Network Inventory YANG
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A YANG Network Data Model of Network Inventory Software Extensions
draft-ietf-ivy-network-inventory-software-01

Abstract

The base Network Inventory YANG model defines the physical network elements (NEs) and hardware components of NEs. This document extends the base Network Inventory model for non-physical NEs (e.g., controllers, virtual routers, virtual firewalls) and software components (e.g., platform operating system (OS), software-patch).

Discussion Venues

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

Discussion of this document takes place on the Network Inventory YANG 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-software.

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 12 December 2025.

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1. Introduction

The Network Inventory consists of the physical and non-physical network elements (NEs), hardware components, firmware components, and software components on the a managed network domain. The non-physical network elements (NEs) are network devices that support network protocols and functions, e.g., routers, firewalls, and controllers, which can reside in any network or compute devices, such as servers in Data Center (DC), server-based virtual machines (VMs), or server-based containers.

[I-D.ietf-ivy-network-inventory-yang] defines the base Network Inventory YANG model for physical network element (NE) and hardware components of NEs. Examples of hardware components could be rack, shelf, slot, board and physical port.

The management of non-physical NE and software components information is similar to the management of physical NE and hardware information. For example, inventory data, including product names, serial numbers, etc. are also applicable. This document defines a network inventory software extension YANG model. In addition to inheriting the common inventory attributes of the base network inventory model, this document also adds some software-specific attributes of non-physical NEs (such as controllers, virtual routers, and virtual firewalls) and software components (such as operating system, software patches, BIOS, and boot loader).

The Network Inventory software extension model is classified as a network model (Section 4 of [RFC8309]).

The YANG data model in this document conforms to the Network Management Datastore Architecture (NMDA) defined in [RFC8342].

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]

1.2. Terminology and Notations

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 tree diagram used in this document follows the notation defined in [RFC8340]..

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

2. Requirements Language

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. Relationship to Other YANG Data Models

The base network inventory model supports the software versions of NEs and software versions of hardware components. This document adds more software component identifiers (e.g. platformos, software patch) and more NE types (e.g. software NE, virtual NE) to provide enhanced software information on the NE to facilitate software compatibility check.

Figure 1 depicts the relationship between the Software Extension model and other models. The Software Extension network inventory model enhances the model defined in the base network inventory model with more software specific attributes.

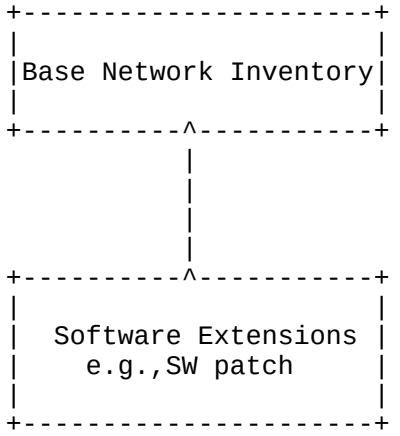

Figure 1: Relationship of SW Extension Model to Other Inventory Models

4. Model Overview

The tree diagram in Figure 2 provides an overview of the data model for "ietf-network-inventory-sw-ext" module.

```
module: ietf-network-inventory-sw-ext
  augment /nwi:network-inventory/nwi:network-elements
            /nwi:network-element:
    +--ro software-attributes
       +--ro status?              identityref
       +--ro installation-time?   yang:date-and-time
       +--ro activation-time?     yang:date-and-time
  augment /nwi:network-inventory/nwi:network-elements
            /nwi:network-element/nwi:components/nwi:component:
    +--ro software-module-attributes
       +--ro status?              identityref
       +--ro installation-time?   yang:date-and-time
       +--ro activation-time?     yang:date-and-time
```

Figure 2: YANG Tree of Software Extensions

5. Non-physical Network Elements

In the base Network Inventory YANG model, "ne-type" is a YANG identity that describes the type of the network element and only the "physical-network-element" identity" is defined. This document adds non-physical NE identity, such as "ne-software", "ne-virtual", and "ne-container".

The base Network Inventory model also defines common inventory attributes, including the software version, patch versions, product name, and serial number. The data is also applicable to non-physical NEs.

The Network Inventory software extension mode defines some new software attributes, consisting of software status, installation time, and activation time.

6. Software components

Software components refer to the softwares installed on the NE, such as operating system, software patches, BIOS, and boot loaders.

Similar to the common inventory attributes of NEs, the common attributes of software components (such as software version, patch versions, product name, and serial number) are also applicable to software components. For software and patch versions, the base inventory (Section 4 of [I-D.ietf-ivy-network-inventory-yang]) defines the "leaf" of "software-rev" and the "leaf-list" of "software-patch-rev". If more detailed installation and activation information is needed, the extension attributes of software components can be used.

7. YANG Data model for Network Inventory Software Extensions

The "ietf-network-inventory-sw-ext" module uses types defined in [RFC6991], [I-D.ietf-ivy-network-inventory-yang].

