;
      config false;
      description
        "1:1 mapping to the Network Element (NE) from which this
         node is abstracted.";
    }
  }
}

grouping tp-inventory-feature-attributes {
  description
    "Network Inventory mapping Termination Point (TP) scope
     attributes.";
  container inventory-mapping-attributes {
    if-feature "topology-to-inventory-navigate";
    description
      "Specifies the TP attributes of Network Inventory mapping.";
    /* 1:1 mapping to physical port component */
    uses nwi:port-ref;
    leaf physical-interface-name {
      type string;
      config false;
      description
        "1:1 mapping to physical interface name (e.g., eth0/1).";
    }
  }
}

grouping link-inventory-feature-attributes {
```

```
    description
      "Network Inventory mapping link scope attributes.";
    container inventory-mapping-attributes {
      if-feature "topology-to-inventory-navigate";
      description
        "Specifies  the link attributes of network inventory
         mapping.";
      leaf cable-name {
        type string;
        config false;
        description
          "Reports the reference of the cable inventory from which
           this link is abstracted.";
      }
      leaf link-type {
        type string;
        config false;
        description
          "Reports the type of the link.";
      }
    }
  }

  /* Main blocks */

  augment "/nw:networks/nw:network/nw:node" {
    description
      "Groups parameters for inventory at the node level.";
    uses node-inventory-feature-attributes;
  }

  augment "/nw:networks/nw:network/nt:link" {
    description
      "Augments inventory topology link information.";
    uses link-inventory-feature-attributes;
  }

  augment "/nw:networks/nw:network/nw:node/nt:termination-point" {
    description
      "Augments inventory termination point information.";
    uses tp-inventory-feature-attributes;
  }

  /* Augment the network-inventory to add topology navigate */

  augment "/nwi:network-inventory/nwi:network-elements"
        + "/nwi:network-element" {
    if-feature "inventory-to-topology-navigate";
```

```
      description
        "Augments the network element with 1:1 mapping with the network
         the element is part of.";
      uses nw:node-ref;
    }
  }
  <CODE ENDS>
```

6. Security Considerations

This section is modeled after the template described in Section 3.7 of [I-D.ietf-netmod-rfc8407bis].

The "ietf-network-inventory-topology" YANG module defines a data model that is designed to be accessed via YANG-based management protocols, such as NETCONF [RFC6241] and RESTCONF [RFC8040]. These YANG-based management (1) have to use a secure transport layer (e.g., SSH [RFC4252], TLS [RFC8446], and QUIC {{?RFC9000]) and (2) have to use mutual authentication.

The Network Configuration Access Control Model (NACM) [RFC8341] provides the means to restrict access for particular NETCONF or RESTCONF users to a preconfigured subset of all available NETCONF or RESTCONF protocol operations and content.

There are a number of data nodes defined in this YANG module that are writable/creatable/deletable (i.e., "config true", which is the default). All writable data nodes are likely to be sensitive or vulnerable in some network environments. Write operations (e.g., edit-config) and delete operations to these data nodes without proper protection or authentication can have a negative effect on network operations. The following subtrees and data nodes have particular sensitivities/vulnerabilities:

’ne-ref’, ’node-ref’, ’port-ref’: Altering the content of these data nodes may alter the accuracy of the correlation between network topology and inventory.

Applications that rely upon such correlations would thus be distorted.

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 (e.g., via get, get-config, or notification) to these data nodes. Specifically, the following subtrees and data nodes have particular sensitivities/ vulnerabilities:

'ne-ref': The reference may be used to track the set of network elements.

7. IANA Considerations

IANA is requested to register the following URI in the "ns" subregistry within the "IETF XML Registry" [RFC3688]:

URI: urn:ietf:params:xml:ns:yang:ietf-network-inventory-topology
Registrant Contact: The IESG.
XML: N/A; the requested URI is an XML namespace.

IANA is requested to register the following YANG module in the "YANG Module Names" registry [RFC6020] within the "YANG Parameters" registry group:

Name: ietf-network-inventory-topology
Namespace: urn:ietf:params:xml:ns:yang:ietf-network-inventory-topology
Prefix: nwit
Maintained by IANA? N
Reference: RFC XXXX

8. References

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