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A YANG Data Model for Passive Network Inventory
draft-ygb-ivy-passive-network-inventory-02

Abstract

This document presents a YANG data model for tracking and managing passive network inventory. The model enhances the base model outlined in [I-D.draft-ietf-ivy-network-inventory-yang] and is intended for use in the northbound interface of a domain controller as defined in [RFC8453].

Status of This Memo

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Table of Contents

1. Introduction	3
2. Examples of Passive Network Inventory	3
2.1. Passive Infrastructure in Optical Transport Networks	4
2.2. Passive Infrastructure in Optical Access Networks	5
2.3. Passive Infrastructure in Microwave Networks	6
3. Terminology and Notations	6
3.1. Requirements Notations	6
3.2. Terminology	6
3.3. Tree Diagram	7
3.4. Prefixes in Data Node Names	8
4. Modeling Considerations	8
4.1. Relationship with Network Inventory	8
4.2. Relationship with Topology	8
5. YANG Model Overview	8
6. Model Tree Diagram	8
7. YANG Modules	10
7.1. YANG Data Model for Passive Device Inventory	10
8. Manageability Considerations	21
9. Security Considerations	21
10. IANA Considerations	22

11. Normative References	22
Authors' Addresses	24

1. Introduction

Passive infrastructure refers to the underlying infrastructure of a telecommunication network that is not actively detectable or manageable. It typically includes non-powered, non-communicating devices and components, such as cabinets, cables, connectors, splitters, antennas, distribution frames, etc., that are either hosted within an actively managed device or deployed along the physical pathway between active devices. Passive infrastructure serves as physical connections between active network devices, forming the backbone for network topology. As a crucial part of communication networks, the inventory information for these devices is also essential for inventory management.

[I-D.draft-ietf-ivy-network-inventory-yang] incorporates the component concept from [RFC8348] to detail the equipment and holder information of a NE. This encompasses chassis, slot/sub-slot, board/sub-board, port, and transceiver. As these items are recognized by the NE through internal protocols, the passive devices that cannot be discovered by the NE are thus not included in the modeling and needs to be addressed.

[I-D.draft-ietf-ivy-network-inventory-location] emphasizes the relative and geographic location, e.g. equipment room, geo-location for NE. A passive device is deployed in a certain location visible by the operator, and thus can reference the location defined by [I-D.draft-ietf-ivy-network-inventory-location].

This document focuses on modeling passive device inventory. The scope of this model is intended to be applicable to a variety types of networks, including but not limited to, IP/MPLS, optical access, optical transport and microwave networks. The methods for learning about these devices are implementation-specific and fall outside the scope of this document.

2. Examples of Passive Network Inventory

Network segments built on different technologies share many common passive infrastructure components across the system. To explore the practical applications of these components, we can examine example scenarios for optical access networks, optical transport systems, and microwave networks.

2.1. Passive Infrastructure in Optical Transport Networks

Passive infrastructure in optical transport networks serves as the backbone for high-capacity data transmission. Key components include fiber optic cables, which act as the primary medium of long distance transmission. Optical connectors, patch panels, and splice enclosures are crucial for joining and managing fiber links. Couplers and splitters are used for signal distribution and combining.

Within a physical network element (NE) there are also presence of passive components. For example, fiber optic cables are used to connect the ports of different modules within the same or between different chassis. Attenuators, on the other hand, are placed at places through connectors or built-in modules for reducing optical power.

Figure 1 illustrates a typical passive infrastructure for a point-to-point optical transport network.

