

# Load and Overload Control Over N4/Sx Interface


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# Feature Summary and Revision History

## Summary Data

| | |
|---|---|
| Applicable Product(s) or Functional Area | UPF |
| Applicable Platform(s) | VPC-SI<br>SMI |
| Feature Default Setting | Disabled – Configuration Required |
| Related Changes in this Release | Not Applicable |
| Related Documentation | Not Applicable |

# Revision History

*Table 1: Feature History*

| Feature Name | Release Information | Description |
|---|---|---|
| Load and Overload Control over N4/Sx Interface | 2024.04.1 | This feature allows UPF to enable load and overload control mechanisms to handle the messages during overloaded or self-protection state.<br>Commands Introduced:<br>• **upf-load-control-profile** *profile_name*<br>• **upf-overload-control-profile** *profile_name*<br>• **associate { upf-load-control-profile** *profile_name* **\| upf-overload-control-profile** *profile_name* **}**<br>**Default Setting:** Disabled-Configuration required to enable. |
| Reporting of Load Control over N4 Interface | 2020.02.0 | This feature enables load control on UPF. This feature allows UPF to send its load information to the SMF in order to balance PFCP session load across the UPFs as per their effective load.<br>**Default Setting:** Disabled-Configuration required to enable. |

# Feature Description

There are three states of UPF and their default values at any given time:

- **Loaded State**: When the load on UPF is up to 70%.
- **Overloaded State**: When the load on UPF is between 70–85%.
- **Self-Protection State**: When the load on UPF is between 85–100%.

**Note** These default values can be configured.

Load control enables the UPF to send its load information to the CP-F in order to balance PFCP session load across the UPF according to their effective load. The load information reflects the operating status of the resources of the UPF. Load control allows for better balancing of the PFCP session load to prevent overload.

Overload control enables throttling of new session requests toward a particular UPF. In the overloaded and self-protection state, if the load exceeds the configured thresholds, the session deletion process is initiated for non-priority sessions.

**NOTE:** Overload mitigation actions are not triggered even if the UPF reports a high load.

# How Load and Overload Control Works

CP-F sends the load and overload features as supported in the Sx Association Request and Response message to UPF. Based on this information, UPF decides whether to send the load or overload information toward CP-F peer.

Load or overload support at CP-F is configured as part of the Sx Service node configuration. This information is sent to the UP during Sx Association Response or Sx Association Update request, if the information has changed through dynamic configuration.

When the UPF is in the overload state, the OCI IE is sent to the control-plane function with reduction metric.

**Note**

- If the load or overload control feature is enabled or disabled on the CP-F node, the CP-F node shall initiate an Association Update Request toward UPF to inform the updated support.
- UPF does not take any action when the cause code **PFCP_ENTITY_IN_CONGESTION** cause is received in any response message.

# Load and Overload Factor Calculation

### Load Factor Calculation

The load factor represents the total load on the system at any given time. The UPF is considered as loaded if either of its CPU, Memory, or Session count is high. Therefore, the load factor is calculated based on system parameters like System CPU, System Memory, Session Count.

### Overload Factor Calculation

The UPF is considered as overloaded if the load exceeds any of its configured threshold values. The following parameters are considered for calculating the overload factor in the self-protection mode:

**System Level Parameters**: CPU, Memory, Session Count

**VPP**: VPP CPU

# Load and Overload Reporting to CP-F

UPF sends load or overload information to CP-F through N4 messages.

| If the UPF is in... | It sends... |
|---|---|
| Load State | LCI IE |
| Overload State | OCI IE |

CP-F parses all the incoming N4 messages and N4 responses for LCI and OCI IEs. Whenever CP-F receives LCI IE or OCI IE from a peer node, CP-F learns about the load and overload parameter of that UPF node.

For more details on how CP-F node handles the LCI and OCI IEs respectively, see the following guides:

- *UCC 5G Session Management Function Configuration and Administration Guide, Release 2024.04*.
- *UCC 5G cnSGWc Configuration and Administration Guide, Release 2024.04*.

