RIB Yang Model (Clarifications)

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Comparison of draft-i2rs-rib-yang-model and draft--ietf-netmod-model

1. High level differences between the drafts

2. Unique features for I2RS RIB

3. Differences draft-i2rs-rib-yang-model and draft-i2rs-ietf-netmod-rtg-config-16
   . Routing instance (3.1)
   . Route (3.2)
   . NextHops (3.3)
   . Notifications (3.4)
   . Capabilities (3.5)

4. Summary of Proposed changes
   . I2RS RIB IM/DM
   . Netconf protocol

1. High level differences between the drafts

draft-ietf-netmod-routing-cfg-16

consists of three YANG modules:
- ietf-routing
- ietf-ipv4-unicast-routing
- ietf-ipv6-unicast-routing

draft-wang-i2rs-rib-data-model

The draft-wang-i2rs-rib-data-model is a Yang module of universal rib:
- IPv4/IPv6-unicast-routing
- IPv4/IPv6-multicast-routing
- MPLS
- L2/L3 VPN
- Tunnel based
- mac of route and nexthop

2. Unique features for I2RS RIB

The following are unique features for I2RS RIB DM:

˝   RIB capability negotiation includes:
  - next-hop-capacity
  - nexthop-tunnel- encap-capacity

˝   A route is essentially a match condition and an action following the match.
  - The match condition specifies the kind of route (IPv4, IPv6,multicast , unicast ,MPLS, MAC,interface.) and the set of fields to match on.
  - IPV4 and IPV6 can be matched by source address or destination address.

˝   Nexthops can be:
  - unicast nexthops   -- protection lists,
  - nexthop chains   -- lists of lists,
  - tunnel nexthops   -- indirect nexthops
  - replication lists(multicast nexthops)   -- weighted lists

˝   RIB notifications including the changes of route and nexthop resolution status.

3. draft-wang-i2rs-data-model compared with draft-ietf-netmod-routing-cfg-16

1. I2RS RIB does not contain a default RIB – Should it?
2. I2RS Route contains match for IPv4, IPv6, MPLS, MAC and interface route – should draft-ietf-netmod-routing-cfg-16 be expanded to include these?
3. I2RS RIB DM contains a recursive next-hop structure based on adopted RIB IM?
   - . I2RS nexthop is a complex structure cannot be supported in netconf/restconf 1.1, but requires experimental draft (RFC 6095)
   - . Draft-ietf-netmod-routing-cfg-16 nexthop contains an IP address,
4. Notifications for route change and nexthop change
   - . draft-ietf-netmod-routing-cfg-16 does not have notification
   - . Pub-sub (draft-voit-i2rs-pub-sub-requirements) is just being proposed in netconf.
   - . Do we allow pub-sub or notification or both?
5. Capability notification
   1. Negotiation of client-agent capabilities allows client-agent to know what simple-complex features are being used by the I2RS client-agent exchange

3.1 Comparisons: routing-instance

The routing-instances defined in these two draft is similar excepting the default-ribs.
- ˝ Default RIBs were not included in the I2RS Info Model
- ˝ Should Default RIBs changes be included in the I2RS Info model?
- ˝ Default RIBS are also need in the Policy Based Routing RIB

routing-instance top YANG in draft-wang-i2rs-rib-data-model:
```
+--rw routing-instance-list* [instance-name]
   +--rw instance-name string
   +--rw interface-list* [name]
   |   +--rw name if:interface-ref
   +--rw-id?  Yang:dotted-quad
   +--rw rib-list* [rib-name]
```

routing-instance YANG in draft-ietf-netmod-routing-cfg-16
```
+--rw routing
   +--rw routing-instance* [name]
   |  +--rw name            string
   |  +--rw type?           identityref
   |  +--rw enabled?        boolean
   |  +--rw router-id?      yang:dotted-quad
   |  +--rw description?    string
   |  +--rw default-ribs {multiple-ribs}?
   |  |  +--rw default-rib* [address-family]
   |  |     +--rw address-family   identityref
   |  |     +--rw rib-name         string
   |  +--rw interfaces
   |  |  +--rw interface* [name]
   |  |     +--rw name   if:interface-ref
   |  +--rw routing-protocols
   +--rw ribs
   +--rw route-filters
      +--rw route-filter* [name]
```

3.2 Comparisons: route

Route:
- In draft-ietf-netmod-routing-cfg-16 prefix match: IPv4 and IPv6 destination prefix
- In **draft-wang-i2rs-rib-data-model** – prefix match IPv4, MPLS, MAC, and Interface prefixes with destination only or destination-source address .