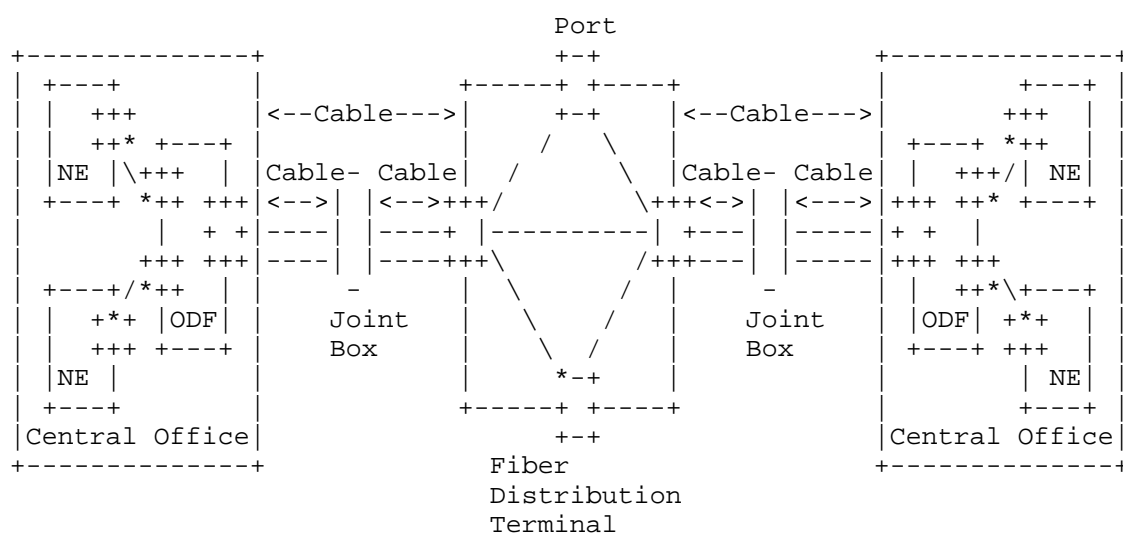


Figure 1: Passive Infrastructure for Optical Transport Networks

Figure 2: Passive Infrastructure for Optical Access Networks

2.3. Passive Infrastructure in Microwave Networks

To be developed.

3. Terminology and Notations

3.1. Requirements Notations

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

3.2. Terminology

The following terms are defined in [RFC7950] and are not redefined here:

- * client
- * server
- * augment
- * data model
- * data node

The following terms are defined in [RFC6241] and are not redefined here:

- * configuration data
- * state data

The following terms are defined and used in this document.

- * **Passive device:** refers to a physical device within a network that does not require external power to function, and simply manipulates signals through processes like transmission, reflection, splitting, filtering, or attenuation without actively amplifying or generating the signal. Examples include optical fibers, splitters, couplers, and optical filters, all of which are used to direct signals within a system without needing power. A passive device typically does not have management interfaces and is typically deployed in a location tracked by the network operator.
- * **Active device:** refers to a physical device that contains hardware and software and is manageable through communication interfaces. Network elements defined by [I-D.draft-ietf-ivy-network-inventory-yang] are examples of active device.
- * **Guiding media:** refers to physical transmission pathways - such as optical fiber cables, electrical cables, and coaxial cables - that direct and confine electromagnetic signals along a specific route. These media provide a bounded channel for data transmission, ensuring signal integrity, minimizing interference, and enabling high-speed communication over varying distances. This category is also commonly known as guided media or wired transmission media. Guiding media can be concatenated to form longer guiding media.
- * **Optical Cable:** refers to a type of guiding media that uses optical fiber as media to transmit optical signals. An optical cable can contain one or multiple fiber cores, also known as fiber strands, each serving as an independent guiding media for data transmission. Optical cables can be spliced or fused through joint boxes, optical distribution frames (ODF), or fiber jumpers.
- * **Electrical Cable:** refers to a type of guiding media that uses metal conductors (such as copper or aluminum wires) as a medium to carry electrical signals for communication or power distribution. Common examples include twisted-pair cables (such as CAT-5/6 and DSL cables), and coaxial cables, which feature a single-core conductor commonly used in DOCSIS and MoCA-based broadband access networks. Electrical cables can be connected through splicing, connectors, or junction boxes.

3.3. Tree Diagram

Tree diagrams used in this document follow the notation defined in [RFC8340].

