Service Function Chaining
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**A Coordinated Forwarding Method for Hierarchical SFC**
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Status of this Memo



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Abstract

Hierarchical SFC is a network architecture for implementing SFC the chain with an ordered set of service functions which could be deployed in multiple geographically dispersed networks. How to forward traffic between networks in Hierarchical SFC is what the draft wants to present.

This document proposes a mapping-based forwarding method with coordinated orchestration by the translation of H-SFC and I-SFC to forward traffic between networks in Hierarchical SFC.

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## 1. Introduction

Hierarchical SFC is a network architecture for implementing SFC the chain with an ordered set of service functions which could be deployed in multiple geographically dispersed networks. Hierarchical SFC is described in detail in [I.D. dolson-sfc-hierarchical] and [I.D.ao-sfc-for-dc-interconnect], and is not repeated here.

Because of hierarchical SFC supports service decomposition which means a SF chained by a SFC can be decomposed into several more refined SFs, a SF might be logical wherever it is deployed. So it is

necessary to check the availability of SFs especially those logical SFs in the procedure of orchestration.

This document proposes that adding an interface in the SFC control plane for coordination between different SFC control planes of separate domains to achieve hierarchical service decompositions and describes a mapping-based forwarding method between multiple SFC domains for Hierarchical SFC in detail.

### 1.1. Assumptions

The following assumptions are made:

- A Hierarchical SFC-enabled network has multiple level network domains. Each domain has their own control plane and data plane.

- Control planes of different domain can work coordinately, but they are independent or non-transparent to each other. For example Top-Level network domain just uses logical SFs, but don't care how to construct a corresponding SFC for these logical SFs in Lower-Level network domains.

### 1.2. 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 RFC 2119 [RFC2119].

## 2. Terminology

The reader should be familiar with the terms contained in [RFC7665], [I-D.ietf-sfc-control-plane], [I-D.dolson-sfc-hierarchical] and [I-D.ao-sfc-for-dc-interconnect].

H-SFC: The SFC in the Top-Level network domain.

I-SFC: The SFC in the Lower-Level network domain.

## 3. Coordinated forwarding

When receiving a service request, the control plane should decide a SFC for it, select appropriate SF instances and make a SFP for the SFC. Furthermore, a classification policy which binds the flow with the request to a given SFC should be told to classifiers so that the flow can pass through relevant SFs along the SFP.

But in hierarchical SFC, SFs might be logical which means it can be decomposed to several less abstract, more refined SFs. Besides, logical SFs always represent SFCs in SFC-enabled sub-domains. So, how to guarantee the availability of logical SFs and forward SFC traffic among multiple SFC-enabled domains is an important problem.

What follows in this document is going to describe how to solve aforementioned problem.

### 3.1. Hierarchical Control Planes

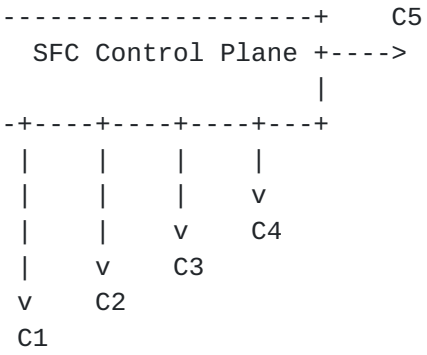


Figure 1: Interfaces of SFC Control Plane

[I-D.ietf-sfc-control-plane] presents a reference architecture of the SFC control plane, including 4 kinds of interfaces between the SFC control plane and various SFC data plane elements.

In hierarchical SFC that SFs are distributed over multiple SFC-enabled domains that the SFC needs to pass through, the control plane also should be hierarchical. As we know, each control plane is responsible for managing a single SFC-enabled domain. Then, each SFC control plane should gather and update information of local domain real-timely. Due to there is no fomal control hierarchy scheme, this document attempts to propose a simple Hierarchical Control Plane Scheme for Hierarchical SFC architecture.

Figure 1 shows the interface reference points of the SFC control plane architecture. C1 is the interface between SFC Control Plane and SFC Classifier; C2 is the interface between SFC Control Plane and SFF; C3 is the interface between SFC Control Plane and SFC-aware SFs; C4 is the interface between SFC Control Plane and SFC Proxy; C5 this document proposes is the interface between SFC Control Planes to provide an interface for coordination among those control planes of separate domains.

