# 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 Status Summary

- Routing WG Standards Track Drafts
- Other Design Team Drafts
- NDMA Status
- Relevant Non-Design Team Drafts
- YANG Network Instance Draft Update
- YANG Tags Draft Update
- Target To Conclude Design Team at IETF 101

# Routing WG Standards Track Drafts

- Routing Area Common YANG Data Types – draft-ietf-rtgwg-routing-types-17
  - On RFC Editor Queue
- YANG Logical Network Elements – draft-ietf-rtgwg-lne-model-04
  - Dependent on NETMOD YANG Schema Mount
  - Minimal change to put schema mount point in container
  - Working Group Last Call complete
- YANG Network Instances – draft-ietf-rtgwg-ni-model-04
  - Also Dependent on NETMOD YANG Schema Mount
  - Update Later
  - Working Group Last Call complete

# Other Design Team Drafts

- YANG Module Tags
  - draft-rtgyangdt-netmod-module-tags-02
  - Work proceeding in NETMOD
  - Needs Review
- Network Device YANG Logical Organization
  - draft-ietf-rtgwg-device-model-02
  - Expired – will not be progressed in current form with fixed device hierarchy (we will never reach consensus on one overall YANG model structure for network devices)
  - Could be revived based but based on YANG Module Tags

# Network Management Datastore Architecture (NDMA)

- Fully embraced by IETF Routing Area
- RFC 8022 BIS
  - Accepted NETMOD WG document
  - Modules revised rather than renaming (e.g., ietf-routing-2)
  - State Trees Retained (e.g., ietf-routing-state)
  - Status state trees is “obsolete” rather than “deprecated” since there is minimal implementation
- Routing Area YANG models should augment this version of draft.

# Non-Design Team Drafts/Issues

- NETMOD Schema Mount
  - Key enabler for Nis and LNEs
  - WG LC completed being discussed in NetMod
- YANG Tree Diagrams
  - Out growth of DT work, but not a DT draft
  - Being discussed in NetMod
- Open issues left from original (private and public list)
  - Handling YANG module revisions
  - Being discussed in NetMod
  - Do we (the routing area) need a DT position on this?

# Network Instance (NI) Update

- Changes to YANG tree representation of schema mount
- Schema mount points put in containers as required
- Server implementation of schema mount restrictions example
  - Uses parent-reference to limit interface instances to those with bind-network-instance-name equal to current network-instance name.
- L3VPN YANG model aligned with YANG Network Instance model
- Discussions with L2VPN/EVPN YANG model authors initiated
  - Proposed refactoring with instance specific information under ni-type and non-instance core information into new (top-level) modules
- Working Group Last complete
  - Minor changes to examples requested

# Logical Network Element (LNE) Update

- Changes to YANG tree representation of schema mount
- Schema mount points put in containers as required
- Server implementation of schema mount restrictions example

