A YANG Data Model for Network Inventory

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Updates Since IETF 119

➢ Resolved some pyang/yanglint compilation errors/warnings
  ✓ Fixed the part-number & serial-number & product-name’s description
  ✓ Added software-patch-rev attribute for NE and components
  ✓ Removed software-specific-info container (out of scope)
➢ Resolved YANG errors/warnings
➢ Fixed nits
Summary of the Open Issues

- Issues to be addressed before WG LC
  - Modelling of port/breakout
  - Terminology and Scope
  - Ensure that all the requirements for ALMO in the scope of the base inventory model are covered
  - Editorial clean-up

- Issues not blocking WG LC (could be addressed in other documents or RFC-bis)
  - Additions (new attributes or inventory elements)
  - Support write operations
  - Peer-mount approach
    - Depends from some work in Netmod WG which is at initial stage
Issues faced with modelling of port/breakout

- Different use cases to be considered
  - Collection of use cases still on-going
  - Lack of (known) standard references: using pictures taken from the Web

- Alternative modelling options
  - Three options on the table, based on existing models (RFC8348, OpenConfig and TAPI)
  - Details of each option still under investigation

- Terminology jargon
  - Different terminology used when describing different use cases
  - Different terminology used by existing models
  - Same terms used with different meanings (e.g., transceiver, channel)
Reference Scenarios of Port Modelling

1) Non-pluggable (integrated) port
2) Empty hole
3) Pluggable port
4) Non-pluggable port (assumed to be quite straightforward after 1, 2 and 3 scenarios are addressed)

Current focus:
1) More commonly used for electrical ports (RJ-45 connectors)
2) and 3) more commonly used for optical ports

Target: common model for electrical and optical ports

Need to consider also breakout ports
Examples of connectors and pins

**RJ-45 electrical connector:**
- Multiple pins
- Each pin carry electrical signal in Tx or Rx direction

**Simplex optical connector (e.g., LC connector):**
- One pin
- Can carry optical signal(s) in Tx or Rx or both directions

**Duplex optical connector (e.g., LC connector):**
- Two pins
- One pin carry optical signal(s) in each (Tx/Rx) direction

**MPO optical connector:**
- Multiple pins
- Each pin carry optical signal in Tx or Rx direction
Examples of ports: Electrical (aka RJ-45)

(Integrated)

(Pluggable)
Examples of ports: Optical, single-channel
Examples of ports: Optical, WDM multi-channel (e.g., 400G-LR)

Note: With or without breakout
Examples of ports: Optical, MPO multi-channel (e.g., 400G-DR)

Note: With or without breakout
Active Optical Cables:
- SFP modules and cable bound together (one part number)
- SFP modules can be inserted in different network elements

Optical CS connectors:
- Multiple CS connectors on the same SFP module
- A CS connector has two pins (one Tx and one Rx)
Pluggable port (RFC8348-like approach)

The port can be:
- Electrical port
- Single-channel optical port
- Multi-channel WDM port (without breakout)
- Multi-channel MPO port (without breakout)

Modelling of port breakouts to be defined

Modelling of location=/ne=ne-name/sl=10/p=3 or /ne=ne-name/sl=10/s_sl=2/p=1 to be clarified

Modelling of the connector type may need to be defined

Modelling of the SFP module attributes may need to be defined

The need to model the SFP module as a module component or as a port to be clarified
Ambiguity of port definition in RFC8348

Should the SFP module be modelled as a port or as a module component?
The port can be associated with:
- Single-channel optical port
- Multi-channel WDM port (with or without breakout)
- Multi-channel MPO port (with or without breakout)

location=/ne=ne-name/sl=10/p=3

The list of *line-side* channels (and references from the interface) is defined only for multi-channel ports.

The breakout group configuration drives the creation of the interfaces associated with a multi-channel port, by configuring the interface rate, the number of interfaces in the group and the number of *host-side* channels assigned to each interface.
Pluggable port (OpenConfig-like approach) – 2/2

- **Board Component**
  - Port Component:
    - install-position=3
    - empty=False
    - Breakout groups

- **Transceiver Component**:
  - parent-rel-pos=1
  - Fru=True
  - connector type
  - List of channels

The list of (line side) channels on the transceiver is reported for any multi-channel port (with or without breakout): the reference from the interface to a port by default assumes all the channels are used by the port (no breakout) unless the list of (line-side) channels is also reported.

- Modelling of pluggable electrical ports to be clarified
- Modelling the association between an interface and multiple ports may need to be added
- Association of Tx/Rx pins to line-side channels not modelled (implicit)

The interface state (RO) references a port and the list of channels (Slot 10).
Pluggable port (TAPI-like approach) – 1/2

- The port can be associated with:
  - Electrical port
  - Single-channel optical port
  - Multi-channel WDM port *(without breakout)*
  - Multi-channel MPO port (with or without breakout)

- Connectors and pins on the SFP module are not explicitly reported in the model (no information about the connector type is provided)

- Occupying fru reference: 
  
  - `holder-name=/ne=ne-name/sl=10/p=3`

- List of contained holders

- Connectors and the pins reference
Pluggable port (TAPI-like approach) – 2/2

References from the access port to the pins in the connector required only in case of breakout ports

A NEP can be mapped to an access port which is using multiple connectors (e.g., 10G-Base-SR4 without MPO)

Modelling of multi-channel WDM port breakouts to be clarified
Empty Hole (RFC8348-like approach)

