Network Inventory YANG
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B. Wu, Ed.
Huawei
M. Boucadair
Orange
C. Zhou
China Mobile
Q. Wu
Huawei

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A YANG Network Data Model for Inventory Topology Mapping
draft-ietf-ivy-network-inventory-topology-07

Abstract

This document defines a YANG data model that extends the network topology data model (RFC 8345) to map network topologies with inventories. The data model introduces the "inventory-topology" network type and augmentations for physical entity mappings and capabilities, which may be used by any overlay network topology for service provisioning validation, network maintenance, and capacity planning.

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

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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 between 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 data 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].

The document adheres to the folding conventions in [RFC8792].

3. Sample Use Cases of the Data Model

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

The inventory topology data model correlates underlay physical resource information with the SAP network data model [RFC9408]. While the SAP data model provides the provider network view with the points from which services can be attached, the inventory topology model maps those SAPs to their underlying physical ports, enabling the orchestrator to verify whether a candidate SAP has sufficient physical capacity.

Figure 1 illustrates the query interactions. During service provisioning, the orchestrator can issue a query using the SAP data model (e.g., obtaining a list of SAPs across multiple PEs as shown in Appendix A of [RFC9408]), and then uses the inventory topology data model to check the physical resources of the candidate SAPs. Specifically, the "parent-termination-point" of a SAP is mapped to the corresponding "port-component-ref" in the inventory topology, allowing the orchestrator to verify port availability and capacity.

If the physical port underlying a candidate SAP has insufficient resources (e.g., port speed fully utilized), the orchestrator can select an alternate SAP that maps to a different port with adequate capacity. If no alternative SAP is available, the orchestrator flags the request for manual intervention, providing the operator with precise inventory information about the bottleneck (e.g., "Port GE0/6/1 on NE-PE1 is at 95% utilization"). The resource constraint can also feed into a "what-if" analysis (see Section 3.2) to evaluate hardware upgrades or alternative underlay paths.

```
                        .-----------------.
                        |     Customer    |
                        '--------+--------'
        Customer Service request |
           (e.g., L3SM and L2SM) v
                        .--------+--------.
                        |    Service      |
                        |  Orchestration  |
                        '------+---+------'
               (1a) Query SAPs |   | (1b) Verify physical
          via SAP Data Model   v   v capacity via Inventory Topology
                        .------+---+------.
                        |     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 End-of-Life, 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:network-types:
    +--rw 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?   identityref
  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 augments the "ietf-network-topology" module as follows:

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

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": An identityref indicating the link media type.

Examples of wired link types are "copper", "fiber", or "coax". For wireless media, values such as "microwave", or "wlan" may be used. See also [RFC9656] for more detailed microwave radio attributes.

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" or "copper") typically references 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 module defined in [RFC8345].

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

```
<CODE BEGINS> file "ietf-network-inventory-topology@2026-05-19.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 2026-05-19 {
       description
         "Initial revision.";
       reference
         "RFC XXXX: A Network Data Model for Inventory Topology
                    Mapping";
     }

     identity link-type {
       description
         "Base identity for classifying the physical media type of a
          link at the inventory topology layer.  Specialized inventory
          models are expected to define derived identities for specific
          media, e.g., fiber, copper, or wireless.";
     }

     identity copper {
       base link-type;
       description
         "Copper-based physical link.";
     }

     identity fiber {
       base link-type;
       description
         "Fiber-based physical link.";
     }

     identity coax {
       base link-type;
       description
         "Coaxial cable-based physical link.";
     }

     identity microwave {
       base link-type;
       description
         "Microwave-based wireless link.
          Detailed microwave radio attributes are defined in the
          microwave topology data model.";
       reference
         "RFC 9656: A YANG Data Model for Microwave Topology";
     }

     identity wlan {
```

```
       base link-type;
       description
         "IEEE 802.11 wireless link.";
     }

     identity unknown {
       base link-type;
       description
         "The link media type is unknown or could not be determined.
          This identity is used as a fallback when the physical medium
          cannot be classified into any of the other defined types.";
     }

     identity leased-fiber {
       base fiber;
       description
         "Leased fiber link.  The physical medium is fiber, but the link
          is provided by a third-party operator.  Detailed physical
          attributes are typically not visible to the lessee.";
     }

