SGW Charging Support

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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	Enabled - Always-on
Related Documentation	Not Applicable

Revision History

Table 2: Revision History

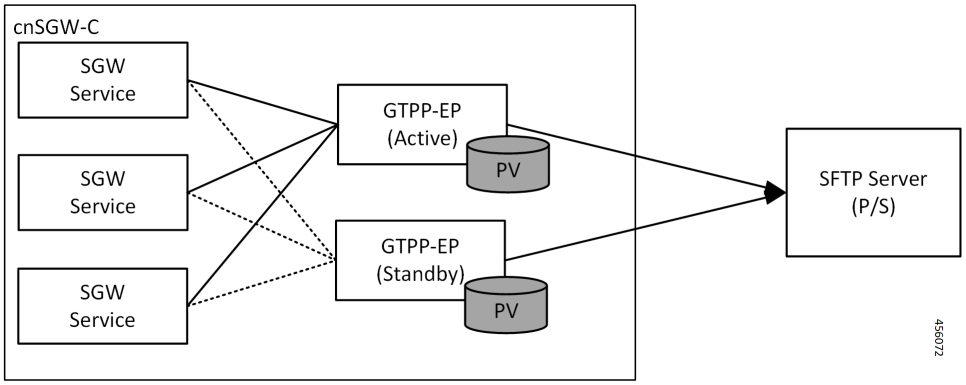
Revision Details	Release
First introduced.	2021.02.0

Feature Description

cnSGW-c supports the following:

- GTPP charging (Gz) interface
- Monitor subscriber for Charging Data Record (CDR)
- CDR dictionary: **custom24**
- Two custom file formats: **custom1** (default) and **custom5**
- One replica of GTPP-EP pod which is functional with active or standby mode (two pods get spawned when GTPP-EP pod configured with one instance)
- Writing CDR records to the local file system

Architecture



- GTP’ (GTP Prime) or GTPP-EP is the new endpoint pod and interfaces with mediation or CGF server over SFTP
- GTP’ attaches to the local disk (Persistent Volume). This attachment is with each server or virtual machine (VM)
- SGW-service generates CDRs and sends the records to the GTP' endpoint for the storage
- GTP' stores the CDRs in ASN.1 encoding in flat files in persistent storage
- GTP' pushes the flat files over SCTP towards the mediation server or CGF

The charging functionality is split into two parts.

- Accounting and CDR generation:
  - SGW-service generates usage reporting rule (URR) for each established bearer on the Sxa interface with SGW-U
  - SGW-service uses the reported usage information with the trigger event to generate accounting information
- CDR management and storage:
  - GTPP-EP microservice or K8 pod archives the CDRs and pushes the CDR files to the external storage server
  - GTPP-EP receives the proto-CDRs from SGW-service over the streaming GRPC IPC endpoint

- GTPP-EP encodes each received proto-CDR into ASN.1 format as specified in the dictionary (from CLI)
- The ASN.1 CDRs are written to flat files in the specified pattern as specified in the CLI configuration
- Transfers to the new CDR files to the configured external storage server using SFTP protocol periodically

Roaming Support

Roaming scenarios uses a Gz interface and offline accounting functions to match the CDR records with the foreign PGW.

The operator policy provides mechanisms to modify the behavior of subsets of subscribers described in the SGW profile. cnSGW-C supports call-control-profile under the operator-policy to control the accounting mode (enable or disable the charging) and define more charging configurations.

The default accounting mode is NONE which indicates charging is disabled.

The accounting mode value from the call control profile overrides the configured value in the SGW profile.

See the following configuration details:

- Call Control Profile Configuration
- Charging-Characteristics under Call-Control-Profile

How it Works

This section describes how this feature works.

Call Flows

This section describes the key call flows for this feature.

URR Installation on Initial Attach Call Flow

This section describes URR Installation on Initial Attach call flow.

Figure 1: URR Installation on Initial Attach Call Flow

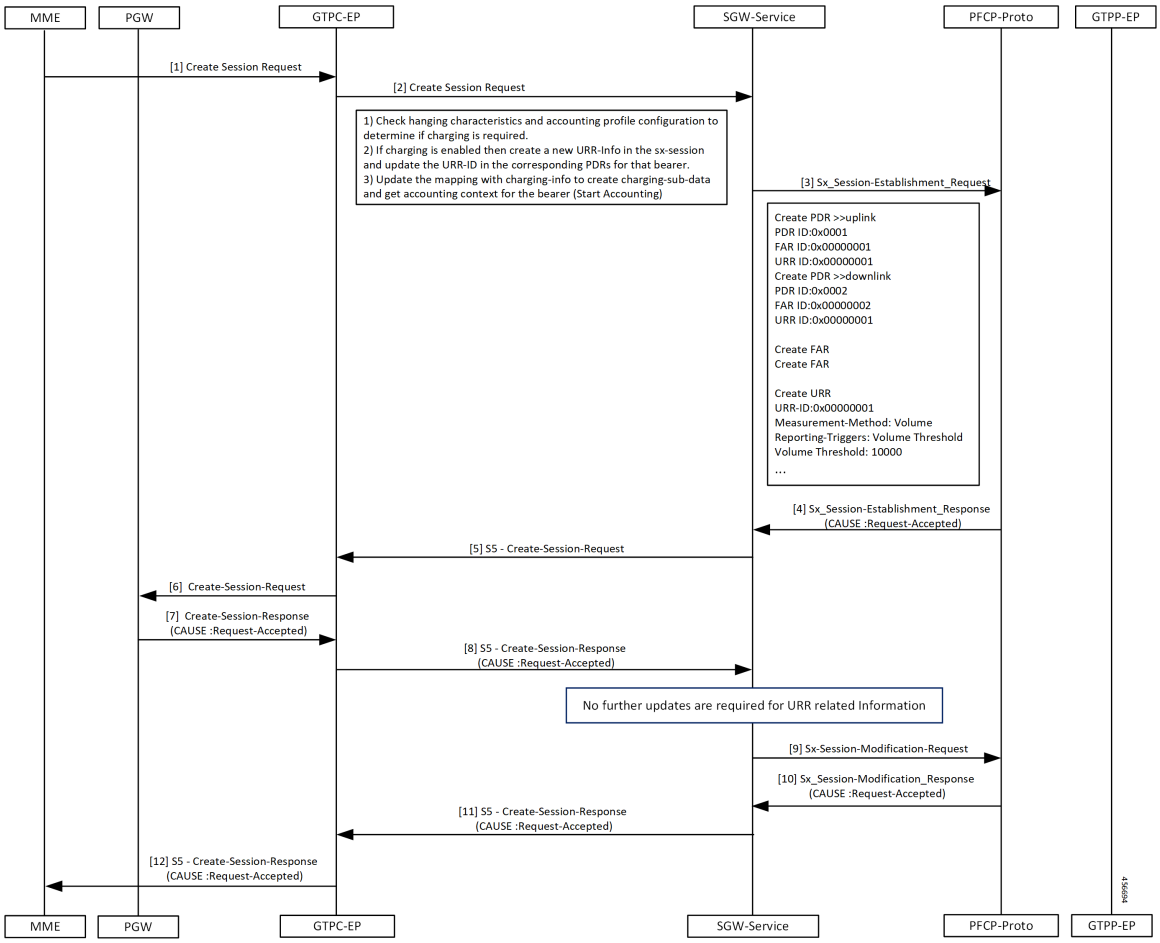


Table 3: URR Installation on Initial Attach Call Flow Description

Step	Description
1	The MME sends the Create Session Request to the GTPC-EP.
2	The GTPC-EP forwards the Create Session Request to the SGW-service pod.
3	The SGW-service pod sends the Sx Session Establishment Request to the PFCP proto
4	The PFCP proto sends the Sx Session Establishment Response to the SGW-service with the cause as Request-Accepted.
5	The SGW-service pod sends the S5 Create Session Request to the GTPC-EP.
6	The GTPC-EP sends the S5 Create Session Request to the PGW.
7	The PGW sends the Create Session Response to the GTPC-EP with the cause as Request-Accepted.
8	The GTPC-EP sends the S5 Create Session Response to the SGW-service with the cause as Request-Accepted.

Step	Description
9	The SGW-service pod sends the Sx Session Modification Request to the PFCP proto.
10	The SGW-service pod receives the Sx Session Modification Response from the PFCP proto with the cause as Request-Accepted.
11	The SGW-service pod sends the S5 Create Session Response to the GTPC-EP with the cause as Request-Accepted.
12	The GTPC-EP forwards the S5 Create Session Response to the MME with the cause as Request-Accepted.

SGW CDR Call Flow

This section describes the SGW CDR call flow.

