Routing Area Yang Architecture Design Team Update

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Wiki: http://trac.tools.ietf.org/area/rtg/trac/wiki/RtgYangArchDT

Repo: https://github.com/ietf-rtg-area-yang-arch-dt/

DT current “work” topics

1. Meta-Model:
   YANG Device Model Structure
2. OpState:
   YANG Relationship of Config and Operational State (and intended)
3. Conventions

Status: Meta-Model

- Significant progress from last meeting!
- Identified need for “schema mount”
  - To simplify organization (more on this later)
    - And remove instance/LNE from all models!
  - NETMOD interim held, NETMOD took action to provide solution
- Published draft-rtgyangdt-rtgwg-device-model-03
  - Assuming schema mount
- Next steps
  - Track schema mount solution development
  - Socialize solution
    - Mostly sync’ed with draft-ietf-netmod-routing-cfg

Status: OpState

- Requirements documented and generally understood
  - Telemetry/streaming use case not called out in netmod req document, but understood by those working solution
- NETMOD solutions authors working on consolidated / unified approach
- Lack of standard OpState solution is blocking other work
  - Options available today:

1. Ignore OpState – assume solution won't require model changes
2. Manually add to every model – current OpenConfig approach

- In holding pattern – next DT steps:
  - Track solution discussion in netmod
  - Once there is a solution, sanity check, update drafts as needed

Status: Conventions

Objectives (from AD):

- Provide YANG structure conventions for area
  - E.g., containers within groupings, lists within containers, etc.
- Provide guidance to routing area protocol WGs on:
  - Process for modifying existing models
  - What to do, i.e., not forget about, WRT YANG when defining new protocol extensions
    - TBD, e.g., a new “YANG considerations section”…

Summary

- Meta-Model looks to be in good shape
  - Presuming schema mount solution will be delivered by NETMOD
  - Time for RTG WGs to review & comment
- OpState solution remains a critical impediment
  - Will track/support NETMOD’s work in this area
- Conventions
  - To be looked at post BA

Network Device YANG Organizational Model
draft-rtgyangdt-rtgwg-device-model-03

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Repo: https://github.com/ietf-rtg-area-yang-arch-dt/meta-model.git

Topics

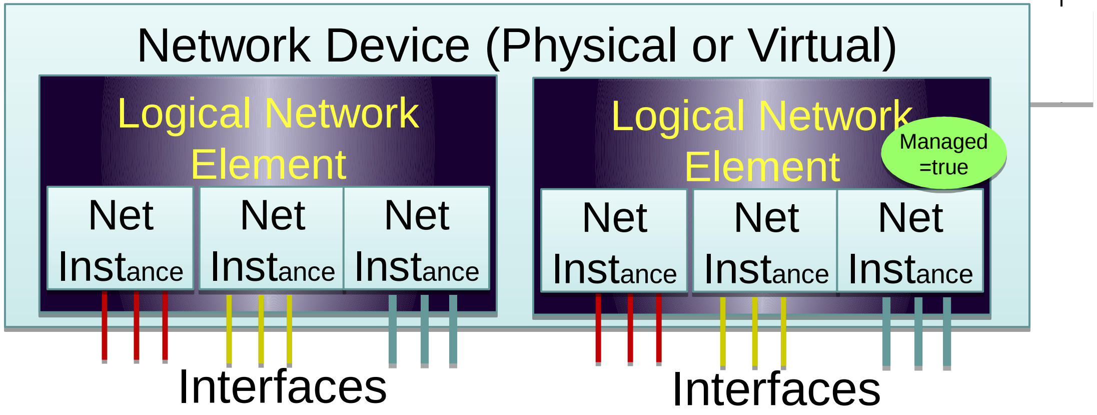
- Brief Review of Models, LNEs, and NIs
- Challenges
- Use of Schema Mount
- Draft Changes since 01
- Model Disposition
- Open issues
- Next steps

Defined Models

1. module: network-device
   - Overall structure for any network device type
     - From small router to Carrier Class
     - Covers relations amongst models –
       Not to be implemented directly
2. module: logical-network-element
   - Separates management/resource domains
     - Commonly called logical system or router, and virtual switch, chassis, or fabric, virtual device contexts, contexts
3. module: network-instance
   - Separates routing or switching domain
     - e.g., VRF or VSI

