

QoS Group of Ruledefs Support

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Feature Summary and Revision History

Summary Data

Table 1: Summary Data

Applicable Product (s) or Functional Area	5G-UPF
Applicable Platforms	VPC-SI SMI
Feature Default Setting	Disabled – Configuration Required
Related Changes in this Release	Not Applicable
Related Documentation	*UCC 5G UPF Configuration and Administration Guide*

Revision History

Revision Details	Release
First introduced.	2023.01.0

Feature Description

The QoS Group of Ruledefs feature helps in enforcing fair usage policy (FUP) per subscriber. QoS Group of Ruledefs is also referred to as QGR or SGQ.

The QGR feature sets different QoS parameters for different subscribers for a named QGR, therefore ensuring fair usage policing for a subscriber.

How it Works

The QGR feature performs flow status and bandwidth limiting under the charging-action configuration. UPF applies the static configuration for QGR using RCM.

When a packet matches a ruledef, UPF performs a QGR match to check if a QGR is present with the matched ruledef or group. UPF returns the highest priority QGR.

- If a QGR matches, UPF applies flow-action enforcement at charging-action, and then at QGR if charging-action allows the packet. If the packet drops, UPF skips the QGR-level flow-action enforcement.
- If flow-action at QGR allows the packet, UPF enforces the QoS Enforcement Rule (QER) limiting on a packet. If the packet drops at QGR, UPF skips QER limiting.
- UPF performs QER limiting at charging-action and then at QGR if the packet is allowed at charging-action.

UPF supports QoS-group-of-ruledefs configuration under the ACS service.

The following is a sample QGR configuration under ACS:

```
configure
   active-charging service acs
     qos-group-of-ruledefs QGR1
        add-group-of-ruledef group
        add-ruledef http
        #exit
     rulebase test
        action priority 2 ruledef http charging-action standard
        action priority 5 ruledef catchall charging-action standard
        route priority 1 ruledef http-rule analyzer http
        end
```

The following configuration is an example of QoS Group "QGR1" received over PCRF:

```
-qos-group-rule-install
--qgr-name QGR1
--qgr-mon-key 1
--qgr-flow-status 2
--qgr-precedence 1
--qgr-eqos-information
--qgr-eqos-mbr 1000 2000
--qgr-eqos-mbr-burst-size 1000 2000
--qgr-eqos-mbr-limit-conform-action 0 -1 0 -1
--qgr-eqos-mbr-limit-exceed-action 1 -1 1 -1
```

IE Support

UPF pushes the QGR in Session Establishment Request or Session Modification Request using the private IE—QGR-INFO-LIST. If there are changes to the QGR dynamic parameters, UPF triggers an Update FAR or QER. UPF sends the updated value in Session Establishment Request or Session Modification Request.

Currently, UPF does not support the monitoring-key parameter in QGR. Hence, UPF does not send URR associated with QGR in Session Establishment Request or Session Modification Request.

The following is the name and format of the private IE:

```
QGR-INFO-LIST:
Value:
Number of QGRs: 2
QGR INFO:
NAME: qgr-gor
PRECEDENCE: 3
OPERATION: QGR ADD
FAR ID: 0x8005
QER ID: 0x0004
QGR INFO:
NAME: qgr2
PRECEDENCE: 9
OPERATION: QGR ADD
FAR ID: 0x8006
QER ID: 0x0005
```

The following table describes the FAR format:

Table 2: FAR Format

FAR ID	Unique ID
Apply Action	Flow-action defined in QGR.
Extended Apply Action	Private IE to communicate to QGR FAR. This IE includes Flow-Action—Discard Uplink, Discard Downlink, and Terminate Flow.
Forwarding Parameters	Contains the destination interface and redirect information if any.

The following table describes the QER format:

Table 3: QER Format

QER ID	Unique ID

Maximum Bitrate	The maximum bit rate of QGR in Kbps.
	`UL MBR`
	`DL MBR`

Burst Size	Private IE to configure the burst size.
	`UL Burst`
	`DL Burst`

Conform Action	Private IE to configure the conform action.
	`Uplink ToS`
	`Downlink ToS`

QER ID	Unique ID

Exceed Action	Private IE to configure the exceed action.
	`Uplink Action`
	`Uplink ToS`
	`Downlink Action`
	`Downlink ToS`

Use the **show subscribers user-plane-only callid** *call_id* **{ far | qer } full all** command to view the FAR and QER values.

Limitations

The QGR feature has the following limitations:

- The monitoring key associated with QGR is not usage monitored, that is, UPF does not support URR creation and enforcement.
- UPF does not support the inclusion of dynamic rules in the static QGR definition.
- UPF does not support flow-Status redirect and kill flow.
- UPF does not support QoS Group Conform action as Drop and Exceed action as ALLOW or MARK_DSCP.
- UPF supports a maximum configuration of 64 QGRs statically.
- UPF supports a maximum of 64 QGRs received from SMF.