3.4. Prefixes in Data Node Names

In this document, names of data nodes and other data model objects are prefixed using the standard prefix associated with the corresponding YANG imported modules, as shown in Table 1.

Prefix	YANG Module	Reference
nwi	ietf-network-inventory	RFC XXXX
nil	ietf-ni-location	RFC YYYY

Table 1: Prefixes and Corresponding YANG Modules

RFC Editor Note: Please replace XXXX with the RFC number assigned to [I-D.draft-ietf-ivy-network-inventory-yang]. Please replace YYYY with the RFC number assigned to [I-D.draft-ietf-ivy-network-inventory-location]. Please remove this note.

4. Modeling Considerations

4.1. Relationship with Network Inventory

TBD

4.2. Relationship with Topology

TBD

5. YANG Model Overview

The YANG data model in this draft augments the model defined in [I-D.draft-ietf-ivy-network-inventory-yang] with the following information: - Passive devices: a list of passive devices with extended attributed reported by the domain controller. - Cables: a list of cables with each containing an optional list of child cables.

6. Model Tree Diagram


```

module: ietf-nwi-passive-inventory

augment /nwi:network-inventory:
  +--rw cable* [id]
  |   +--rw id                string
  |   +--rw length?          uint32
  |   +--rw a-end
  |   |   +--rw device-type?    identityref
  |   |   +--rw (connected-device-type)?
  |   |   |   +---:(passive)
  |   |   |   |   +--rw device-id?    string
  |   |   |   +---:(active)
  |   |   |   |   +--rw ne-ref?      leafref
  |   |   |   |   +--rw component-ref? leafref
  |   +--rw z-end
  |   |   +--rw device-type?    identityref
  |   |   +--rw (connected-device-type)?
  |   |   |   +---:(passive)
  |   |   |   |   +--rw device-id?    string
  |   |   |   +---:(active)
  |   |   |   |   +--rw ne-ref?      leafref
  |   |   |   |   +--rw component-ref? leafref
  |   +--ro uuid?            yang:uuid
  |   +--rw name?            string
  |   +--rw description?     string
  |   +--rw alias?           string
  |   +--rw cable-type?      identityref
  |   +--rw cable-role?      identityref
  |   +--rw optical-cable
  |   |   +--rw fiber-core-num?  uint32
  |   |   +--rw fiber-type?      identityref
  |   |   +--rw attenuation?     decimal64
  |   +--rw child-cable* [index]
  |   |   +--rw index          uint8
  |   |   +--rw id?            string
  |   |   +--rw length?        uint32
  |   |   +--rw a-end
  |   |   |   +--rw device-type?    identityref
  |   |   |   +--rw (connected-device-type)?
  |   |   |   |   +---:(passive)
  |   |   |   |   |   +--rw device-id?    string
  |   |   |   |   +---:(active)
  |   |   |   |   |   +--rw ne-ref?      leafref
  |   |   |   |   |   +--rw component-ref? leafref
  |   |   +--rw z-end
  |   |   |   +--rw device-type?    identityref
  |   |   |   +--rw (connected-device-type)?
  |   |   |   |   +---:(passive)

```

```

|           |  +--rw device-id?          string
|           |  +--:(active)
|           |    +--rw ne-ref?           leafref
|           |    +--rw component-ref?    leafref
+--rw passive-device* [id]
  +--rw id                string
  +--ro uuid?             yang:uuid
  +--rw name?             string
  +--rw description?      string
  +--rw alias?            string
  +--rw device-type?      identityref
  +--rw custom-tags*      string
  +--rw location-ref?     nil:ni-location-ref
  +--rw passive-port* [id]
    +--rw id              string
    +--ro uuid?           yang:uuid
    +--rw name?           string
    +--rw description?    string
    +--rw alias?          string
    +--rw port-type?      identityref
    +--rw fiber-core-num? uint32