#### 3.1.1. C5: Interface between SFC Control Planes

As [I-D.ietf-sfc-hierarchical] said the IBN acts as an SFC-aware SF in the Top-Level domain (receiving SF instructions from the Top-Level control plane) and as a classifier in the Lower-Level domain (receiving classification rules from the Lower-Level control plane).

At the Top-Level, the SFs that compose an SFC might be logical which means they are actually SFCs composed by more refined SFs in the Lower-Levels. To setup these logical SFs, it needs coordinated orchestration between the control planes of the Top-level and the Lower-Levels. During the orchestration for the logical SF of a SFC in the Top-Level, the control plane of the Top-Level should send an instruction to the control plane of the corresponding Lower-Level. When the latter receives this instruction that it is likely that the Top-level receives a service request from users, Lower-Level would construct or assign an I-SFC for this "service request?which is from the Top-Level, and make a classification rules for classifier in the IBN who connects the Top-Level with the Lowe-Level to match the received H-SFC with the corresponding I-SFC.

#### 3.1.2. Interface between SFC Control Planes and IBN

Due to IBN behaves as an SF to Top-level domain, it is controlled by interface C3 or C4. Besides, IBN acts as a classifier and a SFF of end-of-chains to Lower-Level domain, it exchanges information with control plane of Lower-Level domain through interface C1 and C2.

### 3.2. Mapping-based forwarding method

This section shows an example of the processing of traffic forwarding between network domains. It is assumed that all logical SFs of H-SFC have been constructed by Lower-Level subdomains and relevant IBNs have known the classification rules.

