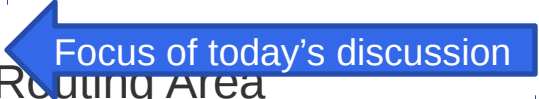

Routing Area Yang Architecture Design Team Update

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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/>

Design Team Background

- Chartered in the routing area (Alia is AD)
 - Work to be based on existing RFCs, WG drafts, and individual drafts
 - DT produced drafts to be discussed in RTGWG
- Chartered scope
 - Focus on needs of YANG models produced in the routing area
 - Highest priority: An overall architecture for “the protocols and functionality contained inside the Routing Area”
 - Conventions
 - Input to netmod WG and draft-ietf-netmod-rfc6087bis
 - Best current practices for YANG model of new routing area defined features

Status: Conventions

- Main focus of related discussion has been on modeling of 'applied' state
 - Triggered by / focused on draft-openconfig-netmod-opstate
 - Discussed a DT draft on the topic, decided it would be redundant
- DT supports the basic requirements
 - That there are differences between 'intended' and 'applied' configuration
 - That there is value in single operation to get one or both
 - There should be conventions to ease programmatic use of models
 - Holds for configuration and operational state
 - Optimize for common operations, e.g., intended and applied configuration
- DT is not recommending a particular solution (yet?)
 - See netmod for draft-openconfig-netmod-opstate discussion

Network Device YANG Organizational Model

draft-rtgyangdt-rtgwg-device-model-00

Authors: Acee Lindem, Christian Hopps, Dean Bogdanovic, Lou Berger (Ed.)
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Repo: <https://github.com/ietf-rtg-area-yang-arch-dt/meta-model/>

draft-rtgyangdt-rtgwg-device-model-00

- First version = Work in Progress
- Based on
 - Existing RFCs, WG drafts and individual drafts
 - Draws heavily draft-openconfig-netmod-model-structure
 - Concepts, organization, lots of text
- Focus is on defining an Organizational Model
 - Requirements defined elsewhere,
 - e.g., a future version of d model-structure or its replacement
- Many ways one could organize
 - Draft is current snapshot into many long discussions
 - Ongoing work captured in repo:
 - <https://github.com/ietf-rtg-area-yang-arch-dt/meta-model/>
- Driving towards reaching consensus
 - Needs more review and discussion

Scope of Effort

- From DT charter: An overall architecture for “the protocols and functionality contained inside the Routing Area”
- What this translated to in discussion
 - Network devices: physical or VM-based
 - Logical partitions: possibly managed
 - ~= logical systems/router, virtual switch/chassis/fabric
 - Virtual routing and forwarding
 - Both L3 and L2 VPNs (including VPLS, VPWS)
 - Many different forms / combinations possible
 - Routers, Hosts, Firewalls, ...
 - Need to allow for all
- Result is a network device organization model
 - Implementations implement all or just appropriate subset

Goals / Approach

- A common schema to access data related to all aspects of a device
- An extensible structure
 - That makes it clear where additional models or data should be fit
 - Does not define details
- A device model
 - That supports higher layer service models (not always a clean line)
- Allows subsets for particular types of devices
 - Possibly defined – but this beyond scope of draft
- Define structure, not detailed models
 - Details from imports, augmentations
- Build on RFCs, WG drafts, individual drafts
 - Wherever possible
 - Identify if/where changes may be beneficial
 - Many detailed models are still TBD

Current Status

- This is a snapshot
 - Disagreement and open issues remain, even within the design team
- The structure is likely to change
 - Particularly related to L2VPNs, Ethernet services, and virtual switching instances
- The representation of operational state is currently omitted
 - Pending resolution of netmod "opstate" discussion
- 8 “open” issue topics
- Living issues list:
 - <https://github.com/ietf-rtg-area-yang-arch-dt/meta-model/blob/master/issues+plan>
 - Eg
 - Where the different types of policy fits in needs to clarified

Overall Structure

- Concept view
 - Network devices: physical or VM-based
 - Logical partitions: possibly managed
 - ~ = logical systems/router, virtual switch/chassis/fabric
 - Virtual routing and forwarding
 - Both L3 and L2 VPNs (including VPLS, VPWS)
 - Today's models are mostly at the top or routing instance level.
 - Tree view
- +--rw device (Real or virtual)
+--rw logical-network-elements (logical partition)
+--rw networking-instances (think VRF/VSI)

Section 2: High Level Tree View

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

- 2.1. Interface Model Components
- 2.2. Logical Network Elements
 - 2.2.1. System Management
 - 2.2.2. Network Instances
 - 2.2.2.1. OAM Protocols
 - 2.2.2.2. Network Instance Policy
 - 2.2.2.3. Control Plane Protocols
 - 2.2.2.4. RIBs
 - 2.2.2.5. MPLS
 - 2.2.2.6. Networking Services