     // Main blocks

     augment "/nw:networks/nw:network/nw:network-types" {
       description
         "Introduces a new network type for inventory topology
          mapping.";
       container inventory-topology {
         presence
           "Indicates this is a bottom-most physical topology instance,
            containing physical-layer attributes including inventory
            mapping, port breakout capabilities, and link media types.";
         description
           "Container for the inventory-topology network type.
            When present, it signals that the network contains
            physical-layer augmentations as defined in this module.
            This network type is intended to serve as the underlay
            for logical network topologies (Layer 2, Layer 3,
            Traffic Engineering (TE), etc.).";
       }
     }

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

```
       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.";
         }
       }
     }

     augment "/nw:networks/nw:network/nt:link" {
       when '../nw:network-types/nwit:inventory-topology';
       description
         "Augments the network topology link with inventory-related
          attributes.";
       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 identityref {
             base link-type;
           }
           description
             "Classification of the link media type at the topology
              layer.

              The base identity 'link-type' is extensible. Examples
              of derived identities include 'copper', 'fiber',
              'coax', 'microwave', and 'wlan'.

              This leaf serves as a lightweight discriminator.  When
              the value is 'microwave', detailed microwave link
```

```
              attributes are defined in the microwave topology data
              model. Wired media (e.g., fiber, copper, or coax) may
              be detailed in a passive network inventory data
              model.";
          }
        }
      }

      augment "/nw:networks/nw:network/nw:node/nt:termination-point" {
        when '../../nw:network-types/nwit:inventory-topology';
        description
          "Augments the TP with inventory mapping and port breakout.";
        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
    }
  }
  <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 3.7.1 of [RFC9907].

The "ietf-network-inventory-topology" YANG module defines a data model that is designed to be accessed via YANG-based management protocols, such as Network Configuration (NETCONF) [RFC6241] and RESTCONF [RFC8040]. These YANG-based management (1) have to use a secure transport layer (e.g., Secure Shell (SSH) [RFC4252], TLS [I-D.ietf-tls-rfc8446bis], 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
Maintained by IANA? N
Namespace: urn:ietf:params:xml:ns:yang:ietf-network-inventory-topology
Prefix: nwit
Reference: RFC XXXX

9. 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 are as follows:


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

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

```
   elements/nwi:network-element[ne-id='NE-SW2']/nwi:components/nwi:\
                                   component[component-id='eth-port-1']"
                   }
                 }
               ]
             }
           ],
           "ietf-network-topology:link": [
             {
               "link-id": "example:Link-SW1-SW2",
               "source": {
                 "source-node": "example:SW-1",
                 "source-tp": "example:TP-SW1-P1"
               },
               "destination": {
                 "dest-node": "example:SW-2",
                 "dest-tp": "example:TP-SW2-P1"
               },
               "ietf-network-inventory-topology:inventory-mapping-\
                                                       attributes": {
                 "link-type": "fiber"
               }
             }
           ]
         }
       ]
     }
   }
```

Appendix B. JSON Example of an Multi-fibre Push On (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"
                },
                "ietf-network-inventory-topology:port-breakout": {
                  "breakout-channel": [
                    { "channel-id": 1 },
                    { "channel-id": 2 },
                    { "channel-id": 3 },
                    { "channel-id": 4 }
                  ]
                }
              }
            ]
          }
        ]
      }
    ]
  }
}
```


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Contributors

Chaode Yu
Huawei
Email: yuchaode@huawei.com

Authors' Addresses

Bo Wu (editor)
Huawei
Email: lana.wubo@huawei.com

Mohamed Boucadair
Orange
Email: mohamed.boucadair@orange.com

Cheng Zhou
China Mobile
Email: zhouchengyjy@chinamobile.com

Qin Wu
Huawei
Email: bill.wu@huawei.com