ERICSSON

Quality of Service Management

OPERATION DIRECTIONS

56/1543-CNA 250 006 Uen BD

Contents

1 Introduction

This document describes the Quality of Service (QoS) management of the SGSN-MME for GSM, WCDMA, and LTE radio network access. For more information, see Quality of Service.

1.1 Scope

This document covers the following issues:

- Prerequisites for the configuration
- Flowchart describing the procedural order of the configuration
- Flowchart describing the procedural order of optional configurations
- Configuration processes for consistency checking, activating, and checkpointing the configuration
- Configuration examples for both basic and optional features

Only certain recommendations regarding configuration parameters are given in this document, since all configuration parameters are not known in advance without a particular General Packet Radio Service (GPRS) backbone network and radio network at hand.

The document does not cover installation of the SGSN-MME, which must be performed by the site installation personnel.

1.2 Target Groups

This document is intended for personnel configuring the SGSN-MME.

2 Prerequisites

This section outlines the prerequisites for QoS management.

2.1 Planning

The planning phase of the configuration should give information on the following topic:

— The SGSN-MME planning parameters, listed in Parameter Description

2.2 User

The person configuring and planning should have a solid knowledge of and training in the following areas:

— How to work in UNIX™

— GPRS communication in the GSM and WCDMA Systems and EPS

— Operation of the SGSN-MME

Knowledge of basic and optional features are beneficial. See Features and Functions Management for information on licensing and enabling of optional features.

3 Overview

The Quality of Service Management provides the operator with the possibility to define the QoS provided to a subscriber using both basic and optional features. Some features can require additional, licensed, features to be enabled before installation. Parameters which are modified with basic features can get further applicable values if a licensed feature is installed.

For example, to install Enhanced Uplink Support Expansion 1, Enhanced Uplink Support must be enabled; and the value streaming is only valid for the Traffic Class parameter if Streaming QoS is installed. For a description of configuring Streaming QoS, see Section 5.3 on page 9. The dependencies are outlined in the following sections.

4 Basic QoS Management (GSM, WCDMA, and LTE)

Processes for checking consistency, activating the configuration, and checkpointing are described in Section 6 on page 15. This can be done at any point in the procedure at the discretion of the operator. See Figure 1 for an outline of basic QoS features. The features are described in the following sections.

