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S. Hares
Huawei
S. Kini
Ericsson
L. Dunbar
Huawei
R. Krishnan
Dell
D. Bogdanovic
Juniper Networks
R. White
Linkedin

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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

This Internet-Draft is submitted in full conformance with the provisions of BCP 78 and BCP 79.

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This Internet-Draft will expire on September 14, 2017.

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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:

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

- a global FB-RIB structures,
- the common structure of the FB-RIB, and
- 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)

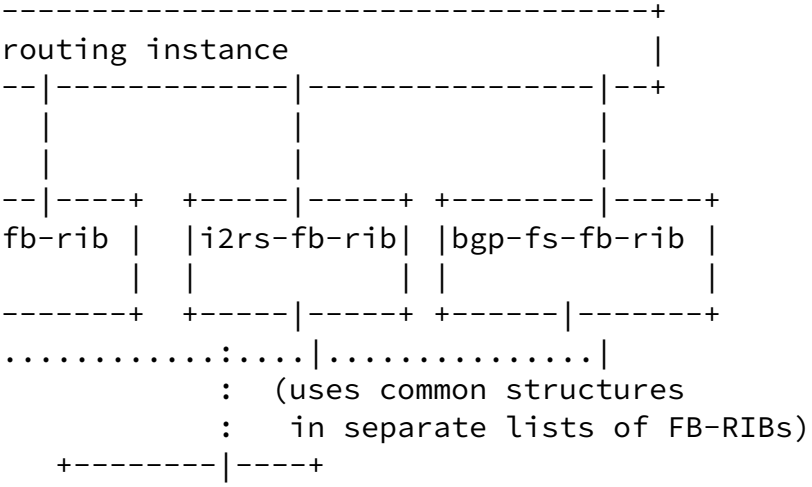
ephemeral control plane (E.g. I2RS Agent, config=TRUE, ephemeral=TRUE, opstate definitions), and

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



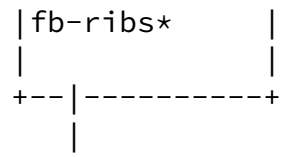


Figure 3: Routing instance with three types of Filter-FIB lists

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

- ietf-fb-rib - contains filter-based RIBS for config, I2RS FB-RIB, and BGP Flow Specification.
- fb-rib - that contains the structures for the filter-based grouping
- 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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Authors' Addresses

Susan Hares
Huawei

7453 Hickory Hill
Saline, MI 48176
USA

Email: shares@ndzh.com

Sriganesh Kini
Ericsson

Email: sriganesh.kini@ericsson.com

Linda Dunbar
Huawei
USA

Email: linda.dunbar@huawei.com

Ram Krishnan
Dell

Email: Ramkri123@gmail.com

Dean Bogdanovic
Juniper Networks
Westford, MA

Email: ivandean@gmail.org

Russ White
Linkedin

Email: russ@riw.us