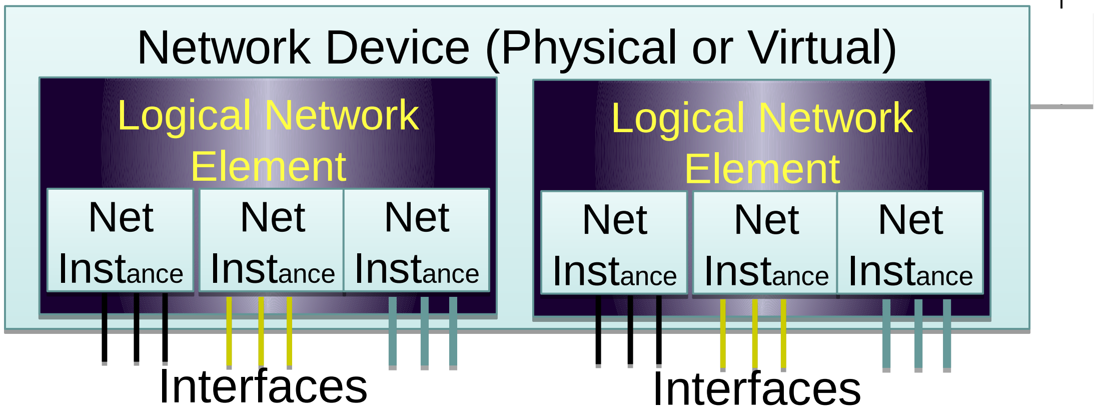
- Will eventually be broken into three documents

Logical Network Elements



- Separate management sub-domains
  - Sub-domains can be managed independently and by a top level manager (managed=true)
- Differs from multiple logical devices and VMs
  - Where top level management of subdomains not supported

Network Instances



- Separate routing / switching domains
- Can represent of an RFC 4364 VRF or a Layer 2 Virtual Switch Instance (VSI) or a bridge/router (i.e., both)
- General virtualized instance implying a separate L2, L3, or L2/L3 context.
  - For L3, this implies a unique IPv4/IPv6 address space.

Challenge Context

- There are many “top-level” modules out there
  - Some RFCs
  - Many drafts
  - Many private/proprietary/consortia
  - Some from other SDOs (e.g., from IEEE)
- None are LNE aware
- draft-ietf-netmod-routing-cfg changed to remove *routing instances*
- One example: RFC7223 – A “top-level” module

*Top-leve*l is sometimes referred to as *root-level*

```
Namespace "urn:ietf:params:xml:ns:yang:ietf-interfaces";
+--rw interfaces
|  +--rw interface* [name]
|     +--rw name                          string
|     +--rw description?                  string
|     +--rw type                          identityref
|     +--rw enabled?                      boolean
|     +--rw link-up-down-trap-enable?   enumeration
```

Original (draft -01) Approach

- An explicit structure with LNEs and NIs

```
+--rw device                       (Real or virtual)
     +--rw info
     +--rw hardware
     +--rw interfaces               (RFC7223, RFC7277, drafts)
     +--rw qos
     +--rw logical-network-elements (logical partition)
         +--rw network-instances (rtg-cfg draft, e.g., VRF/VSI)
```

- Pro:
  - Can support any type of device
  - No YANG modification required
- Cons:
  - Every model and device would see at least 1 LNE and NI
  - Would impact every module
    - Each module would need to pick path based on model type
      - Physical at the top
      - Per management domain, under LNE
      - Per VRF/VSI, under NI

Current (draft -03) Approach

The term *schema mount* is used to be solution neutral

- Rely on “schema” mount
  - Works for any module – ***without modification***
- Adds two tables
  - LNE: logical-network-inventory
  - NI: network-instance
- Each table defines a per {LNE, NI} instance root
  - Under which any top-level model may be *instantiated*
    - Note this is defined in the schema
  - Choice of available model is up to the implementation
    - Some type of device profile definition is expected
  - ietf-yang-library is used to enumerate available models

Example: A Top-Level Device

```
Namespace "urn:ietf:params:xml:ns:yang:...";
   +--rw ietf-yang-library
   |
   +--rw interfaces
   +--rw hardware
   +--rw qos
   |
   +--rw system-management
   +--rw network-services
   +--rw oam-protocols
   |
   +--rw routing
   +--rw mpls
   +--rw ieee-dot1Q
   |
   +--rw ietf-acl
   +--rw ietf-key-chain
   |
   +--rw logical-network-element
   +--rw network-instance
```

```
module: network-device
   +--rw system-management
      +--rw system-management-global
      |  +--rw statistics-collection
      |  ...
      +--rw system-management-protocol* [type]
      |  +--rw type=syslog
      |  +--rw type=dns
      |  +--rw type=ntp
      |  +--rw type=ssh
      |  +--rw type=tacacs
      |  +--rw type=snmp
      |  +--rw type=netconf
```

```
module: network-device
   +--rw network-services
      +--rw network-service* [type]
         +--rw type=ntp-server
         +--rw type=dns-server
         +--rw type=dhcp-server
```

```
module: network-device
   +--rw oam-protocols
      +--rw oam-protocol* [type]
         +--rw type=bfd
         +--rw type=cfm
         +--rw type=twamp
```

```
module: network-device
   +--rw routing
      +--rw control-plane-protocols
      |  +--rw control-plane-protocol* [type]
      |     +--rw type       identityref
      |     +--rw policy
      +--rw ribs
         +--rw rib* [name]
            +--rw name            string
            +--rw description?    string
            +--rw policy
```

```
module: network-device
  +--rw mpls
     +--rw global
     +--rw lsps* [type]
       +--rw type=static
       +--rw type=constrained-paths
       +--rw type=igp-congruent
```