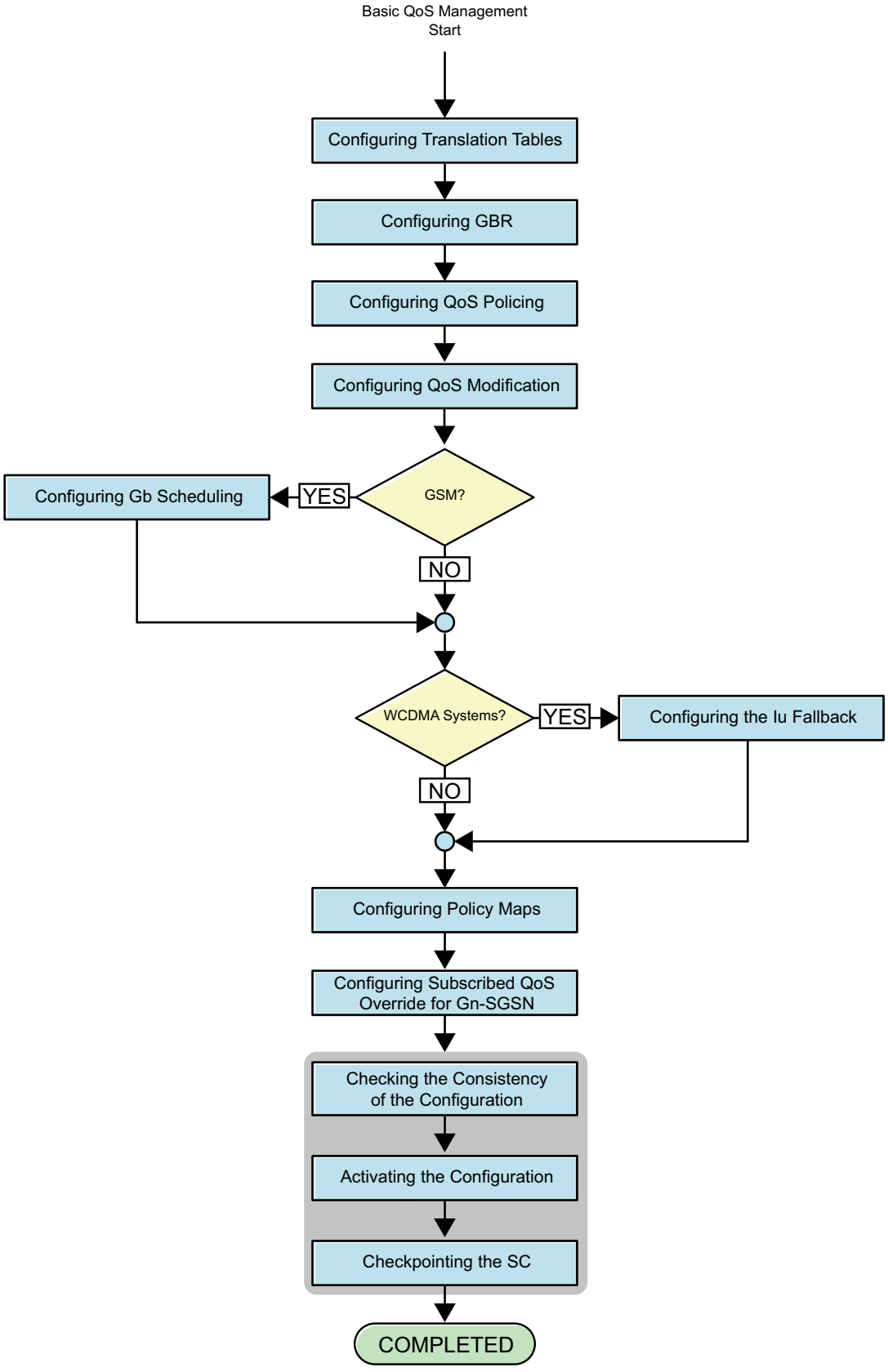

Figure 1 Basic QoS Management Flow

4.1 Configuring Translation Tables

The translations table maps the traffic classes to Expedited Forwarding (EF), Assured Forwarding (AF), or Best Effort (BE) values. Set the translation table using the modify_qos CLI command. For an example of setting the translation table, see QoS - General (CLI).

Display the current configuration using the get_qos CLI command. For an example of displaying the translation table, see QoS - General (CLI). Conversational and streaming QoS classes are not configurable values for the QoSTrafficClass parameter unless the corresponding QoS features are enabled. See Section 5.2 on page 9 and Section 5.3 on page 9 for configuration of conversational and streaming QoS classes respectively.

4.2 Configuring GBR

The aggregated Guaranteed Bit Rate (GBR) is set using the modify_qos CLI command. This CLI command specifies the upper limit for the aggregated GBR accepted by the SGSN, and specifies the maximum transfer rate used by conversational and streaming contexts, in terms of Mbps. For an example, see QoS - General (CLI).

Show the GBR setting with the get_qos CLI command. The CLI command displays the upper limit of the aggregated GBR accepted by the SGSN. For an example, see QoS - General (CLI).

4.3 Configuring QoS Policing

Policing of downlink traffic can be enabled or disabled. Set the QoS Policing using the modify_qos CLI command. Display the current QoS Policing configuration using the get_qos CLI command. For examples, see QoS - General (CLI).

Note: By default, policing is enabled.

4.4 Configuring QoS Modification

The S4-SGSN and MME can be configured to send the Modify Bearer Command message to initiate QoS modification when the subscribed QoS of the subscriber is updated in the HLR/HSS or after the mobility procedures. For more information on the QoS modification procedures, see GSM and WCDMA Session Management, LTE Session Management, and Inter-System Mobility Management.

Note: The S4-SGSN only supports the QoS modification in WCDMA.

4.4.1 Configuring QoS Modification for Updated Subscriber QoS

To enable or disable the S4-SGSN and MME to initiate the QoS modification when the subscribed QoS of the subscriber is updated, configure the `SendMbcAtHssQosMod` parameter using the modify_qos CLI command.

Note: The default value of the `SendMbcAtHssQosMod` parameter is `on`.

4.4.2 Configuring QoS Modification for IRAT Mobility for LTE

To enable or disable the MME to initiate QoS modification after the UE moves from GSM or WCDMA to LTE, configure the `SendMbcAtIratMobility` parameter using the modify_qos CLI command.