- Working Group Last complete
  - Minor changes to examples requested

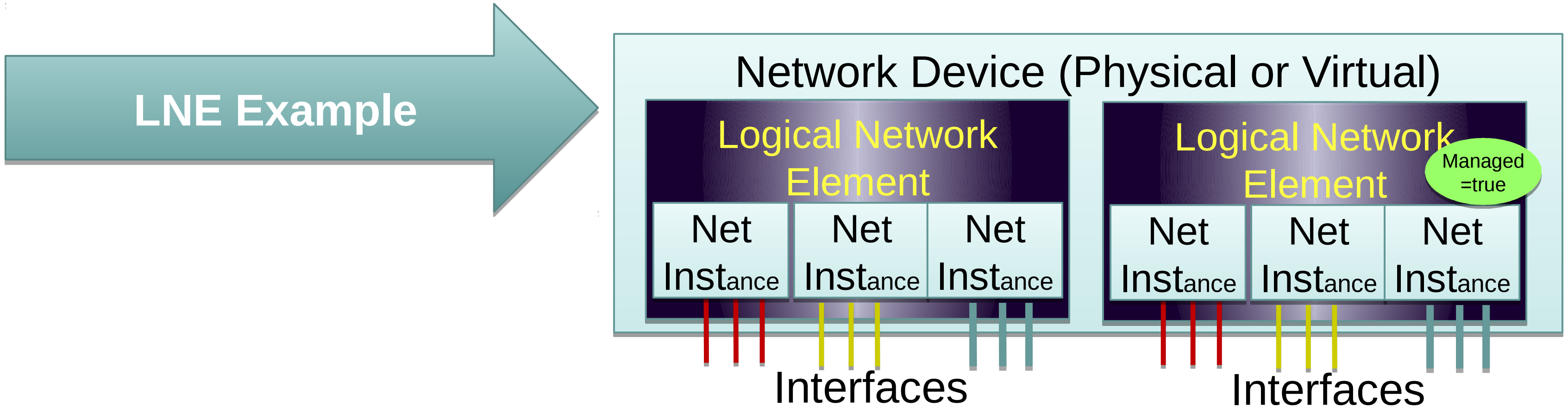
# YANG Tags Draft Update

- Provides user controllable hashtags on modules
- Could be used to support the logical device model
- Being discussed in NetMod
  - Still an individual draft

# Future Plans

- Focus on YANG revisions, based on today’s discussion
- Formally disband before IETF 101
- Support documents through publication
  - LNIs, NIs, Types, 8022bis, Schema Mount, Trees

# LNEs and NIs: Modeling Device Partitioning



## LNE: Logical Network Element

- Separate management sub-domains
  - Sub-domains can be **managed independently** and by a top level manager (managed=true)
  - Commonly called logical system or  router; or virtual switch, chassis, fabric, or device context
- Can be supported via multiple logical devices and VMs
  - Where only limited top level management of subdomains is supported

## NI: Network Instance

- 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.

# LNE: Module Tree

```
module: ietf-logical-network-element
    +--rw logical-network-elements
       +--rw logical-network-element* [name]
          +--rw name              string
          +--rw managed?          boolean
          +--rw description?      string
          +--mp root
  augment /if:interfaces/if:interface:
    +--rw bind-lne-name?
            -> /logical-network-elements/logical-network-element/name

  notifications:
    +---n bind-lne-name-failed
       +--ro name               -> /if:interfaces/interface/name
       +--ro bind-lne-name      -> /if:interfaces/interface/lne:bind-lne-name
       +--ro error-info?        string
```