Example: LNE Model

```
//network-device state
    module: logical-network-element
+--rw logical-network-inventory
   +--rw logical-network-element* [name]
      +--rw name="one"          string
      +--rw manged=true         boolean
      +--rw root                schema-mount
         //Example LNE state when exposed to network-device
         +--rw ietf-yang-library
         +--rw interfaces
         +--rw hardware
         +--rw qos
         +--rw system-management
         +--rw network-services
         +--rw oam-protocols
         +--rw routing
         +--rw mpls
         +--rw ieee-dot1Q
         +--rw network-instance
```

Key Requirements of This Use Case

1. That any data model can be instantiated within another module
   - Instantiated means that information is maintained only within the ‘mounted’ context
   - This use case only requires mounting of top-level models
2. That no additional model is needed to support 1
   - The schema defines what other modules can be mounted
3. That a server can control which models are mounted
4. That all capabilities that exist with the mounted module are available e.g. RPC operations, notifications, and augmentations

Changes: Schema Mount

- Allows device hierarchy to vary for different classes of devices.
  - All modules present in the top level may also be mounted within an LNE.
  - Modules supported within an LNE is implementation dependent.
  - Network Instances can be mounted at top or within LNE.
  - All modules can also be mounted with in LNE though for many it doesn’t make sense.
  - Modules supported by a device learned through ietf-yang-library.

Changes: LNE Model

- Logical Network Element is now in a separate model
  - Unlike meta model, it is to be directly implemented by a device

```
module: logical-network-element
       +--rw logical-network-inventory
         +--rw logical-network-element* [name]
           +--rw name?    string
           +--rw description? string
           +--rw managed?      boolean
           +--rw root?          schema-mount
     augment /if:interfaces/if:interface:
       +--rw bind-lne-name?      string
```

LNE Management

- Different devices will support different management models
- The *"managed"* leaf indicates whether or not the LNE can be managed at the device level.
- LNE management at the level are provided using the conventional facilities (e.g., NETCONF/RESTCONF, SNMP)
  - Only LNE associated resources (e.g., interfaces will be accessible at LNE level)

Changes: Network Instance Model - Separate Model

```
module: network-instance
   +--rw network-instances
      +--rw network-instance* [name]
         +--rw name                          string
         +--rw type?                        identityref
         +--rw enabled?                        boolean
         +--rw description?                   string
         +--rw network-instance-policy
         |  ...
         +--rw root?                       schema-mount
         |  ...
augment /if:interfaces/if:interface:
   +--rw bind-network-instance-name?   string
augment /if:interfaces/if:interface/ip:ipv4:
   +--rw bind-network-instance-name?   string
augment /if:interfaces/if:interface/ip:ipv6:
   +--rw bind-network-instance-name?   string
```

Changes: ietf-routing Relationship

- ietf-routing no longer includes routing-instance list
- ietf-routing is now a module that would be mounted at the top, LNE, or NI level.
- ietf-routing includes its own list of routing protocols since this is needed for static routing definition.
  - Should this list be elsewhere?
- ietf-routing includes a list of interface – this would not be needed with LNE and NI bindings.

Open Issues/Plans

- Relying on Standardized Schema Mount Solution from NETMOD
  - Instantiation of LNEs and NIs triggered simply by list addition?
- Alignment with OpsState Requirements
- Clarification of relationship with different policy containers
- Hardware/QoS structuring
- System management, network services, and OAM protocol base models

Model Disposition Issues

- Plan to move LNE model and NI model to separate standards track RTGWG drafts
- Question is what to do with the device model?
  - Keep it informational and it will not necessary dictate model hierarchy or inter-module relationships?
    - Risk is that the work will not have impact
  - Make it standards track and move to NETMOD WG?
    - Would dictate where other models fit in the hierarchy
    - Hard to get consensus on overall device layout – “Haters gonna hate!”