Network Inventory YANG
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A YANG Network Data Model for Inventory Topology Mapping
draft-ietf-ivy-network-inventory-topology-06

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 will expire on 1 September 2026.

Copyright Notice

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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-modules, 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].

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 independent 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 basis for correlating underlay information, such as physical port components. Figure 1 exemplifies this 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" of the inventory topology data model, which can be used to check the availability and capacity of physical ports.

```
                            +------------------+
                            |     Customer     |
                            +--------+---------+
               Customer Service Models  |
                  (e.g., L3SM, L2SM)    |
                            +--------+---------+
                            |     Service      |
                            |  Orchestration   |
                            +------+---+-------+
                                   |   |
                    SAP Network Model |   | Inventory Topology Model
                            +------+---+-------+
                            |     Network      |
                            |   Controller     |
                            +--------+---------+
                                     |
               +---------------------+---------------------+
               |                   Network                 |
               +-------------------------------------------+
```

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.

[I-D.ietf-nmop-simap-concept] defines Service and Infrastructure Maps (SIMAP) as an abstraction model that provides a unified view of both service and infrastructure information, enabling correlation between service requirements and underlying resource capabilities.

Both architectures require accurate mapping between logical network topology and physical inventory as a foundational data layer. This model provides the essential physical resource information to such systems, enabling them to perform accurate "what-if" analysis (e.g., impact prediction of hardware EOL, path re-optimization under resource constraints, service availability assessment).

