

Service Chaining Configuration

OPERATION DIRECTIONS

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1 Introduction

This document describes service chaining configurations on the PGW and GGSN.

1.1 Scope

This document covers the following issues:

- Enabling service chaining
- Configuring Service Chains (SCs), including special chain for default downlink initiated traffic
- Configuring service function, groups, and instances
- Configuring adaptors
- Configuring I/O interfaces
- Configuring load balancer

A license is required to use the features described in this document. For information about licensed features, refer to [EPG Features](#). For more information on how to configure licenses, refer to [Software License Management and Licensing](#).

For an overview and technical description of service chaining, refer to [Service Chaining](#).

For an overview of the association between an Access Control Rule (ACR) or a Dynamic Charging Rule (DCR) and service chaining, refer to [Policy Control](#).

1.2 Target Groups

This document is intended for personnel performing service chaining related configuration in the GGSN or PGW. The document assumes a basic knowledge of data communication and telecommunication.

2 Enable Service Chaining

To enable service chaining, do the following:

1. Activate the service chaining feature, see [Section 2.1](#) on page 2.



2. Configure Service Chains (SCs), see Section 3 on page 2.
3. Configure service functions, see Section 4 on page 4.
4. Configure adaptors, see Section 5 on page 8.
5. Configure interface I/O, see Section 5.3 on page 8.
6. Optionally, associate ACRs with specific SCs, refer to [Policy Control Configuration](#).
7. Optionally, configure service chaining profiles with default SCs, see Section 7 on page 12.

2.1 Activate Service Chaining

To activate the service chaining feature, include the following statement:

```
Ericsson(config)# epg node feature-activation service-chaining
```

3 Configure an SC

To configure an SC, do the following:

1. Create an ID for the SC, see Section 3.1 on page 2.
2. Configure references to service functions, see Section 3.2 on page 2.
3. Optionally, indicate if the chain is bidirectional, see Section 3.3 on page 3.
4. Optionally, to support network-initiated traffic with service chaining, define an SC as the default SC for downlink flows, see Section 3.4 on page 3.

3.1 Configure SC Identification

To configure an ID for an SC, include the following statement:

```
Ericsson(config)# epg pgw service-chaining service-chain <sc-id>
```

Up to 32 different SCs can be configured.

3.2 Configure References to Service Functions

The EPG uses service functions to create service chains.



To configure the ordered service functions for the SC, include the following statement:

```
Ericsson(config)# epg pgw service-chaining service-chain  
<sc-id> service-function [<sf1> <sf2> <sf3> ... ]
```

At least one service function must be added. Up to 16 service functions can be configured.

The same service function cannot be added more than once.

Note: The insert command cannot be used to insert a service function before another service function. Use NETCONF to insert a service function before another service function.

3.3 Configure a Bidirectional SC

To configure a bidirectional SC, include the following statement:

```
Ericsson(config)# epg pgw service-chaining service-chain  
<sc-id> bidirectional
```

Consider the following when configuring a bidirectional SC:

- The effective order of the service functions is one compared to the configured, so the same chain can be applied to uplink and downlink directions and the uplink and downlink paths are symmetrical.
- If a bidirectional chain is assigned to uplink direction, the effective order of the service functions in uplink path is the same as the configured order.
- If a bidirectional chain is assigned to downlink direction, the effective order of the service functions in downlink path is reversed compared to the configured order.
- If the same bidirectional SC is associated with uplink and downlink directions, the uplink and downlink paths are symmetrical.

Note: An uplink ACR or DCR associated with a bidirectional SC does not automatically assign the downlink flow to the same chain. The downlink flow has to be explicitly associated with a chain if service chaining is also required on the downlink path.

By default, service chains are unidirectional.

3.4 Configure Default Downlink SC

To enable a default downlink SC, do the following:

1. Configure a specific SC with the needed service functions. For information what service functions to add, refer to [Service Chaining](#).



2. Configure the service function for the SC:

```
Ericsson(config)# epg pgw service-chaining defau  
lt downlink <sc-id>
```

4 Configure a Service Function

To configure a service function, do the following:

1. Configure an ID for the service function, see Section 4.1 on page 4.
2. Configure a failure handling policy on the service function level, see Section 4.2 on page 4.
3. Configure a service function group, see Section 4.3 on page 5.
4. Configure service function instances, see Section 4.4 on page 5.
5. Configure the service function load balancer, see Section 4.5 on page 7.
6. Configure a failure handling policy on the service function instance level, see Section 4.6 on page 7.
7. Configure the adaptor reference, which is used to communicate with the service function instances, see Section 4.7 on page 7.