Figure 2: SGW CDR Call Flow

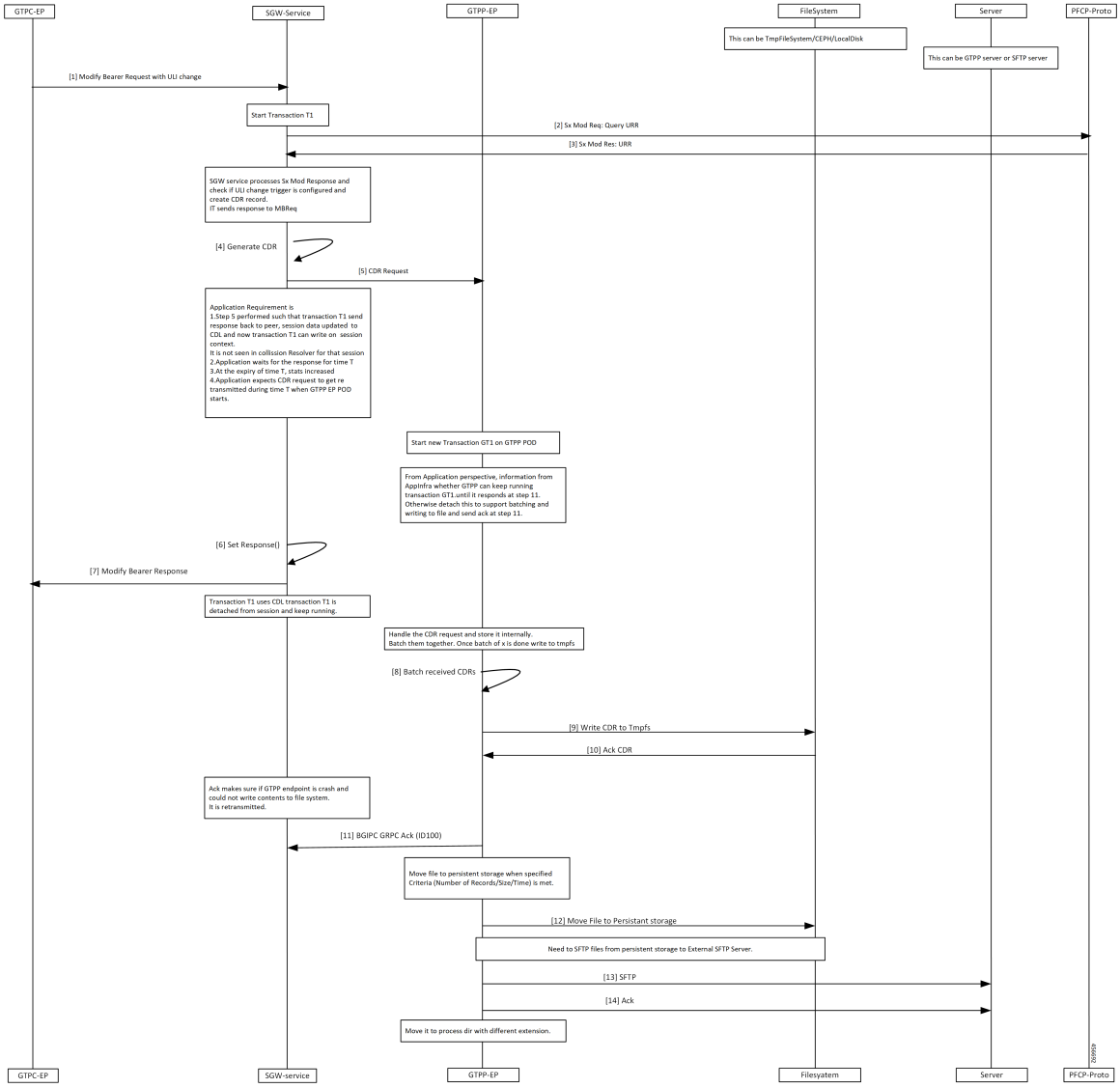


Table 4: SGW CDR Call Flow Description

Step	Description
1	The GTPC-EP sends the Modify Bearer Request with ULI to the SGW-service pod.
2	The SGW-service pod sends the Sx Mod Request with Query URR to the PFCP proto.
3	The SGW-service pod receives the Sx Mod Response with URR from the PFCP proto.
4	The SGW-service pod generate CDR.
5	The SGW-service pod sends the CDR request to the GTPP-EP.
6	The SGW-service pod triggers a set response () function.

Step	Description
7	The SGW-service pod sends the Modify Bearer Response to the GTPC-EP.
8	The GTPP-EP batches the received CDR requests .
9	The GTPP-EP sends the batched CDR requests to the TmpF5 file.
10	The GTPP-EP receives the CDR ACK from the file system.
11	The GTPP-EP sends GRPC ACK to the SGW-service.
12	The GTPP-EP moves the file to persistent storage when specified criteria (number of records or size or time) meets.
13	The GTPP-EP sends SFTP files from persistent storage to the server.
14	The GTPP-EP receives ACK from the server and moves it to the process directory with different extension.

URR Removal and CDR Reporting on Detach Call Flow

This section describes URR Removal and CDR Reporting on Detach call flow.

Figure 3: URR Removal and CDR Reporting on Detach Call Flow

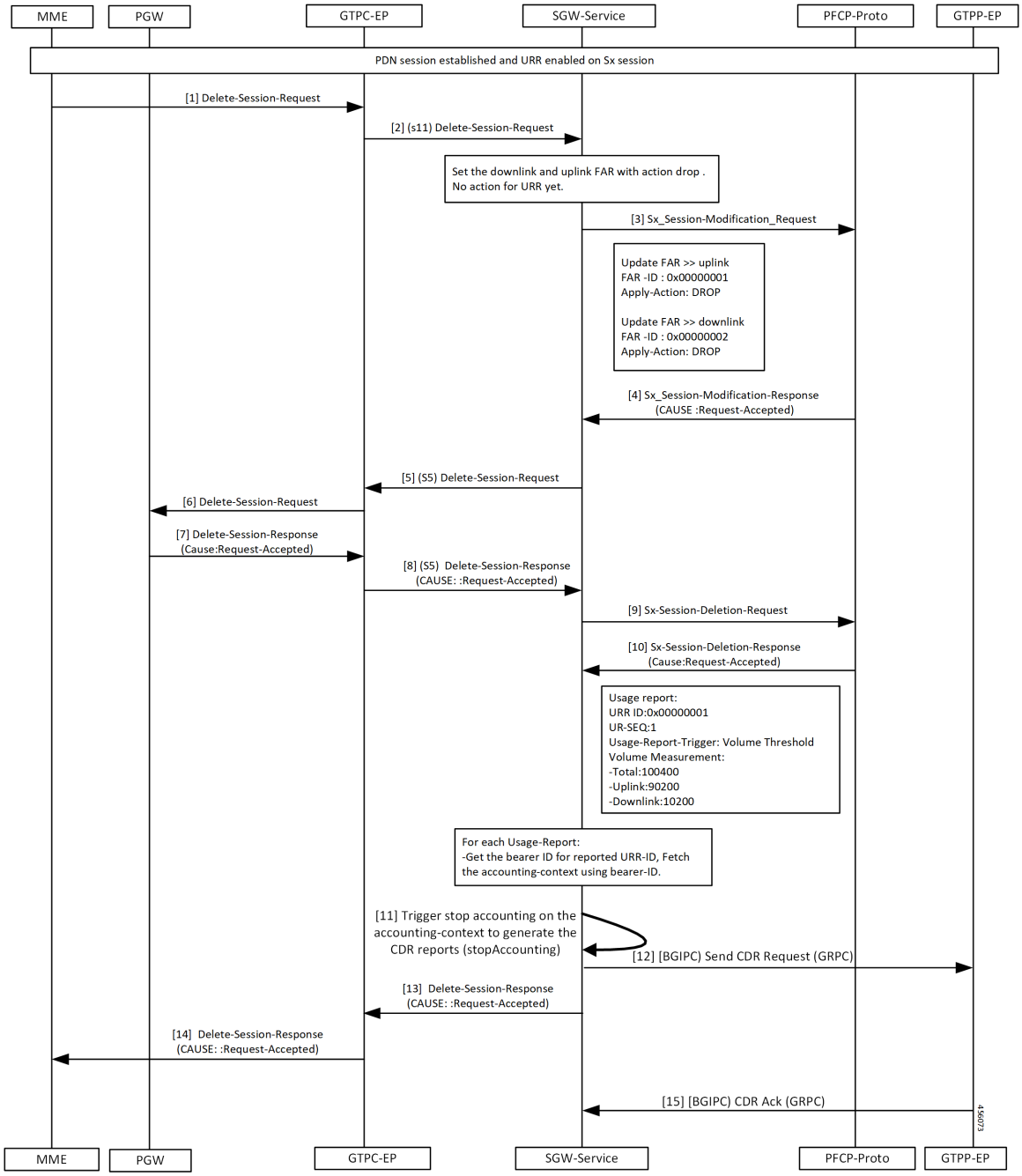


Table 5: URR Removal and CDR Reporting on Detach Call Flow Description

Step	Description
1	A PDN session is established and URR is enabled for Sx session. The MME sends the Delete Session Request to the GTPC-EP.

Step	Description
2	The GTPC-EP forwards the S11 Delete Bearer Request to the SGW-service pod.
3	The SGW-service pod sends the Sx Session Modification Request to the PFCP proto.
4	The PFCP proto sends the Sx Session Modification Response to the SGW-service pod with the cause as Request-Accepted.
5	The SGW-service pod sends the S5 Delete Session Request to the GTPC-EP.
6	The GTPC-EP sends the Delete Session Request to the PGW.
7	The PGW sends the Delete Session Response to the GTPC-EP with the cause as Request-Accepted.
8	The GTPC-EP sends the S5 Delete Session Response to the SGW-service pod with the cause as Request-Accepted.
9	The SGW-service pod sends the Sx Session Delete Request to the PFCP proto.
10	The SGW-service pod receives the Sx Session Delete Response from the PFCP proto with the cause as Request-Accepted.
11	The SGW-service pod triggers the CDR generation.
12	The SGW-service pod sends the CDR request to the GTPP-EP.
13	The SGW-service pod sends the Delete Session Response to the GTPC-EP with the cause as Request-Accepted.
14	The GTPC-EP pod forwards the Delete Session Response to the MME with the cause as Request-Accepted.
15	The GTPP-EP sends the CDR ACK to the SGW-service pod.

Usage Report on Hitting Threshold Call Flow

This section describes Usage Report on Hitting Threshold call flow.

Figure 4: Usage Report on Hitting Threshold Call Flow

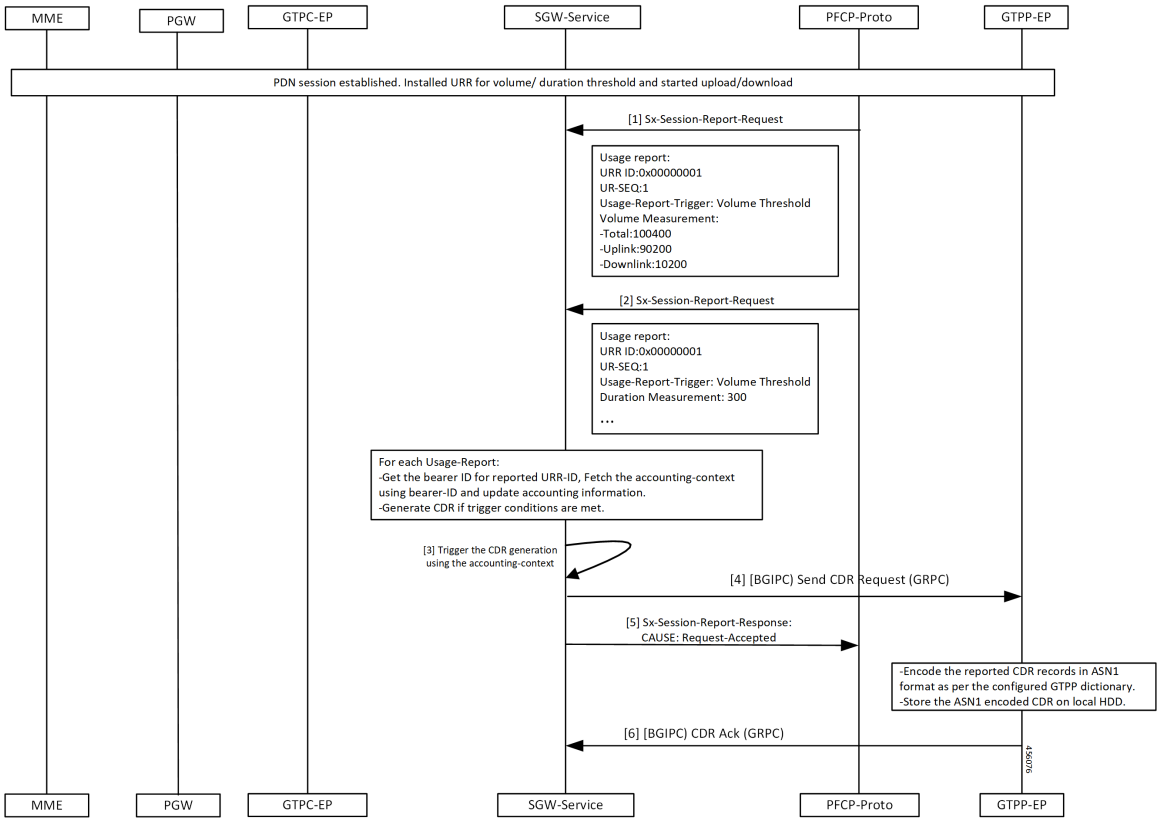


Table 6: Usage Report on Hitting Threshold Call Flow Description

Step	Description
1	Established a PDN session. Installed URR for the threshold duration. Trigger upload and download. The PFCP proto sends the Sx Session Report Request to the SGW-service pod.
2	The PFCP proto sends the Sx Session Report Request to the SGW-service pod until it reaches the threshold value of the User-plane.
3	The SGW-service pod triggers the CDR generation.
4	The SGW-service pod sends the CDR request to the GTPP-EP.
5	The SGW-service pod sends the Sx Session Report Response to the PFCP proto with the cause as Request-Accepted.
6	The GTPP-EP sends the CDR ACK to the SGW-service pod.

