An Information Model for Service Chaining Policy

draft-hares-dunbar-i2rs-sfc-policy-im-01

Abstract

This draft describes an I2RS information model for managing the service chain steering policy rules to a router via the I2RS interface (SFC-Policy IM).

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1. Introduction

This draft describes an I2RS information model for managing the Service Chain via the I2RS interface.

2. Definition of terms

NFV: Network Function Virtualization

[NFV-Terminology].

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SF: Service Function

[I-D.ietf-sfc-problem-statement].

SFF: Service Function Forwarder

Service Chain

[I-D.bitar-i2rs-service-chaining] defines a service chain as an ordered set of services applied to a packet of flow. An example of this is a sequence of service function such as Chain#1 \{s1, s4, s6\} or Chain#2\{s4, s7\} at functional level. Also see the definition of Service Function Chain in [I-D.bitar-i2rs-service-chaining]

Service Chain Instance Path

The actual Service Function Instance Components selected for a service chain.

SFFN: Service Function Forwarder Node

[I-D.bitar-i2rs-service-chaining] states service function can run: a) natively within a router (or routing system), b) on a virtual machine on a server or service engine, or in a dedicated standalone hardware appliance.

VNF: Virtualized Network Function

[NFV-Terminology]

STOPO

Service topology is a topology of Service nodes (SFF).

SFFaddr: Service Node Address

[I-D.ietf-sfc-problem-statement] states this address should be IP Address, or tuple of (SFFaddr, host system IP address) or tuple of (host system IP address, system internal ID for service engine).

Service Type

[I-D.ietf-sfc-problem-statement].
3. Service Chaining Background

```
+---+---+   +---+---+   +--+-----+
| SF#1 |   |SF#n |   |SF#i1|   |SF#im   |
+---+---+   +---+---+   +--+--+   +--+--+

:           :          :         :  :
:           :          :         :  :
\         /            \       /
\        |                     /
\       | SFC Encapsulation /
\      |                   /
\     |                      /
\    |                      /
\   |                      /
\  |                      /
\ |                      /
\|                      /
-- >| Chain        |   | SFF    |   ------    | SFF     | ---->
|classifier    |   |Node-1  |             | Node-i  |
+--------------+   +----+---+             +----+--+-+
\         |                     /
\        | SFC Encapsulation /
\       |                   /
\      |                      /
\     |                      /
\    |                      /
\   |                      /
\  |                      /
\ |                      /
\|                      /
```

Figure 1   Framework of Service Chain

4. Overview of information model for Service Chain

There are three major categories of information models for Service Chain management:

1) Service function instances discovery;

2) Traffic flow steering rules on a router for specific service chain.

3) Service Chain path computation

This document focuses on the first (service function instance discovery), and the second (the traffic flow steering rules) as expressed in I2RS policies. The third category, the Service Chain path computation, is out of scope for this document. An I2RS information model for Service Topology with its Traffic Engineering Databased (TED) and associated inventory can be found in [I-D.hares-i2rs-info-model-service-topo]. Additional I2RS modes on basic network policy (BNP IM) and Policy based Routing (PBR IM) is contained in [I-D.hares-i2rs-info-model-policy].
5. Requirements for Service Function Forwarder Node (SFFN) Resources

SFC Flow Filtering

This section reviews the requirements for SFC Flow Filtering Policies for an existing service for SFFNs within the SFC domain.

Inherent in the [I-D.ietf-sfc-problem-statement] is the need for policies that establish and filter data flow on the Service chain pathways. This document defines an I2RS model to interface to the SFC’s Service Function Forwarder (SFF) to install or change the the Policy controlling data flow to their designated and service functions and subsequent SFFN.

The SFC use case [I-D.bitar-i2rs-service-chaining] suggests SFF resources that must be on each SFF Node (SFFN). The SFFN resources include the following elements that the I2RS Client-I2RS Agent protocol can utilize:

SFC-Use-REQ01:Address (R)

has the following address requirements:

* IP address
* service-node tuple (service node IP address, Host system address)
* host-node tuple (hosting system IP-address, system internal identifier)

SFC-Use-REQ02:Supported Service Types (R/W) SHOULD include:

NAT, IP Firewall, Load balancer, DPI, and others. Note that the current SFC WG suggest that the SFF does not need to know the SFFN type to steer the data to their designated service function. Therefore, this parameter has been given "a forwarding" function value.

