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                        Filter-Based RIB Data Model
                     draft-ietf-i2rs-fb-rib-data-model-01

Abstract

   This document defines a data model to support the Filter-based
   Routing Information Base (RIB) Yang data models. A routing system
   uses the Filter-based RIB to program FIB entries that process
   incoming packets by matching on multiple fields within the packet and
   then performing a specified action on it. The FB-RIB can also
   specify an action to forward the packet according to the FIB entries
   programmed using the RIBs of its routing instance.

   The Filter based RIB is a protocol independent data structure which
   can be deployed in a configuration datastore, an ephemeral control
   plane data stroe.

Status of This Memo

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1. Introduction

   This document provides a protocol-independent yang module for Filter
   Based Routing (FB-RIB) routing filters within a routing element. The
   informational model for this FB-RIB is in
   [I-D.ietf-i2rs-fb-rib-info-model].

1.1. Definition of Filter Based RIB

Filter-based routing is a technique used to make packet forwarding
decisions based on a filter that is matched to the incoming packets
and the specified action. It should be noted that that this is
distinct from the static routes in the RIB where the routing is
destination ddress based.

A Filter-Based RIB (Routing Information Base) is contained in a
routing instance. It contains a list of filters (match-action
conditions) and a list of interfaces the filter-based forwarding
operates on, and default RIB(s).

A Filter Based RIB uses packet forwarding policy. If packet
reception is considered an event, then the Filter-based RIB uses a
minimalistic Event-matchCondition-Action policy with the following
characteristics:

   event = packet/frame received,

   match condition - match on field in frame/packet or circumstances
   relating to packet reception (e.g. time received),

   action - modify packet and forward/drop packet.

A Filter-based RIB entry specifies match filters for the fields in a
packet (which may include layer 1 to layer 3 header fields, transport
or application fields) or size of the packet or interface received
on. The matches are contained in an ordered list of filters which
contain pairs of match condition-action (aka event-condition-action).

If all matches fail, default action is to forward the packet using
Destination Based forward from the default RIB(s). The default RIBs
can be:

o   created by the I2RS Routing Informational Base (RIB) manager using
    the yang model described in: in [I-D.ietf-i2rs-rib-info-model], or

o   configured RIB created using static routes or
    [I-D.ietf-netmod-routing-cfg].

Actions in the condition-action pair may impact forwarding or set
something in the packet that will impact forwarding. Policy actions
are typically applied before applying QoS constraints since policy

actions may override QoS constraint.

The Filter-Based RIB can reside in the configuration datastore, a
control plane datastore, or an ephemeral control plane data store
(e.g. I2RS ephemeral control plane datastore).

The Interface to the Routing System (I2RS) [RFC7921] architecture
provides dynamic read and write access to the information and state
within the routing elements. The I2RS client interacts with the I2RS
agent in one or more network routing systems. The I2RS architecture
defines the I2RS control plane datastore as ephemeral - which means
it does not persist across a reboot.

2. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT",
"SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this
document are to be interpreted as described in [RFC2119].

In this document, these words will appear with that interpretation
only when in ALL CAPS. Lower case uses of these words are not to be
interpreted as carrying RFC-2119 significance.

3. Definitions and Acronyms

CLI

   Command Line Interface

FB-RIB

   Filter-Based Routing Information Base

FB-Route

   The policy rules in the filter-based RIB are prescriptive of the
   Event-Condition-Action form which is often represented by if
   Condition then action".

Policy Group

   Policy Groups are groups of policy rules. The groups of policy in

the basic network policy [I-D.ietf-i2rs-pkt-eca-data-model] allow
grouping of policy by name. This structure allow easier
management of customer-based or provider based filters, but does
not change the policy-rules list.

RIB IM

RIB Informational Model (RIB IM) [I-D.ietf-i2rs-rib-info-model]

Routing instance

A routing instance, in the context of the FB-FIB is a collection
of RIBs, interfaces, and routing parameters. A routing instance
creates a logical slice of the router and allows different logical
slices; across a set of routers; to communicate with each other.