URR Installation for Dedicated Bearer Call Flow

This section describes the URR Installation for Dedicated Bearer call flow.

Figure 5: URR Installation for Dedicated Bearer Call Flow

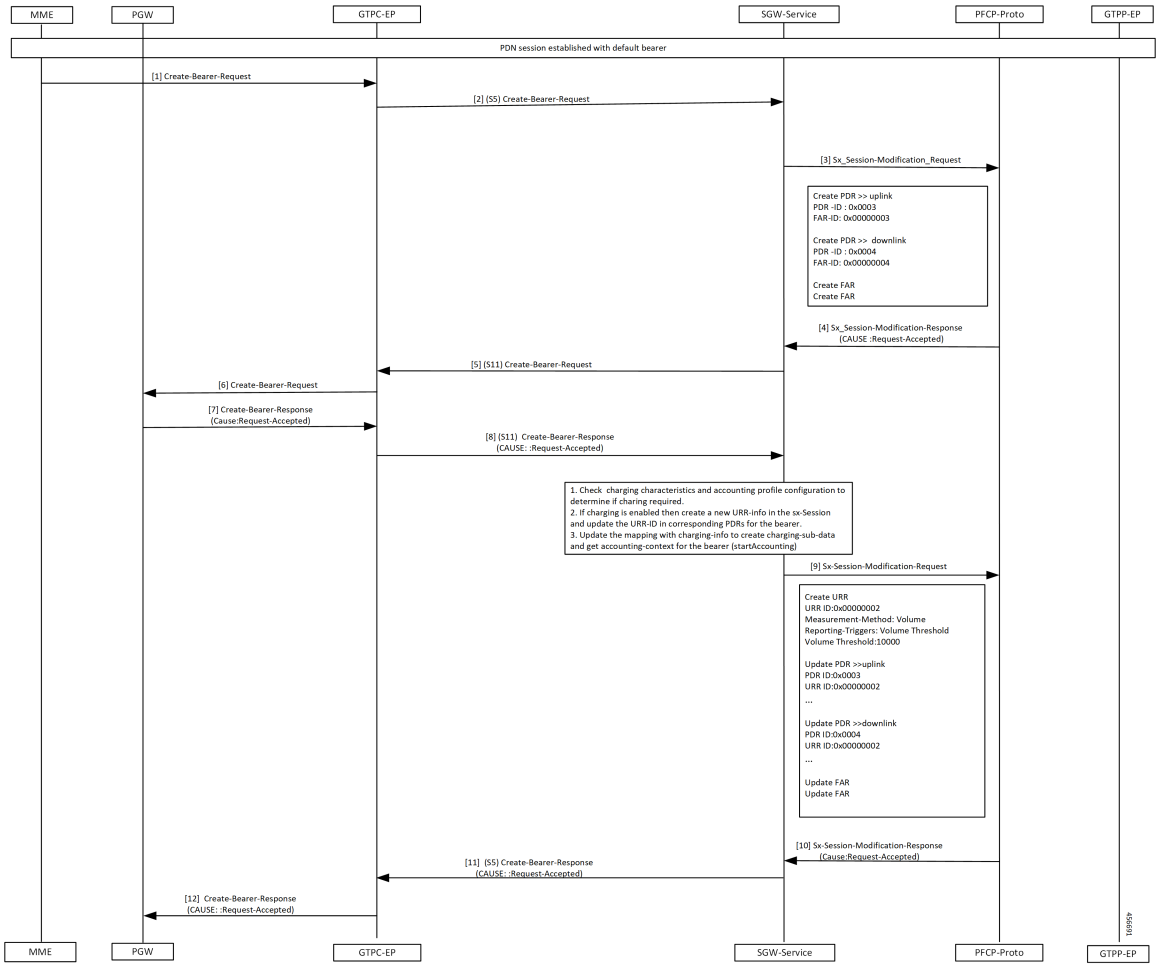


Table 7: URR Installation for Dedicated Bearer Call Flow Description

Step	Description
1	Established a PDN session with a default bearer. The PGW sends the Create Bearer Request to the GTPC-EP.
2	The GTPC-EP forwards the S5 Create Bearer Request to the SGW-service pod.
3	The SGW-service pod sends the Sx Session Modification Request to the PFCP proto.
4	The PFCP proto sends the Sx Session Modification Response to the SGW-service pod with the cause as Request-Accepted.
5	The SGW-service pod sends the S11 Create Bearer Request to the GTPC-EP.

Step	Description
6	The GTPC-EP forwards the S11 Create Bearer Request to the MME.
7	The GTPC-EP receives the Create Bearer Response to the GTPC-EP with the cause as Request-Accepted.
8	The GTPC-EP forwards the S11 Create Bearer Response to the SGW service with the cause as Request-Accepted.
9	The SGW-service pod sends the Sx Session Modification Request to the PFCP proto.
10,	The PFCP proto sends the Sx Session Modification Response to the SGW-service pod with the cause as Request-Accepted.
11	The SGW-service pod sends the S5 Create Bearer Response to the GTPC-EP with the cause as Request-Accepted.
12	The GTPC-EP sends the Create Bearer Response to the PGW with the cause as Request-Accepted.

URR Removal and CDR Generation on Deletion of Dedicated Bearer Call Flow

This section describes the URR Removal and CDR Generation on Deletion of Dedicated Bearer call flow.

Figure 6: URR Removal and CDR Generation on Deletion of Dedicated Bearer Call Flow

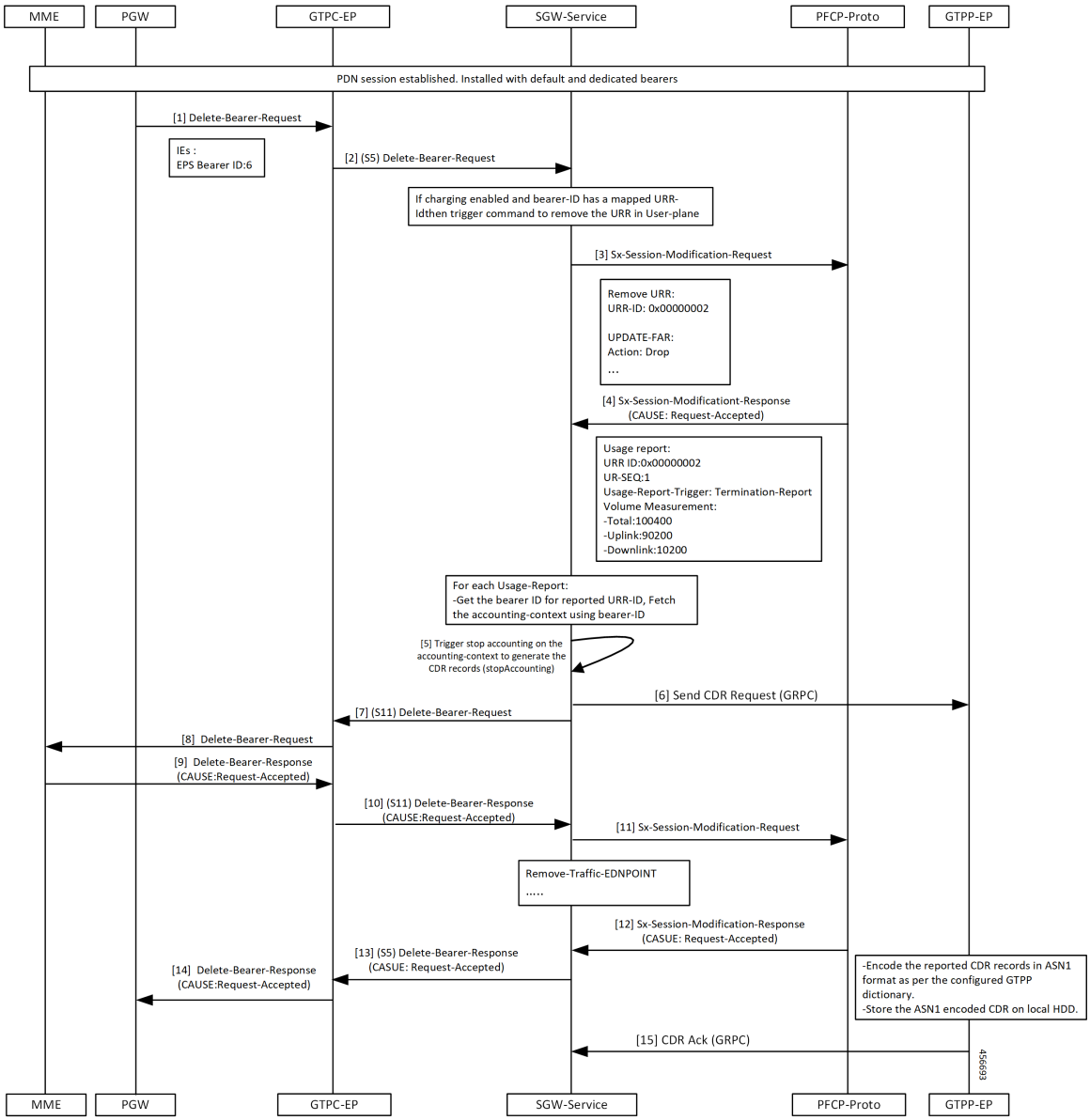


Table 8: URR Removal and CDR Generation on Deletion of Dedicated Bearer Call Flow Description

Step	Description
1	Established a PDN session with the default and dedicated bearer. The PGW sends the Delete Bearer Request to the GTPC-EP.
2	The GTPC-EP forwards the S5 Delete Bearer Request to the SGW-service pod.

Step	Description
3	The SGW-service pod requests a usage report query when charging enabled with QoS trigger and QoS change detected. The SGW-service pod sends the Sx Session Modification Request to the PFCP-Proto.
4	The PFCP proto sends the Sx Session Modification Response to the SGW-service pod with the cause as Request-Accepted.
5	The SGW-service pod triggers the CDR generation and sends CDR request to the GTPP-EP.
6	The SGW-service pod sends the S5 Sx Modify Bearer Request to the GTPP-EP.
7	The SGW-service pod sends the S11 Delete Bearer Request to the GTPC-EP.
8	The GTPC-EP forwards the Delete Bearer Request to the MME.
9	The GTPC-EP receives the Delete Barer Response from the MME with the cause as Request-Accepted.
10	The GTPC-EP forwards the S11 Delete Bearer Response to the SGW-service pod with the cause as Request-Accepted.
11	The SGW-service pod sends the Sx Session Modification Request to the PFCP proto.
12	The SGW-service pod receives the Sx Session Modification Response from the PFCP proto with the cause as Request-Accepted.
13	The SGW-service pod sends the S5 Delete Bearer Response to the GTPC-EP with the cause as Request-Accepted.
14	The GTPC-EP sends the Delete Bearer Response to the PGW with the cause as Request-Accepted.
15	The PFCP proto sends the CDR ACK to the SGW-service pod.

