



## Network Service Headers (NSH)

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### Feature Summary and Revision History

#### Summary Data

Applicable Product(s) or Functional Area	<ul style="list-style-type: none"><li>• P-GW</li><li>• SAEGW</li></ul>
Applicable Platform(s)	<ul style="list-style-type: none"><li>• ASR 5500</li><li>• VPC-DI</li><li>• VPC-SI</li></ul>
Feature Default	Enabled - Always-on
Related Changes in This Release	Not Applicable
Related Documentation	<ul style="list-style-type: none"><li>• <i>Command Line Interface Reference</i></li><li>• <i>P-GW Administration Guide</i></li><li>• <i>SAEGW Administration Guide</i></li></ul>

**Revision History**

Revision Details	Release
In this release, NSH-based Traffic Identification with Traffic Steering is supported.	21.9
First introduced.	21.4

## Feature Description

Network Services Headers (NSH), a new service chaining protocol, is added to the network traffic in a packet header to create a dedicated service plane that is independent of the underlying transport protocol. In general, NSH describes a sequence of service nodes that a packet is routed through before reaching the destination address. The NSH includes meta-data information about the packet and service chain in an IP packet. The NSH protocol addresses the growing requirement to deploy various services functions external to the gateway.

This feature introduces NSH protocol support for P-GW and SAEGW products and supports the following:

- Encoding and decoding of NSH format in the P-GW/SAEGW.
- Configurable parameters to be included for encoding in the variable header.
- NSH treatment for selective traffic based on configuration.
- Configuring the tag values for parameters present in the variable header.
- Selective configuration of policies for acting on the decode parameters received in the NSH.
- Configuring the intelligence of encoding the NSH information in every packet of a flow or only once per flow.
- NSH-based Traffic Identification with Traffic Steering.




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**Important** In this release, selective encryption of parameters is not supported.

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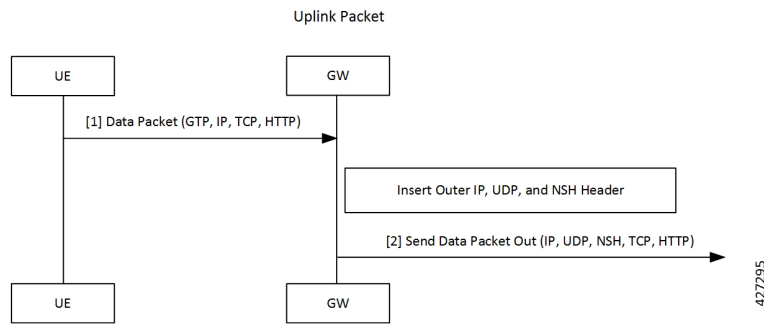
## How It Works

This section describes the working of NSH protocol support in Cisco's P-GW/SAEGW products.

- **The Uplink Packet**

For the uplink packet, P-GW/SAEGW adds the NSH, if the flow matches the specified criteria. NSH has a variable length context header also.

Following call flow shows the NSH protocol support in the Cisco PGW/SAEGW products for an uplink packet.

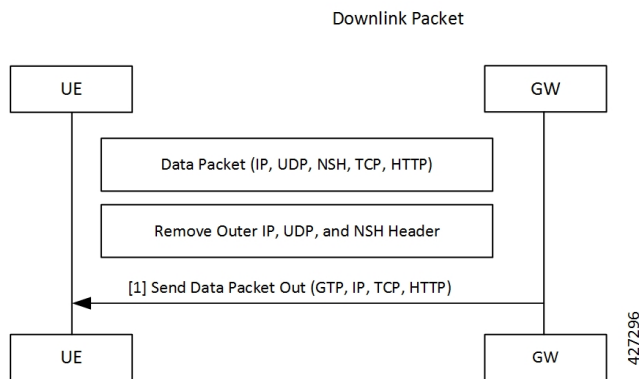


For an uplink packet, if the call flow matches the specified criteria, PGW or SAEGW adds the NSH header to the data packet. NSH header may have variable length context header, which can be encrypted if specified in the configuration.