<CODE BEGINS> file "ietf-network-inventory-sw-ext@2024-10-17.yang"

```
module ietf-network-inventory-sw-ext {
  yang-version 1.1;
  namespace
    "urn:ietf:params:xml:ns:yang:ietf-network-inventory-sw-ext";
  prefix nwis;

  import ietf-yang-types {
    prefix yang;
    reference
      "RFC 6991: Common YANG Data Types";
  }
  import ietf-network-inventory {
    prefix nwi;
    reference
      "RFCAAAA: 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: Cheng Zhou
             <zhouchengyjy@chinamobile.com>
        Editor: Qin Wu
                <bill.wu@huawei.com>
        Editor: Mohamed Boucadair
                <mohamed.boucadair@orange.com>";
     description
       "This YANG module defines a model for network inventory software
        extensions.

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        identified as authors of the code.  All rights reserved.

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        (https://trustee.ietf.org/license-info).

        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.";

     revision 2025-06-10 {
       description
         "Initial version";
       reference
         "RFC XXXX: A YANG Data Model for Network Inventory Software
                    Extensions.";
     }

     identity ne-nonphysical {
       base nwi:ne-type;
       description
         "A non-physical network element (NE) is a network device that
```

```
        support network protocols and functions, e.g., router,
        firewall, and controller, which can reside in any network or
        compute devices, such as a server in Data Center (DC),
        server-based virtual machine (VM), or server-based
        container.";
    }

    identity ne-software {
      base ne-nonphysical;
      description
        "A software NE refers to a a network device residing in any
         network or compute devices, such as a physical server
         (or 'bare metal') in DC. Examples of software NEs are
         network controllers.";
    }

    identity ne-virtual {
      base ne-nonphysical;
      description
        "A virtual NE refers to a network device residing within
         server-based Virtual Machine (VM) implementing a virtual
         network function (VNF). Examples of virtual NEs are
         virtual routers, virtual firewalls.";
    }

    identity ne-container {
      base ne-nonphysical;
      description
        "A container NE refers to a network device residing within
         server-based container implementing a Containerized
         network function (CNF).";
    }

    identity software-component {
      base nwi:non-hardware-component-class;
      description
        "Base identity for software components in a managed
         device.";
    }

    identity operating-system {
      base software-component;
      description
        "OS software type.";
    }

    identity operating-system-patch {
      base software-component;
```

```
    description
      "An operating system update - which should be a subcomponent
       of the ‘operating-system‘ running on a component. A patch is
       defined to be a set of software changes that are atomically
       installed (and uninstalled) together. ";
  }

  identity bios {
    base software-component;
    description
      "Legacy BIOS or UEFI firmware interface responsible for
       initializing hardware components and first stage boot
       loader.";
  }

  identity boot-loader {
    base software-component;
    description
      "Software layer responsible for loading and booting the
       device OS or network OS.";
  }

  identity software-module {
    base software-component;
    description
      "A base identity for software modules installed and/or
       running on the device.  Modules include user-space programs
       and kernel modules that provide specific functionality.";
  }

  identity software-status {
    description
      "Base identity for software status.";
  }

  identity software-installed {
    base software-status;
    description
      "Software status is Installed.";
  }

  identity software-activated {
    base software-status;
    description
      "Software status is Activated.";
  }

  grouping software-info-grouping {
```

```
      description
        "Specific attributes applicable to Software.";
      leaf status {
        type identityref {
          base software-status;
        }
        description
          "Software status.";
      }
      leaf installation-time {
        type yang:date-and-time;
        description
          "Date and time the current revision last changed.";
      }
      leaf activation-time {
        type yang:date-and-time;
        description
          "Date and time the current revision last changed.";
      }
    }

    /* Main blocks */

    augment "/nwi:network-inventory/nwi:network-elements"
          + "/nwi:network-element" {
      description
        "Augment network element (NE) attributes.";
      container software-attributes {
        when "derived-from-or-self(../nwi:ne-type,'ne-software')";
        config false;
        description
          "Container for the attributes applicable only to software
           Network Elements (NEs).";
        uses software-info-grouping;
      }
    }

    augment "/nwi:network-inventory/nwi:network-elements/"
          + "nwi:network-element/nwi:components/nwi:component" {
      description
        "Augment software component attributes.";
      container software-module-attributes {
        when
          "derived-from-or-self(../nwi:class,'software-module')";
        config false;
        description
          "This container contains some attributes belong to
           software modules only.";
```

```
        uses software-info-grouping;
      }
    }
  }
<CODE ENDS>
```

8. Security Considerations

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

The "ietf-network-inventory-sw-ext" YANG module defines a data model that is designed to be accessed via YANG-based management protocols, such as NETCONF NETCONF [RFC6241] or RESTCONF [RFC8040]. These YANG-based management protocols (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: * TBC

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:

* TBC

9. 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-sw-ext
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-sw-ext
Namespace: urn:ietf:params:xml:ns:yang:ietf-network-inventory-sw-ext
Prefix: nwis
Maintained by IANA? N
Reference: RFC XXXX

10. References

10.1. Normative References

[I-D.ietf-ivy-network-inventory-yang]
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