Volume Reporting on S11 Trigger Call Flow

This section describes Volume Reporting on S11 Trigger call flow.

Figure 7: Volume Reporting on S11 Trigger Call Flow

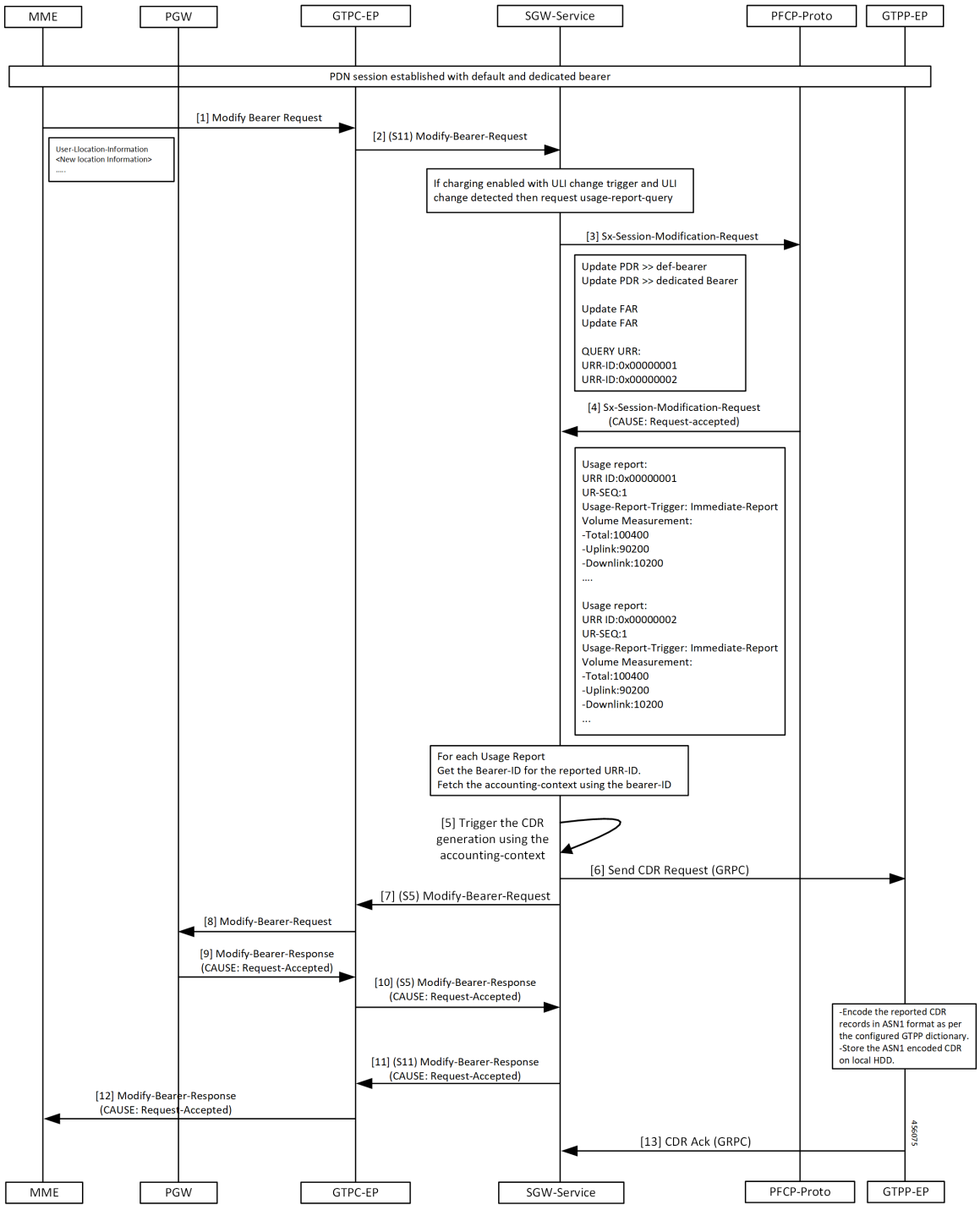


Table 9: Volume Reporting on S11 Trigger Call Flow Description

Step	Description
1	Established a PDN session with the default and dedicated bearers. The MME sends Modify Bearer Request to the GTPC-EP.
2	The GTPC-EP forwards the S11 Modify Bearer Request to the SGW-service pod.
3	The SGW-service pod requests the usage report query when charging enabled with QoS trigger and QoS change detected. The SGW-service pod sends the Sx session Modification Request to the PFCP proto.
4	The PFCP proto sends the Sx Session Modification Response to the SGW-service pod with the cause as Request-Accepted.
5	The SGW-service pod triggers the CDR generation.
6	The SGW-service pod sends the generated CDR request to the GTPP-EP.
7	The SGW-service pod sends the S5 Sx Modify Bearer Request to the GTPC-EP.
8	The GTPC-EP sends the Modify Bearer Request to the PGW.
9	The GTPC-EP receives the Modify Bearer Response from the PGW with the cause as Request-Accepted.
10	The GTPC-EP forwards the S5 Modify Bearer Response to the SGW-service pod with the cause as Request-Accepted.
11	The SGW-service pod sends the S11 Modify Bearer Response to the PGW with the cause as Request-Accepted.
12	The GTPC-EP sends the Modify Bearer Response to the MME with the cause as Request-Accepted.
13	The GTPP-EP sends the CDR ACK to the SGW-service pod.

Volume Reporting on S5 Trigger Call Flow

This section describes the Volume Reporting on S5 Trigger call flow.

Figure 8: Volume Reporting on S5 Trigger Call Flow

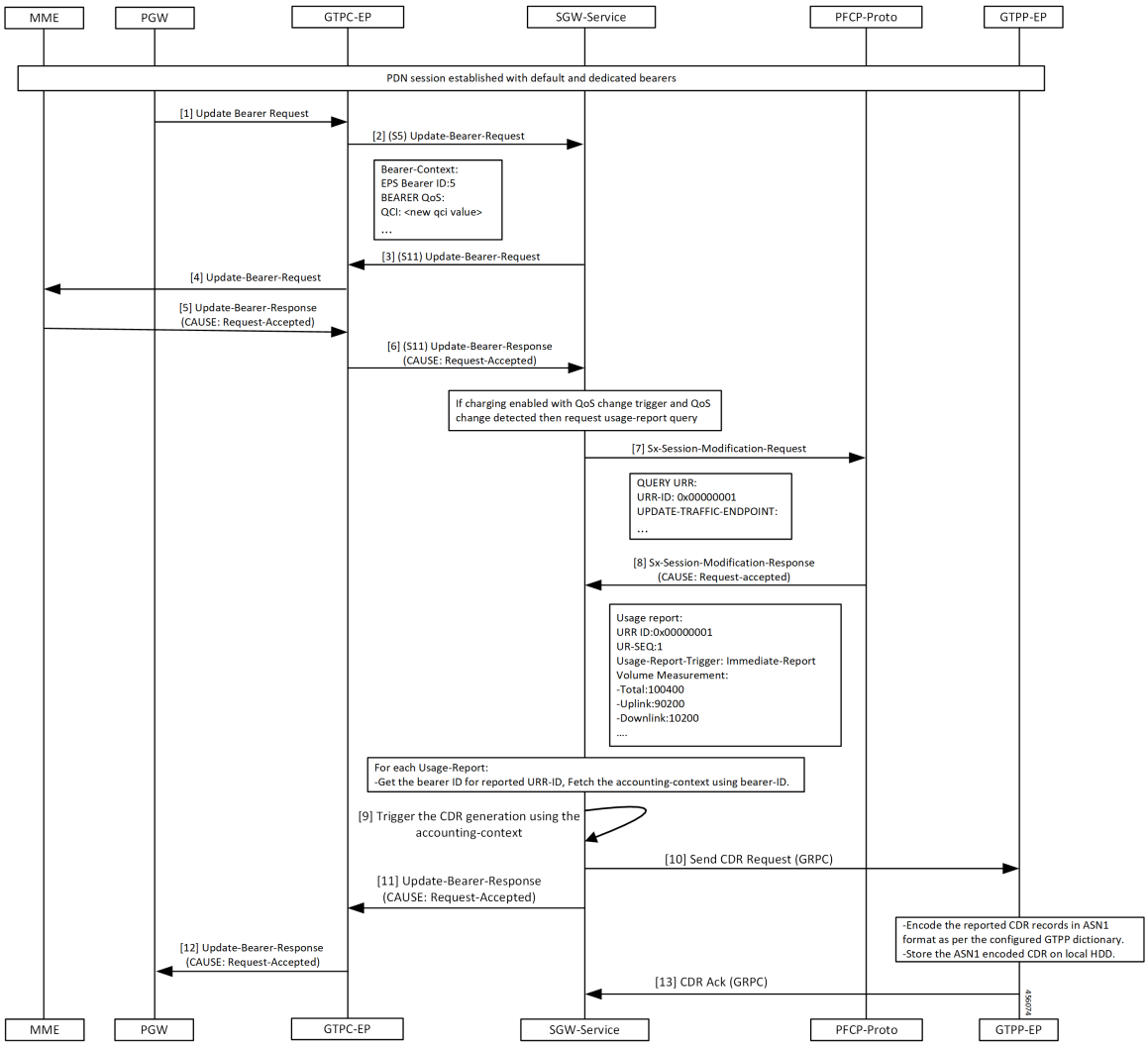


Table 10: Volume Reporting on S5 Trigger Call Flow Description

Step	Description
1	Established a PDN session with the default and dedicated bearers. The PGW sends the Update Bearer Request to the GTPC-EP.
2	The GTPC-EP forwards S5 Update Bearer Request to the SGW-service pod.
3	The SGW sends the Update Bearer request S11 to the GTPC-EP.
4	The GTPC-EP forwards the Update Bearer request to the MME.
5	The MME sends the Update Bearer Response to the GTPC-EP with the cause as Request-Accepted.

Step	Description
6	The GTPC-EP sends the S11 Update Bearer Response to the SGW-service pod with the cause as Request-Accepted.
7	The SGW-service pod requests the Usage report query when charging enabled with QoS trigger and QoS Change detected. The SGW-service pod sends the Sx Session Modification Request to the PFCP proto.
8	The SGW-service pod receives the Sx Session Modification Response from the PFCP proto with the cause as Request-Accepted.
9	The SGW-service pod triggers the CDR generation.
10	The SGW-service pod sends the CDR report to the GTPP-EP.
11	The GTPC-EP receives the Update Bearer response from the SGW-service pod with the cause as Request-Accepted.
12	The PGW forwards the S5 the Update Bearer response from the GTPC-EP with the cause as Request-Accepted.
13	The GTPP-EP sends the CDR ACK to the SGW-service pod.

