



# QoS Group of Ruledefs Support

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## Revision History



**Note** Revision history details are not provided for features introduced before release 21.24.

Revision Details	Release
First introduced	Pre 21.24

## Feature Descriptions

QoS Group of Ruledefs is also called as QGR or SGQ. This feature enables fair usage policing for the subscriber.

## How It Works

The following configuration primarily does Flow-Status and Bandwidth Limiting in hierarchical manner, first doing at matched Charging-Action and then at QoS-Group Level.

```
conf
active-charging service acs
  qos-group-of-ruledefs QGR1
    add-group-of-ruledef group
    add-ruledef http
  #exit
rulebase cisco
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
```

QoS Group QGR1 received over PCRF.

```
qos-group-rule-install
qgr-name QGR2
qgr-mon-key 1
qgr-flow-status 3
qgr-precedence 1
qgr-eqos-information
qgr-eqos-mbr 1000 2000
qgr-eqos-mbr-burst-size 1000 2000
qgr-eqos-mbr-limit-conform-action 1 -1 1 -1
qgr-eqos-mbr-limit-exceed-action 2 7 2 8
```

## Data Path Enforcement

1. Packet matches ruledef 'http'.
2. QGR match is carried out to check if there is a QGR with the matched ruledef/group. Highest Priority QGR is returned. The ruledef/group can be static or predefined.
3. If QGR matches, then Flow-Action Enforcement which is first done at Charging-Action Level and then at QGR Level assuming Charging-Action has allowed the packet. If the packet is dropped, then QGR Level Flow Action Enforcement is skipped.
4. If Flow-Action at QGR allows the packet, then QER Limiting is enforced on a packet. If it is dropped at QGR, QER Limiting is skipped.
5. Likewise, QER Limiting is done stepwise, first at Charging-Action Level and then at the QGR subject to packet is allowed at Charging-Action.

## Static Configuration Push to UPlane

- Static configuration pushed from CP to UP via the PFD mechanism in similar to ECS elements ruledef/charging-action/group-of-ruledefs.
- Show CLIs 'show user-plane-service qos-group-of-ruledefs all/name' displays the static configuration on UPlane.

## QGR Params Push to UPlane

QGR is pushed along with Session Establishment and Modification Request.

QGR Name and Precedence is sent in a private IE. Flow-action, bandwidth parameters, and monitoring-key will create a new FAR, new QER, and new URR respectively.

Any changes to QGR dynamic parameters triggers an update to FAR/QER/URR.

This is sent in Session Establishment or Modification Request.

### Private IE

```
Qos-Group-Of-Ruledef:
Name:
Operation: (0 - Add 1 - Modify 2 - Delete)
```

Precedence:  
 FAR ID:  
 URR ID:  
 QER ID:

**Table 1: FAR Format**

FAR ID	Unique ID
Extended Apply Action	Private IE to include Flow-Action Allow as well Discard, Uplink, Discard Downlink, Terminate Flow.

**Table 2: QER Format**

QER ID	Unique ID
Maximum Bitrate	MBR of QGR in Kbps: UL MBR: DL MBR:
Burst Size	Private IE to include the Burst Size: UL Burst: DL Burst:
Conform Action	Private IE to configure the conform action: Uplink Action: Uplink ToS: Downlink Action: Downlink ToS:
Exceed Action	Private IE to configure the exceed action: Uplink Action: Uplink ToS: Downlink Action: Downlink ToS:

Display the FAR, PDR, QER, and URR in 'show subscribers user-plane-only callid <> far|qer full all'.

## Processing of QGR on UPlane

- On Receiving a IE 'Qos-Group-Of-Ruledef', search for the QGR in static configuration. For each ruledef/group-of-ruledef in QGR, look up for its corresponding PDR and update the FAR/QER list with the received QGR FAR/URR/QER IDs.
- For each ruledef/group-of-ruledef PDR on UPlane, associate high priority QGR's FAR-id, QER-id.

- Maintain QGR map at both Control and UPlane, it consists of QGR name, precedence, QER-ID, and FAR-ID. Use QGR map for recovery and lookup whenever required.

## QGR Hit in Data Path

- For a packet matching rule PDR, search for the highest priority QGR FAR, and QER and enforce the parameters.
- Enforce flow-status and flow-rate as expected.
- QGR matching for Offloaded Flows are handled.
- QGR hit statistics are incremented.

## Limitations

The QoS Group of Ruledefs support feature has the following limitations:

- URR creation and enforcement is not supported.
- Inclusion of dynamic-rules in static QGR definition is not supported.
- Flow-Status Redirect and Kill Flow are not supported.
- QoS Group Conform action as Drop and Exceed action as ALLOW or MARK\_DSCP are not supported.
- CP can communicate maximum 20 QGRs received over PCRF to UP.

## Monitoring and Troubleshooting

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

### Show Commands and Outputs

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

#### **show subscribers user-plane-only full all**

The output of this show command has been enhanced to include the following fields introduced in support of this feature.