```

Figure 3: Tree diagram for passive network inventory

7. YANG Modules

7.1. YANG Data Model for Passive Device Inventory

```

<CODE BEGINS> file "ietf-nwi-passive-inventory@2025-07-07.yang"
module ietf-nwi-passive-inventory {
  yang-version 1.1;
  namespace "urn:ietf:params:xml:ns:yang:ietf-nwi-passive-inventory";
  prefix nwi-passive;

  import ietf-network-inventory {
    prefix nwi;
    reference
    "RFCXXXX: A YANG Data Model for Network Inventory";
    //RFC Editor: replace XXXX with actual RFC number
    //and remove this note
  }
  import ietf-ni-location {
    prefix nil;
    reference
    "RFCYYYY: A YANG Data Model for Network Inventory Location";
    //RFC Editor: replace YYYY with actual RFC number
    //and remove this note
  }
}

```

organization

"IETF Network Inventory YANG (ivy) Working Group";

contact

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description

"This YANG module specifies a data model for passive devices, such as fibers, cables, and passive sites, deployed within and between network elements.

The model fully conforms to the Network Management Datastore Architecture (NMDA).

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

The key words 'MUST', 'MUST NOT', 'REQUIRED', 'SHALL', 'SHALL NOT', 'SHOULD', 'SHOULD NOT', 'RECOMMENDED', 'NOT RECOMMENDED', 'MAY', and 'OPTIONAL' in this document are to be interpreted as described in BCP 14 (RFC 2119) (RFC 8174) when, and only when, they appear in all capitals, as shown here.";

// RFC Ed.: replace XXXX with actual RFC number and remove this
// note.
// RFC Ed.: update the date below with the date of RFC publication
// and remove this note.