• **The Downlink Packet**

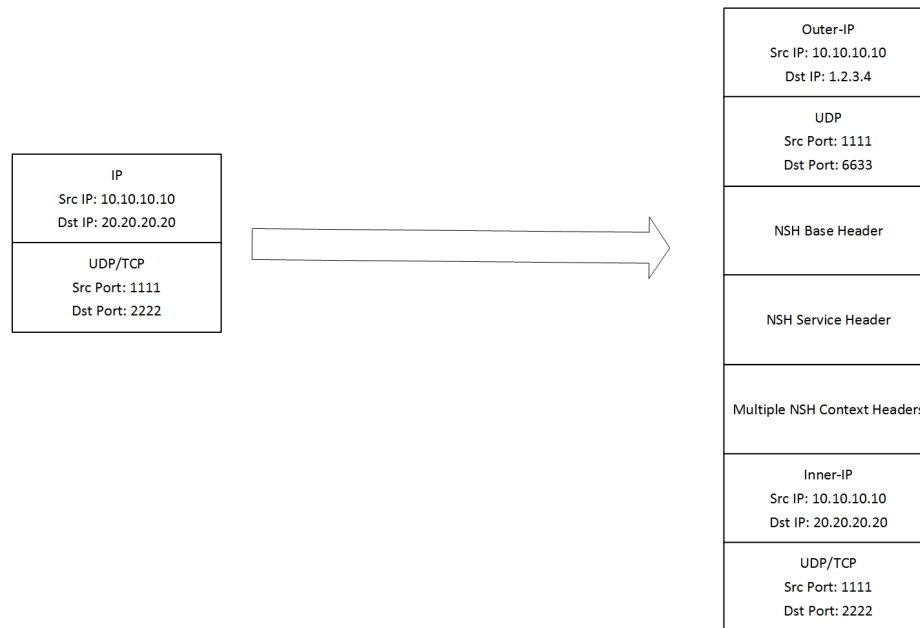
For the downlink packet, P-GW/SAEGW processes and removes the NSH and applies policies based on the extracted NSH parameters.

Following call flow shows the NSH protocol support in the Cisco PGW/SAEGW products for a downlink packet.



For a downlink packet, PGW or SAEGW processes and removes NSH header. Then, PGW or SAEGW apply policies based on the extracted NSH parameters.

- Source and destination IP address for the outer IP packet is taken from the inner IP packet.
- By default, NSH encapsulated packets use the port number 6633.



## Configuring Support for NSH Framework

This section covers configuration steps used in this feature for adding support for NSH framework.

### Charging Action Association

Service chain is associated to charging action in the following way:

```
configure
  active-charging service service_name
  charging-action charging_action_name
  service-chain service_chain_name
end
```

#### Notes:

- **charging-action:** Defines charging action.  
*charging\_action\_name:* Specifies name of the charging action. This is entered as an alphanumeric string of 1 through 64 characters.
- **service-chain:** Defines service chain association.  
*service\_chain\_name:* Specifies name of the service chain. This is entered as an alphanumeric string of 1 through 64 characters.

### Service Chain Association

A new CLI command **nsh-format** is added to the **service-chain** command for service-chain association.

```

configure
  service-chain <service_chain_name>
    nsh-format <nsh_format_name>
  end

```

**Notes:**

- **service-chain**: Defines service chain association.  
*service\_chain\_name*: Specifies name of the service chain. This is entered as an alphanumeric string of 1 through 64 characters.
- **nsh-format**: Associates NSH format with the service chain.

## Service Scheme Association

A new CLI command **nsh-response-received** has been added to the **trigger** command to the ACS service scheme configuration mode.

```

configure
  active-charging service service_name
    service-scheme service_scheme_name
      [ no ] trigger { bearer-creation | flow-create | loc-update |
nsh-response-received | sess-setup }
    end

```

**Notes:**

- **service-scheme**: Enables the association of service-scheme based on subscriber class.  
*service\_scheme\_name*: Specifies name of the service scheme. This is entered as an alphanumeric string of 1 through 64 characters.
- **no**: Disables the trigger action for the service-scheme.
- **trigger**: Specifies the trigger action for service-scheme.
- **bearer-creation**: Triggers for every new bearer.
- **flow-create**: Triggers for every new flow.
- **loc-update**: Triggers whenever location changes of the subscriber.
- **nsh-response-received**: Triggers on NSH response packet.
- **sess-setup**: Triggers at session setup.