4.1 Configure Service Function Identification

To configure an ID for a service function, include the following statement:

```
Ericsson(config)# epg pgw service-chaining servi  
ce-function <sf-id>
```

Up to 32 different service functions can be configured. A service function ID can be referred to by one or more SCs.

4.2 Configure a Failure Handling Policy on the Service Function Level

To configure the EPG to drop packets if none of the service function instances are ready to process traffic, include the following statement.

```
Ericsson(config)# epg pgw service-chaining service-function  
<sf-id> failure-handling drop
```



To configure the EPG to skip a service function, if the service function instance is not ready to process traffic, include the following statement.

```
Ericsson(config)# epg pgw service-chaining service-function  
<sf-id> failure-handling bypass
```

The bypass command is active by default.

4.3 Configure a Service Function Group

To configure an ID for a service function group, include the following statement:

```
Ericsson(config)# epg pgw service-chaining service-function  
<sf-id> group <g-id>
```

A service function must include at least one group.

4.4 Configure Service Function Instances

Service function instances within the same function must be configured by either configuring a range of IPv4 addresses or explicitly configuring each service function instance. Service function instances within the same function cannot be configured using a combination of these methods.

To configure service function instances, select one of the following:

- Configure a range of IPv4 addresses, see Section 4.4.1 on page 5.
- Configure explicitly each service function instance, see Section 4.4.2 on page 5.

4.4.1 Configure Service Function Instances as a Range of IPv4s

To configure a set of service function instance with consecutive IPv4 addresses, include the following statement:

```
Ericsson(config)# epg pgw service-chaining service-function  
<sf-id> group <g-id> network-prefix <Ipv4 CIDR notation>
```

Up to 256 instances can be configured, that is, a prefix of 24 bits for IPv4.

```
Example: 192.168.0.10/24  
Start IP: 192.168.0.0  
End IP: 192.168.0.255  
Addresses: 256
```



4.4.2 Configure an Explicit Service Function Instance

Service function instances within the same function must be configured using the same method. If the service function instances are explicitly configured, the same method must be used for service function instances within the same function – either by VLAN or by IPv4 addresses.

To configure a service function instance explicitly, do the following:

1. Configure a service function instance ID, see Section 4.4.2.1 on page 6.
2. Configure a reference to a service function group, Section 4.4.2.2 on page 6.
3. Configure an IPv4 address for a service function instance, see Section 4.4.2.3 on page 6.
4. Configure specific VLANs for a service function instance, see Section 4.4.2.4 on page 6.

4.4.2.1 Configure Service Function Instance Identification

To configure an ID for a service function instance, include the following statement:

```
Ericsson(config)# epg pgw service-chaining service-function  
<sf-id> sfi <sfi-id>
```

Up to 256 different service functions can be configured.

4.4.2.2 Configure Reference to a Service Function Group

To configure a reference to a group for which the instance belongs, include the following statement:

```
Ericsson(config)# epg pgw service-chaining service-function  
<sf-id> sfi <sfi-id> group <g-id>
```

4.4.2.3 Configure an IPv4 Address for a Service Function Instance

To configure an IPv4 address for the service function instance, include the following statement:

```
Ericsson(config)# epg pgw service-chaining service-function  
<sf-id> sfi <sfi-id> network-address <ip address>
```

4.4.2.4 Configure Specific VLANs for a Service Function Instance

To configure a pair of specific VLANs per service function instance, include the following statements.

To configure the Radio Access Network (RAN) side of the service function, include the following statement:



```
Ericsson(config)# epg pgw service-chaining service-function  
<sf-id> sfi <sfi-id> vlan ran <vlan-tag>
```

To configure the internet side of the service function, include the following statement:

```
Ericsson(config)# epg pgw service-chaining service-function  
<sf-id> sfi <sfi-id> vlan internet <vlan-tag>
```

4.5 Configure the Service Function Load Balancer

The EPG load balancer mode can be configured to select how to steer the user flows over the multiple instances available in a service function.