revision 2025-07-07 {

```
description
  "Initial version";
reference
  "RFC XXXX: A YANG Data Model for Passive Device Info in
  Network Inventory.";
  //RFC Editor: replace XXXX with actual RFC number, update date
  //information and remove this note
}

/* Identities */
identity fiber-type {
  description
    "Base identity for fiber types.";
}
identity G652A {
  base fiber-type;
  description
    "ITU-T G.652A fiber.";
}
identity G652B {
  base fiber-type;
  description
    "ITU-T G.652B fiber.";
}
identity G652C {
  base fiber-type;
  description
    "ITU-T G.652C fiber.";
}
identity G652D {
  base fiber-type;
  description
    "ITU-T G.652D fiber.";
}
identity G653 {
  base fiber-type;
  description
    "ITU-T G.653 fiber.";
}
identity G654 {
  base fiber-type;
  description
    "ITU-T G.654 fiber.";
}
identity G655 {
  base fiber-type;
  description
    "ITU-T G.655 fiber.";
```

```
}
identity G656 {
    base fiber-type;
    description
        "ITU-T G.656 fiber.";
}
identity G657A1 {
    base fiber-type;
    description
        "ITU-T G.657A1 fiber.";
}
identity G657A2 {
    base fiber-type;
    description
        "ITU-T G.657A2 fiber.";
}
identity G657B {
    base fiber-type;
    description
        "ITU-T G.657B fiber.";
}
identity other {
    base fiber-type;
    description
        "Other type of fiber.";
}

identity cable-type {
    description
        "Base identity for cable types.";
}
identity optical-fiber {
    base cable-type;
    description
        "Fiber optic cable.";
}
identity electrical-cable {
    base cable-type;
    description
        "Electrical cable.";
}
identity coaxial-cable {
    base electrical-cable;
    description
        "Coaxial cable.";
}

identity cable-role {
```

```
    description
      "Base identity for cable roles.";
  }
  identity backbone {
    base cable-role;
    description
      "Backbone cable.";
  }
  identity aggregation {
    base cable-role;
    description
      "Aggregation cable.";
  }
  identity access {
    base cable-role;
    description
      "Access cable.";
  }
  identity trunk {
    base cable-role;
    description
      "Trunk cable.";
  }
  identity distribution {
    base cable-role;
    description
      "Distribution cable.";
  }
  identity branch {
    base cable-role;
    description
      "Branch cable.";
  }
}

identity passive-port-type {
  description
    "Base identity for passive port types.";
}
identity service-port {
  base passive-port-type;
  description
    "Service port.";
}
identity input-port {
  base passive-port-type;
  description
    "Input port.";
}
```

```
identity output-port {
  base passive-port-type;
  description
    "Output port.";
}
identity p2mp-port {
  base passive-port-type;
  description
    "Input port.";
}

identity connected-device-type {
  description
    "Base identity for connected device types.";
}
identity passive-device {
  base connected-device-type;
  description
    "Passive/unmanaged device.";
}
identity active-device {
  base connected-device-type;
  description
    "Active device, e.g. network element.";
}

identity passive-device-type {
  description
    "Base identity for passive device types.";
}
identity ODF {
  base passive-device-type;
  description
    "Optical Distribution Frame.";
}
identity WDM {
  base passive-device-type;
  description
    "Wavelength Division Multiplexer.";
}
identity FAT {
  base passive-device-type;
  description
    "Fiber Access Terminal.";
}
identity FDT {
  base passive-device-type;
  description
```

```
        "Fiber Distribution Terminal.";
    }
    identity ATB {
        base passive-device-type;
        description
            "Access Terminal Box.";
    }

    /* Groupings */
    grouping connected-device-end {
        description
            "Attributes applicable to connected device end.";

        leaf device-type {
            type identityref {
                base connected-device-type;
            }
            description
                "Type of connected device.";
        }

        choice connected-device-type {
            description
                "Device end based on the type of connected device.";
            case passive {
                leaf device-id {
                    type string;
                    must "derived-from-or-self(..device-type,
                        'nwi-passive:passive-device')";
                    description
                        "Connected passive device identifier.";
                }
            }
            case active {
                leaf ne-ref {
                    type leafref {
                        path "/nwi:network-inventory/nwi:network-elements"
                            + "/nwi:network-element/nwi:ne-id";
                    }
                    must "derived-from-or-self(..device-type,
                        'nwi-passive:active-device')";
                    description
                        "Referenced Network Element (NE).";
                }
                leaf component-ref {
                    type leafref {
                        path "/nwi:network-inventory/nwi:network-elements"
                            + "/nwi:network-element[nwi:ne-id=current()]/.."
                    }
                }
            }
        }
    }
}
```



```
        + "/ne-ref]/nwi:components/nwi:component"
        + "/nwi:component-id";
    }
    must "derived-from-or-self(..../device-type,
        'nwi-passive:active-device');"
    description
        "Referenced connected active device's component,
        e.g. port component.";
    }
}
}
}

grouping connected-device-ref {
    description
        "Attributes applicable to connected devices.";

    container a-end {
        description
            "A-end device reference";
        uses connected-device-end;
    }

    container z-end {
        description
            "Z-end device reference";
        uses connected-device-end;
    }
}

grouping common-cable-attributes {
    description
        "Common attributes of cables applicable to the cable
        and its child cables.";

    leaf id {
        type string;
        description
            "Cable identifier.";
    }

    leaf length {
        type uint32;
        units "meter";
        description
            "Length of the cable in meter.";
    }
}
```

```
    uses connected-device-ref;
  }

  grouping optical-cable-attributes {
    description
      "Attributes applicable to fiber optic cables.";

    container optical-cable {
      when
        "derived-from-or-self(.. /cable-type, 'optical-fiber')";

      description
        "Container for attributes associated with fiber
        optic cables.";

      leaf fiber-core-num {
        type uint32;
        description
          "Number of fiber cores within the cable.";
      }
      leaf fiber-type {
        type identityref {
          base fiber-type;
        }
        description
          "Type of fiber contained in the cable.";
      }
      leaf attenuation {
        type decimal64 {
          fraction-digits 2;
        }
        units "dB";
        description
          "The fiber attenuation in dB.";
      }
    }
  }

  grouping cable-attributes {
    description
      "Attributes of cables.";

    uses common-cable-attributes;
    uses nwi:basic-common-entity-attributes;

    leaf cable-type {
      type identityref {
        base cable-type;
      }
    }
  }
```

```
    }
    description
      "Type of cable.";
  }

  leaf cable-role {
    type identityref {
      base cable-role;
    }
    description
      "Role of cable.";
  }

  uses optical-cable-attributes;
}

grouping child-cables {
  description
    "Attributes applicable to child cables that are concatnated
    to form the cable.";

  list child-cable {
    key "index";
    min-elements 2;
    description
      "Ordered list of concatenated child cables.";

    leaf index {
      type uint8;
      description
        "An index number used to identify the concatenation
        order of the child cables.";
    }

    uses common-cable-attributes;
  }
}

grouping cables {
  description
    "Attributes applicable to cables.";

  list cable {
    key "id";
    description
      "List of cables.";

    uses cable-attributes;
  }
}
```

```
    uses child-cables;
  }
}

grouping passive-device-ports {
  description
    "Attributes applicable to passive device ports.";

  list passive-port {
    key "id";
    description
      "List of ports on a passive device.";

    leaf id {
      type string;
      description
        "Port identifier.";
    }
    uses nwi:basic-common-entity-attributes;
    leaf port-type {
      type identityref {
        base passive-port-type;
      }
      description
        "Type of passive port.";
    }
    leaf fiber-core-num {
      type uint32;
      description
        "Number of fiber cores within the port.";
    }
  }
}

grouping passive-devices {
  description
    "Attributes applicable to passive devices.";

  list passive-device {
    key "id";
    description
      "List of passive devices.";

    leaf id {
      type string;
      description
        "Cable identifier.";
    }
  }
}
```

```
    uses nwi:basic-common-entity-attributes;
    leaf device-type {
        type identityref {
            base passive-device-type;
        }
        description
            "Type of passive device.";
    }
    leaf-list custom-tags {
        type string;
        description
            "Customized tags, e.g. RFID, QR code that are
             attached to the device.";
    }
    leaf location-ref {
        type nil:ni-location-ref;
        description
            "Referenced location for the passive device.";
    }
    uses passive-device-ports;
}

/* Augmentation */
augment "/nwi:network-inventory" {
    description
        "Augment network inventory with information
         for optical cables and passive devices.";
    uses cables;
    uses passive-devices;
}
}
<CODE ENDS>
```