## Load Information Reporting to CP-F

The UPF sends its load control information to reflect the operating status of its resources at the node level. It allows the CP-F to use this information to augment the UPF selection procedures. The load control information is piggybacked in PFCP request or response messages such that the exchange of load control information does not trigger extra signaling.

Load Control Information IE can be present in the following messages from UPF to CP-F:

- PFCP Session Establishment Response
- PFCP Session Modification Response
- PFCP Session Deletion Response
- PFCP Session Report Request

### Information Elements of LCI IE

Load information is reported using the following elements present in the LCI IE:

- **Load Control Sequence Number**: This number is incremented whenever the updated or new load control information is sent. The parameter **current-time** is used for Load Control Sequence Number.
- **Load Metric**: This parameter indicates the current load level of the UPF. It is sent as a percentage within the range of 0-100.



**Note**

- Multiple SessMgrs report the same value of Load Metric with the same sequence number.
- The System timestamp is used as a Sequence Number.

## Overload Information Reporting to CP-F

When the UPF is in an overload state, it sends OCI IE in the N4/Sx messages. The OCI IE can be present in the following messages:

- PFCP Session Establishment Response
- PFCP Session Modification Response
- PFCP Session Deletion Response
- PFCP Session Report Request

### Information Elements of OCI IE

Overload information is reported using the following elements present in the OCI IE:

- **Overload Control Sequence Number**: This number is incremented whenever the updated or new overload control information is sent. The parameter **current-time** is used for Overload Control Sequence Number.
- **Overload Reduction Metric**: In the self-protection mode, the CP function throttles the Sx Establishment request message toward UPF. The messages are throttled based on the reported Overload Reduction metric value. It is sent as a percentage within the range of 0–100.
- **Period of Validity**: This parameter indicates the length of time during which the overload condition specified by the OCI IE is to be considered as valid (unless overridden by subsequent new overload control information).
- **Overload Control Information Flags**: This parameter contains the flags for overload control-related information. The Bit 1 represents Associate OCI with Node ID (AOCI). This flag is set to "1" by the UP function, if the OCI IE is included in the PFCP Session Establishment Response and the Cause IE is set to a rejection cause value.

# Session Clear in Self-Protection Mode

If the system is in the self-protection mode and the system state keeps deteriorating, it may lead to session throttling at UPF.

The session reports are sent in following two ways:

- If the EPFAR feature is supported or negotiated on the peers, the UPF initiates the PFCP Session Report Request message for the sessions with report type as 'USAR' or 'UISR'. (When there is a non-zero usage report for the PFCP) or UISR (UP Initiated Session Request) if there is no usage report to send.
  - **USAR (Usage Report)**: When there is a non-zero usage report for the PFCP.
  - **USIR (UP Initiated Session Request)**: When there is no usage report to send.

  The 'cause' IE in PFCP Session Report Request will be set to **PFCP_CAUSE_SELF_PROTECTION_TERMINATION (205)**. The session is deleted after sending a Session Report Request.
- If the EPFAR feature is not negotiated with the peers, it initiates the PFCP Session Report Request message for the sessions with report type as 'SPTER' and waits for the peer to initiate the session deletion gracefully. If the session deletion is not initiated within 120 sec, the session will be deleted locally.

# Enable Load and Overload Control on N4 or Sx Interface

Follow these steps to enable load and overload control on UPF:

- Configure Load Control Profiles
- Configure Overload Control Profiles
- Associate the Load and Overload Control Profiles with User Plane Service

## Configure the Load Control Profile

Follow these steps to configure the load control profile:

### Procedure

**Step 1** Configure a load control profile instance in the Global Configuration mode using the command **upf-load-control-profile** *profile_name*.

**Example:**

```
local]UPlane# config
[local]UPlane(config)# upf-load-control-profile loadcontrolprof
[local]UPlane(config-upf-load-control-profile)#
```

**Step 2** Configure advertisement interval and change factor for under the configured load control profile using the commands **inclusion-frequency advertisement-interval** *interval_value* and **inclusion-frequency change-factor** *changefactor_value*.