OAM Support

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

Show Commands Support

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

show subscribers user-plane-only callid call_id far full all

This command displays the Extended Apply Action IE information on UPF.

```
[local]qvpc-si# show subscribers user-plane-only callid 00004e21 far full all
FAR-ID                   : 0x8004
         Destination Interface    : Core
         Apply Action             : FORWARD
         Outer Header Creation    :
         Remote TEID              : 0x0
         Transport Level Marking         : N/A
         Transport Level Marking Options :
           Copy Inner:                     No
           Copy Outer:                     No
         Inner Packet Marking            : N/A
         Remote IP Address        :
         Remote Port              : N/A
```

```
Number of Associated PDRs: 0
Associated with QGR      : Yes
    Extended Apply Action : ULDROP DLDROP
```

show subscribers user-plane-only callid call_id qer full all

This command displays the bandwidth parameters associated with QGR on UPF.

```
[local]qvpc-si# show subscribers user-plane-only callid 00004e21 qer full all

        QER-id                  : 0x00000003        Correlation-id          : n/a
        GBR uplink (bps)        : 0                 GBR downlink (bps)      : 0

        UL Gate Status          : OPEN              DL Gate Status          : OPEN
        Number of Associated PDRs  :0
        Associated with QGR     : Yes
        MBR uplink (bps)        : 1000              MBR downlink (bps)      : 2000
        UL Burst         : 1000                    DL Burst              : 1000

           UL Conform Action          : ALLOW                 DL Conform
Action     : ALLOW
           UL DSCP Value              : NA                    DL DSCP Value
         : NA
            UL Exceed Action          : DROP                DL Exceed Action
      : DROP
           UL DSCP Value              : NA                    DL DSCP Value
         : NA
```

show subscribers user-plane-only callid call_id qos-group all

This command displays the QGR information from QGR-INFO-LIST IE on UPF.

```
[local]qvpc-si# show subscribers user-plane-only callid call_id qos-group
all       name   statistics
[local]qvpc-si# show subscribers user-plane-only callid 00004e21 qos-group all

Callid: 00004e21
Interface Type: Sxb
    QGR-Name:      Priority:       FAR-ID:         QER-ID:         URR-ID:
    ---------      ---------       -------         -------         ------
     QGR1           5               0x8003          0x0002          0x0000
     QGR2           1               0x8004          0x0003          0x0000

Total Number of QGRs found: 2
```

show subscribers user-plane-only callid call_id qos-group statistics

This command displays QoS-group statistics on UPF.

```
[local]qvpc-si# show subscribers user-plane-only callid 00004e21 qos-group statistics
all       name      |         <cr>
QoS-Group-of-Ruledef:
    Total Uplink Pkts:                0     Total Dnlink Pkts:                0
    Total Uplink Bytes:               0     Total Dnlink Bytes:               0
    Uplink Pkts Allowed:              0     Dnlink Pkts Allowed:              0
    Uplink Bytes Allowed:             0     Dnlink Bytes Allowed:             0
    Uplink FP Pkts:                   0     Dnlink FP Pkts:                   0
    Uplink FP Bytes:                  0     Dnlink FP Bytes:                  0
     Flow-Status Statistics:
       Total Uplink Packets:           0     Total Downlink Packets:           0
```

```
      Total Uplink Bytes:             0     Total Downlink Bytes:             0
      Uplink Packets Redirected:      0     Downlink Packets Redirected:      0
      Uplink Bytes Redirected:        0     Downlink Bytes Redirected:        0
      Uplink Packets Dropped:         0     Downlink Packets Dropped:         0
      Uplink Bytes Dropped:           0     Downlink Bytes Dropped:           0
      Uplink Packets Term-Flow:       0     Downlink Packets Term-Flow:       0
      Uplink Bytess Term-Flow:        0     Downlink Bytes Term-Flow:         0
    Bandwidth-Control Statistics:
      Total Uplink Packets:           0     Total Downlink Packets:           0
      Total Uplink Bytes:             0     Total Downlink Bytes:             0
      Uplink Packets QoS-Exceed:      0     Downlink Packets QoS-Exceed:      0
      Uplink Bytes QoS-Exceed:        0     Downlink Bytes QoS-Exceed:        0
      Uplink Packets QoS-Conform:     0     Downlink Packets QoS-Conform:     0
      Uplink Bytes QoS-Conform:       0     Downlink Bytes QoS-Conform:       0
      Uplink Packets Dropped:         0     Downlink Packets Dropped:         0
      Uplink Bytes Dropped:           0     Downlink Bytes Dropped:           0
      Uplink Packets Marked:          0     Downlink Packets Marked:          0
      Uplink Bytes Marked:            0     Downlink Bytes Marked:            0

Total qos-group-of-ruledefs matched: 2

Total subscribers matching specified criteria: 1
```

