



# Sx Load/Overload Control Handling

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## Feature Summary and Revision History

### Summary Data

*Table 1: Summary Data*

Applicable Product(s) or Functional Area	cnSGW-C
Applicable Platform(s)	SMI
Feature Default Setting	Disabled – Configuration required to enable
Related Documentation	Not Applicable

### Revision History

*Table 2: Revision History*

Revision Details	Release
First introduced.	2021.01.0

## Feature Description

This feature supports enabling Sx load and overload for user-plane. UP selection takes place when the user-plane reports LCI (Load control information) and OCI (Overload Control Information).

Load control enables the user-plane function to send its load information to the control plane function. This load information is to balance the PFCP session load across the user-plane functions according to their effective loads.

Overload controls the information for throttling of new session requests towards specific user-plane.

## How it Works

This section describes how this feature works.

## Node Feature Support

As per 3GPP standard:

- CP informs load and overload feature to the user-plane.
- User-plane decides to send load or overload information towards the CP peer or not.

Configure load and overload feature at CP as a part of PFCP Sxa endpoint node feature. This configuration in turn communicates to UP during Sx Association Response message or Sx Association Update Request message when change in configuration occurs.

The CP Function Feature IE indicates the supported CP function features. This IE contains features which have (system-wide) UP function behavior impact.




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**Note** If CP does not support load or overload feature through CLI then it ignores the user-plane reported load or overload information for the UP selection process.

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## UP Selection

UP selection occurs as per LCI value only whereas throttling occurs as per OCI value only (Specified in 3GPP standards).

Per Peer Level LCI and OCI display:

```
show peers | tab | exclude rest
```

ENDPOINT	LOCAL ADDRESS	PEER ADDRESS	DIRECTION	INSTANCE	POD TYPE	CONNECTED TIME	RPC
ADDITIONAL DETAILS							
S5/S8	<nil>:2123	209.165.202.143:2123	Inbound	nodemgr-0	Udp	6 minutes	SGW Recovery: 10
SXA	209.165.200.226:8805	209.165.202.143:8805	Inbound	nodemgr-0	Udp	About a minute	SGW-U Capacity: 65535, LoadMetric: 20,LoadSeqNo: 1,OverloadMetric: 0,OverloadSeqNo: 0,Priority: 10
SXA	209.165.200.226:8805	209.165.202.147:8805	Inbound	nodemgr-0	Udp	2 minutes	SGW-U

```
Capacity: 10,
LoadMetric: 40,LoadSeqNo: 1,OverloadMetric: 100,OverloadSeqNo: 1,Priority: 20
SXA 209.165.200.226:8805 209.165.202.159:8805 Inbound nodemgr-0 Udp 2 minutes SGW-U
Capacity: 10,
LoadMetric: 100,LoadSeqNo: 1,OverloadMetric: 77,OverloadSeqNo: 1,Priority: 1
```

## Throttling Support for Sx Establishment

When user-plane is in overload situation, cnSGW-C establishes throttling the Sx Establishment request message toward user-plane. This throttling avoids new calls (Low priority or non-emergency) towards the overloaded user-plane.

Throttling takes place as per the reported OCI values in percentage. Following actions takes place when throttling happens:

- Random drop of percentage in reported Sx Establishment Request messages towards that user-plane.
- Call drop occurs at cnSGW-C with `sx_no_resource_available` disconnect reason.
- Respective statistics get incremented.

## Session Termination Trigger From User-Plane in Self-Protection

User-plane triggers the session termination request towards cnSGW-C in pacing manner through Sx Report Request message. User-plane triggers session termination request when it is in self-protection mode and there is no improvement in load. This trigger happens with setting of SPTER (Self Protection Termination Request) bit.

cnSGW-C initiates Sx Termination Request for those PDNs and releases the PDN session with disconnect reason as `userplane_requested_termination`.

## Failure-handling Profile Support for Congestion Cause

When the user-plane is in self-protection mode and rejects the new sessions with the cause `PFCP_ENTITY_IN_CONGESTION (74)`, cnSGW-C selects different user-plane as per the failure template profile configuration.

Failure-handling profile is associated with UPF-Group.

Reselection of UPF follows the UPF selection process and considers the retries count to different UPF from profile configuration.




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**Note** Currently, only `PFCP_ENTITY_IN_CONGESTION (74)` is supported as cause code for retry and reselection of user-plane as part of this feature.

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## Configuring the Sx Load/Overload Feature

This section describes how to configure Sx Load/Overload.