4. High level Yang structure for the FB-RIB

   There are three levels in the Filter-Based RIB (FB-RIB) structure:

   o a global FB-RIB structures,

   o the common structure of the FB-RIB, and

   o the groupings that make up the FB-RIB

   All structures have two types: configuration/ephemeral state and
   operational state.

   This yang model allows for three types of FB-RIB installations in
   three types of datastores:

      configuration (Config=TRUE, ephemeral=false, opstate definitions)

      ephemeral control plane (E.g. I2RS Agent, config=TRUE,
      ephemeral=TRUE, opstate definitions), and

      non-ephemeral control plane datastore (e.g. dBGP FB-FIB with

config=TRUE; ephemeral=false, opstate which stores BGP Flow
        Specification received by bgp speaker from BGP peers).

   Each of these cases is differentiated by using an "if-feature" to
   provide unique RIB under the routing instance.

   Configuration RIBS

        +--+
        | routing instance |
        +-------|-------------|---------------|--+
                | | |
                | | |
      +---------|----+ +-----|-----+ +--------|-----+
      |config-fb-rib | |i2rs-fb-rib| |bgp-fs-fb-rib |
      | | | | | |
      +------|-------+ +-----|-----+ +------|-------+
             |...............:....|...............|
                        : (uses common structures
                        :   in separate lists of FB-RIBs)
              +--------|----+
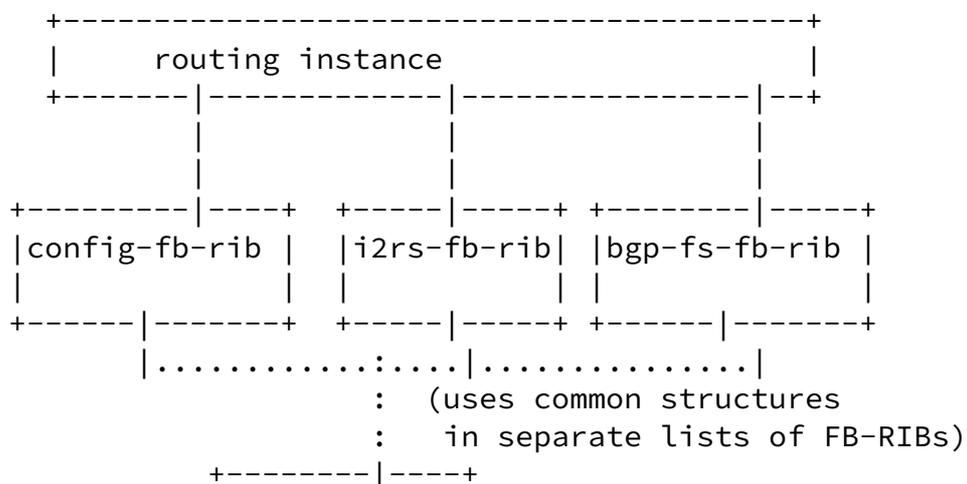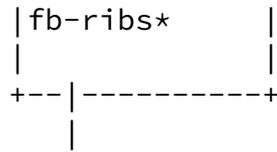
```
                       |fb-ribs*     |
                       |             |
                       +--|----------+
                          |


          Figure 3: Routing instance with three types of
                    Filter-FIB lists

   The following section provides the high level yang structure diagrams
   for the following levels of structures for both config/ephemeral
   state and operationa.

   o  ietf-fb-rib - contains filter-based RIBS for config, I2RS FB-RIB,
      and BGP Flow Specification.

   o  fb-rib - that contains the structures for the filter-based
      grouping

   o  fb-rib-types - that contains the structures for groupings within
      the filter-based RIBS

   These structures are contained within the yang section in this draft.

   The packet-reception ECA policy yang module is contained in the draft
   [I-D.ietf-i2rs-pkt-eca-data-model].

   For those who desire more information regarding the logic behind the
   I2RS Filter-Based RIB, please see the Informational Model at:
   [I-D.ietf-i2rs-fb-rib-info-model].
```