show subscribers user-plane-only full all

This command displays the number of per subscriber QoS-groups that UPF has successfully activated and the QoS-group statistics matched for data packets.

```
[local]qvpc-si# show subscribers user-plane-only full all

  Local SEID      : [0x0004000000000000] 1125899906842624
  Remote SEID     : [0x0004000000000000] 1125899906842624
  State           : Connected
  Connect Time    : Wed Mar 18 07:53:57 2020
  Idle time       : 18h53m24s
  Access Type: uplane-ipv4              Network Type: IP
  user-plane-service-name: user-plane-service
  Callid: 00004e21
  Rulebase: prepaid
  Interface Type: Sxb
  Card/Cpu: 1/0                         Sessmgr Instance: 1
  IP address: 10.0.0.1
  Source context: ingress               Destination context: egress
  PDN-Instance: intershat
  User-plane-Sx-addr: 192.60.182.1
  Control-plane-Sx-addr: 192.60.181.1
  Number of associated PDRs : 0
  Number of associated ADC PDRs : 0
  Number of associated FARs : 1
  Number of associated QERs : 2
  Number of associated URRs : 3
  ….
  ….
  ….
  CC Dropped Uplink bytes: 0                    CC Dropped Downlink Bytes: 0
  Uplink Inflight Pkts: 0                       Downlink Inflight Pkts: 0
  Total QoS-Group(s) Active: 1

  Flow information:
    Current Active Flows:
      TCP: 0
      UDP: 0
    Total Flows:
```

```
      TCP: 2
      UDP: 0
      FP:  0

Static & Predef Rule Match stats:
Rule Name            Pkts-Down  Bytes-Down Pkts-Up    Bytes-Up   Hits       Match-Bypassed
  FP-Down(Pkts/Bytes)  FP-Up(Pkts/Bytes)
-------------------- ---------- ---------- ---------- ---------- ---------- --------------
  -------------------  -----------------
http                          2       1352          2        250          4              0
          0/0              0/0
catchall                      4        160          8        320         12              0
          0/0              0/0

Dynamic Rule Match stats:
PDR Id   Pkts-Down  Bytes-Down Pkts-Up    Bytes-Up   Hits       Match-Bypassed
FP-Down(Pkts/Bytes)    FP-Up(Pkts/Bytes)
-------- ---------- ---------- ---------- ---------- ---------- --------------
-------------------    -----------------

Post-Processing Rule Match stats:
Rule Name            Pkts-Down  Bytes-Down Pkts-Up    Bytes-Up   Hits       Match-Bypassed
  FP-Down(Pkts/Bytes)  FP-Up(Pkts/Bytes)
-------------------- ---------- ---------- ---------- ---------- ---------- --------------
  -------------------  -----------------
QoS-Group Statistics:
QGR Name  Pkts-Down   Bytes-Down    Pkts-Up    Bytes-Up    Hits
Match-Bypassed   FP-Down(Pkts/Bytes)  FP-Up(Pkts/Bytes)
-------- ----------   ----------   ---------  ----------  ------
--------------   -------------------  -----------------
QGR1        3            756           5            285          8         0
               0/0                    0/0
```

show user-plane-service qos-group-of-ruledefs

This command displays the static QoS-groups configuration received on UPF through PFD.

```
[local]qvpc-si# show user-plane-service qos-group-of-ruledefs
all       name
[local]qvpc-si# show user-plane-service qos-group-of-ruledefs all
  QOS-Group-of-Ruledefs Name: QGR1
   Ruledef Name
   ============
   group

Total QoS group(s) of ruledefs found: 1
```

show user-plane-service statistics qos-group sessmgr

This command displays cumulative statistics across all QoS-Groups.

```
[local]laas-si-setup# show user-plane-service statistics qos-group sessmgr
1..1152   all

Sessmgr Instance: 1
      Total Uplink Pkts:                5       Total Dnlink Pkts:                3
      Total Uplink Bytes:               274     Total Dnlink Bytes:               756
      Uplink FP Pkts:                   0       Dnlink FP Pkts:                   0
      Uplink FP Bytes:                  0       Dnlink FP Bytes:                  0
      Flow-Status Statistics:
        Total Uplink Packets:           5       Total Downlink Packets:           3
        Total Uplink Bytes:             274     Total Downlink Bytes:             756
```

```
  Uplink Packets Redirected:       0       Downlink Packets Redirected:       0
  Uplink Bytes Redirected:         0       Downlink Bytes Redirected:         0
  Uplink Packets Dropped:          0       Downlink Packets Dropped:          0
  Uplink Bytes Dropped:            0       Downlink Bytes Dropped:            0
  Uplink Packets Term-Flow:        0       Downlink Packets Term-Flow:        0
  Uplink Bytess Term-Flow:         0       Downlink Bytes Term-Flow:          0
Bandwidth-Control Statistics:
  Total Uplink Packets:            5       Total Downlink Packets:            3
  Total Uplink Bytes:            274       Total Downlink Bytes:            756
  Uplink Packets QoS-Exceed:       0       Downlink Packets QoS-Exceed:       0
  Uplink Bytes QoS-Exceed:         0       Downlink Bytes QoS-Exceed:         0
  Uplink Packets QoS-Conform:      5       Downlink Packets QoS-Conform:      3
  Uplink Bytes QoS-Conform:      274       Downlink Bytes QoS-Conform:      756
  Uplink Packets Dropped:          0       Downlink Packets Dropped:          0
  Uplink Bytes Dropped:            0       Downlink Bytes Dropped:            0
  Uplink Packets Marked:           0       Downlink Packets Marked:           0
  Uplink Bytes Marked:             0       Downlink Bytes Marked:             0
```