Note: The default value of the `SendMbcAtIratMobility` parameter is `off`.

4.4.3 Configuring QoS Modification for Mobility for WCDMA

To enable or disable the S4-SGSN to initiate QoS modification after the UE moves from a Gn-SGSN, S4-SGSN or MME to another S4-SGSN (including the IRAT mobility procedures), configure the `SendMbcAtMobilityForSgsn` parameter using the modify_qos CLI command.

Note: The default value of the `SendMbcAtMobilityForSgsn` parameter is `off`.

4.5 Configuring Gb Scheduling (GSM)

The Gb scheduling is set and displayed with the modify_qos_gb_queue and get_qos_gb_queue CLI commands respectively. For examples, see QoS - Gb Scheduling (CLI). The weight factor given to each traffic class determines the Gb scheduling order for downlink packets over the Gb interface.

The CLI commands are valid for GSM only.

Note: The weight factor is not applicable if the license-dependent feature PFC Flow Control is invoked.

4.6 Configuring the Iu Fallback (WCDMA)

The Iu fallback templates define a set of QoS parameters in a Radio Access Bearer (RAB) assignment reattempt. These values are likely to be accepted by the RNC if the initial request has been rejected because of QoS. The Iu Fallback for the streaming and interactive class is set with the modify_qos_iu_fallback_streaming and modify_qos_iu_fallback_interactive CLI commands respectively. For examples, see QoS - Iu Fallback (CLI). For the streaming class, GBR and transfer delay are set; for interactive, the Maximum Bit Rate (MBR) and traffic handling priority. The streaming class is invalid unless Streaming QoS is enabled, see Section 5.3 on page 9.

The current Iu Fallback for the streaming and interactive class is displayed with the get_qos_iu_fallback_streaming and get_qos_iu_fallback_interactive CLI commands respectively. For examples, see QoS - Iu Fallback (CLI). Iu Fallback is applicable for WCDMA Systems only.

4.7 Configuring Policy Maps (GSM and WCDMA)

A policy map consists of a set of QoS parameters to be used for QoS validations during Packet Data Protocol (PDP) context activation or modification. Two default policy maps are stored in the SGSN. One is for GSM and one is for WCDMA. These policy maps can be modified, displayed, and listed using basic features, see Section 4.7.1 on page 7.

A new policy map is created by using the create_qos_policymap_g and create_qos_policymap_w CLI commands for GSM and WCDMA respectively. To delete a policy map, use the delete_qos_policymap_g and delete_qos_policymap_w CLI commands for GSM and WCDMA respectively. For examples, see QoS - Policy Map (CLI). To create policy maps requires optional licensed features. See Section 5.7 on page 10 for more information.

Conversational and streaming QoS classes are not configurable values for the QoSTrafficClass parameter unless the corresponding QoS features are enabled. See Section 5.2 on page 9 and Section 5.3 on page 9 for configuration of conversational and streaming QoS classes respectively.

4.7.1 Modifying Policy Maps

Before modifying a policy map, checkpoint the software configuration. Modify a policy map by using the modify_qos_policmap_g and modify_qos_policmap_w CLI commands for GSM and WCDMA respectively. For an example of modifying an existing policy map, see QoS - Policy Map (CLI).

4.7.2 Deleting Policy Maps

To delete a policy map, do as follows:

1. Check if the policy map is linked to any International Mobile Subscriber Identity Number Series (IMSINS) or policy profiles by using the list_imsins and list_qos_policy_profile_apn CLI commands.
2. If the policy map is linked to an IMSINS or policy profile, or both, delete the policy map id in the IMSINS and policy profile by using the modify_qos_policy_profile_apn and modify_imsins CLI commands.
3. Perform a large restart for the changes to take effect.
4. Delete the policy map by using the delete_qos_policymap_g and delete_qos_policymap_w CLI commands for GSM and WCDMA respectively.

4.8 Configuring Subscribed QoS Override for GSM and WCDMA for Gn-SGSN

In the PDP context activation and modification procedures for GSM and WCDMA, the Gn-SGSN can allow the negotiated QoS to exceed the subscribed QoS without rejecting the procedures.

To enable or disable subscribed QoS override for GSM and WCDMA for Gn-SGSN, configure the `GnOverrideSubscribedQos` parameter using the modify_qos CLI command.