Board Component

Child component

Container Component:
- parent-rel-pos=1

It can be used to plug:
- Electrical port
- Single-channel optical port
- Multi-channel WDM port (with or without breakout)
- Multi-channel MPO port (with or without breakout)
Empty Hole (OpenConfig-like approach)

Board Component

Port Component: 
- install-position=2 
- empty=True

It can be used to plug:
• Electrical port
• Single-channel optical port
• Multi-channel WDM port (with or without breakout)
• Multi-channel MPO port (with or without breakout)

location=/ne=ne-name/sl=10/p=2
Empty Hole (TAPI-like approach)

- Board Equipment
- List of contained holders

- Contained holder - name

It can be used to plug:
- Electrical port
- Single-channel optical port
- Multi-channel WDM port (with or without breakout)
- Multi-channel MPO port (with or without breakout)

location=holder-name=/ne=ne-name/sl=10/p=2

(Slot 10)
Non-pluggable integrated port (RFC8348-like approach)

The port can be:
- Electrical port
- Single-channel optical port
- Multi-channel WDM port (without breakout)
- Multi-channel MPO port (without breakout)

location=/ne=ne-name/sl=10/p=1
Non-pluggable integrated port (OpenConfig-like approach)

The port can be:
- Electrical port
- Single-channel optical port
- Multi-channel WDM port (without breakout)
- Multi-channel MPO port (without breakout)

location=/ne=ne-name/sl=10/p=1

The interface state (RO) references a port and the list of channels
Non-pluggable integrated port (TAPI-like approach)

Connectors and pins on the board are not explicitly reported in the model.

The port can be associated with:
- Electrical port
- Single-channel optical port
- Multi-channel WDM port (*without breakout*)
- Multi-channel MPO port (*with or without breakout*)

(Slot 10)
Terminology and Scope: input from mailing list (1/2)

- Hardware component as generalization of:
  - From RFC8348: chassis, backplane, container (slot, ...), power supply, fan, sensor, module (board, ...), cpu, battery, storage device
  - New components can be added to the list based on requirements
  - Definitions from RFC8348 that require some further discussion/clarifications: port, energy object, stack
  - In general operators have expressed the interest to retrieve any component which has a part number

- Software component: more input needed
  - One option is to indicate that other type of components (non-hardware component) are in the scope of IVY but outside the scope of the base inventory model
  - Further terminology enhancements (outside the scope of the base inventory model) can be defined in the SW inventory model I-D
(Physical) network element: implementation or application specific grouping of components (e.g., hardware component)

Virtual network element: more input needed
- One option is to indicate the other type of network elements are in the scope of IVY but outside the scope of the base inventory model
- Further terminology enhancements (outside the scope of the base inventory model) can be defined in the SW inventory model I-D
Additions

➢ Proposed additions that required further discussion
   ✓ Attributes proposed by China Unicom (issue #11)
   ✓ Timestamp information (issue #17)
   ✓ Attributes from RFC 7317 (issue #2)
   ✓ *Modelling of fibers and cables (issue #32) → new draft*
   ✓ Asset-id attribute for network-element (issue #36)
   ✓ Support for SW upgrades (issue #41)
   ✓ Component location (issue #42)
   ✓ Inventory of passive components (issue #46)

➢ Need to prioritize and evaluate which issue to address before WG LC
   ✓ Which issue to postpone to a future revision (RFC-bis)
   ✓ Which issue to address in an augmentation model
Next Step

➢ Resolve the terminology and scope issue
➢ Resolve the port and breakout modelling issue
➢ Discuss the scope of the initial revision of the base inventory
  ✓ Consider multiple revisions of the base inventory model
  ✓ Consider other models augmenting the base inventory model
Backup
References

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2) Cavo Ethernet Cat6 (F/UTP) RS PRO, guaina in PVC col. Grigio, L. 3m, Con terminazione | RS (rs-online.com)
3) Category 5 cable – Wikipedia
4) 10GBASE-T Ultimate Guide: Introduction, Cable, Pros and Cons (qsfptek.com)
5) What Are MTP®/MPO Cables and How to Choose Them? | FS Community
6) How to Choose MTP/MPO Cable for 10G/40G/100G Connections? (fiber-optic-solutions.com)
7) Everything You Need to Know About Ethernet Ports and Their Uses – Infinity Cable Products (infinity-cable-products.com)
8) Deep Dive: 400GBASE-LR4 QSFP-DD Optical Transceiver (fluxlight.com)
9) Single Lambda 100GBASE-LR1 - FluxLight Blog
10) VSC8522 | Microsemi
Optical Fibers and Connectors

One fiber pair, one (unidirectional) fiber carrying one optical signal for each direction (aka dual-fiber patch cable)

One Tx/Rx optical connectors pair

One bidirectional optical connector

One (bidirectional) fiber carrying two optical signals, one for each direction

Note: There are also cases where there is a single fiber used to carry signal in a single direction: to be analyzed in a later step
Electrical Cables and Connectors

One twisted-pair cable carrying electrical signals in both directions

More than one twisted-pair wires in one cable

One bidirectional RJ45 connector

An SPF module can have an RJ-45 connector

More than pin in one RJ-45 connector
MPO Cables and Connectors

MPO Trunk Cable

Multiple Tx/Rx optical connectors pair

MPO Breakout Cable

One MPO connector

MPO breakout cables can connect one NE with multiple NEs

More than pin in one MPO connector

Key Up

White Dot

Fiber Position

Pin Location