**Example:**

```
[local]UPlane(config-upf-load-control-profile)# inclusion-frequency advertisement-interval
 300
 [local]UPlane(config-upf-load-control-profile)# inclusion-frequency change-factor 5
```

The parameter **inclusion-frequency** specifies the frequency at which the LCI IE is sent out. The following 2 factors are considered for sending LCI IE:

- The parameter **advertisement-interval** is the interval at which LCI IE is sent out. The default value is 300 seconds.
- The parameter **change-factor** is the % change from the previous LCI factor, at which the LCI IE is sent out. The default value is 5%.

**Step 3** Exit the current configuration mode using the command **end**.

**Example:**

```
[local]UPlane(config-upf-load-control-profile)# end
[local]UPlane# config#
```

# Configure the Overload Control Profile

Follow these steps to configure the overload control profile:

**Procedure**

**Step 1** Configure a load control profile instance in the Global Configuration mode using the command **upf-overload-control-profile** *profile_name*.

**Example:**

```
[local]UPlane# config
[local]UPlane(config)# upf-overload-control-profile ovrloadcontrolprof
[local]UPlane(config-upf-overload-control-profile)#
```

**Step 2** Configure lower and upper limits of the overload threshold parameters (System level and VPP CPU) under the overload control profile.

**Example:**

```
[local]UPlane(config-upf-overload-control-profile)# overload-threshold system cpu lower
limit 80 upper-limit 90
[local]UPlane(config-upf-overload-control-profile)# overload-threshold system memory lower
 limit 70 upper-limit 80
[local]UPlane(config-upf-overload-control-profile)# overload-threshold system session-count
 lower limit 80 upper-limit 90
[local]UPlane(config-upf-overload-control-profile)# overload-threshold vpp-cpu lower limit
 50 upper-limit 80
```

The parameter **system** configures the overload system thresholds. System moves to the overload state once the lower-limit is crossed and moves to self-protection state after the upper-limit is crossed. The system state can change due to either system level or VPP CPU parameters.

| Overload Control Parameters | Lower Limit (Overload Control State) | Upper Limit (Self-Protection State) |
|---|---|---|
| System CPU | 80 | 90 |
| System Memory | 70 | 80 |
| System Session Count | 80 | 90 |
| VPP CPU | 50 | 80 |

**Note**
When the system enters the self-protection state, the Reduction Metric is set to 100%.

**Step 3** Configure advertisement interval, change factor, and validity period under the configured overload control profile using the commands **inclusion-frequency advertisement-interval** *interval_value*, **inclusion-frequency change-factor** *changefactor_value*, and **validity-period** *validity_period*.

**Example:**

```
[local]UPlane(config-upf-overload-control-profile)# inclusion-frequency
advertisement-interval 300
```

```
[local]UPlane(config-upf-overload-control-profile)# inclusion-frequency change-factor 5
[local]UPlane(config-upf-overload-control-profile)# validity-period 300
```

The parameter **inclusion-frequency** specifies the frequency at which the OCI IE is sent out. The following 2 factors are considered for sending OCI IE:

- The parameter **advertisement-interval** is the interval at which OCI IE is sent out. The default value is 300 seconds.
- The parameter **change-factor** is the % change from the previous OCI factor, at which the OCI IE is sent out. The default value is 5%.
- The parameter **validity-period** is the validity of the OCI factor. The default value is 300.

**Step 4** Exit the current configuration mode using the command **end**.

**Example:**

```
[local]UPlane(config-upf-overload-control-profile)# end
[local]UPlane(config)#
```

# Associate the Load and Overload Control Profiles with User Plane Service

Follow these steps to associate the load and overload control profiles with the user plane service:

### Before you begin

Before associating the load and overload control profile with the user plane service, you need to configure the following:

- Load Control Profile
- Overload Control Profile

### Procedure

**Step 1** Configure a context instance in the Global Configuration mode using the command **context** *context_name*.

**Example:**

```
[local]UPlane# config
[local]UPlane (config)# context EPC
[EPC]UPlane (config-ctx)#
```

**Step 2** Configure a User Plane Service instance under the configured context using the command **user-plane-service** *userplane_service_name*.

**Example:**

```
[EPC]UPlane (config-ctx)# user-plane-service UPlane1
[EPC]UPlane (config-user-plane-service)#
```

**Step 3** Configure the maximum number of sessions that are to be supported on the UPF using the command **load-control capacity** *session_value*.