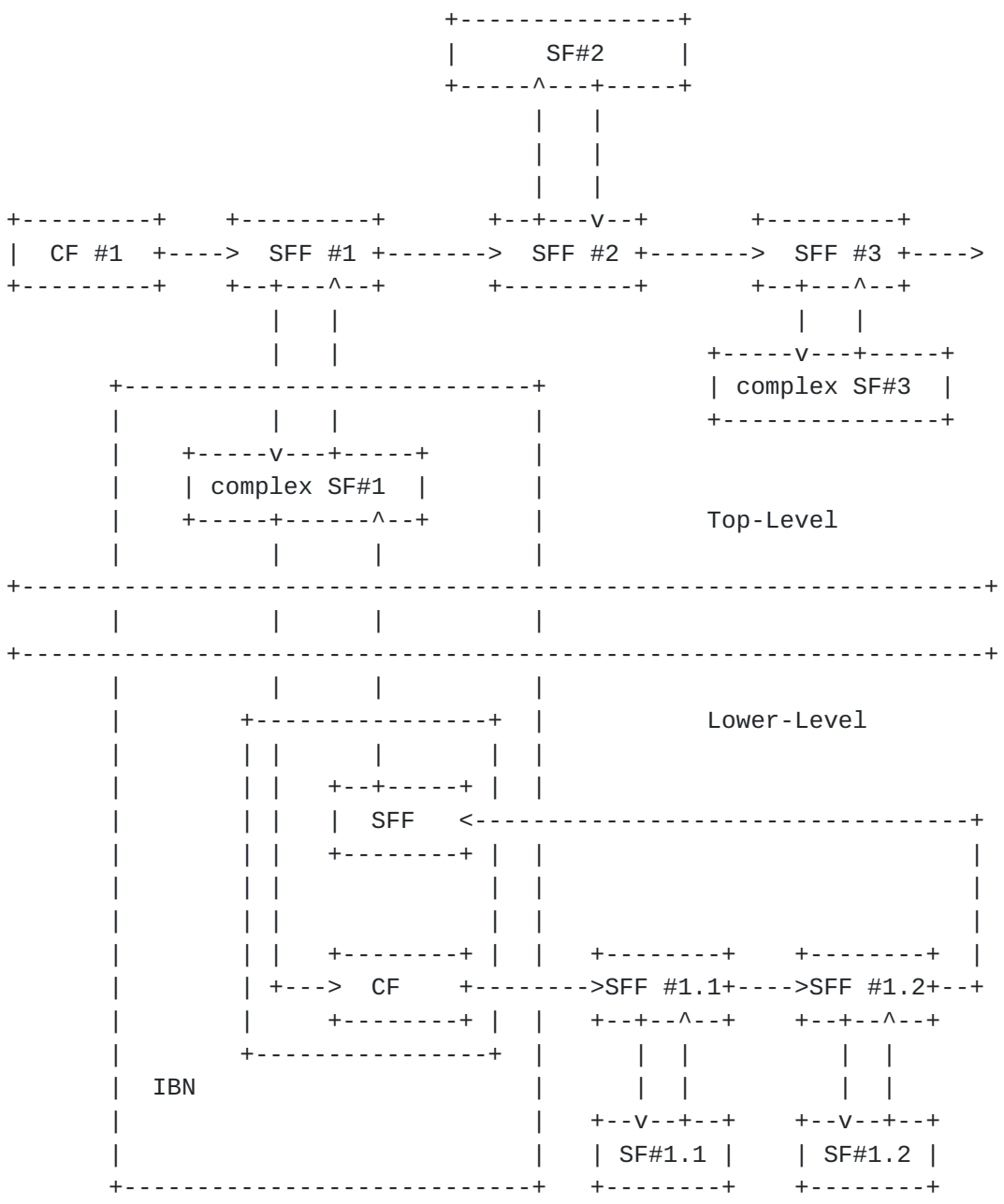


Figure 2: An example of Hierarchical SFC

Below is the working process:

1. The IBN receives an H-SFC encapsulated packet from a Top-Level network domain.

2. To select an appropriate I-SFC encapsulation for the packet within the Lower-Level network domain, reclassification would be performed by classifier module of the IBN according to H-SFC header information and classification rules, as the example of figure 3. Extraordinarily, the last SI of I-SFC MUST be the IBN so that the flow can go back to the H-SFC through the IBN when the I-SFC is over.

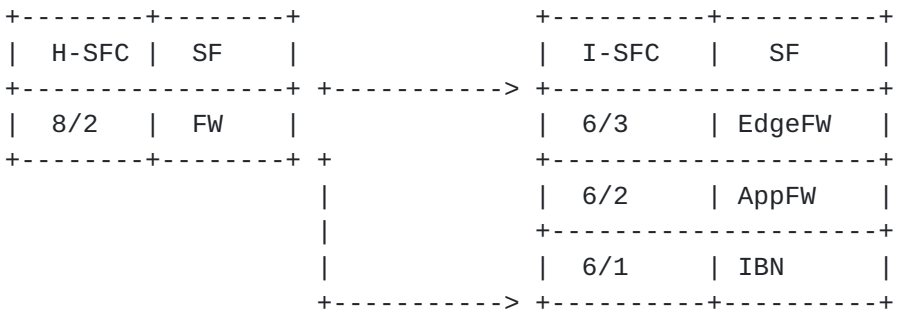


Figure 3: An example of Reclassification

3. The IBN stores the entire original H-SFC header information, as well as the mapping relation of H-SFC and I-SFC.

4. After reclassification, original H-SFC header of the packet would be replaced by the I-SFC header so that the packet could traverse the Lower-Level domain along the SFP of I-SFC.

5. When the I-SFC encapsulated packets return to the IBN at the end, the SFF module of the IBN would parse the I-SFC header of the packets to check whether the I-SFC is over.

6. For returning traffic from Lower-Level to Top-Level, IBN MUST look up the mapping relation to remove the I-SFC header and retrieve the original H-SFC header for the packets.

7. Before the packets with the original H-SFC header return to the Top-level domain, IBN MUST decrement the value of SI of the H-SFC header. If necessary, IBN would modify or consume or produce metadata according to the policy of the complex SF.

## 4. Metadata Consideration

Because the IBN is regarded as a Service Function to the Top-level domain, it should provide the ability to handle the metadata in the NSH header if necessary.

For example, it is common that checking the liveness of the service function of a service function path before the traffic selected by a Classifier traverse the network along a SFC which has been describe in [I-D.penno-sfc-trace-03]. Therefore the IBN must be able to add its identifying information at the end of the existing NSH headers as a Service Function.

## 5. Security Considerations

TBD.

## 6. IANA Considerations

TBD.

## 7. References

### 7.1. Normative References

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