Standards Compliance

The SGW Charging support complies with the following 3GPP standards:

- *3GPP TS 32.251 "Telecommunication management;Charging management;Packet Switched (PS) domain charging"*
- *3GPP TS 32.295 "Telecommunication management; Charging management; Charging Data Record (CDR) transfer"*
- *3GPP TS 32.297 "Telecommunication management; Charging management; Charging Data Record (CDR) file format and transfer"*
- *3GPP TS 32.298 "Telecommunication management; Charging management; Charging Data Record (CDR) parameter description"*

Limitations

This feature has the following limitations in this release:

- In 2021.02.0 release, cnSGW-C supports the following:
  - Enable or Disable of anp-mbr and node-id-prefix CDR attributes. Other cnSGW-C CDR attributes are enabled by default
  - Only encrypted-url configuration while performing push operation to a remote SFTP server
- In 2021.02.0 release, cnSGW-C does not support the following:

- Monitor protocol doesn't support CDR
- Served PDP or PDN Address Extension CDR attribute for the dual stack (IPv4v6) calls
- Behavior bit. Default value is zero
- Compression of CDR files
- Purging of CDR files using user provided regex

- For cnSGW-C Charging Profile dynamic configuration:
  - You cannot remove the Charging Profile configuration dynamically. Before removing the Charging Profile configuration, the existing subscriber must be cleared.

Feature Configuration

Configuring this feature involves the following steps:

- CLI Configuration-This configuration provides commands to configure cnSGW-C charging profile, mode, threshold, and its characteristics. For more information, refer to CLI Configuration, on page 19.
- Show CLI-This configuration provides the commands to display the SFTP push CLI. For more information, refer to Show CLI, on page 30.

CLI Configuration

cnSGW-C charging CLI configuration involves the following steps:

- Charging Profile or GTP Prime-This configuration provides commands to configure cnSGW-C GTPP profile. For more information, refer to Configuring the cnSGW-C Charging Profile or GTP Prime, on page 20.
- Charging Mode-This configuration provides commands to configure the cnSGW-C charging mode. For more information, refer to Configuring the Charging Mode, on page 25.
- Charging Threshold-This configuration provides commands to configure the cnSGW-C charging threshold. For more information, refer to Configuring the cnSGW-C Charging Threshold, on page 25.
- Charging Threshold and Charging Profile Association-This configuration provides commands to configure cnSGW-C charging threshold and cnSGW-C charging profile association. For more information, refer to Configuring cnSGW-C Charging Threshold and cnSGW-C Charging Profile Association, on page 27.
- Call Control Profile-This configuration provides commands to configure cnSGW-Ccall control profile. For more information, refer to Configuring Call Control Profile, on page 28.
- Charging Characteristics Under Call Control Profile-This configuration provides commands to configure cnSGW-C charging characteristics under call control profile. For more information, refer to Configuring Charging Characteristics Under Call Control Profile, on page 29.

Configuring the cnSGW-C Charging Profile or GTP Prime

Note

- cnSGW-C charging supports multiple replicas of GTP Prime.
- cnSGW-C switches from primary storage server to secondary storage server on four consecutive failures with the primary storage server. It switches back to primary storage server on four consecutive failures to secondary storage server or after 30 minutes of switchover from primary storage server to secondary storage server whichever is earlier.
- When CDR file storage reaches beyond 95% of its allocated size, then old CDR files are deleted.

Configuring cnSGW-C charging profile or GTP prime involves the following steps:

- GTPP profile-This configuration provides commands to configure cnSGW-C GTPP profile. For more information, refer to Configuring the GTPP Profile, on page 20.
- Existing endpoint-related CLI-This configuration provides commands to configure cnSGW-C existing endpoint-related CLI. For more information, refer to Configuring the GTPP Endpoint, on page 23.
- SGW charging profile--This configuration provides commands to configure cnSGW-C GTPP profile. For more information, refer to Configuring SGW Charging Profile, on page 23.

Configuring the GTPP Profile

You can configure server details, dictionary, timeout, and so on, to use by the GTPP-EP pod.

To configure the GTPP profile, use the following configuration:

```
config
  profile gtpp-profile profile_name gtpp
    local-storage
      file
        rotation
         volume volume_value
         cdr-count cdrcount_value
         time-interval interval_value
        exit
        name
         prefix prefix_value
         format format
         max-file-seq-num max_sequence_number
         start-file-seq-num start_sequence_number
         recover-file-seq-num { true | false }
        exit
        purge-processed-files purge-interval purgeinterval_value
       exit
       push
        encrypted-url url_name
        encrypted-secondary-url url_name
       exit
      exit
```

```
dictionary  custom_value
end
```

NOTES:

- **local-storage**—Local storage details.
- **file**—Specify the file details.
- **rotation**—Specify the file rotation details.
- **volume** *volume_value*—Specify the file volume in MiB for file rotation. Must be an integer in the range of 2-40. Default value is 4.
- **cdr-count** *cdrcount_value*—Specify the CDR count for file rotation. Must be an integer in the range of 1000-65000. Default value is 10000.
- **time-interval** *interval_value*—Specify the time interval in seconds for file rotation. Must be an integer in the range of 30-86400. Default value is 3600.
- **prefix** *prefix_value*—Specify the file name prefix to be used. If the prefix value isn't specified, the configuration takes default profile name.
- **format** *format*—Specify the file name format to be used to override the name format associated with the file format.
- **max-file-seq-num** *max_sequence_number*—Specify the maximum file sequence number to rollover. Default value is 4294967295.
- **start-file-seq-num** *start_sequence_number*—Specify the start sequence number during rollover. Default value is 1.
- **recover-file-seq-num { true | false }**—When set to true, file sequence number continues from the last sequence number on application restart. Default value is false.
- **purge-processed-files** —Enables periodic purging of processed files.
- **purge-processed-files purge-interval** *purgeinterval_value*—Specify the purging interval of processed files in minutes. Default value is 60.
- **encrypted-url**—Specify the primary SFTP URL to push CDR files to.
- **encrypted-secondary-url**—Specify the secondary SFTP URL to push when push fails on primary host.
- **dictionary** *custom_value*—Specify the dictionary to be used to ASN.1 encode a CDR.

Note

- The path in SFTP URL is by default a relative path to home directory of SFTP URL user specified in URL.

  Example: `encrypted-url sftp://user:pass@example.com:2020/upload/pf1`. It pushes files to `%USER_HOME/upload/pf1`

  Example: `encrypted-url sftp://user:pass@example.com:2020`. It pushes files to `%USER_HOME`

- To upload files to a folder outside the user's home directory, configure an absolute path by preceding the path with // at the beginning of the SFTP server path.

  Example: `encrypted-url sftp://user:pass@example.com:2020//var/opt`. It pushes the files to absolute path `/var/opt`

  SFTP user must have the write access to this path for the upload to be successful.

If password contains any special character outside the permissible URL character set, they must be percent coded as per the RFC 3986. For example, a URL with password `pass!word`, entered as `sftp://user:pass%21word@example.com/path/to/folder`

Configuration Example

The following is an example configuration.

```
config
   profile gtpp-profile pf1 gtpp
      local-storage
         file
            rotation
               volume   5
               cdr-count 1000
               time-interval 60
               exit
               name
                  prefix  NYPCF508
                  format  .%Y-%m-%d%H-%M-%S.%4Q
                  max-file-seq-num     4
                  start-file-seq-num   1
                  recover-file-seq-num false
                  exit
               purge-processed-files purge-interval 10
               exit
               push
                  encrypted-url sample.com sftp://user:pass@example.com//var/opt
                  encrypted-secondary-url sftp://user:pass@mirror.example.com//var/opt
                  exit
               exit
               dictionary custom24
               end
```

Configuring the GTPP Endpoint

Note

- GTPP-EP pod uses this configuration.
- GTPP-EP pod always ignores nodes configuration.
- When **k8s single-node** is set to **`false`**, it spawns two replicas of GTPP-EP pod in active or standby mode independent of replicas and nodes configuration.
- When **k8s single-node** is set to **`true`**, the configured replicas have its impact.
- When **k8s use-volume-claim** is set to **`true`**, endpoint GTP prime is used to set the storage size limit. Default value of storage size limit is one GB.
- When system is up and running, we can't change the storage size.

To configure GTPP endpoint, use the following commands:

```
config
 instance instance-id instance_id
   endpoint gtpprime
      replicas replicas_count
      nodes nodes_count
      storage storage_capacity
      end
```

NOTES:

- **replicas** *replicas_count*—Specify the number of replicas per node. Must be an integer.
- **nodes** *nodes_count*—This property is ignored. You may skip configuring it.
- **storage** *storage_capacity*—Specify the storage size of persistent volume in GB. Must be an integer in the range of 1-20.

Note CLI doesn't allow changing storage size while system is running. To change the storage size, bring the system down first.

Configuration Example

The following is an example configuration.

```
config
   instance instance-id 1
      endpoint gtpprime
         replicas 1
         storage  2
         end
```

Configuring SGW Charging Profile

This section describes how to configure SGW Charging profile.

You can configure the SGW charging profile for the following:

- Attribute details and adding them to the CDRs
- Different triggers in generating CDR

SGW service pod uses this configuration in cnSGW-C charging.

Use following commands to configure cnSGW-C charging profile.

```
config
  profile sgw-charging-profile profile_name
    gtpp-triggers
      volume-limit { enable | disable }
      time-limit { enable | disable }
      serving-node-change-limit { enable | disable }
      serving-node-plmn-change { enable | disable }
      uli-change { enable | disable }
      qos-change { enable | disable }
      ms-timezone-change { enable | disable }
    gtpp-attributes
      apn-ambr
        include-for-all-bearers
        include-for-default-bearer
        include-for-non-gbr-bearers
      node-id-suffix suffix_value
    gtpp-profile association_profile_name
    exit
```

Note The value of node-id-suffix is implementation-specific. However, it's recommended to give same value as prefix configured as a part of GTPP Profile.

NOTES:

- **apn-ambr**—Includes APN-AMBR value in CDR.
- **node-id-suffix** *suffix_value*—Specify the node ID suffix to include in NodeId field of CDR.
- **ms-timezone-change { enable | disable }**—Specify enable or disable the MS time zone change as a trigger for CDR generation. Default value is enable.
- **qos-change { enable | disable }**—Specify enable or disable the QoS change as a trigger for container addition to CDR. Default value is enable.
- **serving-node-change-limit { enable | disable }**—Specify enable or disable the serving node change (address) as a trigger for CDR generation. Default value is enable.
- **serving-node-plmn-change { enable | disable }**—Specify enable or disable the serving node PLMN change as a trigger for CDR generation.
- **time-limit { enable | disable }]**—Specify enable or disable the time limit breach as a trigger for CDR generation. Default value is enable.

- **uli-change { enable | disable }**—Specify enable or disable the ULI change as a trigger for container addition to CDR. Default value is enable.
- **volume-limit { enable | disable }**—Specify enable or disable the volume limit breach as a trigger for CDR generation. Default value is enable and that is included in NodeId field of CDR.

Configuration Example

The following is an example configuration.

```
config
   profile sgw-charging-profile ch1
      gtpp-triggers volume-limit enable
      gtpp-triggers time-limit  enable
      gtpp-triggers serving-node-change-limit disable
      gtpp-triggers uli-change  enable
      gtpp-triggers qos-change  disable
      gtpp-triggers ms-timezone-change disable
      gtpp-attributes apn-ambr include-for-all-bearers
      gtpp-attributes node-id-suffix test
      gtpp-profile pf1
      end
```

Configuring the Charging Mode

Charging mode configures the cnSGW-C service mode for accounting GTPP or none (default).

Note Enable offline charging when charging mode is set to GTPP.