- Total QoS-Group Active
- QoS-Group Statistics
  - QGR Name
  - Pkts-Down
  - Bytes-Down

- Pkts-Up
- Bytes-Up
- Hits
- Match-Bypassed
- FP-Down(Pkts/Bytes)
- FP-Up(Pkts/Bytes)

### **show user-plane-service qos-group-of-ruledefs all name**

The output of this show command has been enhanced to include the following fields introduced in support of this feature.

#### **QGR-INFO-LIST**

- Value
- Number of QGRs
- QGR INFO
  - NAME
  - PRECEDENCE
  - OPERATION
  - FAR ID
  - QER ID
- QGR INFO
  - NAME
  - PRECEDENCE
  - OPERATION
  - FAR ID
  - QER ID

### **show subscribers user-plane-only callid 00004e21 qos-group all**

The output of this show command has been enhanced to include the following fields introduced in support of this feature.

```
Callid: 00004e21
      Interface Type: Sxb
      QGR-Name:      Priority:      FAR-ID:      QER-ID:      URR-ID:
      -----      -
```

Total Number of QGRs found:

**show subscribers user-plane-only callid 00004e21 far full all**

The output of this show command has been enhanced to include the following fields introduced in support of this feature.

- Associated with QGR
  - Extended Apply Action

**show subscribers user-plane-only callid 00004e21 qer full all**

The output of this show command has been enhanced to include the following fields introduced in support of this feature.

- UL Burst
- UL Conform Action
  - UL DSCP Value
- UL Exceed Action
  - UL DSCP Value
- DL Burst
- DL Conform Action
  - DL DSCP Value
- DL Exceed Action
  - DL DSCP Value

**show subscribers user-plane-only callid 00004e21 qos-group statistics all name**

This show command and its output is introduced to support of this feature.

- Flow-Status Statistics
  - Total Uplink Packets
  - Total Uplink Bytes
  - Uplink Packets Redirected
  - Uplink Bytes Redirected
  - Uplink Packets Dropped
  - Uplink Bytes Dropped
  - Uplink Packets Term-Flow
  - Uplink Bytes Term-Flow
  - Total Downlink Packets

- Total Downlink Bytes
- Downlink Packets Redirected
- Downlink Bytes Redirected
- Downlink Packets Dropped
- Downlink Bytes Dropped
- Downlink Packets Term-Flow
- Downlink Bytes Term-Flow
  
- Bandwidth-Control Statistics
  - Total Uplink Packets
  - Total Uplink Bytes
  - Uplink Packets QoS-Exceed
  - Uplink Bytes QoS-Exceed
  - Uplink Packets QoS-Conform
  - Uplink Bytes QoS-Conform
  - Uplink Packets Dropped
  - Uplink Bytes Dropped
  - Uplink Packets Marked
  - Uplink Bytes Marked
  - Total Downlink Packets
  - Total Downlink Bytes
  - Downlink Packets QoS-Exceed
  - Downlink Bytes QoS-Exceed
  - Downlink Packets QoS-Conform
  - Downlink Bytes QoS-Conform
  - Downlink Packets Dropped
  - Downlink Bytes Dropped
  - Downlink Packets Marked
  - Downlink Bytes Marked
  
- Total qos-group-of-ruledefs matched
- Total subscribers matching specified criteria

**show user-plane-service statistics qos-group sessmgr all**

Sessmgr Instance

- Total Uplink Pkt
- Total Uplink Bytes
- Uplink FP Pkts
- Uplink FP Bytes
- Total Dnlink Pkts
- Total Dnlink Bytes
- Dnlink FP Pkts
- Dnlink FP Bytes
  
- Flow-Status Statistics
  - Total Uplink Packets
  - Total Uplink Bytes
  - Uplink Packets Redirected
  - Uplink Bytes Redirected
  - Uplink Packets Dropped
  - Uplink Bytes Dropped
  - Uplink Packets Term-Flow
  - Uplink Bytes Term-Flow
  - Total Downlink Packets
  - Total Downlink Bytes
  - Downlink Packets Redirected
  - Downlink Bytes Redirected
  - Downlink Packets Dropped
  - Downlink Bytes Dropped
  - Downlink Packets Term-Flow
  - Downlink Bytes Term-Flow
  
- Bandwidth-Control Statistics
  - Total Uplink Packets
  - Total Uplink Bytes
  - Uplink Packets QoS-Exceed
  - Uplink Bytes QoS-Exceed



- Uplink Packets QoS-Conform
- Uplink Bytes QoS-Conform
- Uplink Packets Dropped
- Uplink Bytes Dropped
- Uplink Packets Marked
- Uplink Bytes Marked
- Total Downlink Packets
- Total Downlink Bytes
- Downlink Packets QoS-Exceed
- Downlink Bytes QoS-Exceed
- Downlink Packets QoS-Conform
- Downlink Bytes QoS-Conform
- Downlink Packets Dropped
- Downlink Bytes Dropped
- Downlink Packets Marked
- Downlink Bytes Marked