4.1. Top Level Yang Structure for ietf-fb-rib

   The Top-level Yang structure for a global FB-RIB types (similar to
   acl) is not defined for filter-based RIBS. The I2RS Filter-Based RIB
   should be defined under this structure under a routing instance. The
   three things under this RIB would be: configured Filter-Based RIB
   (aka Policy routing), I2RS reboot Ephemeral Filter-Based RIB, and BGP
   Flow Specification's Filter-Based RIB. All of these RIBs have

similar actions.

There are two types top-level structures for ietf-fb-ribs: config and
operational state.

The Top-level Yang structure for a global configuration of Filter-
Based RIBs are:

Augments rt:logical-network-elements:\
        :logical-network-element:network-instances: \
           network-instance

```
ietf-fb-rib module
  +--rw ietf-fb-rib
     +--rw default-instance-name string
     +--rw default-router-id rt:router-id
     +--rw config-fb-ribs
           if-feature "config-filter-based-RIB";
        uses fb-ribs;
     +--rw i2rs-fb-ribs
                if-feature "I2RS-filter-based-RIB";
                uses fb-rib-t:fb-ribs;
     +--rw bgp-fs-fb-ribs
                if-feature "BGP-FS-filter-based-RIB";
                uses fb-rib-t:fb-ribs;
```

     Figure 5: configuration state

The Top-level Yang structure for a global operational state of
Filter-Based RIBs are:

Augments rt:logical-network-elements:\

```
              :logical-network-element:network-instances: \
                 network-instance

    ietf-fb-rib module
      +--rw ietf-fb-rib-opstate
        +--rw default-instance-name string
        +--rw default-router-id rt:router-id
            +--rw config-fb-rib-opstate
                    if-feature "config-filter-based-RIB";
                    uses fb-rib-t:fb-ribs-oper-status;
            +--rw i2rs-fb-rib-opstate {
                    if-feature "I2RS-filter-based-RIB";
                    uses fb-rib-t:fb-ribs-oper-status;
            +--rw bgp-fs-fb-rib-opstate
                    if-feature "BGP-FS-filter-based-RIB";
                    uses fb-rib-t:fb-ribs-oper-status;

         Figure 5: operational state
```

4.2. Filter-Based RIB structures

The Top-level yang structures at the Filter-Based RIB level have two
types: configuration and operational state.

The Top-level Yang structure for the FB-RIB types is:

```
   module: fb-rib-types:
    +--rw fb-ribs
       +--rw fb-rib* [rib-name]
       |   +--rw rib-name string
       |   |   rw fb-type identityref / ephemeral or not
       |   +--rw rib-afi rt:address-family
       |   +--rw fb-rib-intf* [name]
       |   |   +--rw name string
       |   |   +--rw intf if:interface
       |   +--rw default-rib
       |   |   +--rw rt-rib string
       |   |   +--rw config-rib string;  // config rib name
       |   |   +--rw i2rs-rib:routing-instance:name
       |   |   +--rw i2rs-rib string;   //ephemeral rib name
       |   |   +--rw bgp-instance-name string
       |   |   +--rw bgp-rib  string    //session ephemeral
       |   +--rw fb-rib-refs
       |   |   +--rw fb-rib-update-ref uint32
       |   |   |       /count of writes
       |   +--rw instance-using*
       |   |   device:networking-instance:\
       |   |   |       /networking-instance-name
       |   +--uses pkt-eca:pkt-eca-policy-set
           |   +--uses acls:access-lists
```

                Figure 6: FB RIB Type Structure

   Note: acls:access-lists is the list of ACL filters in
   [I-D.ietf-netmod-acl-model].