4.9 Optionally Configuring QCI Indexes for the SGSN-MME_Session_SM_E_QCI Measurement Group (LTE)

Configure the `QciCounterIndexList` parameter by using the modify_qos CLI command. The parameter specifies a list of QCI index used in the measurement types within the Session_SM_E_QCI area.

Note: Each time after the `QciCounterIndexList` parameter is modified, a large restart is required for the new indexes of counters to take effect.

Example

```
modify_qos -qcil 1-9,65,66,69,70

check_config

activate_config_pending

start_large_restart -reason maint
```

5 Optional QoS Management (GSM, WCDMA, and LTE)

To use an optional QoS feature, install the corresponding license. Some features described in the following sections have an impact on the basic QoS features described in Section 4 on page 2. See the separate sections for details.

See Features and Functions Management for more information on optional QoS management features.

5.1 Optional QoS Management Overview (GSM and WCDMA)

The dependence of the licensed QoS features in SGSN-MME for GSM and WCDMA Systems are shown in Figure 2.

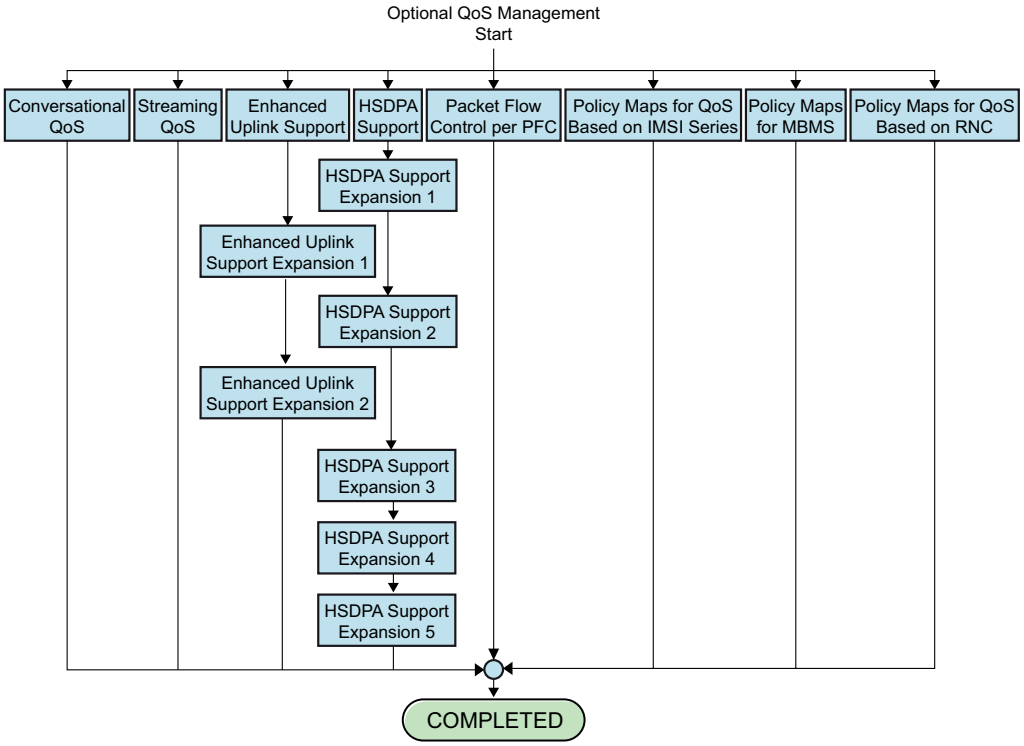

Figure 2 Optional QoS Management Flow for GSM and WCDMA Systems

5.2 Configuring Conversational QoS (GSM and WCDMA)

Conversational QoS enables configuration of the conversational class when configuring QoS policy maps, using basic and licensed features, see Section 4.7 on page 6 and Section 5.7 on page 10. The main characteristics of the conversational class are GBR, minimal delay variations, and absolute minimal transfer delay. See Features and Functions Management for further information.

5.3 Configuring Streaming QoS (GSM and WCDMA)

Streaming QoS enables configuration of the streaming class when configuring QoS policy maps, using basic and licensed features, see Section 4.7 on page 6, Section 5.7 on page 10, and Section 5.9 on page 14. Using the streaming class requires support in the WCDMA Systems Radio Access Network (RAN) and MSs. See Features and Functions Management for further information.