To configure load balancer mode per subscriber, include the following statement:

```
Ericsson(config)# epg pgw service-chaining service-function  
<sc-id> group <g-id> load-balancer mode subscriber
```

To configure load balancer mode per session, include the following statement:

```
Ericsson(config)# epg pgw service-chaining service-function  
<sc-id> group <g-id> load-balancer mode session
```

By default, the EPG uses the load balancer mode per session.

4.6 Configure a Failure Handling Policy on the Service Function Instance Level

The EPG can be configured to drop, bypass, or rebalance packets if a service function instance is not available. For more information, refer to [Service Chaining](#).

To configure the EPG to drop packets, include the following statement:

```
Ericsson(config)# epg pgw service-chaining service-function  
<sc-id> group <g-id> failure-handling-instance drop
```

To configure the EPG to bypass a service function, include the following statement:

```
Ericsson(config)# epg pgw service-chaining service-function  
<sc-id> group <g-id> failure-handling-instance bypass
```

To configure the EPG to rebalance packets, include the following statement:

```
Ericsson(config)# epg pgw service-chaining service-function  
<sc-id> group <g-id> failure-handling-instance rebalance
```

By default, the EPG bypasses the failed service function.



4.7 Configure the Adaptor Reference in a Service Function Group

To configure the adaptor reference, which uses the service function instances within a group, include the following statement:

```
Ericsson(config)# epg pgw service-chaining service-function  
<sc-id> group <g-id> adaptor <adaptor-id>
```

5 Configure an Adaptor

To configure an adaptor, do the following:

1. Configure an ID that is referred by one or several service function groups, see Section 5.1 on page 8.
2. Configure the adaptor type, see Section 5.2 on page 8.
3. Configure the adaptor I/O interfaces, see Section 5.3 on page 8.
4. Optionally, configure specific adaptor VLANs for Virtual Interfaces on top of I/O interfaces, see Section 5.4 on page 9.
5. Configure service function monitoring, see Section 5.5 on page 10.

5.1 Configure Adaptor Identification

To configure an ID for an adaptor, include the following statement:

```
Ericsson(config)# epg pgw service-chaining adaptor <a-id>
```

Up to 16 different adaptors can be configured. An adaptor ID can be referred to by one or more service function groups.

5.2 Configure Adaptor Type

To configure the adaptor Layer 2 networking type, include the following statement:

```
Ericsson(config)# epg pgw service-chaining adaptor  
<a-id> type network-l2
```



5.3 Configure Adaptor I/O Interfaces

The adaptor type must be configured before configuring the adaptor interfaces.

To configure an adaptor managing a service function with only one interface, include the following statements:

```
Ericsson(config)# epg pgw service-chaining adaptor
<a-id> interface-io type rts
Ericsson(config)# epg pgw service-chaining adaptor <a-i
d> interface-io single <s-id>
```

Use the <s-id> parameter to refer to the routing instance as defined in Direct IO configuration.

To configure an adaptor managing a service function with two interfaces, one emulating the radio access side and one emulating the internet side, include the following statements:

```
Ericsson(config)# epg pgw service-chaining adaptor <a-id
> interface-io type dual-transparent
Ericsson(config)# epg pgw service-chaining adaptor <a-id> interface-io ran <
Ericsson(config)# epg pgw service-chaining adaptor <a-id
> interface-io internet <internet-id>
```

Use the <ran-i-id> parameter to refer to the routing instance as defined in Direct IO configuration, as the RAN side of the service function.

Use the <internet-id> parameter to refer to the routing instance as defined in Direct IO configuration, as the internet side of the service function.

For more information how to configure direct I/O routing instances and ports, refer to [User Plane Optimization](#).

The same interface cannot be defined for RAN and internet interface.

5.4 Configure Adaptor VLANs for User Traffic

To configure a pair of specific VLANs per adaptor, include the following statements:

To configure the RAN side of the service function, include the following statement:

```
Ericsson(config)# epg pgw service-chaining adaptor
<a-id> vlan ran <vlan-tag>
```

To configure the internet side of the service function, include the following statement:

```
Ericsson(config)# epg pgw service-chaining adaptor
<a-id> vlan internet <vlan-tag>
```



Note: If traffic monitoring requires a VLAN tag, see Section 5.5.4 on page 11.