   HIgh Level Yang

```
   +--rw fb-ribs-oper-status
      +--rw fb-rib-oper-status* [fb-rib-name]
          uses pkt-eca:pkt-eca-opstate
```

5. yang models

5.1. Filter-Based RIB types

```
 <CODE BEGINS> file "ietf-fb-rib-types@2017-03-13.yang"
  module ietf-fb-rib-types {

    yang-version "1";
```

```
   // namespace
      namespace "urn:ietf:params:xml:ns:yang:ietf-fb-rib-types";
```

```
      prefix "fb-rib-t";
          import ietf-interfaces {prefix "if";}
          import ietf-routing {prefix "rt";}
          import ietf-pkt-eca-policy {prefix "pkt-eca";}
          import ietf-access-control-lists {prefix "acls";}

   // meta
   organization
      "IETF";

   contact
      "email: shares@ndzh.com;
           email: sriganesh.kini@ericsson.com
       email: cengiz@packetdesign.com
       email: ivandean@gmal.org
       email: linda.dunbar@huawei.com;
       email: russ@riw.com;
           ";

   description
      "This module describes a YANG model for the I2RS
      Filter-based RIB Types.  These types
      specify types for the Filter-Based RIB.

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      the document authors.  All rights reserved.

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      without modification, is permitted pursuant to, and subject
      to the license terms contained in, the Simplified BSD
      License set forth in Section 4.c of the IETF Trust's Legal
      Provisions Relating to IETF Documents
      (http://trustee.ietf.org/license-info).";


   revision "2017-03-13" {
      description
        "Filter-Based RIB protocol ";
        reference "draft-ietf-i2rs-fb-rib-data-model-01";
```

```
        }

      typedef fb-rib-type-def {
            type identityref {
              base "fb-rib-type";
                }
                description
                "This type is used to refer to
                 source of Filter-Based RIB:
```

```
                  configuration, I2RS, Flow-Spec.";
       }

          identity fb-rib-type {
                  description
                  "This type is used to refer to
                   source of Filter-Based RIB:
                   configuration, I2RS, Flow-Spec.";
          }

          identity fb-rib-config-type {
                  base fb-rib-type;
              description
              "config Filter-Based RIB";
           }

          identity fb-rib-i2rs-ephemeral-type {
                  base fb-rib-type;
              description
              "I2RS Reboot ephemeral Filter-Based RIB";
           }

          identity fb-rib-BGP-FS-type {
                  base fb-rib-type;
              description
              "BGP Flow Specification Filter-Based RIB";
           }

      typedef fb-rib-policy-type-def {
            type identityref {
              base "fb-rib-policy-type";
                  }
```

```
                 description
                 "This type is used to refer to FB-RIB type";
        }

           identity fb-rib-policy-type {
                description
                "Types of filter-based policies
                     acl and eca";
            }

             identity fb-rib-acl {
                   base fb-rib-policy-type;
                 description
             "filter based policy based on access-lists";
               }
```

```
             identity fb-bnp-eca-rules {
                   base fb-rib-policy-type;
                 description
             "filter based policy based on qos forwarding rules";
               }

          typedef fb-rules-status  {
             type identityref {
               base "fb-rule-opstat";
                   }
                 description
                 "This type is used to refer to FB-RIB type";
           }

            identity fb-rule-opstat {
                 description
                 "operational statues for filter rules
                  inactive and active";
                  }

            identity fb-rule-inactive {
                 base fb-rule-opstat;
                 description
                 "policy rule is inactive";
             }
```

```
         identity fb-rule-active {
               base fb-rule-opstat;
               description
               "policy rule is active";
          }

         grouping fb-rib-rule-order-status {
         leaf statement-order {
                type uint16;
                description "order identifier";
          }
          leaf statement-oper_status {
                 type fb-rules-status;
                 description "status of rule";
               }
               description "filter-rib
                 policy rule order and status";
            }

     grouping fb-rib-group-order-status {
         leaf group-refcnt {
           type uint16;
```

```
           description "refcnt for this group";
                }
          leaf group-installed {
           type uint32;
           description "number of rules installed";
                }
               leaf group-matches {
                type uint64;
                description "number of matches by all
                  rules in group";
               }
               description "fb-rib group list order
                  and status info.";
