

A YANG Data Model for Network Hardware Inventory

IVY WG, IETF117

draft-ietf-ccamp-network-inventory-yang-02

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History of the draft

- First version of the draft presented at IETF 112
 - Focused on (hardware) network inventory only for optical networks
 - Considered generic to become technology-agnostic
 - Presented at both OPSAWG and CCAMP WG
 - Not presented at Netmod WG due to lack of time
- Updated version of the draft presented at IETF 113
 - Generalized to become technology-agnostic
 - Focused on hardware network inventory
 - Presented at CCAMP WG
 - OPSAWG and Netmod WG informed
- Adopted as CCAMP WG document in January 2023
 - Progressing the work through normal CCAMP WG process
 - OPSAWG, Netmod WG and IVY WG (and former inventory mailing list) informed

Major Updates Since IETF 116

➤ Provided a pattern for component's location

□ The relative/logical position of a component within the NE

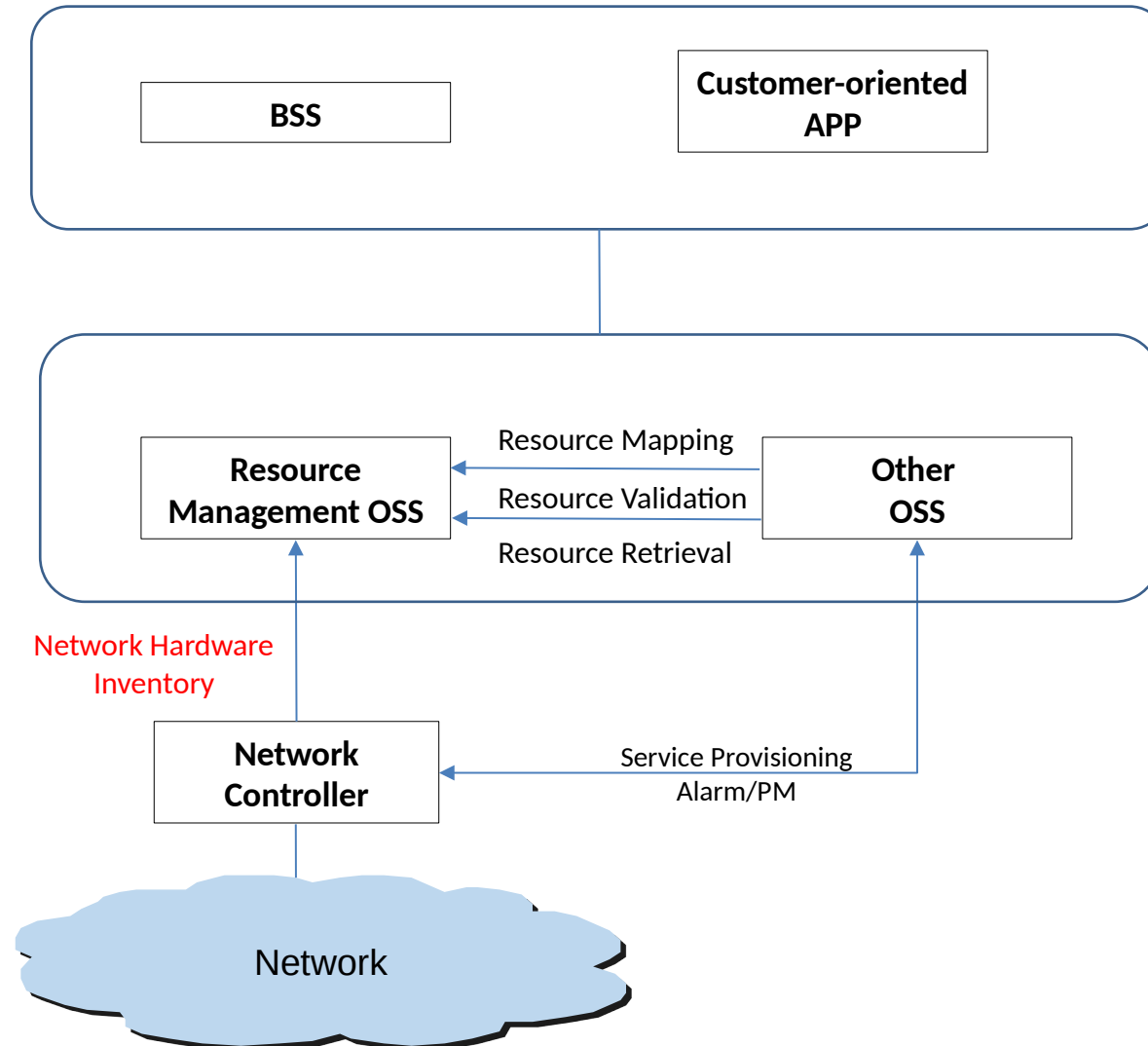
- ONF TR-547 provides a string pattern to describe the relative position of INVENTORY_ID property
- Though TR-547 is aimed to adopt in optical technology, we consider this string pattern is also applicable for other technologies
- The string pattern is concatenation of n tuple elements '/<field>=<index>', the meaning of '<field>' includes:

