Sx Load/Overload Control Handling

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.

> **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.

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
                                                    POD
ENDPOINT  LOCAL ADDRESS  PEER ADDRESS  DIRECTION  INSTANCE  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-pane 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.

✎

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.

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 pfcp
   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 pfcp
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

    - pfcp-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 pfcp-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="pfcp_entity_in_congestion",sgw_procedure_type="initial_attach",
status="rejected"}
```