**Example:**

```
[EPC]UPlane (config-user-plane-service)# load-control capacity 120000
[EPC]UPlane (config-user-plane-service)#
```

**Step 4** Associate the load and overload control profiles with the configured user plane service using the command **associate { upf-load-control-profile** *profile_name* **| upf-overload-control-profile** *profile_name* **}**.

**Example:**

```
[EPC]UPlane (config-user-plane-service)# associate upf-load-control-profile loadcontrolprof
[EPC]UPlane (config-user-plane-service)# associate upf-overload-control-profile
ovrloadcontrolprof
[EPC]UPlane (config-user-plane-service)#
```

**Step 5** Exit the current configuration mode using the command **end**.

**Example:**

```
[EPC]UPlane (config-user-plane-service)# end
[EPC]UPlane (config-ctx)#
```

# Monitoring and Troubleshooting

This section provides information regarding the CLI commands available for monitoring and troubleshooting the feature.

## Show Commands and Outputs

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

### show upf-load-control-profile

The show command **show upf-load-control-profile [ name** *name* **| all ]** displays the load control profile for UPF.

```
[local]qvpc-si# show upf-load-control-profile name lci1
UPF Load Control Profile
--------------------------------
lci1
```

```
[local]qvpc-si# show upf-load-control-profile full name lci1
UPF Load Control Profiles
--------------------------------
UPF Load Control Profile Name: lci1
 Inclusion Frequency:
   Change Factor                        : 6
   Advertisement Interval               : 300
```

### show upf-overload-control-profile

The show command **show upf-overload-control-profile [ name** *name* **| all ]** displays the overload control profile for UPF.

```
[local]qvpc-si# show upf-overload-control-profile name oci1
UPF Overload Control Profile
```

```
--------------------------------
oci1

[local]qvpc-si# show upf-overload-control-profile full name oci1
UPF Overload Control Profiles
--------------------------------

UPF Overload Control Profile Name: OC1
 System Thresholds:
   CPU Lower Limit           : 80
   CPU Upper Limit           : 90
   Memory Lower Limit        : 70
   Memory Upper Limit        : 80
   Session Count Lower Limit : 80
   Session Count Upper Limit : 90
 VPP Thresholds:
   CPU Lower Limit           : 50
   CPU Upper Limit           : 80
 Inclusion Frequency:
   Change Factor             : 5
   Advertisement Interval    : 300
 Validity Period             : 300
```

## show user-plane-service statistics name

The show command **show user-plane-service statistics name** *service_name* displays the load and overload control factors along with other existing stats.

```
[local]asr5000# show user-plane-service statistics name <user_plane_service_name>
  UPF Overload Stats:
    Current state                                                :        Normal
    Overload mode count                                          :             0
    Self-protection mode count                                   :             0
    Last detected Overload state                                 :   0000:00:00:00:00:00

    Last detected Out-of Overload state                          :   0000:00:00:00:00:00

    Last reported (system) Overload Factor
      CPU                                                        :             0
      Memory                                                     :             0
      Session Capacity                                           :             0
    Last reported (VPP CPU) Overload Factor                      :             0
    Last reported Reduction Metric                               :             0

   Sessions Stats:
      Sx-Sessions removed in Self-protection mode                :             0
      Non-Priority Sx Messages:
        Sx-Establishment reqs rcvd in Overload mode              :             0
        Sx-Establishment reqs rejected in Self-protection mode   :             0
        Sx-Modification reqs rejected in Self-protection mode    :             0
      Unclassified Sx Messages:
        Sx-Establishment reqs rcvd in Overload mode              :             0
        Sx-Establishment reqs rejected in Self-protection mode   :             0
        Sx-Modification reqs rejected in Self-protection mode    :             0
      IMS Sx Messages:
        Sx-Establishment reqs rcvd in Overload mode              :             0
        Sx-Establishment reqs rejected in Self-protection mode   :             0
        Sx-Modification reqs rejected in Self-protection mode    :             0
        Sx-Establishment reqs allowed in Self-protection mode    :             0
        Sx-Modification reqs allowed in Self-protection mode     :             0
      WPS/Emergency Sx Messages:
        Sx-Establishment reqs rcvd in Overload mode              :             0
        Sx-Establishment reqs rejected in Self-protection mode   :             0
        Sx-Modification reqs rejected in Self-protection mode    :             0
```

```
      Sx-Establishment reqs allowed in Self-protection mode         :              0
      Sx-Modification reqs allowed in Self-protection mode          :              0

  Data Stats:
    Overload Mode:
      WPS/Emergency new flows allowed                               :              0
      WPS/Emergency new flows dropped                               :              0
      Non WPS/Emergency new flows allowed                           :              0
      Non WPS/Emergency new flows dropped                           :              0
      Unclassified new flows dropped                                :              0
      Total Packets dropped                                         :              0
    Self-Protection Mode:
      WPS/Emergency new flows allowed                               :              0
      WPS/Emergency new flows dropped                               :              0
      Non WPS/Emergency new flows allowed                           :              0
      Non WPS/Emergency new flows dropped                           :              0
      Unclassified new flows dropped                                :              0
      Total Packets dropped                                         :              0

UPF Load Stats:
  Current (system) Load Factor
    CPU                                                             :              0
    Memory                                                          :              0
    Session Capacity                                                :              0
  Last reported sequence number                                     :              0
```