## NSH Configuration Mode

The Network Service Header (NSH) configuration mode is a sub-mode of the Global Configuration mode. This NSH mode is used to encode or decode NSH.

Exec > Global Configuration> Network Service Entity - IP Configuration

```
configure
nsh
end
```

Entering the above command sequence results in the following prompt:

```
[local]host_name(nsh)#
```

## NSH Fields Configuration Mode

The NSH Fields configuration mode is a sub-mode of the NSH Configuration mode. This NSH Fields configuration mode is used to tag value to the NSH fields.

Exec > Global Configuration> Network Service Header > Network Service Header - Fields Configuration

```
configure
nsh
nsh-fields fields_name
end
```

Entering the above command sequence results in the following prompt:

```
[local]host_name(nsh-nshfields)#
```

### tag-value

This new CLI command is added to the NSH Fields Configuration mode to associate a tag value to a NSH field.

```
configure
nsh
nsh-fields fields_name
tag-value tag_value { content-type | enterprise-id | imei | imsi |
msisdn | rating-group | rulebase | tdf-app-id }
end
```

#### Notes:

- **nsh-fields:** Defines NSH fields tag values.  
*fields\_name:* Specifies name of the *nsh-field*. This is entered as an alphanumeric string of 1 through 64 characters.
- **tag-value** Associates a tag to a field.  
*tag\_value* : Tag value for the NSH field.
- **content-type:** Specifies content type of payload.
- **enterprise-id:** Specifies the enterprise-ID to be sent in NSH context header.
- **imei:** Specifies IMEI of the subscriber.
- **imsi:** Specifies IMSI of the subscriber.
- **msisdn:** Specifies MSISDN of the subscriber.

- **rating-group**: Specifies rating-group applied for the traffic.
- **rulebase**: Specifies rule-base of the subscribers.
- **tdf-app-id**: Specifies TDF Application ID applied to the traffic.

## NSH Format Configuration Mode

The NSH Format Configuration mode is a sub-mode of the NSH Configuration mode. This NSH Format mode is used to encode or decode NSH.

Exec > Global Configuration> Network Service Header > Network Service Header - Format

```
configure
nsh
nsh-format format_name
end
```

Entering the above command sequence results in the following prompt:

```
[local]host_name(nsh-nshformat)#
```

### encode

This new CLI command is added to the NSH Format configuration mode. This command defines the NSH encoding fields to be associated with the NSH format.

```
configure
nsh
nsh-format format_name
encode nsh-fields fields_name
end
```

#### Notes:

- **nsh-format**: Defines format in NSH header.  
*format\_name*: Specifies name of the *NSH format*. This is entered as an alphanumeric string of 1 through 64 characters.
- **encode**: Associates nsh-fields for encoding.
- **nsh-fields**: Defines nsh fields tag value.  
*fields\_name*: Specifies name of the fields. This is entered as an alphanumeric string of 1 through 64 characters.

### encoding-frequency

This command defines frequency of encoding the NSH fields to be associated with the NSH format.

```
configure
nsh
nsh-format format_name
```

```

    encoding-frequency { always | once-per-flow }
end

```

**Notes:**

- **encoding-frequency**: Defines frequency of encoding nsh-fields.
- **always**: Encodes nsh fields on every hit.
- **once-per-flow**: Encodes nsh fields once per flow.

**decode**

This command defines the NSH decoding fields to be associated with the NSH format.

```

configure
nsh
    nsh-format format_name
        decode nsh-fields fields_name
    end
end

```

**Notes:**

- **nsh-format**: Defines format in NSH header.  
*format\_name*: Specifies name of the *NSH format*. This is entered as an alphanumeric string of 1 through 64 characters.
- **decode**: Associates nsh-fields for decoding.
- **nsh-fields**: Defines nsh fields tag value.  
*fields\_name*: Specifies name of the fields. This is entered as an alphanumeric string of 1 through 64 characters.