route top YANG in draft-wang-i2rs-rib-dataa-model

```
+--rw route-list* [route-index]
  +--rw route-index                uint64
  +--rw route-type                 route-type-def
  +--rw (rib-route-type)?
  |  +--:(ipv4)
  |  +--:(ipv6)
  |  +--:(mpls-route)
  |  +--:(mac-route)
  |  +--:(interface-route)
  +--rw nexthop-list* [nexthop-list-index]
     . . .
 +--ro route-state?               route-state-def
   +--ro route-installed-state?  route-installed-state-def
   +--ro route-reason?           route-reason-def
   +--rw route-preference            uint32
   +--rw local-only                  boolean
   +--rw address-family-route-attributes
```

route top YANG in draft-ietf-netmod-routing-cfg-16

```
+--rw route* [destination-prefix]
  +--rw destination-prefix    inet:ipv4-prefix
  +--rw description?          string
  +--rw next-hop
    +--rw (simple-or-list)?
      +--:(multipath-entry)
        . . .
      +--:(simple-next-hop)
        +--rw (next-hop-options)
          +--:(simple-next-hop)
          |  +--rw outgoing-interface?  leafref
          +--:(special-next-hop)
          |  +--rw special-next-hop?    enumeration
          +--:(next-hop-address)
            +--rw next-hop-address?    inet:ipv4-address
```

3.3 Comparisons: nexthop

˝ Draft-wang-i2rs-rib-data-model includes the following types of nexthops

- . unicast nexthops,
- . tunnel nexthops
- . replication list,
- . Weighted lists,
- . protection lists,
- . nexthop chains,
- . lists of lists,
- . indirect nexthops.

˝ All types of nexthops

- . Defined in one module with case to support:
- . ipv4 ,ipv6 , mac ,mpls, l2vpn, l3vpn, tunnel .

˝ The Draft-ietf-netmod-routing-cfg-16 includes:

- . outgoing-interface or indirect nexthop
- . nexthop is defined in different IPV4 and IPV6 address family module.

3.3 Comparisons: nexthop

nexthop top YANG in draft-wang-i2rs-rib-data-model

```
  +--:(normal-nexthop)
  +--rw (nexthop-member-or-list-of-list)?
    +--:(one-nexthop-list-member)
    | +--rw (nexthop-chain-or-identifier)?
    | | +--:(nexthop-chain)
    | | | +--rw nexthop-chain
    | | |   +--rw nexthop-chain-identifier
    | | |   +--rw nexthop* [nexthop-index]
    | | |     +--rw nexthop-index  uint32
    | | |     +--rw (next-hop-options)?
    | | |       +--:(nexthop-identifier-next-hop)
    | | |       +--:(egress-interface-next-hop)
    | | |       +--:(ipv4-address-next-hop)
    | | |       +--:(ipv6-address-next-hop)
    | | |       +--:(egress-interface-ipv4-next-hop)
    | | |       +--:(egress-interface-ipv6-next-hop)
    | | |       +--:(egress-interface-mac-next-hop)
    | | |       +--:(logical-tunnel-next-hop)
    | | |       +--:(tunnel-encap-next-hop)
    | | |         +--rw tunnel-encap
    | | |           +--rw (nexthop-second-encap-or-not)?
    | | |             | +--:(nexthop-second-encap)
    | | |             |   +--rw (nexthop-third-encap-or-not)?
    | +--rw nexthop-chain-identifier
  | +--ro nexthop-state          nexthop-state-def
    | +--rw priority?             enumeration
    | +--rw weight?               uint8
    +--:(nexthop-list-of-list)
```

Recursive Complex structure

nexthop top YANG in draft-ietf-netmod-routing-cfg-16

```
| +--ro next-hop-lists
| | +--ro next-hop-list* [id]
| |   +--ro id            uint64
| |   +--ro address-family   identityref
| |   +--ro next-hop*
| |     +--ro (next-hop-options)
| |       | +--:(next-hop-list)
| |       | | +--ro next-hop-list?      next-hop-list-ref
| |       | +--:(use-rib)
| |       | | +--ro use-rib?            rib-state-ref
| |       | +--:(simple-next-hop)
| |       | | +--ro outgoing-interface?  leafref
| |       | +--:(special-next-hop)
| |       |   +--ro special-next-hop?    enumeration
| |     +--ro priority?          enumeration
| |     +--ro weight?            uint8
```

Simpler Structure

3.4 Comparisons: Notifications

″ **draft-wang-i2rs-rib-data-model**

. RIB IM mode and RIB Data Model include asynchronous notifications which are sent by the I2RS agent to an I2RS client when some event triggers on the network device.