5.4 Configuring Enhanced Uplink Support (WCDMA)

Enhanced Uplink Support is an optional licensed feature which increases the uplink capacity. This affects the available value range for parameters set when configuring QoS policy maps, see Section 4.7 on page 6, Section 5.7 on page 10, and Section 5.9 on page 14. After installing the feature, two extensions, Enhanced Uplink Support Expansion 1 and 2, are available to further increase the maximum uplink bit rate. To install Expansion 2, Expansion 1 must be active. Enhanced Uplink Support, Expansion 1 and 2 are applicable for WCDMA Systems only. See Features and Functions Management for more extensive information.

5.5 Configuring HSDPA Support (WCDMA)

High-Speed Downlink Packet Access (HSDPA) Support is optional licensed features that increase the downlink capacity. This affects the available value range for parameters set when configuring QoS policy maps, see Section 4.7 on page 6, Section 5.7 on page 10, and Section 5.9 on page 14. The feature is available at five levels, HSDPA Support Expansion 1, 2, 3, 4, and 5. To install Expansion 2, Expansion 1 must be active. Therefore, to install Expansion 3, Expansion 2 must be active; to install Expansion 4, Expansion 3 must be active; and to install Expansion 5, Expansion 4 must be active. HSDPA Support requires support in the GGSN, Home Location Register (HLR), or Home Subscriber Server (HSS), MS, and WCDMA RAN. See Features and Functions Management for further information.

5.6 Configuring Packet Flow Control per PFC (GSM)

Packet Flow Control per PFC enables a BSS to perform traffic policing and resource allocation based on the QoS profiles per PFC. For further information, see Features and Functions Management.

5.7 Configuring QoS Policy Maps Based on IMSI Number Series

With the optional feature QoS Based on IMSI Series, 8 additional (in GSM and WCDMA) and 100 (in LTE) policy maps can be created and associated with one or more IMSI number series. This allows the operator to distribute resources to subscribers based on their IMSI number series.

Note: When the configuration in the following sections is completed, the procedures in Section 6 on page 15 must be performed.

5.7.1 Creating Policy Maps

Create a policy map as follows:

— For GSM, use the create_qos_policymap_g CLI command.

— For WCDMA, use the create_qos_policymap_w CLI command.

— For LTE, use the create_qos_policymap_l CLI command. Configure the allowed QCI values for a specific policy map by using the create_qos_policymap_lqci CLI command.

Note: If multiple QoS policy maps are to be associated with the same IMSI number series, Ericsson recommends setting UE-AMBR to the same values for the policy maps through parameters UeAmbrDownlinkL and UeAmbrUplinkL. If the parameters are set to different values for the policy maps, the minimum value is used for the QoS policy maps.

If multiple QoS policy maps are to be associated with the same IMSI number series, QCIs allowed in one of the QoS policy maps cannot overlap with QCIs allowed in another. One of the QoS policy maps must have QCI 9 configured as one of the allowed QCIs.

If only one QoS policy map is to be associated with the same IMSI number series, the QoS policy map must have QCI 9 configured as one of the allowed QCIs.

If multiple QoS policy maps are to be configured, repeat this step for each QoS policy map.

For configuration examples, see QoS - Policy Map (CLI) If the feature is deactivated, these CLI commands are disabled.

Note: QoS policy maps with ID one for GSM and WCDMA respectively are predefined and therefore cannot be created by the operator.

5.7.2 Associating Policy Maps with IMSI Number Series

Associate a policy map with a new or existing IMSI number series, by using the create_imsins or modify_imsins CLI command. Use the following parameters to specify the QoS policy maps:

— For GSM, use the QoSpolicyMap (parameter ID: `qpmg`) parameter.

— For WCDMA, use the QoSpolicyMap (parameter ID: `qpmw`) parameter.

— For LTE, use the QosPolicymapId (parameter ID: `qpml`) or QosPolicyMapListL (parameter ID: `qpmll`) parameter.

Note: The QosPolicyMapListL parameter can be used to specify one or more QoS policy maps.

Parameters QosPolicyMapListL and QosPolicymapId cannot both be used for the same IMSI number series.

To use the QosPolicyMapListL parameter (`qpmll`) for an IMSI number series already configured with the QosPolicymapId (`qpml`) parameter, operators can simply use `NULL` as follows to modify the LTE QoS policy map from one to a list:

```
modify_imsins -imsi value -qpmll "value 1,value
2,...,value n" -qpml NULL
```

Display the current association using the get_imsins CLI command.