Figure 4: YANG model for passive network inventory

8. Manageability Considerations

TBD.

9. Security Considerations

The YANG module specified in this document defines a schema for data that is designed to be accessed via network management protocols such as NETCONF [RFC6241] or RESTCONF [RFC8040]. The lowest NETCONF layer is the secure transport layer, and the mandatory-to-implement secure transport is Secure Shell (SSH) [RFC6242]. The lowest RESTCONF layer is HTTPS, and the mandatory-to-implement secure transport is TLS

[RFC8446].

The NETCONF access control model [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). These data nodes may be considered sensitive or vulnerable in some network environments. Write operations (e.g., edit-config) to these data nodes without proper protection can have a negative effect on network operations. Considerations in Section 8 of [RFC8795] are also applicable to their subtrees in the module defined in this document.

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. Considerations in Section 8 of [RFC8795] are also applicable to their subtrees in the module defined in this document.

10. IANA Considerations

It is proposed to IANA to assign new URIs from the "IETF XML Registry" [RFC3688] as follows:

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

This document registers the following YANG module in the YANG Module Names registry [RFC6020].

name: ietf-nwi-passive-inventory
namespace: urn:ietf:params:xml:ns:yang:ietf-nwi-passive-inventory
prefix: nwi-passive
reference: RFC XXXX

11. Normative References

- [I-D.draft-ietf-ivy-network-inventory-location]
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