. MUST support two types of asynchronous notifications: route change and nexthop change

″ **draft-ietf-netmod-routing-cfg-16** doesn't include notification

. Pub-sub: Draft-voit-i2rs-pub-sub-requirements-00 presented in netconf (12/15/2014)

. Notification not shown

″ **Suggestion by design team:**

. Use groupings like the OSPF/ISIS

augment "/igp:igp-link-event" {

uses isis-topology-type;

uses isis-link-attributes;   }

notifications top YANG in draft-wang-i2rs-rib-data-model

```
+---n nexthop-resolution-status-change
|  +--ro nexthop-chain-identifier
|  |  +--ro (nexthop-identifier-type)?
|  |     +--:(nexthop-name)
|  |     |  +--ro nexthop-name    string
|  |     +--:(nexthop-id)
|  |        +--ro nexthop-id      uint32
|  +--ro nexthop* [nexthop-index]
|  |  +--ro nexthop-index                uint32
|  |  +--ro (next-hop-options)?
|  |     +--:(nexthop-identifier-next-hop)
|  |     +--:(egress-interface-next-hop)
|  |     |  +--ro outgoing-interface              string
|  |     +--:(ipv4-address-next-hop)
|  |     |  +--ro next-hop-ipv4-address           inet:ipv4-address
|  |     |  +--ro ipv4-rib-name?                  string
|  |     +--:(ipv6-address-next-hop)
|  |     |  +--ro next-hop-ipv6-address           inet:ipv6-address
|  |     |  +--ro ipv6-rib-name?                  string
|  |     +--:(egress-interface-ipv4-next-hop)
|  |     |  +--ro next-hop-egress-interface-ipv4-address
|  |     |     +--ro outgoing-interface           string
|  |     |     +--ro next-hop-egress-ipv4-address    inet:ipv4-address
|  |     +--:(egress-interface-ipv6-next-hop)
|  |     |  +--ro next-hop-egress-interface-ipv6-address
|  |     |     +--ro outgoing-interface           string
|  |     |     +--ro next-hop-egress-ipv6-address    inet:ipv4-address
|  |     +--:(egress-interface-mac-next-hop)
|  |     |  +--ro next-hop-egress-interface-mac-address
|  |     |     +--ro outgoing-interface   string
|  |     |     +--ro ieee-mac-address     uint32
|  |     +--:(logical-tunnel-next-hop)
```

3.5 Comparisons: Capabilities

″ Draft-wang-i2rs-rib-data-model include RIB capability negotiation

- . Nexthop capacities
- . Nexthop tunnel encap capacity.

″ **Capability negotiation has been used successfully with BGP**

- . BGP defaults to simple (IPv4 with simple next hop), and uses capabilities to negotiate more
- . I2RS client-agent can use to go from simple to complex with each model
- . Default capability could be IPv4 and IPv6 and nexthop found in draft-ietf-netmod-routing-cfg-16

the next-hop-capacity and the nexthop-tunnel-encap-capacity top YANG in draft-wang-i2rs-rib-data-model

```
+--rw nexthop-capacity
| +--rw support-tunnel?        boolean
| +--rw support-chains?        boolean
| +--rw support-list-of-list?   boolean
| +--rw support-replication?    boolean
| +--rw support-weighted?       boolean
| +--rw support-protection?     boolean
| +--rw lookup-limit?           uint8
+--rw nexthop-tunnel-encap-capacity
| +--rw support-ipv4?    boolean
| +--rw support-ipv6?    boolean
| +--rw support-mpls?    boolean
| +--rw support-gre?     boolean
| +--rw support-vxlan?   boolean
| +--rw support-nvgre?   boolean
```

Suggested changes

˝ RIB I2RS IM/DM

- Capabilities specify capabilities beyond very simple set
- Determine if IPv4, IPv6, MPLS, Ethernet and Interface are simple or complex matches

˝ Netconf needs

- RPC from agent to client for the route change,
- Support notification and pub/sub features

˝ netmod-routing-cfg

- Add via augment more state for route and nexthop state
- Add statistics via augment for route and nexthop state or changes
- Support both notification and pub/sub features
- Determine common group typing that can be used for notifications

Q & A