For more related CLI commands, see IMSI Number Series (CLI).

5.7.3 Enabling the QoS Based on IMSI Series Feature

The configured policy maps for each IMSI number series do not take effect until the QoS Based on IMSI Series feature is enabled.

Enable the QoS Based on IMSI Series feature, by setting the feature state to `ACTIVATED` for the `highest_qos_imsi` parameter, using the modify_feature_state CLI command.

Note: When the QoS Based on IMSI Series feature is not enabled, the default policy map takes effect for GSM and WCDMA access types, and no policy map takes effect for LTE.

5.8 Configuring a QoS Profile Based on APN

With the optional feature APN Based QoS Control, a policy profile can be created for a specified APN-NI and session type and associated with one or more IMSI number series or with all subscribers.

The QoS Based on IMSI Series feature needs to be enabled for the APN Based QoS Control feature to take effect. Enable the QoS Based on IMSI Series feature, by setting the feature state to `ACTIVATED` for the `highest_qos_imsi` parameter, using the modify_feature_state CLI command.

Note: When the configuration in the following sections is completed, the procedures in Section 6 on page 15 must be performed.

5.8.1 Configuring a QoS Profile Based on APN for IMSI NS

Configure a QoS policy profile for an APN on the IMSI NS level as follows:

1. Create a policy map as follows:

- For GSM, use the create_qos_policymap_g CLI command.
- For WCDMA, use the create_qos_policymap_w CLI command.
- For LTE, use the create_qos_policymap_l CLI command. Configure the allowed QCI values for a specific policy map by using the create_qos_policymap_lqci CLI command.

  Note: If multiple QoS policy maps are to be associated with the same APN-NI and session type, QCIs allowed in one of the QoS policy maps cannot overlap with QCIs allowed in another. One of the QoS policy maps must have QCI 9 configured as one of the allowed QCIs.

  If only one QoS policy map is to be associated with the same APN-NI and session type, the QoS policy map must have QCI 9 configured as one of the allowed QCIs.

If multiple QoS policy maps are to be configured, repeat this step for each QoS policy map.

2. Create a QoS policy profile using the create_qos_policy_profile CLI command.
3. Associate the policy profile with QoS policy maps for the specified APN-NI and session type using the create_qos_policy_profile_apn CLI command. Use the following parameters to specify the QoS policy maps:
   - For GSM, use the QoSpolicyMap (parameter ID: `qpmg`) parameter.
   - For WCDMA, use the QoSpolicyMap (parameter ID: `qpmw`) parameter.
   - For LTE, use the QosPolicymapId (parameter ID: `qpml`) or QosPolicyMapListL (parameter ID: `qpmll`) parameter.

     Note: The QosPolicyMapListL parameter can be used to specify one or more QoS policy maps.

     Parameters QosPolicyMapListL and QosPolicymapId cannot both be used for the same APN-NI and session type.

     To use the QosPolicyMapListL parameter (`qpmll`) for an APN-NI and session type already configured with the QosPolicymapId (`qpml`) parameter, operators can simply use `NULL` as follows to modify the LTE QoS policy map from one to a list:

     ```
     modify_qos_policy_profile_apn -qpp value -apn value
     -st value -qpmll "value 1,value 2,...,value n" -qpml
     NULL
     ```
4. Map a QoS policy profile to a new or existing IMSI number series using the QosPolicyProfileName parameter in the create_imsins or the modify_imsins CLI command.

5.8.2 Configuring a QoS Profile Based on APN for All Subscribers

Configure a QoS policy for an APN on the node level as follows:

1. Create policy maps as described in Step 1.
2. Create a QoS policy profile using the create_qos_policy_profile CLI command.
3. Associate the policy profile with QoS policy maps for the specified APN-NI and session type as described in Step 3.
4. Map a QoS policy profile to all subscribers using the QosPolicyProfileName parameter in the modify_qos CLI command.

5.9 Configuring Policy Maps for MBMS (WCDMA)

The Multimedia Broadcast Multicast System (MBMS) is applicable to WCDMA Systems only. See MBMS for more information. Before configuring a policy map for MBMS, it is required to checkpoint the software configuration. Configure a policy map for MBMS by using the modify_mbms_policymap CLI command. Display the MBMS policy map using the get_mbms_policymap CLI command. For configuration examples, see MBMS (CLI).