<field>	meaning
ne	network element
r	rack
sh	chassis component
s_sh	sub-chassis component
sl	slot component
s_sl	sub-slot component
p	port component

- Though Chassis has broader applicability, we still use the acronyms 'sh' and 's_sh' for consistency consideration

➤ Indicated that equipment-room and rack could be optional

UC1. Central View of Asset Management



Operators' Urgent Needs

- Address a gap identified in 2020/2021 for ACTN POI applicability
 - Retrieve and correlate hardware inventory information from IP and Optical controllers (O-PNCs and P-PNCs)
- Objective is to define a technology-agnostic hardware inventory model
 - Open for technology-specific augmentations to be defined in a later stage, if needed
- The CCAMP WG draft has reached a good level of maturity
 - Few enhancements are needed to become ready for implementation and deployment
- The CCAMP WG draft could be considered as the basis for future inventory enhancements without delaying its delivery for real implementation and deployment in carrier networks

Proposed approach

- Generalize the current model to support a step-by-step extensible approach
 - Initial focus on a base model supporting hardware inventory for carrier networks
 - Open to extensions to add support for software and license inventory
 - Open to extensions to add support for enterprise networks
- Extensions can be done through a new revision or through augmentations
 - **Challenge:** design the model to allow extensions through BC changes

Proposed changes to the model

- Change the name of the root to ietf-network-inventory
- Generalize the list of equipment rooms as a list of sites
 - Define equipment rooms as one type of site
 - Open to support other type of sites by future extensions (identity)
- Keep out of scope from the base model items that requires further discussion
 - SW components, licences, virtual NEs, other type of sites
- Keep the model open to future extensions (BC changes)
 - Only pending open issues to address at the beginning (now) is whether to define one common list or separated lists for HW and SW components

Proposed changes to the model - Tree View

```
module: ietf-network-inventory
  +--ro network-inventory
    +--ro sites
      | +--ro site* [uuid]
      |   +--ro uuid          yang:uuid
      |   +--ro class        identityref
    +--ro network-elements
      | +--ro network-element* [uuid]
      |   +--ro uuid          yang:uuid
      |   +--ro is-virtual?   boolean
      |   +--ro (hardware-)components
      |     | +--ro (hardware-)component* [uuid]
      |     |   +--ro uuid          yang:uuid
      |     |   +--ro class?      identityref
      |     +--ro software-components
      |       +--ro software-component* [uuid]
    +--ro virtual-network-elements
      | +--ro network-element* [uuid]
    +--ro virtual-network-elements
      +--ro software-component* [uuid]
```

Legenda

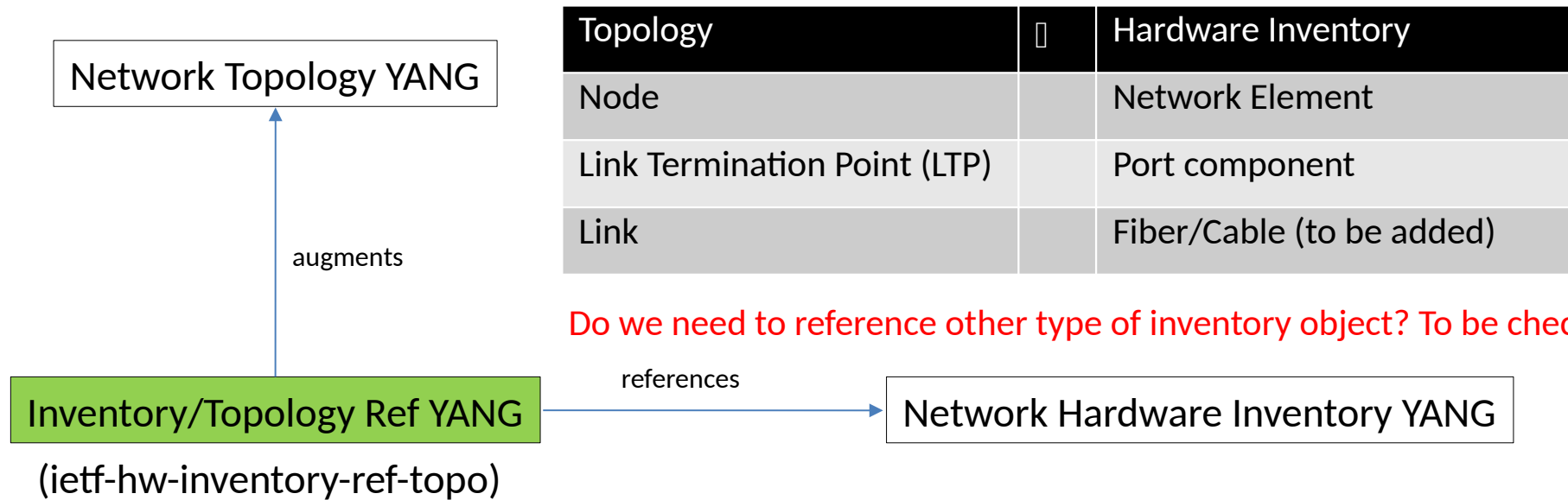
In the current YANG model

Proposed changes to the current YANG model

Possible future extensions to the YANG model (for further considerations)