To configure charging mode, use the following configuration:

```
config
  profile sgw sgw_srv_name
     charging-mode { gtpp | none }
     sgw-charging-threshold sgw_threshold_name
     sgw-charging-profile  sgw_charging-profile_name
     end
```

NOTES:

- **charging-mode { gtpp | none }**—Specify cnSGW-C charging mode.
- **sgw-charging-threshold** *sgw_threshold_name*—Specify the name of associated cnSGW-C charging threshold
- **sgw-charging-profile** *sgw_charging-profile_name*—Specify the name of associated cnSGW-C charging profile

Configuring the cnSGW-C Charging Threshold

cnSGW-C charging threshold configuration helps in configuring the thresholds or limits corresponding to volume or duration or buckets per CC (charging-characteristics).

Configuration of cnSGW-c charging threshold can be done in two ways.

Method - 1

```
config
   profile sgw-charging-threshold threshold_name
      cc profile value cc_profile_value
         volume total total_value
         buckets buckets_value
         duration duration_value
         end
```

Method - 2

```
config
   profile sgw-charging-threshold threshold_name
      cc profile value cc_profile_value
         volume
            total total_value
            uplink uplink_value
            downlink downlink_value
         volume total
         buckets buckets_value
         serving-node-changesnode_changes_value
         duration duration_value
         end
```

NOTES:

- **buckets** *buckets_value*—Specify the number of traffic volume container changes due to QoS change or other triggers before an accounting record must be closed. It ranges 1–20 and the default value is 4.
- **duration** *duration_value*—Specify the normal time duration that must elapse before closing an accounting record.
- **volume total**—Specify the CC volume details.

Configuration Example

The following is an example configuration:

```
config
   profile sgw-charging-threshold thre1
      cc profile value 1
         volume total 100000
         buckets  1
         duration 60
         end

config
   profile sgw-charging-threshold thre1
      cc profile value 2
         volume uplink 100000
         volume downlink 100000
         buckets  1
         serving-node-changes 4
         duration 120
         end
```

Note When **gtpp-triggers serving-node-change-limit** is enabled and **serving-node-changes** configured under SGW charging threshold, CDR gets generated after 4 times serving node changes (MME).

Configuring cnSGW-C Charging Threshold and cnSGW-C Charging Profile Association

This section describes how to configure the SGW Charging Threshold and SGW Charging profile association.

This configuration associate **sgw-charging-threshold** and **sgw-charging-profiles** to the SGW profile.

Configuration of cnSGW-c charging threshold and cnSGW-c charging profile association can be done in two ways.

Method - 1

To configure cnSGW-c charging threshold and cnSGW-c charging profile association, use the following commands.

```
config
  profile sgw sgw_srv_name
    locality location_code
    fqdn dnn_name
    plmn-id
      mcc mcc_value
      mnc mnc_value
    charging-mode { gtpp | none }
    sgw-charging-profile value
    sgw-charging-threshold limit_name
    end
```

Method - 2

Use the following commands to configure SGW Charging Threshold and SGW Charging Profile association.

```
config
  profile sgw sgw_srv_name
    sgw-charging-threshold threshold_value
    locality location_code
    fqdn dnn_name
    charging-mode mode_name
    subscriber-policy policy_name
    end
```

Configuration Example

The following is an example configuration.

```
config
   profile sgw sgw1
      locality LOC1
      fqdn 209.165.200.254
      allowed-nssai [ slice1 ]
      plmn-id mcc 123
      plmn-id mnc 456
      charging-mode gtpp
```

```
      sgw-charging-profile ch1
      sgw-charging-threshold limit1
      end
config
   profile sgw sgw1
      sgw-charging-threshold thre1
      locality  LOC1
      fqdn 209.165.200.254
      charging-mode none
      subscriber-policy polSub
      end
```

Configuring Call Control Profile

Call control profile configuration defines and applies the call handling rules through an operator policy.

The charging mode value from the call control profile overrides the configured value in cnSGW-C profile.

Note

- One call control profile is associated with one operator policy
- It's a standalone configuration

Configuring cnSGW-C call control profile involves the following steps:

- Call Control Profile Creation-This configuration provides commands to configure cnSGW-C call control profile Creation. For more information, refer to Configuring the Call Control Profile Creation, on page 28.
- Operator Policy Association-This configuration provides commands to configure cnSGW-operator policy association. For more information, refer to Configuring the Operator Policy Association, on page 28.

Configuring the Call Control Profile Creation

To configure the call control profile creation, use the following configuration:

```
config
   policy call-control-profile call_control_profile_name
      charging-mode sgw_charging_mode
      sgw-charging-profile assocaited_sgw_charging_profile
      end
```

Configuration Example

The following is an example configuration.

```
config
   policy call-control-profile ccp1
      charging-mode gtpp
      sgw-charging-profile ch1
      end
```

Configuring the Operator Policy Association

To configure the operator policy association, use following configuration:

```
config
   policy operator operator_name
   policy dnn  dnn_policy_name
   policy network-capability network_name
   call-control-profile value
   end
```

Configuration Example

The following is an example configuration.

```
config
   policy operator opPol1
   policy dnn polDnn
   policy network-capability nc1
   call-control-profile ccp1
   end
```

Configuring Charging Characteristics Under Call Control Profile

You can define local values and select the source of charging characteristics for charging decisions.

To configure charging characteristics under call control profile, use the following configuration:

```
config
   policy call-control-profile  call_control_profile_name
      sgw-charging-profile charging_type
      charging-mode mode_type
      cc prefer preference_type
      cc local-value profile index_bit
      end
```

NOTES:

- **cc prefer local-value** and **cc prefer hlr-hss-value** are optional parameters.
- **cc prefer { hlr-hss-value | local-value }**—Specify a preference to use in charging characteristics from the following:
  - When received from HLR or HSS through MME and preference set to hlr-hss.
  - When preference set to local-value. See the following CLI:

    ```
    cc prefer local-value
    cc local-value profile index-bit
    ```

- **cc local-value profile** —Specify the local-value parameter information as follows:
  - index_bit default value is 8
  - Sets the local value of the profile index for the charging characteristics, when the charging characteristics(CC) prefer value is set to local-value

Configuration Example

The following is an example configuration.

```
config
   policy call-control-profile CCP
```

```
      sgw-charging-profile test
      charging-mode gtpp
      cc prefer local-value
      cc local-value profile 4
      end
```

```
config
   policy call-control-profile CCP1
      sgw-charging-profile test
      charging-mode gtpp
      cc prefer hlr-hss-value
      end
```

Note Use the system default configured value as 8 otherwise use the value which comes in CSR.

```
config
   policy call-control-profile CCP2
      sgw-charging-profile test
      charging-mode gtpp
      cc prefer local-value
      end
```

Note Default value for cc profile is 8.

Show CLI

GTPP-EP SFTP Push CLI

- **show gtpp-ep endpoints**: Displays the list of running GTPP-EP pods and their corresponding IPs
- **show gtpp-ep files endpoint** *pod-name* **profile** *gtpp-profile_name*: Displays the archived files on specific GTPP-EP pod for the given gtpp
- **cdr push endpoint** *pod-name* **profile** *gtpp-profile* **filename** *file-to-be-uploaded*: Pushes the available file to archive folder on specific GTPP-EP pod for given GTPP profile.

CDR Fields Supported in cnSGW-CDRs

The tables in this section list the cnSGW-CDR fields present in the available dictionaries.

custom24 Dictionary

Table 11: custom24 Dictionary Description

Field Name	Tag Number	Category	Description
Record Type	0	M	SGW IP-CAN bearer record.

Field Name	Tag Number	Category	Description
Served IMSI	3	M	IMSI of the served party.
S-GW Address	4	M	The control plane IP address of the SGW used.
S-GW BINARY IPV4 ADDRESS	4-0	M	The octet string includes the Gn address of the GGSN service i binary coding.
S-GW BINARY IPV6 ADDRESS	4-0	M	The octet string included in the field described includes the Gn address of the GGSN service in binary coding.
Charging ID	5	M	IP-CAN bearer identifier. To identify IP-CAN bearers created b PCNs in different records
List of Serving Node Address	6	M	List of serving node control plane IP addresses (Example: SGS MME) used during this record.
Serving Node BINARY IPV4 ADDRESS	6-0	M	The octet string included in the field described above includes t IPv4 address of the MME.
Serving Node BINARY IPV6 ADDRESS	6-0	M	The octet string included in the Serving node binary IPv4 addre field includes the IPV6 address of the MME.
Access point name network identifier	7	M	The logical name of the connected access point to the external pa data network (network identifier part of APN).
PDP/PDN Type	8	M	This field indicates PDN type (Example IPv4, IPv6 or IPv4v6).
Served PDP/PDN Address	9	M	IP address allocated for the PDP context or PDN connection, if available. IPv4 when PDN type is IPv4 or IPv6 when PDN type is IPv6 o IPv4v6.
PDP IP Address	9-0	M	This field contains the IP address for the PDP context.
PDP IPv4 Address	9-0-0	M	The octet string included in the PDP IP address field includes th SGW assigned IPv4 address to the subscriber in binary format.
PDP IPv6 Address	9-0-0	M	The octet string included in the PDP IP address field includes t IPv6 address assigned to the subscriber by the SGW in binary coc
Dynamic Address Flag	11	O	Indicates whether served PDP/PDN address is dynamic, which allocated during IP-CAN bearer activation, initial attach (E-UTR or over S2x) and UE requested PDN connectivity. This field is missing if address is static.

Field Name	Tag Number	Category	Description
List of Traffic Data Volumes	12	M	A list of changes in charging conditions for QCI, ARP pair, each change is time stamped. Charging conditions categorize traffic volumes, such as per tariff period. Initial and subsequently changed QoS and corresponding data values are also listed.
Change of charging condition	12-0	M	Each traffic volume container contains details of a charging condition. A new container is usually created for a QoS change and for tariff changes.
Data Volume GPRS Uplink	12-0-3	M	This field is a part of the ChangeOf CharCondition element in the List of Traffic Volumes. It includes the number of octets received in the uplink direction during the timeframe specified by the container. For each new container, the counter is reset and does not accumulate.
Data Volume GPRS Downlink	12-0-4	M	This field is a part of the ChangeOf CharCondition element in the List of Traffic Volumes. It includes the number of octets transmitted in the downlink direction during the timeframe specified by the container. For each new container, the counter is reset and does not accumulate.
Change Condition	12-0-5	M	This field is part of the ChangeOf CharCondition element in the List of Traffic Volumes. It defines the change in user plane to UE.
Change Time	12-0-6	M	This field is part of the ChangeOf CharCondition element in the List of Traffic Volumes. It provides the local time when a change condition (example: record closure) occurred and the container is closed.
User Location Information	12-0-8	O	This field contains the User Location Information.
EPC QoS Information	12-0-9	O	In case of IP-CAN bearer specific container, this field contains authorized QoS for the IP-CAN bearer. First container for each QCI/ARP pair includes this field. In the following containers this field is present if previous change condition is "QoS change". This field is applicable only in SGW-CDR.
CP CIoT EPS Optimisation Indicator	12-0-19	O	The cPCIo TEPSOptimisation Indicator field indicates whether Control Plane CIoT EPS optimisation is used for the transfer of the data volume captured by the container. This is included in the Traffic data container only if previous container's change condition is "change in user plane to UE". Note, the CP CIoT EPS Optimisation indicator field in SGW-CDR main level contains the CP CIoT EPS optimisation indicator value when SGW-CDR was opened.