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
       +--rw ne-ref?   nwi:ne-ref
  augment /nw:networks/nw:network/nt:link:
    +--rw inventory-mapping-attributes
       +--rw link-type?   string
  augment /nw:networks/nw:network/nw:node/nt:termination-point:
    +--rw inventory-mapping-attributes
       +--rw ne-ref?          nwi:ne-ref
       +--rw port-ref?        leafref
       +--ro port-breakout!
          +--ro breakout-channel* [channel-id]
             +--ro channel-id    uint16
```

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:

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

  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.

4.1. Link Extensions

This document adds a lightweight "link-type" leaf to the topology link mapping to enable basic physical media classification.

* "link-type" A string indicating the link media type, such as "copper", "fiber", or "coax". For wireless media, values such as "microwave", or "wifi" may be used

The "link-type" serves as a lightweight discriminator that guides to the appropriate specialized inventory model for detailed resource information. For example, wired media (fiber, copper) typically reference a passive network inventory model, such as the one defined in [I-D.ygb-ivy-passive-network-inventory].

4.2. Port-Breakout Capability

High-density Ethernet ports (e.g., 400 Gb/s DR4) can be split into multiple independent lower-speed channels. The breakout channels represent the intrinsic capability of the port to be partitioned, regardless of whether the port is currently configured as a trunk or as a breakout port.

A trunk port is associated with exactly one physical interface. A breakout port is a port that is decomposed into two or more physical interfaces; those interfaces may run at the same or different speeds and may consume the same or a different number of breakout channels.

The container "port-breakout" is added under the termination-point augmentation. It lists the logical channels into which the single physical port can be divided. Only termination-points whose parent port is breakout-capable need to instantiate the container; otherwise the container is omitted, keeping the topology model minimal for the common non-breakout case.

Breakout channel is an atomic resource element obtained by partitioning a breakout port. One physical interface may be associated with one or more breakout channels, but one breakout channel MUST NOT be associated with more than one physical interface. Appendix B provides example configurations.

It is assumed that a port which supports breakout can be configured either as a trunk port or as a breakout port. Interface channelisation (e.g., VLAN sub-interfaces) is outside the scope of this document and is addressed by the Layer 2 network topology model [RFC8944].

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@2026-02-28.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:  IVY <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) 2026 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 2026-02-28 {
        description
          "Initial revision.";
        reference
          "RFC XXXX: A Network Data Model for Inventory Topology
                     Mapping";
      }

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

      grouping node-inventory-mapping-attributes {
        description
          "Attributes for mapping a topology node to a Network Element
           (NE) in the physical inventory.";
        container inventory-mapping-attributes {
          description
            "Container for inventory mapping attributes of a node.";
          leaf ne-ref {
            type nwi:ne-ref;
            description
              "Reference to the NE in the inventory that corresponds to
               this topology node.

               This reference establishes a 1:1 mapping between the
               logical node and its physical NE.";
          }
        }
      }
```

```
     // TP Grouping with 1:1 mapping to physical port

     grouping tp-inventory-mapping-attributes {
       description
         "Attributes for mapping a topology termination point (TP)
          to a physical port in the network inventory.";
       container inventory-mapping-attributes {
         description
           "Container for inventory mapping attributes of a TP.";
         uses nwi:port-ref {
           refine "port-ref" {
             description
               "Reference to the physical port component in the
                network inventory. This reference establishes a 1:1
                mapping between the logical TP and its physical port
                component.";
           }
         }
         // breakout channels (lightweight, per physical port)
         container port-breakout {
           presence "Indicates the port supports channel breakout.";
           config false;
           description
             "Breakout capability of the physical port represented by
              this TP. One TP maps to one physical port; channels are
              listed here. This container is present only when the
              underlying hardware supports partitioning the port into
              multiple independent channels (e.g., 400G to 4x100G).";
           list breakout-channel {
             key "channel-id";
             description
               "List of breakout channels available on this port.
                Each entry represents an independent lane or sub-port
                that can be used for channelized interfaces.";
             leaf channel-id {
               type uint16;
               description
                 "Unique identifier for the breakout channel within the
                  scope of the parent port.";
             }
           } // breakout-channel
         } // port-breakout
       }
     }

     // Link Grouping  with placeholder for future augumentation

     grouping link-inventory-mapping-attributes {
```

```
       description
         "Attributes for classifying link media type.
          Detailed inventory reference is intentionally omitted from
          this model; implementations should use the appropriate
          specialized inventory modules based on the indicated
          link-type.";
       container inventory-mapping-attributes {
         description
           "Container for inventory-related attributes of a link.

            This container provides lightweight media classification.
            The link-type indicates which specialized inventory model
            contains detailed resource information:

            - Wired media (fiber, copper): passive network inventory
            - Wireless media (microwave, Wi-Fi): wireless-specific
              inventory

              Detailed inventory references may be added in future
              modules.";
         leaf link-type {
           type string;
           description
             "Classification of the link media type at the topology
              layer. Example values include 'copper', 'fiber',
              'microwave', or 'wifi'.";
         }
       }
     }

     // Main blocks

     augment "/nw:networks/nw:network/nw:node" {
       description
         "Augments the network topology node with inventory mapping
          attributes. This enables correlation between the logical node
          and its physical network element.";
       uses node-inventory-mapping-attributes;
     }

     augment "/nw:networks/nw:network/nt:link" {
       description
         "Augments the network topology link with inventory-related
          attributes.";
       uses link-inventory-mapping-attributes;
     }

     augment "/nw:networks/nw:network/nw:node/nt:termination-point" {
```

```
        description
          "Augments the TP with inventory mapping attributes for
           physical port correlation and breakout capability reporting.";
        uses tp-inventory-mapping-attributes;
      }
    }
    <CODE ENDS>
```

6. Operational Considerations

This model enables a network controller to report discovered network topology and inventory information. Automatic discovery serves as the primary mechanism, with selective configuration capabilities provided for scenarios where discovery is not feasible.

For typical operations such as service provisioning and network planning, the model offers read-only query access to authoritative mappings between logical topology and physical inventory. The inventory-mapping-attributes containers are defined as read-write (config true) to accommodate cases where automatic discovery is not possible, including:

* Customer-premises equipment (CPE) outside the operator’s management domain

* Leased lines and third-party transport resources

* Planned or hypothetical resources for future deployment

In these cases, the operator manually configures the mapping to maintain accurate topology-to-inventory correlation.