5.5 Configure Service Function Instance Monitoring

Instance monitoring can be configured in the following ways:

- Address Resolution Protocol (ARP) monitoring, see Section 5.5.1 on page 10.
- UDP monitoring, see Section 5.5.2 on page 10.
- Custom traffic payload monitoring, see Section 5.5.3 on page 10.

For ARP and UDP monitoring, specific VLANs can be configured, see Section 5.5.4 on page 11.

Optionally, for all types, to configure the monitoring period in seconds, include the following statement:

```
Ericsson(config)# epg pgw service-chaining adaptor  
<a-id> monitoring interval
```

By default, the monitoring period is 5 seconds.

5.5.1 ARP Monitoring

To configure an ARP monitoring, include the following statement:

```
Ericsson(config)# epg pgw service-chaining adaptor  
<a-id> monitoring type arp
```

This value is a reference to a routing instance defined in Direct IO configuration.

Note: ARP traffic uses VLAN monitoring if VLAN monitoring is configured, see Section 5.5.4 on page 11.

5.5.2 UDP Monitoring

To configure a UDP monitoring, include the following statements:

```
Ericsson(config)# epg pgw service-chaining adaptor  
<a-id> monitoring type udp  
Ericsson(config)# epg pgw service-chaining adaptor  
<a-id> monitoring port <port>
```

Note: UDP traffic uses VLAN monitoring if VLAN monitoring is configured, see Section 5.5.4 on page 11.

5.5.3 Custom Traffic Payload Monitoring

To configure custom traffic monitoring, include the following statements:



```
Ericsson(config)# epg pgw service-chaining adaptor <a-id>
> monitoring type custom-traffic
Ericsson(config)# epg pgw service-chaining adaptor
<a-id> monitoring port <port>
```

By default, the EPG uses the same IP address assigned to the EPG I/O interfaces to monitor traffic toward a service instance, refer to [User Plane Optimization](#).

Optionally, to configure ad-hoc source and destination IP addresses for monitoring, include the following statements:

```
Ericsson(config)# epg pgw service-chaining adaptor <a-id> moni
toring custom-traffic src-network-address
Ericsson(config)# epg pgw service-chaining adaptor <a-id> moni
toring custom-traffic dst-network-address
```

5.5.4 VLAN Monitoring

To configure the monitoring of the RAN side of the service function, include the following statement:

```
Ericsson(config)# epg pgw service-chaining adaptor <a-id>
> monitoring vlan ran <vlan-tag>
```

To configure the monitoring of the internet side of the service function, include the following statement:

```
Ericsson(config)# epg pgw service-chaining adaptor <a-id>
> monitoring vlan internet <vlan-tag>
```

When traffic monitoring uses the same VLAN for the RAN and the internet sides of the service function, configure the same RAN and internet attribute values.

6 Configure Service Chaining Flow Management

Optionally, to configure the maximum number of active flows per user plane vSFO, include the following statement:

```
Ericsson(config)# epg pgw service-chaining flow-
table limit <value>
```

By default, the maximum number of active flows per user plane vSFO is 3,000,000.

Optionally, to configure the idle timeout in seconds for a flow, include the following statement:



```
Ericsson(config)# epg pgw service-chaining flow-table  
idle-timeout <value>
```

By default, the idle timeout is 180 seconds.

7 Configure Service Chaining Profiles

A service chaining profile consists of conditional and default actions for a flexible selection of the default SC to use for a user session. A default SC can be selected at user session establishment to be used in the absence of a PCC rule specific SC. The default SC of a conditional action is used in case the condition's match criteria is met, alternatively the default SC of the default action is used.

7.1 Configure a Service Chaining Action

To configure the uplink SC of an action for a service chaining profile, include the following statement:

```
Ericsson(config)# epg pgw service-chaining profile <profile-name>  
action <action-name> service-chain uplink <sc-id>
```

To configure the downlink SC of an action for a service chaining profile, include the following statement:

```
Ericsson(config)# epg pgw service-chaining profile <profile-name>  
> action <action-name> service-chain downlink <sc-id>
```

7.2 Configure a Service Chaining Condition

Service chaining conditions are evaluated in priority order, in order to sort overlapping match criteria. The match criteria for a conditional action can be the value of a configured custom attribute received from the AAA or the PCRF. For information on configuring a custom attribute, refer to [RADIUS Configuration and Policy Control Configuration](#).