## show user-plane-service statistics all

The show command **show user-plane-service statistics all** displays the load and overload stats for UPF.

```
UPF Overload Stats:
  Current state                                                     :         Normal
  Overload mode count                                               :              0
  Self-protection mode count                                        :              0
  Last detected Overload state                                    :   0000:00:00:00:00:00

  Last detected Out-of Overload state                             :   0000:00:00:00:00:00

  Last reported (system) Overload Factor
    CPU                                                             :              0
    Memory                                                          :              0
    Session Capacity                                                :              0
  Last reported (VPP CPU) Overload Factor                           :              0
  Last reported Reduction Metric                                    :              0

 Sessions Stats:
    Sx-Sessions removed in Self-protection mode                     :              0
    Non-Priority Sx Messages:
      Sx-Establishment reqs rcvd in Overload mode                   :              0
      Sx-Establishment reqs rejected in Self-protection mode        :              0
      Sx-Modification reqs rejected in Self-protection mode         :              0
    Unclassified Sx Messages:
      Sx-Establishment reqs rcvd in Overload mode                   :              0
      Sx-Establishment reqs rejected in Self-protection mode        :              0
      Sx-Modification reqs rejected in Self-protection mode         :              0
    IMS Sx Messages:
      Sx-Establishment reqs rcvd in Overload mode                   :              0
      Sx-Establishment reqs rejected in Self-protection mode        :              0
      Sx-Modification reqs rejected in Self-protection mode         :              0
      Sx-Establishment reqs allowed in Self-protection mode         :              0
      Sx-Modification reqs allowed in Self-protection mode          :              0
    WPS/Emergency Sx Messages:
      Sx-Establishment reqs rcvd in Overload mode                   :              0
      Sx-Establishment reqs rejected in Self-protection mode        :              0
```

```
        Sx-Modification reqs rejected in Self-protection mode         :            0
        Sx-Establishment reqs allowed in Self-protection mode         :            0
        Sx-Modification reqs allowed in Self-protection mode          :            0

    Data Stats:
      Overload Mode:
        WPS/Emergency new flows allowed                               :            0
        WPS/Emergency new flows dropped                               :            0
        Non WPS/Emergency new flows allowed                           :            0
        Non WPS/Emergency new flows dropped                           :            0
        Unclassified new flows dropped                                :            0
        Total Packets dropped                                         :            0
      Self-Protection Mode:
        WPS/Emergency new flows allowed                               :            0
        WPS/Emergency new flows dropped                               :            0
        Non WPS/Emergency new flows allowed                           :            0
        Non WPS/Emergency new flows dropped                           :            0
        Unclassified new flows dropped                                :            0
        Total Packets dropped                                         :            0

  UPF Load Stats:
    Current (system) Load Factor
      CPU                                                             :            0
      Memory                                                          :            0
      Session Capacity                                                :            0
    Last reported sequence number                                     :            0
```