SFC-Use-REQ03:Virtual contexts (R/W) SHOULD include:

* Maximum Number of virtual contexts supported
* Current number of virtual contexts in use
* Number of virtual contexts available
* Supported Context (VRF)

SFC-Use-REQ04: Customers currently on node (R)

SFC-Use-REQ05: Customer Support Table (per customer ID) (R)

with the following contents per entry:
* Customer-id
* List of supported Virtual Contexts

SFC-Use-REQ06: Service Resource Table (R/W)

which includes:
* index: Comprised of service node, virtual context, service type
* service bandwidth capacity
* supported packet rate (packets/second)
* supported bandwidth (kps)
* IP Forwarding support: specified as routing-instance(s), RIBs, Address-families supported
* Maximum RIB-size
* Maximum Forward Data Base size
* Maximum Number of 64 bit statistics counters for policy accounting
* Maximum number of supported flows for services

SFC-Use-REQ07: Virtual Network Topology (VNT) (R)

which includes:
* number of access points to which service topology applies
* topology of access points
6. Service Forwarder Node RBNF

```plaintext
<SFF_node> ::= <SFFN_address> /*SFC-Use-REQ01 */
   [<Attached_Service_node>] /*SFC-Use-REQ02 */
   [<SFFN_virtual_contexts>] /*SFC-Use-REQ03 */
   [<SFFN_customer_cnt>] /*SFC-Use-REQ04 */
   [<SFFN_Customer_support_table>] /*SFC-Use-REQ05 */
   [<SFFN_Service_Resource_table>] /*SFC-Use-REQ06 */
   [<SFFN_VNTopo>] /*SFC-Use-07*/

<SFFN_address> ::= <ip_address>

<Attached_Service_node> ::= |
   ( [ <service-node-ip_address> ]
   <host-system-ip_address> )
   / | ( [ <hosting-system-ip_address> ]
   <system-internal_ID> )

<service-node-ip_address> ::= <ip_address>
<host-system-ip_address> ::= <ip_address>
<hosting-system-ip_address> ::= <ip_address>
<system-internal_ID> ::= INTEGER-64;
/* SFC-Use-02 */
<SFFN_supported_types> ::= <Attached_Service_node_types>

/* These are the types specified by the SFC-REQ-02 */
<SF_Types> ::= [<SF_TYPE_FW>] 
   <SF_TYPE_LB>
   <SF_TYPE_DPI>
   <SF_TYPE_NAT>
/* SFC-Use-03 */
... 
<SFFN_virtual_contexts> ::= <VContext_max>
   <VContext_current_inuse>
   <VContext_current_avail>
   <SFFN_Types>
/*SFC-Use-04 */
<SFFN_customer_cur_cnt> ::= INTEGER;
/* SFC-Use-05: Customer Support Table per Customer ID */
<SFFN_customer_table> ::= [ <SFFN_customer< ... ]

<SFFN_customer> ::= <SFFN_customer_Name>
   <SFFN_customer_ID>
   <SFFN_customers_contexts>
```

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7. Information Model for Service Chain Function Instance Discovery

A Service function instance can be either attached to a router via a physical interface or instantiated on a virtual machine that is attached to a router. Following are our assumptions:

1) The Service Chain Manager can get all the IP addresses or IP prefix of the service function instances needed from a database or provisioning system, and passed to the relevant routers. The Routers can send ARP/ND broadcast/multicast messages to all the attached nodes.

2) Service function instances will respond to ARP (IPv4)/ND (IPv6) requests from its L2/L3 boundary router.
8. Information Model for Interested Service Function Instances

Service Function Instances placement can be managed by entities that are not integrated with Service Chain Manager. Therefore, it is necessary for the Service Chain Manager to discover all the Service Function Instances that might be needed for a specific service chain. Service Chain Manager can send down the filter periodically or on-demand (i.e. when there is a request for building a specific service chain for a client).

Some service function instances are attached to router via tunnels, e.g. VxLAN. Service Function Instances might be partitioned by clients, which are differentiated by different network ID (e.g. VNID, VPN ID, etc). Some filter will carry the network ID (tenant ID, or VPN ID) to get specific service functions.

The I2RS Client can operate as the service chain manager/controller communicating with the I2RS Agents operating in the router or I2RS Agents operating on the service function instances in the server racks to discover and control specific service function instances.