Field Name	Tag Number	Category	Description
QCI	12-9-1	M	—
Uplink MBR	12-9-2	O	—
Down link MBR	12-9-3	O	—
Uplink GBR	12-9-4	O	—
Down link GBR	12-9-5	O	—
arp	12-9-6	O	—
APN AMBR Uplink	12-9-7	O	—
APN AMBR Downlink	12-9-8	O	—
Extended Maximum Requested BW UL	12-9-9	O	—
Extended Maximum Requested BW DL	12-9-10	O	—
Extended GBR UL	12-9-11	O	—
extended GBRDL	12-9-12	0	—
Extended APN AMBR UL	12-9-13	O	—
Extended APN AMBR DL	12-9-14	O	—
Record Opening Time	13	M	Time stamp when IP-CAN bearer is activated in this S-GW or re opening time on subsequent partial records.
Duration	14	M	This field contains the duration in seconds for the record.
Cause for Record Closing	15	M	This field contains a reason for the closure of the CDR.
Diagnostics	16	O	This field is included in the CDR when the bearer context is rele and when the **gtpp attribute diagnostics** is configured.
gsm408cause	16-0	M	—
Record Sequence Number	17	O	Partial record sequence number, only present in case of partial rec
Node ID	18	O	Name of the recording entity.

Field Name	Tag Number	Category	Description
Record Extensions	19	O	A set of network operator or manufacturer specific extensions to the record. Conditioned when the extension is available.
Local Record Sequence Number	20	O	Consecutive record number created by this node. The number is allocated sequentially including all CDR types.
APN Selection Mode	21	M	An index indicating how the APN is selected.
Served MSISDN	22	M	The primary MSISDN of the subscriber.
Charging Characteristics	23	M	The charging characteristics that are applied to the IP-CAN bearer.
Charging Characteristics Selection Mode	24	O	Holds the information about how charging characteristics are selected
IMS Signaling Context	25	O	Included if the IM-CN Subsystem Signalling Flag is set, see [201] IP-CAN bearer is used for IMS signalling.
Serving Node PLMN Identifier	27	O	Serving node PLMN Identifier (MCC and MNC) used during this record, if available.
Served IMEISV	29	O	IMEISV of the ME, if available.
RAT Type	30	O	This field indicates the Radio Access Technology (RAT) type currently used by the Mobile Station, when available.
MS Time Zone	31	O	The Time Zone IE that the MME may provide to the SGW during the PDN context activation or modification procedure.
User Location Information	32	O	This field contains the user location information as described in TS 29.274 for eGTP case (Example: CGI, SAI, RAI TAI and ECGI). This field is provided by the SGSN or MME and transferred to the SGW or PGW during the IP-CAN bearer activation or modification
S-GW Change	34	O	This field is present only in the SGW-CDR to indicate that this is the first record after an SGW change. In this case, it is set to TRUE (FF)
Serving Node Type	35	M	These fields contain one or several serving node types in control plane of SGW or PGW, which is connected during the record. The serving node types listed here map to the serving node addresses listed in the field Serving node Address in sequence.
Serving Node Type enum	35-1	M	—
P-GW Address Used	36	M	This field is the PGW IP address for the control plane.

Field Name	Tag Number	Category	Description
P-GW Binary IPV4 Address	36-0	M	This field includes the PGW assigned IPv4 address to the subscr in binary format.
P-GW Binary IPV6 Address	36-0	M	This field includes the PGW assigned IPv6 address to the subscr in binary format.
P-GW PLMN Identifier	37	O	—
Start Time	38	O	This field holds the time when User IP-CAN session starts. It's available in the CDR for the first bearer in an IP-CAN session.
Stop Time	39	O	This field holds the time when User IP-CAN session is termina It's available in the CDR for the last bearer in an IP-CAN sessio
PDN Connection ID	40	O	This field holds the PDN connection (IP-CAN session) identifi identify different records belonging to same PDN connection.
iMSI unauthenticated Flag	41	O	This field indicates the provided served IMSI is not authenticat (emergency bearer service situation).
user CSG Information	42	O	This field contains the User CSG Information status of the user accessing a CSG cell. It comprises CSG ID within the PLMN, Ac mode and indication on CSG membership for the user when hy access applies, as defined in *TS 29.060* for GPRS case, and in *T 29.274* for EPC case.
cSGId	42-0	O	A CSG ID is a unique identifier within the scope of PLMN whi identifies a Closed Subscriber Group (CSG) in the PLMN associ with a CSG cell or group of CSG cells.
cSGAccess Mode	42-1	O	cSGAccessMode. It's either closed or hybrid.
cSG Membership Indication	42-2	O	This field provides an indication on CSG membership for the u
Served PDP PDN Address Extension	43	O	This field contains the IPv4 address for the PDN connection (P context, IP-CAN bearer) when dual-stack IPv4 IPv6 is used, and IPv6 adress is included in served PDP address or served PDP or address.
PDP IP Address	43-0	M	This field contains the IP address for the PDP context.
PDP IPV4 Address	43-0-0	M	This field includes the IPv4 address assigned to the subscriber SGW in binary coding.
lowAccess Priority Indicator	44	O	This field indicates if the PDN connection has a low priority, w is for machine type communication.

Field Name	Tag Number	Category	Description
dynamic Address FlagExt	47	O	This field indicates whether served IPv4 PDP or PDN address is dynamic, which is allocated during IP-CAN bearer activation, initia attach (E-UTRAN or over S2x) and UE requested PDN connectivity with PDP or PDN type IPv4v6. This field is missing if IPv4 addres is static.
s-GW iPv6 Address	48	O	The control plane IPv6 address, in case of IPv4v6 dual stack, of the S-GW.
SGW BINARY IPV6 ADDRESS	48-0	O	This field includes the Gn address of the GGSN service in binary format.
List of Serving Node IPv6Address	49	O	List of serving node control plane IPv6 addresses, in case of IPv4v6 dual stack, (Example: S4-SGSN, MME) used during this record.
Serving Node BINARY IPV6 ADDRESS	49-0	M	The octet string in this field includes the IPV6 address of the MME
p-GW iPv6 Address Used	50	O	This field is the PGW IPv6 Address, in case of IPv4v6 dual stack, for the control plane.
PGW BINARY IPV6 ADDRESS	50-0	O	The octet string in this field includes the IPV6 address assigned to the subscriber by of the P-GW in binary coding.
last User Location Information	55	O	Indicates the UE's last user location information during bearer deactivation or session release.
last MSTime Zone	56	O	Indicates the Latest timezone of UE while bearer deactivation or session release.
CP CIoT EPS Optimisation Indicator	59	O	This field indicates whether Control Plane CIoT EPS optimisation is used by the PDN connection during data transfer with the UE (tha is, Control Plane NAS PDU viaS11-U between S-GW and MME) o not (that is, User Plane via S1-U between S-GW and eNB).
UNI PDU CP Only Flag	60	O	The uNIPDUCP OnlyFlag field indicates whether this PDN connection is applied witl "Control Plane Only flag", that is, transferred using Control Plane NAS PDUs only, when Control Plane CIoT EPS Optimisation is enabled. This field is not flagged when both user plane and control plane UNI for PDU transfer (that is, S1-U and S11-U from S-GW) are allowed, when Control Plane CIoT EPS Optimisation is enabled
List of RAN Secondary RAT Usage Reports	64	OC	This field includes one or more containers reported from the RAN for a secondary RAT.
RAN Secondary RAT Usage Report	64-0	M	This field includes RAN reported containers for a secondary RAT.

Field Name	Tag Number	Category	Description
Data Volume Uplink	64-0-1	M	This field includes the number of octets transmitted during the u of the packet data services in the uplink direction reported from R The counting and reporting from RAN of uplink data volumes i optional.
Data Volume Downlink	64-0-2	M	This field includes the number of octets transmitted during the u of the packet data services in the downlink direction reported fr RAN. The counting and reporting from RAN of downlink data volumes is optional.
RAN Start Time	64-0-3	M	This field is a timestamp at which RAN opens the volume conta
RAN End Time	64-0-4	M	This field is a time stamp at which RAN closes the volume conta
Secondary RAT Type	64-0-5	OC	This field contains the RAT type for the secondary RAT.
UE Local IP Port Info	253	O	This field includes the S2b user local IP port information.
UE Local IP Address	253-0	O	This field includes the UWAN user IP address.
UDP Source Port	253-1	O	This field includes the UWAN user source port.

Note All IP addresses are encoded in binary format.