## show user-plane-service name

The show command **show user-plane-service name** *service_name* displays the load and overload control profile information along with the other information for a specific user plane service.

```
show user-plane-service name UPlane1

Service name                        : UPlane1
  Service-Id                        : 6
  Context                           : EPC
  Status                            : STARTED
  PGW Ingress GTPU Service          : pgwIngress
  UPF Ingress N3 GTPU Service       : Not defined
  UPF Ingress N9 GTPU Service       : Not defined
  UPF Ingress S5U GTPU Service      : Not defined
  UPF Ingress S8U GTPU Service      : Not defined
  UPF Ingress N9_S5U_S8U GTPU Service: Not defined
  UPF Egress GTPU Service           : Not defined
  SGW Ingress GTPU Service          : SGW1EGTPINGTPUIN
  SGW Egress GTPU Service           : SGW1EGTPOUTGTPUOUT
  Control Plane Tunnel GTPU Service : UP1SXU
  Sx Service                        : sx1
  Control Plane Group               : cp1
  Userplane Load Control Profile    : Not defined
  Userplane Overload Control Profile: Not defined
  Fast-Path service                 : Disabled
  NRF Management Service            : Not defined
  Nf-Instance-Id                    : Not defined
  Session Priority Profile          : Not defined
  Ise Server Profile                : Not defined
  UPF Load Control Profile          : ULCI1
  UPF Overload Control Profile      : UOCI1
```

## show user-plane-service all

The show command **show user-plane-service all** displays the load and overload control profile information along with other information for a user plane service.

```
show user-plane-service all

Service name                        : UPlane1
  Service-Id                        : 6
  Context                           : EPC
  Status                            : STARTED
  PGW Ingress GTPU Service          : pgwIngress
  UPF Ingress N3 GTPU Service       : Not defined
  UPF Ingress N9 GTPU Service       : Not defined
  UPF Ingress S5U GTPU Service      : Not defined
  UPF Ingress S8U GTPU Service      : Not defined
  UPF Ingress N9_S5U_S8U GTPU Service: Not defined
  UPF Egress GTPU Service           : Not defined
  SGW Ingress GTPU Service          : SGW1EGTPINGTPUIN
  SGW Egress GTPU Service           : SGW1EGTPOUTGTPUOUT
  Control Plane Tunnel GTPU Service : UP1SXU
  Sx Service                        : sx1
  Control Plane Group               : cp1
  Userplane Load Control Profile    : Not defined
  Userplane Overload Control Profile: Not defined
  Fast-Path service                 : Disabled
  NRF Management Service            : Not defined
  Nf-Instance-Id                    : Not defined
  Session Priority Profile          : Not defined
  Ise Server Profile                : Not defined
  UPF Load Control Profile          : ULCI1
  UPF Overload Control Profile      : UOCI1
```

## show sx-service statistics all

The show command **show sx-service statistics all** displays the session management messages terminated in self-protection state.

```
show sx-service statistics all

Session Management Messages:
….
Session Report Request:
 Total TX:                          1   Total RX:                          0
 Initial TX:                        1   Initial RX:                        0
 Retrans TX:                        0   Retrans RX:                        0
 Discarded:                         0   No Rsp RX:                         0
 Causes:
  User Initiated Session Deletion from UP:                                  0
  Association Release initiated by UP:                                     0
  Recovery Failure:                                                         0
  IP Source Violation:                                                      0
  Self Protection Termination:                                              1
```