The following nodes are read-only (config false) as they represent hardware-determined state:

port-breakout: Hardware capability determined by physical port characteristics

7. 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', 'port-ref', 'link-type': These nodes are sensitive as they establish the mapping between logical topology and physical inventory. Unauthorized modification could lead to incorrect resource allocation or service disruption.

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 references may be used to track the set of network elements. While read-only, they may reveal network infrastructure details.

'port-breakout': This node exposes hardware capabilities.

8. 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

9. References

9.1. Normative References

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Appendix A. "link-type" Usage Examples

This appendix provides examples illustrating the usage of the link-type data node.

Scenario: Device SW-1 and device SW-2 are directly connected by a fiber.

Physical topology:

```
+--------+                                    +--------+
|        |                                    |        |
| [SW-1] +========= fiber link ===============+ [SW-2] |
|        |                                    |        |
+--------+                                    +--------+
```

Key parts of the JSON example is as follows:

```
{
  "ietf-network:networks": {
    "network": [
      {
        "network-id": "campus-topology",
        "node": [
          {
            "node-id": "SW-1",
            "ietf-network-inventory-topology:inventory-mapping-attributes": {
              "ne-ref": "NE-SW1"
            },
            "ietf-network-topology:termination-point": [
              {
                "tp-id": "TP-SW1-P1",
                "ietf-network-inventory-topology:inventory-mapping-attributes": {
                  "ne-ref": "NE-SW1",
                  "port-ref": "/nwi:network-inventory/nwi:network-elements/nwi:network-el
ement[ne-id='NE-SW1']/nwi:components/nwi:component[component-id='eth-port-1']"
                }
              }
            ]
          },
          {
            "node-id": "SW-2",
            "ietf-network-inventory-topology:inventory-mapping-attributes": {
              "ne-ref": "NE-SW2"
            },
            "ietf-network-topology:termination-point": [
              {
                "tp-id": "TP-SW2-P1",
                "ietf-network-inventory-topology:inventory-mapping-attributes": {
                  "ne-ref": "NE-SW2",
                  "port-ref": "/nwi:network-inventory/nwi:network-elements/nwi:network-el
ement[ne-id='NE-SW2']/nwi:components/nwi:component[component-id='eth-port-1']"
                }
              }
            ]
          }
        ],
        "ietf-network-topology:link": [
          {
            "link-id": "Link-SW1-SW2",
            "source": {
              "source-node": "SW-1",
              "source-tp": "TP-SW1-P1"
            },
            "destination": {
              "dest-node": "SW-2",
              "dest-tp": "TP-SW2-P1"
            },
```

```
            "ietf-network-inventory-topology:inventory-mapping-attributes": {
              "link-type": "fiber"
            }
          }
        ]
      }
    ]
  }
}
```


Appendix B. JSON Example of an MPO Breakout-Channel Port

This appendix provides an example of a 400 Gb/s DR4 port that is physically implemented as four independent 100 Gb/s lanes (an MPO breakout). The lanes are exposed as breakout-channel entries so that the port can later be configured as either a single 400G trunk or four 100G breakout interfaces. The instance data below shows the minimal JSON encoding [RFC7951] of the "port-breakout" container for this port.

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

{
  "ietf-network-topology:networks": {
    "network": [
      {
        "network-id": "example:underlay-topology-400g",
        "node": [
          {
            "node-id": "example:n1",
            "termination-point": [
              {
                "tp-id": "example:400g-1/0/1",
                "ietf-network-inventory-topology:inventory-mapping-\
                                                       attributes": {
                  "ne-ref": "example:NE-1",
                  "port-ref": "example:port-1",
                  "port-breakout": {
                    "breakout-channel": [
                      { "channel-id": 1 },
                      { "channel-id": 2 },
                      { "channel-id": 3 },
                      { "channel-id": 4 }
                    ]
                  }
                }
              }
            ]
          }
        ]
      }
    ]
  }
}
```

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