Possible changes to the current YANG model (pending discussion)

Navigation from Topology to Inventory



Do we need to reference other type of inventory object? To be checked by examples

Proposed approach: keep functional aspects (which are technology-specific) within the scope of the Network Topology YANG can keep the inventory model technology-agnostic

Next Steps

- Update the draft as proposed
 - Become the basis for network inventory YANG model(s)
 - Keep focus on the detailed definitions for hardware inventory
 - Ensure support of other inventory requirements (e.g., software and license inventory) could be added by future BC changes
- Move the I-D to IVY WG?
- Continue discussions in weekly open meetings (welcome to join)
 - Meeting slot: Wednesday 4pm CEST / 10am NA EDT / 10pm CST
 - Github: <https://github.com/ietf-ccamp-wg/ietf-network-inventory>

Comparison with draft-wzwb-opsawg-network-inventory-management

Differences

- Defining a new root versus augmenting RFC8345
- Additional aspects beyond hardware network inventory
 - Software network inventory
 - Licence network inventory
 - Virtual NE inventory
- Additional aspects beyond equipment rooms/racks
 - Stand-alone devices (not located within a rack)
 - Outdoor devices (not located in a room)
 - Mobile devices (with no fixed location)

Why not augmenting Network YANG (RFC8345) - 1/2

- Hardware Inventory and Network Topology are different concepts
 - Hardware inventory is used for asset management
 - Network topology represents logical resources used for service provisioning
- Defining a new root avoids the need for the client to do some filtering to recognize the network-id of the hardware inventory network instance
- No real advantages on re-using Network YANG model
 - Navigation from Network Topology and Network Hardware Inventory models requires anyhow some augmentations to the Network Topology YANG model

Why not augmenting Network YANG (RFC8345) - 2/2

- The solution in draft-wzwb-opsawg-network-inventory-management is not aligned with RFC8345
 - According to RFC8345, network inventory should augment the Network Model
 - In the I-D, network inventory is augmenting the Topology Model instead
 - Augmenting the Topology Model (RFC8345) also creates a duplication between a port component and a termination point

Management of software components - 1/2

- **Option 1:** define a single component list (under node/network-element) for both HW and SW components
 - See draft-wzwb-opsawg-network-inventory-management
 - Closer to the approach of OpenConfig
 - Common model for HW and SW components, but requires to understand some open issues about SW inventory since the beginning:
 - Not clear whether there are common attributes between HW and SW components
 - Not clear whether the relationship between SW components or between HW and SW components is the same as the relationship between HW components (containment)
 - What is the SW component? The running code or the software module?
 - Requires more complex filtering process e.g., when retrieving only HW components (common operation in today's networks)

Management of software components - 2/2

- **Option 2:** define two different component lists (under node/network-element): one for HW component and the other for SW component
 - No common model for HW and SW components needed
 - SW component list(s) can be easily added in future extensions (BC change)
 - Common attributes can be moved to a grouping in future extensions (BC change)
 - Higher level of modularity:
 - Servers can implement either HW-only inventory, or SW-only inventory, or HW&SW inventory
 - Simpler to retrieve only HW components (common operation in today's networks) or only SW components

Management of virtual NEs - 1/2

- **Option 1:** define a single node/network-element list for both physical and virtual NEs
 - See draft-wzwb-opsawg-network-inventory-management
 - Not clear the meaning of RFC8348 hardware components with virtual NEs
 - Not clear whether the requirement to manage virtual NEs in the same way as physical NEs applies to network inventory or only to the topology model (functional aspects of a virtual NE)
 - No physical HW components exist for virtual NEs
- **Option 2:** define two different node/network-element list: one for physical NEs and one for virtual NEs

Management of virtual NEs - 2/2

- **Option 3:** provide a navigation from SW components to topological elements representing the functional aspects of the virtual NE
- Any of these options can be added in future extensions (BC changes)

Management of equipment rooms and sites

- Discussion on-going on adding a list of sites
 - Focus on the details of equipment room as a type of site in the initial phase
 - Consider whether to structure it in a recursive manner (such as a site can contain other sites)
 - For example, a campus can be a site which contains buildings and a building can be another site which contains equipment rooms, and so on
- New types of sites can be defined in future extensions (BC change)

Thank You ☐