Use the following commands to configure Sx Load/Overload configuration.

```

config
  instance instance-id instance_id
    endpoint endpoint_name
      interface interface_name
        supported-features [ load-control | overload-control ]
      exit
    exit

```

**NOTES:**

- **endpoint** *endpoint\_name* - Specify the endpoint name.
- **interface** *interface\_name* - Specify the interface name.
- **supported-features** [ **load-control** | **overload-control** ] - Enable load/overload control.

**Sample Configuration**

Following is a sample configuration.

```

configure
  instance instance-id 1
  endpoint pfc
  interface sxa
    supported-features load-control overload-control
  exit

```

**Verifying Sx Load/Overload Configuration**

Use the following `show` command to view the Sx load/overload configuration.

```

show running-config instance instance-id 1 endpoint
instance instance-id 1
endpoint pfc
interface sxa
supported-features load-control overload-control
exit
exit

```

## Configuring Failure Handling Profile

This section describes how to configure failure handling profile.

Use the following commands to configure failure handling profile.

```

config
  profile failure-handling failure-handling_profile_name
    interface interface_name
      message message_type
        cause-code cause_code
        action action_type
        max-retry max_retry_count
      exit
    exit
  exit
  profile upf-group upf-group_profile_name

```

```
failure-profile profile_name
exit
```

**NOTES:**

- **profile failure-handling** *failure-handling\_profile\_name* - Specify the failure-handling profile name.
- **interface** *interface\_name* - Specify the interface name.
- **message** *message\_type* - Specify the message type.
- **cause-code** *cause\_code* - Specify the cause ID (range of 2-255) or range of cause IDs (range of 2-255) separated by either '-' or ',' or both.

-Or-

Must be one of the following:

- no-resource-available
- no-response-received
- pfc-p-entity-in-congestion
- reject
- service-not-supported
- system-failure
- **action** *action\_type* - Specify the action type for the cause. Must be one of the following:
  - retry-terminate
  - terminate
- **max-retry** *max\_retry\_count* - Specify the maximum retry count for the retry-terminate action. Must be an integer in the range of 0-5. Default value is 1.
- **profile upf-group** *upf-group\_profile\_name* - Specify the UPF group profile name.
- **failure-profile** *profile\_name* - Specify the UPF failure profile name.

**Sample Configuration**

Following is the sample configuration:

```
profile failure-handling fh1
  interface sxa
    message SessionEstablishmentReq
      cause-code pfc-p-entity-in-congestion action terminate
    exit
  exit
exit
profile failure-handling fh2
  interface sxa
    message SessionEstablishmentReq
      cause-code 74 action retry-terminate max-retry 3
    exit
  exit
exit
```

```

profile upf-group g1
  failure-profile fh1
exit
profile upf-group g2
  failure-profile fh2
exit

```

## Sx Load/Overload Control OAM Support

This section describes operations, administration, and maintenance information for this feature.

### Bulk Statistics

#### UE Disconnect Statistics

```

sgw_ue_disconnect_stats{app_name="smf",cluster="cn",data_center="cn",instance_id="0",reason="sx_no_resource_available",service_name="sgw-service"} 1

```

```

sgw_ue_disconnect_stats{app_name="smf",cluster="cn",data_center="cn",instance_id="0",reason="userplane_requested_termination",service_name="sgw-service"} 1

```

#### PDN Disconnect Statistics

```

sgw_pdn_disconnect_stats{app_name="smf",cluster="cn",data_center="cn",instance_id="0",pdn_type="ipv4",rat_type="EUTRAN",reason="sx_no_resource_available",service_name="sgw-service"} 1

```

```

sgw_pdn_disconnect_stats{app_name="smf",cluster="cn",data_center="cn",instance_id="0",pdn_type="ipv4v6",rat_type="EUTRAN",reason="userplane_requested_termination",service_name="sgw-service"} 1

```

#### SGW Service Statistics

```

sgw_service_stats{app_name="smf",cluster="cn",data_center="cn",fail_reason="sx_oci_throttling_reject",instance_id="0",interface="interface_sgw_ingress",reject_cause="no_resources_available",service_name="sgw-service",sgw_procedure_type="initial_attach",status="rejected",sub_fail_reason=""} 1

```

```

sgw_service_stats{app_name="smf",cluster="cn",data_center="cn",fail_reason="",instance_id="0",interface="interface_sgw_egress",reject_cause="",service_name="sgwservice",sgw_procedure_type="upf_initiated_deletion",status="attempted",sub_fail_reason=""} 1

```

```

sgw_service_stats{fail_reason="sx_cause_fail",interface="interface_sgw_ingress",reject_cause="service_denied",sub_fail_reason="pfcpc_entity_in_congestion",sgw_procedure_type="initial_attach",status="rejected"}

```