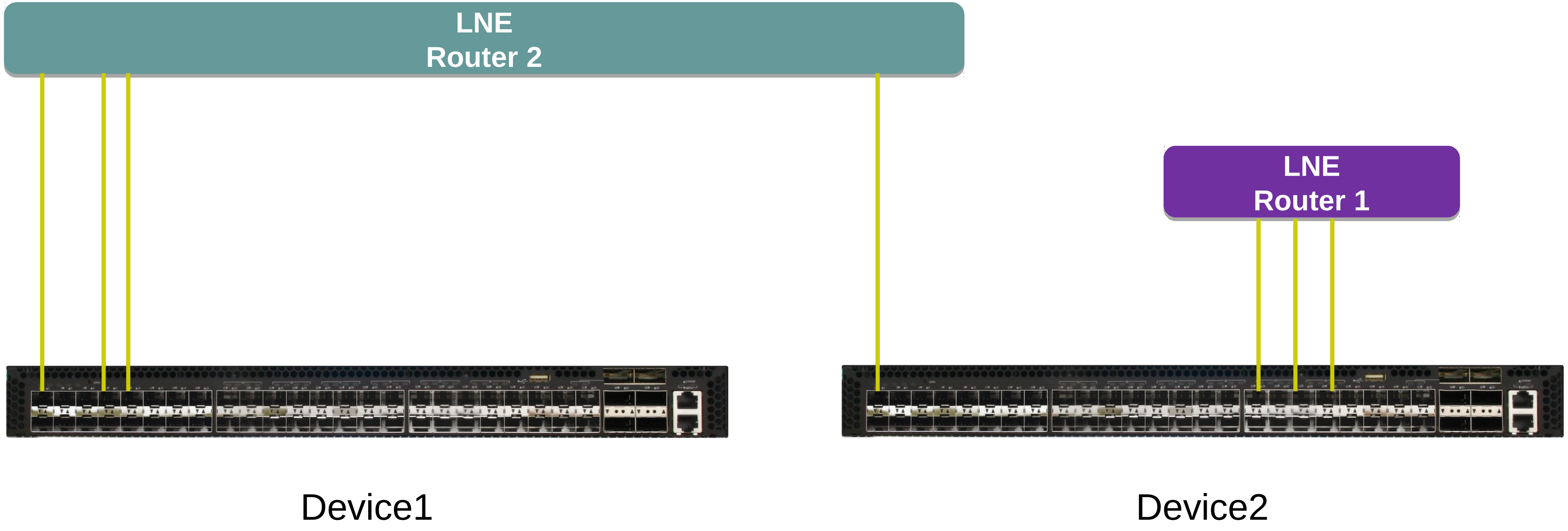
LNE Root only used when managed=true

Covers cases of asynchronous interface ㄹㅌ NI bind failures

# Implementation example: LNE

Raymond Cheh, Dean Bogdanovic

# LNE Architecture Example



# Adding Interfaces to LNE

```
grouping interface-grp {
   list interface {
      key name;
      leaf name {
       type string;
      }
      leaf-list address {
       type inet:ip-prefix;
      }
      leaf iso-address {
       type string;
      }
   }
  }
```

```
list logical-network-element {
      key name;
      leaf name {
         type string;
      }
      uses interface-grp;
     }
```

# Interface naming

- Since the interfaces of  a LNE can reside on different physical devices, potentially, the same interface on the different devices can be assigned to the same LNE.

```
 config {
        ietf-sys:system : {
             hostname : "device1”
         },
         ietf-if:interfaces : {
             interface : [ {
                 name : eth-0/0/0,
                 ietf-lne:bind-lne-name : "Router1”
             } ]
         }
}
```

```
 config {
        ietf-sys:system : {
             hostname : "device2”
         },
         ietf-if:interfaces : {
             interface : [ {
                 name : eth-0/0/0,
                 ietf-lne:bind-lne-name : "Router1”
             } ]
         }
}
```

# The interface name on an LNE has the device-name and the interface-name on that device together

```
logical-network-elements {
    logical-network-element {
        name : "Router1",
        ietf-if:interfaces : {
            interface : [
            {
                name : "device1:eth-0/0/0",
                description : "Connection to Server 1”
            },
            {
                name : "device2:eth-0/0/0",
                description : "Connection to Backbone network"
            }
        }
    }
}
```

- Pros: Having the device name in the LNE interface name makes it easy for  users to know exactly which interface they are managing
- Cons: From YANG point-of-view, requires a new construct to be able to take multiple "leaf-ref" to make up the new value.

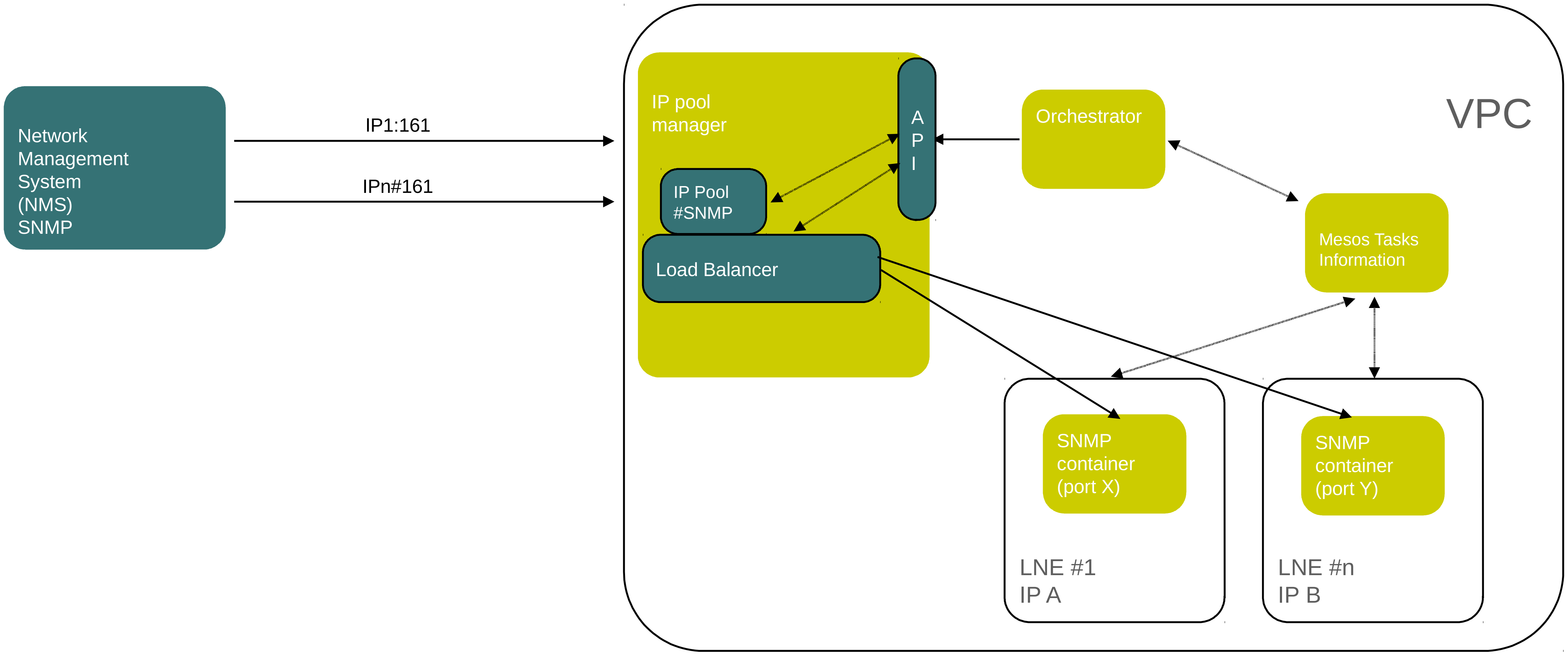
# One LNE across multiple physical network elements

