Network Inventory YANG
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A YANG Network Data Model for Inventory Topology Mapping
draft-ietf-ivy-network-inventory-topology-05

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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Internet-Drafts are draft documents valid for a maximum of six months and may be updated, replaced, or obsoleted by other documents at any time. It is inappropriate to use Internet-Drafts as reference material or to cite them other than as "work in progress."

This Internet-Draft will expire on 23 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-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.

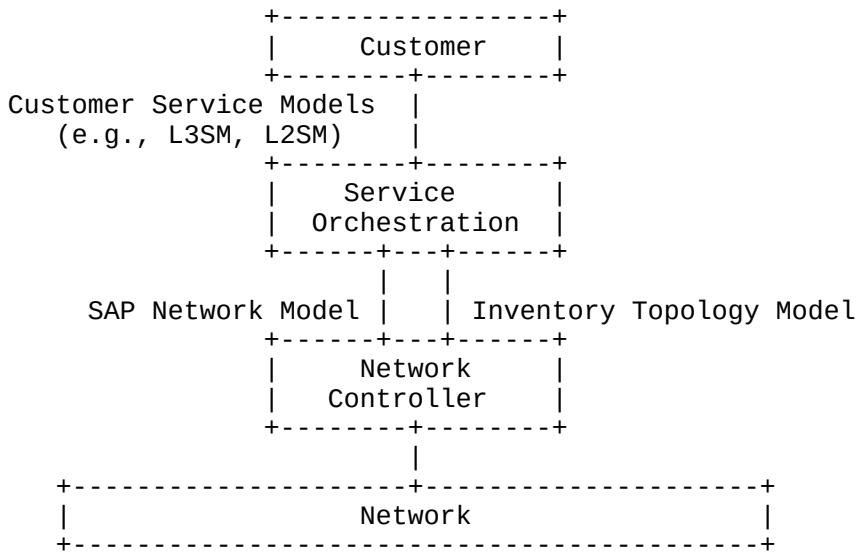

Figure 1: An Example Usage of Network Inventory Topology

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:
     +--ro inventory-mapping-attributes
             {topology-to-inventory-navigate}?
        +--ro ne-ref?   nwi:ne-ref
   augment /nw:networks/nw:network/nt:link:
     +--ro 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:
     +--ro inventory-mapping-attributes
             {topology-to-inventory-navigate}?
        +--ro ne-ref?          nwi:ne-ref
        +--ro port-ref?        leafref
        +--ro port-breakout!
           +--ro breakout-channel* [channel-id]
              +--ro channel-id    uint16
   augment /nwi:network-inventory/nwi:network-elements
             /nwi:network-element:
     +--ro node-ref?      leafref {inventory-to-topology-navigate}?
     +--ro 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:

* 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.

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’).

4.1. Cable-Level Extensions: cable-name and link-type

In order to provide a direct point-to-point cable or fibre between two devices, this document adds lightweight leaves to the topology link:

* cable-name optional asset identifier for a single physical cable (e.g., "CAB-2025-042").

* link-type flexible-text hint such as "copper", "single-mode-fibre", "multi-mode-fibre", "coax".

When the link is formed by a single physical cable (e.g., one factory-terminated patch cord), both leaves may be populated. If the link is composed of several passive elements (such as jumpers, adapters, patch panels, or splice points), the "cable-name" data node can be omitted, and the controller can derive the full path by traversing the TP → port-ref references and usig a more elaborated passive network inventory. An example of such module is defined [I-D.ygb-ivy-passive-network-inventory] which tracks and manages complex passive paths.

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 breakout-config 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@2025-10-20.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 2025-10-20 {
      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";
    config false;
    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";
    config false;
    description
      "Specifies the TP attributes of Network Inventory mapping.";
    /* 1:1 mapping to physical port component */
    uses nwi:port-ref;
    // breakout channels (lightweight, per physical port)
    container port-breakout {
      presence "When present, it indicates that port breakout is
                supported.";
      description
```

```
            "Breakout capability of the physical port represented by
             this TP.
             One TP = one physical port; channels are listed here.";
          list breakout-channel {
            key "channel-id";
            description
              "A single lane or sub-port that the physical port can be
               partitioned into.";
            leaf channel-id {
              type uint16;
              description
                "Unique index of the breakout channel within the port.";
            }
          } // breakout-channel
        } // port-breakout
      }
    }

    grouping link-inventory-feature-attributes {
      description
        "Network Inventory mapping link scope attributes.";
      container inventory-mapping-attributes {
        if-feature "topology-to-inventory-navigate";
        config false;
        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.

No writable data nodes are defined in this module; all nodes are read-only ("config false").

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

8.1. Normative References

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8.2. Informative References

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Appendix A. "cable-name and "link-type" Usage Examples

This appendix illustrates when to populate the link-level "cable-name" and "link-type" data nodes and when to rely on "ietf-passive-inventory" module for multi-segment passive paths.

* Direct Point-to-Point Cable

Topology: [TP-A] ——— 3 m duplex fibre ——— [TP-B]

The link is realised by exactly one cable stock-keeping unit. "cable-name" is filled with the operator’s asset tag; "link-type" is set to "fiber".

* Three-Segment Passive Path of Fiber Distribution Terminal (FDT)

Topology: [TP-A] —— FDT-1 —— segment —— FDT-2 —— [TP-B]

The link spans two FDTs and one cable segment (no active inventory). "cable-name" is omitted; the controller derives the complete passive path by:

1. Retrieving "port-ref" of TP-A and TP-B.

2. Walking the passive-inventory relationships (FDT-1 cable FDT-2).

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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