Section 2.1: Interfaces Tree

```
+--rw interfaces (RFC 7223)
|  +--rw interface* [name]
|    +--rw name string
|    +--rw bind-network-element-id? uint8
|    +--rw ethernet
|      | +--rw bind-networking-instance-name? string
|      | +--rw aggregates
|      | +--rw rstp
|      | +--rw lldp
|      | +--rw ptp
|    +--rw vlans
|    +--rw tunnels
|    +--rw ipv4 (RFC 7277)
|      | +--rw bind-networking-instance-name? string
|      | +--rw arp
|      | +--rw icmp
|      | +--rw vrrp
|      | +--rw dhcp-client
|    +--rw ipv6 (RFC 7277)
|      | +--rw bind-networking-instance-name? string
|      | +--rw vrrp
```

Interface comments

- Interfaces Configured/Managed as silos - consistent with RFC 7223 and RFC 7277.
 - Operational Preference
 - Interfaces bound to logical-networking-elements
 - IPv4/IPv6 Configuration bound to networking-instance
 - Details to be worked out - not necessary for model to enforce all structure
 - May be side effects of moving interfaces/IP interface configuration among logical-network-elements and networking-instances.

Section 2.2: Logical Network Elements Tree

```
+--rw device
+--rw logical-network-elements (Virtual Router)
  +--rw logical-network-element* [network-element-id]
    +--rw network-element-id          uint8
    +--rw network-element-name?       string
    +--rw default-networking-instance-name? string
    +--rw system-management
      | ...
    +--rw ietf-acl
    +--rw ietf-key-chain
    +--rw networking-instances
      | ...
```

Section 2.2.1: System Management Tree

```
+--rw device
+--rw logical-network-elements
  +--rw system-management      (Partially RFC 7317)
    |  +--rw device-view?      Boolean
    |  +--rw syslog
    |  +--rw dns
    |  +--rw ntp
    |  +--rw statistics-collection
    |  +--rw ssh
    |  +--rw tacacs
    |  +--rw snmp
    |  +--rw netconf
```

Identification of Management Instance

- For system management connectivity

```
+--rw device
  +--rw logical-network-elements
    +--rw logical-network-element* [network-element-id]
      +--rw network-element-id          uint8
      +--rw network-element-name?       string
      +--rw default-networking-instance-name? string
      +--rw system-management
        | +--rw device-view?            boolean
        | +-- ...
      +--rw ietf-acl
      +--rw ietf-key-chain
      +--rw networking-instances
        +--rw networking-instance* [networking-instance-name]
          +--rw networking-instance-name string
          +-- ...
```


Section 2.2.2: Logical Network Element Tree

```
+--rw device
  +--rw logical-network-elements
    +--rw networking-instances (draft rtg-cfg)
      +--rw networking-instance* [networking-instance-name]
        +--rw networking-instance-name    string
        +--rw type?                        identityref
        +--rw enabled?                     boolean
        +--rw router-id?                   uint32
        +--rw description?                 string
        +--rw oam-protocols
          | ...
        +--rw networking-instance-policy
          | ...
        +--rw control-plane-protocols
          | ...
        +--rw ribs
          | ...
        +--rw mpls
          |
```

Section 2.2.2.1: OAM Protocols Tree

```
+--rw device
  |--rw logical-network-elements
  |--rw networking-instances
  |--rw networking-instance*[networking-instance-name]
    |--rw oam-protocol
      |--rw bfd
      |--rw cfm
      |--rw twamp
```

Section 2.2.2.2: Networking Instance Policy Tree

```
+--rw device
  +--rw logical-network-elements
    +--rw networking-instances
      +--rw networking-instance* [networking-instance-name]
        +--rw networking-instance-policy
          o o o
```

- Policies at the networking-instance level
 - Exceptions are ACL and key-chain - since they are not necessarily bound to an IP/IPv6 address space

Section 2.2.2.3: Control Plane Protocols Tree

```
+--rw device
  +--rw logical-network-elements
    +--rw networking-instances
      +--rw networking-instance* [networking-instance-name]
        +--rw control-plane-protocols
          | +--rw bgp      (IDR WG Draft - from OpenConfig)
          | | +--rw policy
          | +--rw is-is   (IS-IS WG Draft) - Includes TE
          | | +--rw policy
          | +--rw ospf   (OSPF WG Draft) - Includes TE
          | | +--rw policy
          | +--rw rsvp
          | +--rw segment-routing
          | +--rw ldp
          | +--rw pim
          | +--rw igmp
          | +--rw mld
          | +--rw static-routes (rtf-cfg draft)
```

Section 2.2.2.4: RIBs Tree

```
+--rw device
  +--rw logical-network-elements
  +--rw networking-instances
    +--rw networking-instance* [networking-instance-name]
      +--rw ribs
        | +--rw rib* [name]
        |   +--rw name          string
        |   +--rw description?  string
        |   +--rw policy
```