- Has to consider the capabilities of the different HW when you mix them into a logical network-element.
  - E.g. if a user wants to construct an aggregated-ethernet interface from physical interfaces on different HW, that HW needs to support multi-chassis LAG, and they need to be compatible between each other.
  - When the different HW have different capabilities
    - Should the resulting LNE only use the common features that are present on every one of the component chassis in the LNE or
    - Should the operator be aware of the differences and can make sure of them if the interface resides on the chassis that can do it.

# Out-of-band management

- It is easy to identify the management IP address of a physical device (even one with multiple REs but managed as a single device).
- In case of LNE, what is, say, the IP address of the LNE? There needs to be a separate IP address and what about the out-of-band management address?
- This is a problem for multiple LNEs on a single physical device or a LNE spanning multiple physical devices.

# Out-of-band management



# Out-of-band management

- The hierarchy is :

- Public IP Pools (Floating Pool CIDR)

+-- nodes (get 1 IP address of the pool)

+-- services (map to one container task: 1 internal IP Address, one or many internal ports)

+-- ports (The list of ports that are exposed via the public IP, tcp, udp, and the internal port they are mapped to)

# Recycled Slides from NETMOD Presentations and Previous IETFs

See:

https://datatracker.ietf.org/doc/slides-99-bess-03b-yang-lneni-impact-on-mvpn-models/

# LxVPN Support

- NI Type
  - For per VRF, PE/core information
- Root Type
  - For VRF/VSI information in the CE/Vxx context

draft-ietf-rtgwg-ni-model-03:

```
module: ietf-network-instance
  +--rw network-instances
     +--rw network-instance* [name]
        +--rw name                 string
        +--rw enabled?             boolean
        +--rw description?         string
        +--rw (ni-type)?
        +--rw (root-type)?
           +--:(vrf-root)
           |  +--mp vrf-root?
           +--:(vsi-root)
           |  +--mp vsi-root?
           +--:(vv-root)
              +--mp vv-root?
```

# NI Likely Impact on BESS

There are three types of LxVPN information to model:

1. Core/PE + **not** instance specific
   - Goes in augmentation of a module present at top level
     e.g., bgp, interfaces, or even top of network instances
2. Core/PE + **is** associated with a named NI
   - Goes into augmentation of:
     a) ni-types (preferred) or
     b) other module and associated with bind-ni-name (ala interfaces)
3. CE-Context Information, per VRF/VSI
   - Goes in augmentation of a module present under vrf/vsi-root
   - Do any any of these exist?

- Reminder: Implementations, not models, decide what gets mounted at top level and under each vrf/vsi-root

```
+--rw network-instances
   +--rw network-instance*  [name]
      +--rw name            string
      +--rw enabled?        boolean
      +--rw description?    string
      +--rw (ni-type)?
      |  +--:(l3vpn)  //augmentation
      |     +--rw l3vpn:l3vpn
      |     |  ...
      +--rw (root-type)?
         +--:(vrf-root)
            +--mp vrf-root
               +--ro rt:routing-state/
               |  +--ro router-id?
               |  +--ro control-plane-protocols
               |     +--ro control-plane-protocol*
               |        +--ro ospf:ospf/
               |           ...
               +--rw rt:routing/
               |  +--rw router-id?
               |  +--rw control-plane-protocols
               |     +--rw control-plane-protocol*
               |     +--rw ospf:ospf/
               |        ...
               +--ro if:interfaces@
               |  ...
```