To configure a condition for a service chaining profile, to match the exact value of a custom attribute, include the following statement:

```
Ericsson(config)# epg pgw service-chaining profile <profile-name>  
> condition <name> custom-attribute <attribute-name> is <value>
```

To configure a condition for a service chaining profile, to match a partial content of a custom attribute, include the following statement:



```
Ericsson(config)# epg pgw service-chaining profile
<profile-name> condition <name> custom-attribute
<attribute-name> contains <value>
```

To configure the conditional evaluation priority, where a lower value indicates higher priority, for a service chaining profile, include the following statement:

```
Ericsson(config)# epg pgw service-chaining profile <profil
e-name> condition <name> priority <value>
```

To configure the conditional action, in case the match criteria is met, for a service chaining profile, include the following statement:

```
Ericsson(config)# epg pgw service-chaining profile <profile-
name> condition <name> action <action-name>
```

7.3 Configure the Default Service Chaining Action

To configure the default action, in case no match criteria are met, for a service chaining profile, include the following statement:

```
Ericsson(config)# epg pgw service-chaining profile <profi
le-name> default-action <action-name>
```

7.4 Associate a Service Chaining Profile with a User Category

To associate a service chaining profile with the default user category, include the following statement:

```
Ericsson(config)# epg pgw apn <apn-name> user-category default
service-chaining-profile <profile-name>
```

To associate a service chaining profile with a specific user category, include the following statement:

```
Ericsson(config)# epg pgw apn <apn-name> user-category category
<number> service-chaining-profile <profile-name>
```

For instructions on configuring a user category, refer to [SACC Overview](#).

8 Configuration Examples

Example 1 shows an example of SC definition.



```
epg pgw service-chaining service-chain SC_A service-function SF_A
epg pgw service-chaining service-chain SC_B service-function SF_B
epg pgw service-chaining service-function SF_A failure-handling drop
epg pgw service-chaining service-function SF_A group G_A failure-handling-insta
epg pgw service-chaining service-function SF_A group G_A load-balancer mode ses
epg pgw service-chaining service-function SF_A group G_A adaptor Adaptor_IO
epg pgw service-chaining service-function SF_B failure-handling bypass
epg pgw service-chaining service-function SF_B group G_B failure-handling-insta
epg pgw service-chaining service-function SF_B group G_B load-balancer mode ses
epg pgw service-chaining service-function SF_B group G_B adaptor Adaptor_IO
epg pgw service-chaining service-function SF_C failure-handling drop
epg pgw service-chaining service-function SF_C group G_C failure-handling-insta
epg pgw service-chaining service-function SF_C group G_C load-balancer mode ses
epg pgw service-chaining service-function SF_C group G_C adaptor Adaptor_IO
epg pgw service-chaining service-function SF_A sfi SFi_A_1 group G_A
epg pgw service-chaining service-function SF_A sfi SFi_A_1 network-address 192
epg pgw service-chaining service-function SF_B sfi SFi_B_1 group G_B
epg pgw service-chaining service-function SF_B sfi SFi_B_1 network-address 193
epg pgw service-chaining service-function SF_C sfi SFi_C_1 group G_C
epg pgw service-chaining service-function SF_C sfi SFi_C_1 network-address 192
epg pgw service-chaining adaptor Adaptor_IO type network-l2
epg pgw service-chaining adaptor Adaptor_IO interface-io type rts
epg pgw service-chaining adaptor Adaptor_IO interface-io single sc-dio
epg pgw service-chaining adaptor Adaptor_IO monitoring type arp
epg pgw service-chaining adaptor Adaptor_IO monitoring interval 5
epg pgw rule-space rs-pcc-1 access-control-rule 10 service-chain uplink SC_A
epg pgw rule-space rs-pcc-1 access-control-rule 10 service-chain downlink SC_A
epg pgw rule-space rs-pcc-1 access-control-rule 20 service-chain uplink SC_B
epg pgw rule-space rs-pcc-1 access-control-rule 20 service-chain downlink SC_B
```

Example 1 Example of SC Definition