Cisco NSH Service Chaining Configuration Guide

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NSH Service Chaining

Service chaining allows multiple service nodes to be included in a service path so that the packets that belong to a particular flow can travel through all the virtual service nodes in the service chain. NSH Service Chaining feature uses Network Service Header (NSH), a service plane protocol, to create dynamic service chains. NSH Service Chaining allows you to place and dynamically add services anywhere in the network, and gives flexibility in the network for service provisioning.

Information About NSH-Service-Chaining

NSH Service Chaining

In common deployment models, Service Functions (SFs) are inserted into the data-forwarding path of peers communicating with each other. However, with the introduction of service chaining functionality, SFs are not required to be located on the direct data path, rather the network traffic is routed through required SFs, wherever they are deployed.

Classification

NSH Service Chaining allows traffic flows to be classified so that only the desired flows are passed to the service. Moreover, classification enables network traffic to be dynamically moved to different service functions and service function paths without the need for major configuration changes or topology rewiring.

Network Service Header (NSH)

NSH is added to network traffic, in the packet header, to create a dedicated service plane that is independent of the underlying transport control protocol. In general, NSH contains path identification information, which is needed to realize a service path. In addition, NSH adds the metadata information about the packet, service chain or both to an IP packet, depending on the header type configured.

Enterprise Policy Application (EPA)

NSH Service Chaining feature can be configured either by using the Command Line Interface (CLI), or by using Enterprise Policy Application (EPA). EPA is an application that is hosted on controllers such as Application Policy Infrastructure Controller Enterprise Module (APIC-EM). You can use EPA GUI to configure a service chain based on services available in the network and apply a classifier to that chain. This information is then pushed to the controller (APIC-EM) to be applied to the network.

Benefits of Using NSH Service Chaining

NSH Service Chaining provides the following benefits:

• Agility: Services can be placed anywhere in the network, and dynamically added.

• Service provisioning: NSH service chaining need not be provisioned for peak traffic. Traffic types are classified so that only the desired flows are passed to the service.

• Flexibility: Easy to implement across a range of devices, both physical and virtual.

• Topological Independence: Network traffic can be dynamically moved to different service functions without requiring any changes to the network topology.
How to Configure NSH-Service-Chaining

Configuring Service Function Forwarder

To configure local Service Function Forwarder:

```
service-chain service-function-forwarder local
description local sff
ip address 10.1.108.23
```

To configure remote Service Function Forwarder:

```
service-chain service-function-forwarder abc
ip address 10.10.108.1
```

Verifying the Service Function Forwarder Configuration

Use the `show service-chain sff` command to verify the SFF configuration.

```
Device# show service-chain sff all statistics
Service-Chaining SFF(local) Statistics Count
...........................................
Sent:
  Packets diverted: 39
  Packets copied : 0
  Packets dropped : 0

Service-Chaining SFF(abc) Statistics Count
-----------------------
Sent:
  Packets diverted: 0
  Packets copied : 0
  Packets dropped : 0
```

Configuring Service Function

To configure a Service Function (SF):

```
service-chain service-function load-balance
description load-balancer VM
ip address 10.1.108.45
encapsulation gre
```

Configuring Service Path

To configure service path:

```
service-chain service-path 20
service-index 2 service-function load-balance
```

## Configuring Service-Chain Policy

To configure service-chain policy:

```plaintext
access-list 103 permit ip any any

class-map match-all all-ip
match access-group 103
!
policy-map type service-chain dynamic
  class all-ip
    forward service-path 20 service-index 2
```

## Applying Service-Chain Policy to an Interface

To apply service-chain policy to an interface:

```plaintext
interface GigabitEthernet1
  description Lab 10.1.108.0 on VMNet4
  ip address 10.1.108.23 255.255.255.0
  service-policy type service-chain input dynamic
```
Use Cases for NSH Service Chaining

Dynamic Service Insertion

Service functions can be inserted or deleted dynamically in a branch network. See the following figure for an illustration of dynamic service insertion scenario.

*Figure 1: Dynamic Service Insertion*

The following example shows how to configure the dynamic service insertion scenario:

**Service Chain Configuration**

```
service-chain service-function-forwarder local
  description local sff
  ip address 10.1.108.23

service-chain service-function waas
  description waas-lan
  ip address 10.1.108.45
  encapsulation gre

service-chain service-function load-balance
  description Load Balancer VM
  ip address 10.1.108.46
  encapsulation gre

service-chain service-path 20
```
Service Classifier Configuration

access-list 103 permit ip any any
class-map match-all all-ip
match access-group 103
	policy-map type service-chain dynamic
class all-ip
	forward service-path 20 service-index 255

interface GigabitEthernet1
description Lab 10.1.108.0 on VMNet4
ip address 10.1.108.23 255.255.255.0
service-policy type service-chain input dynamic

Service Chaining to Internet

You can classify the traffic destined or originated from the Internet, and pass the traffic through a set of security features without disrupting traffic on the branch network. See the following figure for an illustration of service chaining to Internet.