# LNE: Module Example

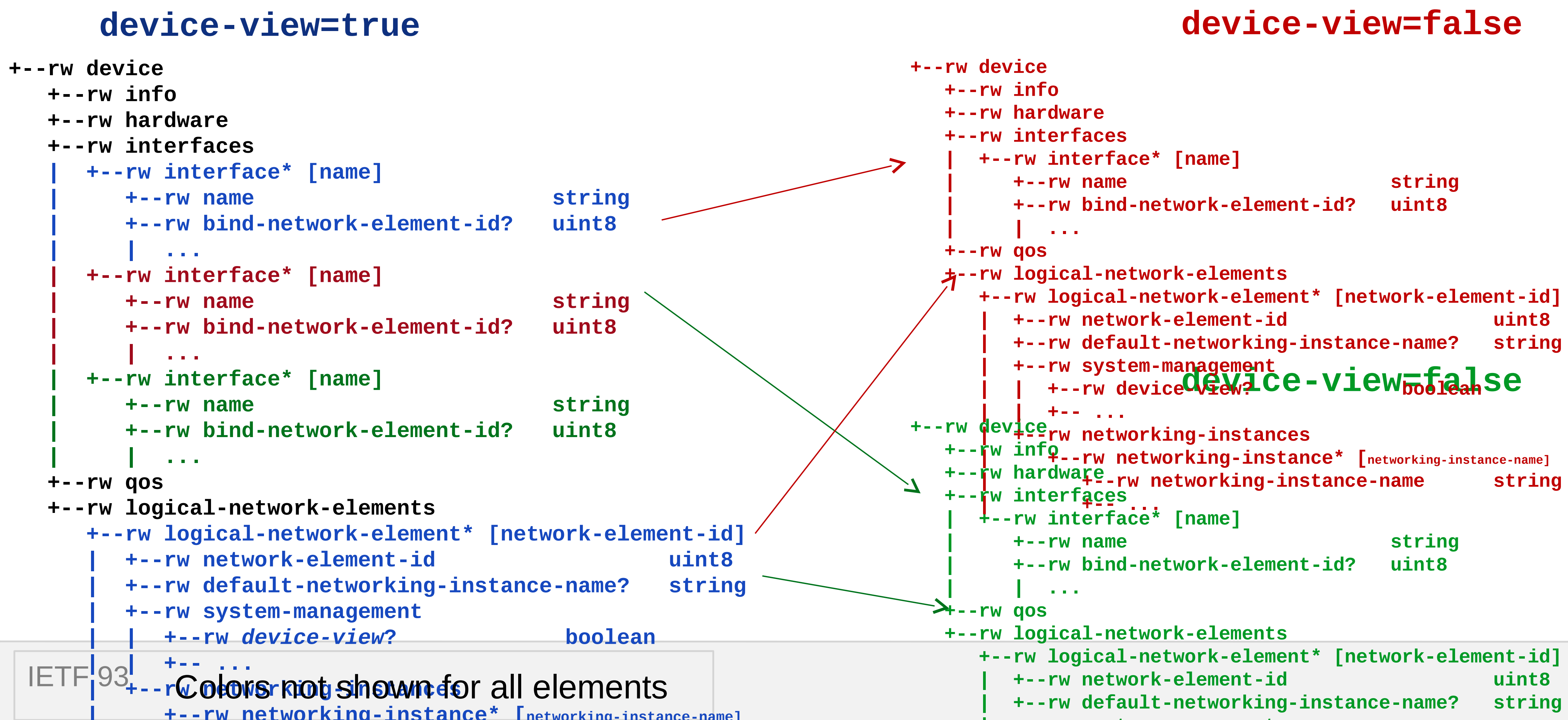
```
module: ietf-logical-network-element
   +--rw logical-network-elements
      +--rw logical-network-element* [name]
         +--rw managed?        boolean
         +--rw name            string
         +--mp root
            ...
```

Managed=true

```
+--ro yanglib:modules-state/
|  ...
+--rw sys:system/
|  ...
+--ro sys:system-state/
|  ...
+--ro rt:routing-state/
|  +--ro router-id? quad
|  +--ro control-plane-protocols
|     +--ro control-plane-protocol* []
|        +--ro ospf:ospf/
|           +--ro instance* [af]
|           ...
+--rw rt:routing/
|  ...
+--rw if:interfaces/
|  ...
+--ro if:interfaces-state/
   ...
```

# 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]
```

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 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
```

Colors not shown for all elements