Section 2.2.2.5: MPLS Tree

```
+--rw device
  +--rw logical-network-elements
    +--rw networking-instances
      +--rw networking-instance* [networking-instance-name]
        +--rw mpls
          | +--rw global
          | +--rw label-switched-paths
          | +--rw constrained-path
          | +--rw igp-congruent
          | +--rw static
```

- MPLS control plane protocols included in control plane tree
- TE routing is under OSPF and ISIS

Section 2.2.2.6: Network Services Tree

```
+--rw device
  +--rw logical-network-elements
    +--rw networking-instances
      +--rw networking-instance* [networking-instance-name]
        +--rw networking-services
          +--rw ntp-server
          +--rw dns-server
          +--rw dhcp-server
```

Section 2.3: Device View vs Logical Network Element

- Management functions, e.g., netconf, can be limited to their logical-network-element
 - Controlled by *device-view*

```
+--rw device
  +--rw info
  +--rw hardware
  +--rw interfaces
  |   +--rw interface* [name]
  |       +--rw name                string
  |       +--rw bind-network-element-id?  uint8
  |       |   ...
  +--rw qos
  +--rw logical-network-elements
    +--rw logical-network-element* [network-element-id]
      +--rw network-element-id          uint8
      +--...
      +--rw system-management
      |   +--rw device-view?           boolean
      |   +-- ...
    +--rw networking-instances
```


Section 2.3: Device View vs Logical Network Element (cont.)

- Each view logical-network-element can have *Full Device View* or Logical Network Element *Limited View*

device-view=true

```
+--rw device
+--rw info
+--rw hardware
+--rw interfaces
|  +--rw interface* [name]
|  |  +--rw name                string
|  |  +--rw bind-network-element-id? uint8
|  |  |  ...
|  |  +--rw interface* [name]
|  |  |  +--rw name                string
|  |  |  +--rw bind-network-element-id? uint8
|  |  |  |  ...
|  |  +--rw interface* [name]
|  |  |  +--rw name                string
|  |  |  +--rw bind-network-element-id? uint8
|  |  |  |  ...
+--rw qos
+--rw logical-network-elements
+--rw logical-network-element* [network-element-id]
|  +--rw network-element-id        uint8
|  +--rw default-networking-instance-name? string
|  +--rw system-management
|  |  +--rw device-view?           boolean
|  |  |  ...
+--rw networking-instances
+--rw networking-instance* [networking-instance-name]
|  +--rw networking-instance-name  string
```

device-view=false

```
+--rw device
+--rw info
+--rw hardware
+--rw interfaces
|  +--rw interface* [name]
|  |  +--rw name                string
|  |  +--rw bind-network-element-id? uint8
|  |  |  ...
+--rw qos
+--rw logical-network-elements
+--rw logical-network-element* [network-element-id]
|  +--rw network-element-id        uint8
|  +--rw default-networking-instance-name? string
|  +--rw system-management
|  |  +--rw device-view?           boolean
|  |  |  ...
+--rw device-view?
+--rw networking-instances
+--rw networking-instance* [networking-instance-name]
|  +--rw networking-instance-name  string
+--rw interfaces
|  +--rw interface* [name]
|  |  +--rw name                string
|  |  +--rw bind-network-element-id? uint8
|  |  |  ...
+--rw qos
+--rw logical-network-elements
+--rw logical-network-element* [network-element-id]
|  +--rw network-element-id        uint8
|  +--rw default-networking-instance-name? string
```

device-view=false

Open Issues (1/2)

- The structure related to L2VPNs, Ethernet services, and virtual switching instances has not yet received sufficient discussion and is likely to change.
- Additional discussion and text is need to ensure that the interpretation of different policy containers is clear.
- Configuration information related to network-instanced interconnection (over a "core" network) is currently commingled with configuration of related to operation within the instance.
- The description of network-instance policy needs to be broadened to include VSI

<https://github.com/ietf-rtg-area-yang-arch-dt/meta-model/blob/master/issues+plan>

Open Issues (2/2)

- Need to revisit values of networking-instance type to ensure all VRF+VSI+Core types are represented
- Need to revisit VRF policy definition and relationship to L3VPN Config/Policy.
- This model may not support the zone-based policy firewall - TBD to figure this out. Any opinion?
- Is this too small

```
leaf network-element-id {  
    type uint8; // expect a small number of logical routers  
    description "Device-wide unique identifier for the  
                logical network element";  
}
```

<https://github.com/ietf-rtg-area-yang-arch-dt/meta-model/blob/master/issues+plan>

Design Team Next Steps

1. Finalize and document device model
2. Finalize Operational State recommendation
3. Other YANG model conventions
4. YANG usage best current practices