Figure 2: Service Chaining to Internet

The following example shows how to configure service chaining to internet.
Service Chain Configuration

```bash
service-chain service-function-forwarder local
description local sff
ip address 10.1.108.23

service-chain service-function wireshark
description Wireshark VM
ip address 10.1.108.45
encapsulation gre

service-chain service-function firewall
ip address 10.1.108.19
encapsulation none

service-chain service-function firewall-out
ip address 10.40.108.19
encapsulation none

service-chain service-path 40
  service-index 255 service-function wireshark
  service-index 254 service-function firewall
  service-index 253 terminate

service-chain service-path 41
  service-index 255 service-function firewall-out
  service-index 254 terminate
```

Service Classifier Configuration

```bash
access-list 103 permit ip any any

class-map match-all all-ip
match access-group 103

policy-map type service-chain dia
class all-ip
  forward service-path 40 service-index 255

policy-map type service-chain dia-out
class all-ip
  forward service-path 41 service-index 255

interface GigabitEthernet1
description Lab 10.1.108.0 on VMNet4
ip address 10.1.108.23 255.255.255.0
service-policy type service-chain input dia

interface GigabitEthernet2
description FW WAN side
ip address 10.40.108.23 255.255.255.0
service-policy type service-chain input dia-out
```

Troubleshooting Tips

Conditional Debugging

NSH service chaining feature uses conditional debugging for troubleshooting any problems on the IOS-XE data plane side.

Conditional Debugging allows you to selectly enable debugging and logging for the feature based on the set of conditions you define.

Before You Begin

You need to understand these sequence of steps before you start conditional debugging on your system:
First, define a set of conditions. The common conditions examples are, interface, access list, IP address, and so on.

Secondly, enable conditional debugging for the specific set of features.

Finally, start the conditional debug on your system.

**Defining Conditions**

debug platform condition feature service-chain controlplane level verbose
debug platform condition feature service-chain dataplane submode all level verbose

**Enabling Conditional Debugging**

debug platform condition [ingress | both]

**Starting Conditional Debugging**

debug platform condition start

**Stopping Conditional Debugging**

debug platform condition stop

The debug logs are stored in the platform shell of the specific Forwarding Processor (FP).

**Verifying Conditional Debugging**

show platform conditions

---

**Note**

Use the `clear debug platform condition all` command to remove the debug conditions applied to the platform.

---

**Additional References for NSH Service Chaining**

**Related Documents**

<table>
<thead>
<tr>
<th>Related Topic</th>
<th>Document Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cisco IOS commands</td>
<td>Cisco IOS Master Commands List, All Releases</td>
</tr>
<tr>
<td>Cisco IOS Wide-Area Networking Command Reference</td>
<td>Cisco IOS Wide-Area Networking Command Reference</td>
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**Standards and RFCs**

<table>
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<tr>
<th>Standard/RFC</th>
<th>Title</th>
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<tbody>
<tr>
<td>RFC 7665</td>
<td>Service Function Chaining (SFC) Architecture</td>
</tr>
</tbody>
</table>
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<th>Link</th>
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<tr>
<td>The Cisco Support and Documentation website provides online resources to download documentation, software, and tools. Use these resources to install and configure the software and to troubleshoot and resolve technical issues with Cisco products and technologies. Access to most tools on the Cisco Support and Documentation website requires a Cisco.com user ID and password.</td>
<td><a href="http://www.cisco.com/c/en/us/support/index.html">http://www.cisco.com/c/en/us/support/index.html</a></td>
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</tbody>
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### Feature Information for NSH Service Chaining

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to [www.cisco.com/go/cfn](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

**Table 1: Feature Information for NSH Service Chaining**

<table>
<thead>
<tr>
<th>Feature Name</th>
<th>Releases</th>
<th>Feature Information</th>
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</thead>
<tbody>
<tr>
<td>NSH Service Chaining</td>
<td>Cisco IOS XE Denali 16.3.1</td>
<td>Service chaining allows multiple service nodes to be included in a service path so that the packets that belong to a particular flow can travel through all the virtual service nodes in the service chain. NSH Service Chaining feature uses Network Service Header (NSH), a service plane protocol, to create dynamic service chains. NSH Service Chaining allows you to place and dynamically add services anywhere in the network, and gives flexibility in the network for service provisioning. The following commands were introduced or modified by this feature: <code>service-chain</code> <code>service-function-forwarder</code>.</td>
</tr>
<tr>
<td>Location</td>
<td>Address</td>
<td></td>
</tr>
<tr>
<td>--------------------------</td>
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<td></td>
</tr>
<tr>
<td><strong>Americas Headquarters</strong></td>
<td>Cisco Systems, Inc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>San Jose, CA 95134-1706 USA</td>
<td></td>
</tr>
<tr>
<td><strong>Asia Pacific Headquarters</strong></td>
<td>Cisco Systems (USA) Pte. Ltd.</td>
<td></td>
</tr>
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<td></td>
<td>Singapore</td>
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<td><strong>Europe Headquarters</strong></td>
<td>Cisco Systems International BV</td>
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<td></td>
<td>Amsterdam, The Netherlands</td>
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