            }

        grouping fb-rib-updates {
          leaf fb-rib-update-ref {
                type uint64;
```

```
               description
                   "number of updates to this FB RIB
                    since last reboot";
           }
         description "FB-RIB update info";
        }

        grouping default-fb-rib {
           // configuration instance for default RIB
        leaf config-instance {
               type string;
               description "instance name - string until
                   netmod fixes mount issues";
               }
               leaf config-rib {
                 type string;
                 description "name of config default RIB";
               }
               //I2RS default instance for default RIB
           leaf i2rs-instance-name {
                type string;
                description "I2RS instance name";
               }
               leaf i2rs-rib-name {
                       type string;
               description "name of default I2RS RIB";
               }
               leaf bgp-instance-name {
                  type string;
                  description "name of bgp instance";
```

```
               }

               leaf bgp-fs-rib-name {
                  type string;
                       description "name of BGP
                        flow specification default RIB";
               }
          description "default RIB for forwarding
                 if the policy match";
      }
```

```
      grouping fb-ribs {
             list fb-rib {
                    key fb-rib-name;
                    leaf fb-rib-name {
                        type string;
                              mandatory true;
                        description "RIB name";
             }
                    uses rt:address-family;
                    leaf fb-type {
                           type fb-rib-type-def;
                           description "type of RIB
                                 list: config, I2RS rebooot
                                 ephemeral, BGP Flow Specification
                                 ephemeral. ";
                    }
                list fb-rib-intf {
                           key "name";
                           leaf name {
                                  type if:interface-ref;
                              description
                                "A reference to the name of a
                                     configured network layer
                                interface.";
                            }
                           description "This represents
                              the list of interfaces
                              associated with this routing instance.
                              The interface list helps constrain the
                              boundaries of packet forwarding.
                              Packets coming on these interfaces are
                              directly associated with the given routing
                              instance. The interface list contains a
                              list of identifiers, with each identifier
                              uniquely identifying an interface.";
                }
                        uses default-fb-rib;  // defaults ribs
```

```
                        uses fb-rib-updates;  // write refs to this RIB
                list instance-using {
                        key instance-name;
                        leaf instance-name {
```

```
                                type string;
                                description
                                    " name of instance using this fb-rib
                                     rt:routing-instance";
                                }
                              description "instances using
                               this fb-rib";
                            }
                     // ordered rule list + group list
                     uses pkt-eca:pkt-eca-policy-set;

                           // ordered acl list
                           uses acls:access-lists;

                   description "Configuration of
                      an filter-based rib list";
               }
            description "fb-rib group";
      }

         grouping fb-ribs-oper-status {
             list fb-rib-oper-status {
               key fb-rib-name;
                   leaf fb-rib-name {
                           type string;
                           description "rib name";
                   }
                   leaf pkt-eca-cfged {
                       type boolean;
                           description
                           "pkt eca configured";
                    }
                   leaf acls-cfged {
                       type boolean;
                           description
                           "acls configured";
                   }
           uses pkt-eca:pkt-eca-opstate;
                   description
                    "Configuration of
                      an filter-based rib list";
             }
           description
           "list of FB-FIB operational
```

```
                    status";
          }


      }

    <CODE ENDS>
```