**Trigger Condition Configuration Mode Commands****content-type**

This command specifies the content type to be matched.

```

configure
    active-charging service service_name
        trigger-condition trigger_condition_name
            content-type { operator condition }
        end
end

```

**Notes:**

- **trigger-condition**: Defines ACS trigger conditions.  
*trigger\_condition\_name*: Specifies name of the trigger condition. This is entered as an alphanumeric string of 1 through 64 characters.
- **content-type**: Specifies the content type.



- **operator** : Specifies how to match. Operator must be one of the following:
  - **!=**: not equals
  - **!contains**: not contains
  - **!ends-with**: not ends with
  - **!starts-with**: not starts with
  - **=**: equals
  - **contains**: contains
  - **ends-with**: ends with
  - **starts-with**: starts with
- **condition**: Specifies the condition to match. Condition must be one of the following:
  - FALSE
  - TRUE

## tdf-app-id

This command specifies the identifier for application-based rules to be matched.

### configure

```
active-charging service service_name
  trigger-condition trigger_condition_name
    tdf-app-id { operator condition }
  end
```

### Notes:

- **trigger-condition**: Defines ACS trigger conditions.
  - trigger\_condition\_name*: Specifies name of the trigger condition. This is entered as an alphanumeric string of 1 through 64 characters.
- **tdf-app-id**: Specifies the identifier for application based rules.
- **operator condition**: Specifies how to match. Operator must be one of the following:
  - **!=**: not equals
  - **!contains**: not contains
  - **!ends-with**: not ends with
  - **!starts-with**: not starts with
  - **=**: equals
  - **contains**: contains
  - **ends-with**: ends with

- **starts-with**: starts with
- **condition**: Specifies the condition to match. Condition must be one of the following:
  - FALSE
  - TRUE

## Sample Configuration for NSH Creation

The following is a sample configuration for this NSH service creation:

```

config
  nsh
    nsh-fields xyz
      tag-val 1 imei
      tag-val 2 imsi
    exit
    nsh-fields abc
      tag-val 4 content-type
    exit
    nsh-format format1
      encoding frequency always
      encode nsh-fields xyz
      decode nsh-fields abc
    exit
  exit
  traffic-steering
  appliance-group firewall
  nsh-format format1
  ip address 1.2.3.4
  #exit
#exit
service-chain sch1
  sfp direction uplink service-index 1 appliance firewall
#exit
exit
config
  active-charging service ACS
    trigger-action tal
      throttle-suppress
    exit
    trigger-condition tc1
      content-type contains text
    exit
    service-scheme schemel
      trigger nsh-response-received
      priority 1 trigger-condition tc1 trigger-action tal
    exit
  exit
  subs-class class1
    any-match = TRUE
  exit
  subscriber-base basel
    priority 1 subs-class class1 bind service-scheme schemel
  exit
  charging-action cal
    service-chain xyz
  exit

```

```

    exit
exit

```

## Show Commands and Outputs

This section provides information regarding show commands and their outputs in support of the feature.

### show nsh statistics

This command has been newly added in this release to display the nsh statistics. Following is the output when you execute this command:

```

Total Encap Successful           :           0
Total Decap Successful           :           0

Total Encap Failed               :           0
  Memory Allocation               :           0
  Config Error                   :           0
  Encryption Failed              :           0

Total Decap Failed               :           0
  Config Error                   :           0
  Base Header
    Invalid Length                :           0
    Unsupported Version            :           0
    Unsupported Next Protocol      :           0
    Next Protocol Mismatch        :           0
    Unsupported MD-Type            :           0
  Context Header
    Unsupported MD-Class           :           0
    Unsupported Type               :           0

OAM Packets
  Received                       :           0
  Dropped                        :           0

Unknown Context Header Type     :           0

```

### show active-charging trigger-condition statistics

The output of this command includes the following field for this feature:

- NSH-Rsp-Rcvd

This field displays the matching of trigger condition based on NSH response.

■ show active-charging trigger-condition statistics