For MBMS sessions using the streaming traffic class, the license-controlled feature Streaming QoS must be activated.

When the configuration is completed, the procedures in Section 6 on page 15 must be performed.

5.10 Configuring Policy Maps for QoS Based on RNC (WCDMA)

With the optional QoS Based on RNC feature, a maximum of 10 policy maps can be created. Each of them can be mapped to one or multiple RNCs.

Enable the QoS Based on RNC feature, by setting the feature state to `ACTIVATED` for the `highest_qos_rnc` parameter, using the modify_feature_state CLI command. This allows the operator to configure the highest QoS profiles based on the capability of the RNC.

Note: When the configuration in the following sections is completed, perform the procedures in Section 6 on page 15.

5.10.1 Creating Policy Maps

The QoS based on RNC provides configuration of policy maps using the create_qos_policymap_rnc CLI command. If the feature is deactivated, this CLI command is disabled. For more information, see QoS - Policy Map (CLI).

5.10.2 Mapping Policy Maps to RNC

Each of the policy maps can be mapped to one or multiple RNCs. The QoS requested by a subscriber served by an RNC is validated against that profile during QoS negotiation. The negotiated QoS for a RAB is not allowed to exceed the configured limits. This mapping allows the operator to configure the highest QoS profiles based on the capability of the RNC. Map a policy map to an RNC using the create_rnc or modify_rnc CLI command. For more information, see RNC (CLI).

Display the current mapping using the get_rnc CLI command.

5.11 Configuring QoS Downgrade for GSM and WCDMA

The SGSN can downgrade the QoS in a `Create PDP Context Response` or `Update PDP Context Response` message from the GGSN if the QoS exceeds the local policy map or subscribed QoS.

To configure the QoS downgrade function for GSM and WCDMA, set the `gn_qos_downgrade_allowed_g` parameter and the `gn_qos_downgrade_allowed_w` parameter respectively, using the modify_node_function CLI command.

To enable the QoS downgrade function, activate the QoS Based on IMSI Series feature. For more information, see Section 5.7.3 on page 12.

5.12 Configuring QoS Downgrade for LTE

The MME can downgrade the QoS if the QoS from the PGW/PCRF or the transferred QoS from an old node exceeds the local policy map.

To enable the QoS downgrade function, activate the QoS Based on IMSI Series feature. For more information, see Section 5.7.3 on page 12.

Note: Some QoS parameters can be downgraded while some others cannot. For more information, see Quality of Service.

6 Consistency Checking, Activating, and Checkpointing

This section describes procedures for consistency checking, and for activating and checkpointing the configuration.

6.1 Checking the Consistency of the Configuration

A consistency check must always be performed before activating the pending configuration.

The consistency check is performed to guarantee that an inconsistent configuration is not activated. A consistency check is performed on the configuration that will be active after an activation, that is, on the active configuration combined with the changes in the pending configuration.

Instructions

1. Run a consistency check on the active configurations with pending configurations, by using the check_config CLI command.

To cancel the pending configuration, use the undo_config_pending CLI command.

6.2 Activating the Configuration

The pending configuration must be activated for the configuration to take effect.

Instructions

1. Activate the pending configuration, by using the activate_config_pending CLI command.

6.3 Checkpointing the SC

To store the Software Configuration (SC) persistently, a checkpoint must be performed.

Instructions

1. Checkpoint the SC, by using the checkpoint CLI command.

7 Available Operations

Additional operations, normally available for creating, modifying, deleting, viewing, and listing parameter values, can be found in each CLI group document.

For more information on translation tables, policing, and the aggregated GBR, see QoS - General (CLI).

For more information on the scheduling queue, see QoS - Gb Scheduling (CLI).

For more information on Iu fallback, see QoS - Iu Fallback (CLI).

For more information on policy maps to Quality of Service, see QoS - Policy Map (CLI).

For more information on policy maps based on IMSI number series, see IMSI Number Series (CLI).

For more information on policy profiles based on APN, see QoS - Policy Profile (CLI).

For more information on policy map for MBMS, see MBMS (CLI).

For more information on policy maps based on RNC, see RNC (CLI).

To display the configuration classes and parameters related to QoS, use the get_config_area -can QoS CLI command.