5.2. FB-RIB

```
 <CODE BEGINS> file "ietf-fb-rib@2017-03-13.yang"
module ietf-fb-rib {
  yang-version "1";

  // namespace
  namespace "urn:ietf:params:xml:ns:yang:ietf-fb-rib";
  // replace with iana namespace when assigned
    prefix "fb-rib";


  // import some basic inet types
  import ietf-yang-types {prefix "yang";}
  import ietf-fb-rib-types { prefix "fb-rib-t";}

  // meta
  organization
    "IETF";

  contact
     "email: sriganesh.kini@ericsson.com
          email: cengiz@packetdesign.com
      email: anoop@ieee.duke.edu
      email: ivandean@gmail.org
      email: shares@ndzh.com;
      email: linda.dunbar@huawei.com;
      email: russ@riw.com;
          ";

  description
    "This Top level module describes a YANG model for the I2RS
        Filter-based RIB which is an global protocol independent FB RIB module.

      revision "2017-03-13" {
        description "initial revision";
        reference "draft-ietf-i2rs-fb-rib-data-model-01";
      }
```

```
          feature config-filter-based-RIB {
```

```
      description
        "This feature means that a node support
         config filter-based rib.";
      }
          feature I2RS-filter-based-RIB {
      description
        "This feature means that a node support
         I2RS filter-based rib.";
      }
          feature BGP-FS-filter-based-RIB {
      description
        "This feature means that a node support
        BGP FS filter-based rib.";
      }


            container ietf-fb-rib {
              presence "top-level structure for
                configuration";
          leaf default-instance-name {
              type string;
                  mandatory true;
            description
              "A routing instance is identified by its name,
               INSTANCE_name.  This MUST be unique across all routing
               instances in a given network device.";
            }
                leaf default-router-id {
                      type yang:dotted-quad;
                      description "Default router id";
                  }
                  container config-fb-rib {
                   if-feature config-filter-based-RIB;
                    uses fb-rib-t:fb-ribs;
                   description "config filter-based RIB";
                  }

                  container i2rs-fb-rib {
                    if-feature I2RS-filter-based-RIB;
                    uses fb-rib-t:fb-ribs;
```

```
              description "bgp-fs filter-based RIB";
            }
            container bgp-fs-fb-rib {
              if-feature BGP-FS-filter-based-RIB;
              uses fb-rib-t:fb-ribs;
             description "bgp fs filter-based RIB";
            }
        description "fb-rib augments routing instance";
```

```
       }

      container ietf-fb-rib-opstate {
         presence "top-level structure for
          op-state";
         config "false";
      leaf default-instance-name {
           type string;
             mandatory true;
        description
          "A routing instance is identified by its name,
          INSTANCE_name.  This MUST be unique across all routing
          instances in a given network device.";
        }
           leaf default-router-id {
                 type yang:dotted-quad;
                 description "Default router id";
              }
              container config-fb-rib-opstate {
                if-feature config-filter-based-RIB;
                uses fb-rib-t:fb-ribs-oper-status;
               description "config filter-based RIB";
              }
              container i2rs-fb-rib-opstate {
                if-feature I2RS-filter-based-RIB;
                uses fb-rib-t:fb-ribs-oper-status;
               description "bgp-fs filter-based RIB";
              }
              container bgp-fs-fb-rib-opstate {
                if-feature BGP-FS-filter-based-RIB;
                uses fb-rib-t:fb-ribs-oper-status;
               description "bgp fs filter-based RIB";
              }
```

```
            description "fb-rib augments routing instance";
        }
}


<CODE ENDS>


6.  IANA Considerations

    TBD

7.  Security Considerations

    A I2RS RIB is ephemeral data store that will dyanamically change
    traffic paths set by the routing configuration.  An I2RS FB-RIB
    provides dynamic Event-Condition-Action policy that will further
    change the operation of forwarding by allow dyanmic policy and
    ephemeral RIBs to alter the traffic paths set by routing
    configuration.  Care must be taken in deployments to use the
    appropriate security and operational control to make use of the tools
    the I2RS RIB and I2RS FB-RIB provide.

8.  References

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