The I2RS Client-Agent must be able to discover the I2RS Agent associated with a specific Service Function instance by querying for: SFFN Address, SFFN type, or SFFN virtual context or SFFN Customer;
9. SFFN Instances Addresses

\[
\text{<interested-SF-filter> ::= } \text{<SF-FILTER-NAME>}
\text{[<ipv4-address-list>|<ipv6-address-list>]}
\text{[<client-identifier>]} \\
\text{<ipv4-address-list> ::= } ((\text{<ipv4-address> | <ipv4-prefix>}) ...) \\
\text{<ipv4-prefix> ::= <IPV4_ADDRESS><IPV4_PREFIX_LENGTH>}
\text{<ipv6-address-list> = ((<ipv6-address> | <ipv6-prefix>) ...)} \\
\text{<ipv6-prefix> ::= <IPV6_ADDRESS><IPV6_PREFIX_LENGTH>}
\text{<client-identifier> ::= <client-identifier-type>}
\text{<client-identifier-type> ::= <GRE>}
\text{<VxLAN>}
\text{<NVGRE>}
\text{<client-identifier> ::= (}<VXLAN> <VXLAN_IDENTIFIER>) \\
\text{<NVGRE> <VIRTUAL_SUBNET_ID>)}
\text{<GRE> <GRE_KEY>)}
\]

10. Information Model for Reporting Directly Attached Instances

When a router receives the filter of the interested Service Function Instances, it can scan through all its interfaces to check if any of the addresses in the filter list are attached to the interfaces. For the Service Function Instances attached via Layer 2, the router can send ARP/ND to get the matching instances to respond. For the Service Function Instances attached via Layer 3, the router can use Ping to check if the addresses in the filter are attached.

The response should be grouped by <SF-FILTER-NAME >

11. RBNF for Reporting Directly Attached Instances

\[
\text{<sf-instance-list> ::= <INSTANCE-LIST-NAME>}
\text{<SF-FILTER-NAME>}
\text{[<INTERFACE_IDENTIFIER>}
\text{<ipv4-address-list>}
\text{<ipv6-address-list>]}]
\]
12. Information Model for Traffic steering rules

The semantics of traffic steering rules is "Match" and "Action", similar to the "route" described in [I-D.ietf-i2rs-rib-info-model]. However, there are more matching criteria for traffic steering rules.

```
+-------+-------+-------+--------+-------+-----------+-----
|       |       |       |        |       |           |
|       |       |       |        |       |           |
IPv4 | IPv6 | tunnel | MAC | VLAN | VxLAN ID | Interface
(unicast/multicast SAFI)
```

The steering rules include matches on combinations of:

- Addresses: IP addresses (IPv4/IPv6), Multicast IP addresses, MAC Addresses;
- Label fields: MPLS labels, VLAN-IDs, GRE-Keys
- interfaces
- Layer 4 fields
- packet sizes

13. Traffic Steering Rules RBNF
<SFC-Policy> ::= <steering-rules>

<steering-rules> ::= <match> <action>
    <match> ::= <address>
        | <label>
        | <interface>
        | <l4-field>
        | <packet-size>
    <address> ::= <ip-address>
        | <multicast-address>
        | <mac-address>
    <ip-address> ::= <IPV4_ADDRESS>
        | <ipv4-prefix>
        | <IPV6_ADDRESS>
        | <ipv6-prefix>
    <label> ::= [MPLS_LABEL] | <VXLAN-ID> | <GRE-KEY>
    <l4-field> ::= <TCP_PORT> | <UDP-PORT>

<action> ::= <nexthop-list>
    | <drop-policy>
    | <metadata>
    <drop-policy> ::= <PASS> | <DROP>
    <metadata> ::= [<ATTACH> <object>] | <detach>

The I2RS interface of a router should allow "write" and "read" of above objects.

14. Security Considerations

The SC use cases described in this document assumes use of I2RS programmatic interfaces described in the I2RS framework mentioned in [I-D.ietf-i2rs-architecture]. This document does not change the underlying security issues inherent in the existing in [I-D.ietf-i2rs-architecture].

15. IANA Considerations

This draft includes no request to IANA.

16. Acknowledgements

We’d like to thank Qin Wu for his comments on this document relating to the service topologies.

17. References
17.1. Normative References

[I-D.ietf-i2rs-architecture]


17.2. Informative References

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[I-D.ietf-sfc-problem-statement]

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