# Bulkstats

Following bulkstats are supported as part of this feature:

| Variable Name | Data Type | Key | Counter Type |
|---|---|---|---|
| %upf-num-overload-state-reached% | Int32 | 0 | Counter |
| %upf-num-self-protection-reached% | Int32 | 0 | Counter |
| %upf-last-in-overload-state-timestamp% | Int32 | 0 | Info |
| %upf-last-out-overload-state-timestamp% | Int32 | 0 | Info |
| %upf-overload-reduction-metric% | Int32 | 0 | Info |
| %upf-overload-factor-system-cpu% | Int32 | 0 | Info |
| %upf-overload-factor-system-mem% | Int32 | 0 | Info |
| %upf-overload-factor-system-sesscnt% | Int32 | 0 | Info |
| %upf-overload-factor-vpp-cpu% | Int32 | 0 | Info |
| %upf-load-factor-system-cpu% | Int32 | 0 | Info |
| %upf-load-factor-system-mem% | Int32 | 0 | Info |
| %upf-load-factor-system-sesscnt% | Int32 | 0 | Info |
| %upf-load-factor-seq-num% | Int32 | 0 | Info |
| %upf-num-sessions-removed-during-self-protection-mode% | Int32 | 0 | Info |
| %upf-num-non-priority-session-estab-req-received-in-overload% | Int32 | 0 | Counter |
| %upf-num-non-priority-session-estab-req-reject-in-sp% | Int32 | 0 | Counter |
| %upf-num-non-priority-session-mod-req-reject-in-sp% | Int32 | 0 | Counter |
| %upf-num-unclassified-session-estab-req-received-in-overload% | Int32 | 0 | Counter |
| %upf-num-unclassified-session-estab-req-reject-in-sp% | Int32 | 0 | Counter |
| %upf-num-unclassified-session-mod-req-reject-in-sp% | Int32 | 0 | Counter |
| %upf-num-ims-session-estab-req-received-in-overload% | Int32 | 0 | Counter |
| %upf-num-ims-session-estab-req-reject-in-sp% | Int32 | 0 | Counter |
| %upf-num-ims-session-mod-req-reject-in-sp% | Int32 | 0 | Counter |
| %upf-num-ims-session-estab-req-allowed-in-sp% | Int32 | 0 | Counter |
| %upf-num-ims-session-mod-req-allowed-in-sp% | Int32 | 0 | Counter |
| %upf-num-wps-emer-session-estab-req-received-in-overload% | Int32 | 0 | Counter |
| %upf-num-wps-emer-session-estab-req-reject-in-sp% | Int32 | 0 | Counter |

| Variable Name | Data Type | Key | Counter Type |
|---|---|---|---|
| %upf-num-wps-emer-session-mod-req-reject-in-sp% | Int32 | 0 | Counter |
| %upf-num-wps-emer-session-estab-req-allowed-in-sp% | Int32 | 0 | Counter |
| %upf-num-wps-emer-session-mod-req-allowed-in-sp% | Int32 | 0 | Counter |
| %upf-num-wps-emer-new-flows-allowed-in-overload% | Int32 | 0 | Counter |
| %upf-num-wps-emer-new-flows-dropped-in-overload% | Int32 | 0 | Counter |
| %upf-num-non-wps-emer-new-flows-allowed-in-overload% | Int32 | 0 | Counter |
| %upf-num-non-wps-emer-new-flows-dropped-in-overload% | Int32 | 0 | Counter |
| %upf-num-unclassified-new-flows-dropped-in-overload% | Int32 | 0 | Counter |
| %upf-num-packets-dropped-in-overload% | Int32 | 0 | Counter |
| %upf-num-wps-emer-new-flows-allowed-in-self-protection% | Int32 | 0 | Counter |
| %upf-num-wps-emer-new-flows-dropped-in-self-protection% | Int32 | 0 | Counter |
| %upf-num-non-wps-emer-new-flows-allowed-in-self-protection% | Int32 | 0 | Counter |
| %upf-num-non-wps-emer-new-flows-dropped-in-self-protection% | Int32 | 0 | Counter |
| %upf-num-unclassified-new-flows-dropped-in-self-protection% | Int32 | 0 | Counter |
| %upf-num-packets-dropped-in-self-protection% | Int32 | 0 | Counter |

# SNMP Traps

The following SNMP Traps are added in support of this feature:

- **UPFOverloadState**: This trap is generated when the system enters the overload state.
- **UPFOverloadStateClear**: This trap is generated when the system is out of the overload state.
- **UPFSelfProtectionMode**: This trap is generated when the system enters the self-protection mode.
- **UPFSelfProtectionModeClear**: This trap is generated when the system is out of the self-protection mode.