ASN.1 Definition for Fields in custom24

The following section provides the complete ASN.1 definition of all cnSGW-CDR related fields in the custom24 dictionary.

```
GPRS-SGW-Charging-DataTypes-REL8 DEFINITIONS IMPLICIT TAGS ::=
BEGIN

-------------------------------------------------------------------------------
--
--    GPRS RECORDS
--
-------------------------------------------------------------------------------

GPRSRecord::= CHOICE
--
-- Record values 20, 22..27 are specific
-- Record values 76..77 are MBMS specific
-- Record values 78..79 are EPC specific
{
    sGWRecord[78] SGWRecord
}

SGWRecord    ::= SET
{
    recordType                                  [0] RecordType,
    servedIMSI                                  [3] IMSI,
    s-GWAddress                                 [4] GSNAddress,
```

```
    chargingID                                  [5] ChargingID,
    servingNodeAddress                          [6] SEQUENCE OF GSNAddress,
    accessPointNameNI                           [7] AccessPointNameNI OPTIONAL,
    pdpPDNType                                  [8] PDPType OPTIONAL,
    servedPDPPDNAddress                         [9] PDPAddress OPTIONAL,
    dynamicAddressFlag                          [11] DynamicAddressFlag OPTIONAL,
    listOfTrafficVolumes                        [12] SEQUENCE OF ChangeOfCharCondition
OPTIONAL,
    recordOpeningTime                           [13] TimeStamp,
    duration                                    [14] CallDuration,
    causeForRecClosing                          [15] CauseForRecClosing,
    diagnostics                                 [16] Diagnostics OPTIONAL,
    recordSequenceNumber                        [17] INTEGER OPTIONAL,
    nodeID                                      [18] NodeID OPTIONAL,
    recordExtensions                            [19] ManagementExtensions OPTIONAL,
    localSequenceNumber                         [20] LocalSequenceNumber OPTIONAL,
    apnSelectionMode                            [21] APNSelectionMode OPTIONAL,
    servedMSISDN                                [22] MSISDN OPTIONAL,
    chargingCharacteristics                     [23] ChargingCharacteristics,
    chChSelectionMode                           [24] ChChSelectionMode OPTIONAL,
    iMSsignalingContext                         [25] NULL OPTIONAL,
    servingNodePLMNIdentifier                   [27] PLMN-Id OPTIONAL,
    servedIMEISV                                [29] IMEI OPTIONAL,
    rATType                                     [30] RATType OPTIONAL,
    mSTimeZone                                  [31] MSTimeZone OPTIONAL,
    userLocationInformation                     [32] OCTET STRING OPTIONAL,
    sGWChange                                   [34] SGWChange OPTIONAL,
    servingNodeType                             [35] SEQUENCE OF ServingNodeType,
    p-GWAddressUsed                             [36] GSNAddress OPTIONAL,
    p-GWPLMNIdentifier                          [37] PLMN-Id OPTIONAL,
    startTime                                   [38] TimeStamp OPTIONAL,
    stopTime                                    [39] TimeStamp OPTIONAL,
    pDNConnectionID                             [40] ChargingID OPTIONAL,
    servedPDPPDNAddressExt                      [43] PDPAddress OPTIONAL,
    lowAccessPriorityIndicator                  [44] NULL OPTIONAL,
    dynamicAddressFlagExt                       [47] DynamicAddressFlag OPTIONAL,
    s-GWiPv6Address                             [48] GSNAddress OPTIONAL,
    servingNodeiPv6Address                      [49] SEQUENCE OF GSNAddress OPTIONAL,
    p-GWiPv6AddressUsed                         [50] GSNAddress OPTIONAL,
    lastUserLocationInformation                 [55] OCTET STRING OPTIONAL,
    lastMSTimeZone                              [56] MSTimeZone OPTIONAL,
    cPCIoTEPSOptimisationIndicator              [59] BOOLEAN OPTIONAL,
    uNIPDUCPOnlyFlag                            [60] BOOLEAN OPTIONAL,
    listOfRANSecondaryRATUsageReports           [64] SEQUENCE OF RANSecondaryRATUsageReport
 OPTIONAL,
    uELocalIPAddressPort                       [253] SEQUENCE OF UELocalIPPortInfo OPTIONAL

}

AccessPointNameNI::= IA5String (SIZE(1..63))
 --
 -- Network Identifier part of APN in dot representation.
 -- For example, if the complete APN is 'apn1a.apn1b.apn1c.mnc022.mcc111.gprs'
 -- NI is 'apn1a.apn1b.apn1c' and is presented in this form in the CDR.

APNSelectionMode::= ENUMERATED
{
 --
 -- See Information Elements TS 29.060, TS 29.274    or TS 29.275
 --
     mSorNetworkProvidedSubscriptionVerified    (0),
     mSProvidedSubscriptionNotVerified          (1),
     networkProvidedSubscriptionNotVerified     (2)
}
```

```
CallDuration::= INTEGER
                --
                -- The call duration is counted in seconds.
                -- For successful calls /sessions / PDP contexts, this is the chargeable
duration.
                -- For call attempts this is the call holding time.
                --


CauseForRecClosing ::= INTEGER
{
 --
 -- In PGW-CDR and SGW-CDR the value servingNodeChange is used for partial record
 -- generation due to Serving Node Address list Overflow
 -- In SGSN servingNodeChange indicates the SGSN change
 --
 -- LCS related causes belong to the MAP error causes acc. TS 29.002
 --
 -- cause codes 0 to 15 are defined 'CauseForTerm' (cause for termination)
 -- All cause values are not relevent to SGW. Refer the spec to find out the
          -- cause values for SGW.
     normalRelease                           (0),
     abnormalRelease                         (4),
     cAMELInitCallRelease                    (5),
     volumeLimit                             (16),
     timeLimit                               (17),
     servingNodeChange                       (18),
     maxChangeCond                           (19),
     managementIntervention                  (20),
     intraSGSNIntersystemChange              (21),
     rATChange                               (22),
     mSTimeZoneChange                        (23),
     sGSNPLMNIDChange                        (24),
     unauthorizedRequestingNetwork           (52),
     unauthorizedLCSClient                   (53),
     positionMethodFailure                   (54),
     unknownOrUnreachableLCSClient           (58),
     listofDownstreamNodeChange              (59)
}


ChangeCondition ::= ENUMERATED
{
     qoSChange                              (0),
     tariffTime                             (1),
     recordClosure                          (2),
     cGI-SAICHange                          (6),    -- bearer modification. CGI-SAI Change
     rAIChange                              (7),    -- bearer modification. RAI Change
     dT-Establishment                       (8),
     dT-Removal                             (9),
     eCGIChange                             (10),    -- bearer modification. ECGI Change
     tAIChange                              (11),    -- bearer modification. TAI Change
     apnAmbrChange                          (50)     -- apn-ambr change

}


ChangeOfCharCondition ::= SEQUENCE
{
        --
        -- qosRequested and qosNegotiated are used in S-CDR only
        -- ePCQoSInformation used in SGW-CDR,PGW-CDR, IPE-CDR, TWAG-CDR and ePDG-CDR only
        -- userLocationInformation is used only in S-CDR, SGW-CDR and PGW-CDR
```

```
        -- chargingID used in PGW-CDR only when Charging per IP-CAN session is active
        -- accessAvailabilityChangeReason and relatedChangeOfCharCondition applicable only
 in PGW-CDR
        -- cPCIoTOptimisationIndicator is used in SGW-CDR only
        --
        qosRequested                    [1] QoSInformation OPTIONAL,
        qosNegotiated                   [2] QoSInformation OPTIONAL,
        dataVolumeGPRSUplink            [3] DataVolumeGPRS OPTIONAL,
        dataVolumeGPRSDownlink          [4] DataVolumeGPRS OPTIONAL,
        changeCondition                 [5] ChangeCondition,
        changeTime                      [6] TimeStamp,
        userLocationInformation         [8] OCTET STRING OPTIONAL,
        ePCQoSInformation               [9] EPCQoSInformation OPTIONAL,
        chargingID                      [10] ChargingID OPTIONAL,
        userCSGInformation              [12] UserCSGInformation OPTIONAL,
        diagnostics                     [13] Diagnostics OPTIONAL,
        rATType                         [15] RATType OPTIONAL,
        uWANUserLocationInformation     [17] UWANUserLocationInfo OPTIONAL,
        cPCIoTEPSOptimisationIndicator [19] CPCIoTEPSOptimisationIndicator OPTIONAL


}

ChargingCharacteristics ::= OCTET STRING (SIZE(2))


ChargingID ::= INTEGER (0..4294967295)
 --
 -- Generated in P-GW, part of IP CAN bearer
 -- 0..4294967295 is equivalent to 0..2**32-1
 --

ChChSelectionMode    ::= ENUMERATED
{
     servingNodeSupplied        (0), -- For S-GW/P-GW
     subscriptionSpecific       (1), -- For SGSN only
     aPNSpecific                (2), -- For SGSN only
     homeDefault                (3), -- For SGSN, S-GW and P-GW
     roamingDefault             (4), -- For SGSN, S-GW and P-GW
     visitingDefault            (5) -- For SGSN, S-GW and P-GW
}

DataVolumeGPRS ::= INTEGER
 --
 -- The volume of data transferred in octets.
 --

DynamicAddressFlag ::= BOOLEAN


EPCQoSInformation ::= SEQUENCE
{
     --
     -- See TS 29.212 for more information
     --
     qCI                            [1] INTEGER,
     maxRequestedBandwithUL         [2] INTEGER OPTIONAL,
     maxRequestedBandwithDL         [3] INTEGER OPTIONAL,
     guaranteedBitrateUL            [4] INTEGER OPTIONAL,
     guaranteedBitrateDL            [5] INTEGER OPTIONAL,
     aRP                            [6] INTEGER OPTIONAL,
     apnAmbrUplink                  [7] INTEGER OPTIONAL,
     apnAmbrDownlink                [8] INTEGER OPTIONAL,
     extendedMaxRequestedBWUL       [9] INTEGER OPTIONAL,
```

```
     extendedMaxRequestedBWDL       [10] INTEGER OPTIONAL,
     extendedGBRUL                  [11] INTEGER OPTIONAL,
     extendedGBRDL                  [12] INTEGER OPTIONAL,
     extendedAPNAMBRUL              [13] INTEGER OPTIONAL ,
     extendedAPNAMBRDL              [14] INTEGER OPTIONAL
}

ETSIAddress::= AddressString
 --
 -- First octet for nature of address, and numbering plan indicator (3 for X.121)
 -- Other octets TBCD
 -- See TS 29.002
 --

GSNAddress::= IPAddress


MSNetworkCapability ::= OCTET STRING (SIZE(1..8))
 -- see TS 24.008

NetworkInitiatedPDPContext ::= BOOLEAN
 --
 -- Set to true if PDP context was initiated from network side
 --

NodeID ::= IA5String (SIZE(1..20))

NumberOfDPEncountered    ::= INTEGER


PDPAddress ::= CHOICE
{
     iPAddress         [0] IPAddress,
     eTSIAddress     [1] ETSIAddress
}

PDPType    ::= OCTET STRING (SIZE(2))
 --
 -- OCTET 1: PDP Type Organization
 -- OCTET 2: PDP Type Number
 -- See TS 29.060 for GTP, TS 29.274 for eGTP and TS 29.275 for PMIP
 --

PLMN-Id    ::= OCTET STRING (SIZE (3))
 --
 -- This is a 1:1 copy from the Routing Area Identity (RAI) IE specified in TS 29.060
 --            as follows:
 -- OCTET 1 of PLMN-Id = OCTET 2 of RAI
 -- OCTET 2 of PLMN-Id = OCTET 3 of RAI
 -- OCTET 3 of PLMN-Id = OCTET 4 of RAI
 --

QoSInformation ::= OCTET STRING (SIZE (4..255))
 --
 -- This    octet string
 -- is a 1:1 copy of the contents (i.e. starting with octet 5) of the "Bearer Quality of
 -- Service" information element specified in TS 29.274
 --

RANSecondaryRATUsageReport ::= SEQUENCE
                -- ]
{
                dataVolumeUplink              [1] DataVolumeGPRS,
                dataVolumeDownlink            [2] DataVolumeGPRS,
```

```
                rANStartTime                    [3] TimeStamp,
                rANEndTime                      [4] TimeStamp,
                secondaryRATType                [5] SecondaryRATType OPTIONAL
}

SecondaryRATType ::= INTEGER
{
                reserved (0),
                nR (1) -- New Radio 5G
}

RATType ::= INTEGER (0..255)
 --
 -- This integer is 1:1 copy of the RAT type value as defined in TS 29.060 for GTP,
 -- TS 29.274 for eGTP and TS 29.275 for PMIP.
 --

UWANUserLocationInfo ::= SEQUENCE
{
     uELocalIPAddress    [0] IPAddress,
     uDPSourcePort       [1] OCTET STRING (SIZE(2)) OPTIONAL,
    sSID               [2] OCTET STRING OPTIONAL,     -- see format in IEEE Std 802.11-2012
 [408]
    bSSID              [3] OCTET STRING OPTIONAL      -- see format in IEEE Std 802.11-2012
 [408]
}

RecordType    ::= INTEGER
{
    -- Record values 0..17 are CS specific.
    -- The contents are defined in TS 32.250

    sGWRecord         (84)
}

ResultCode ::= INTEGER
 -- charging protocol return value, range of 4 byte (0...4294967259)
 -- see Result-Code AVP as used in 3GPP 32.299
 --


ServingNodeType ::= ENUMERATED
{
     sGSN                (0),
     pMIPSGW             (1),
     gTPSGW              (2),
     ePDG                (3),
     hSGW                (4),
     mME                 (5)
}

SGWChange ::= BOOLEAN
 --
 -- present if first record after inter S-GW change
 --

Diagnostics            ::= CHOICE
{
     gsm0408Cause                                    [0] INTEGER,
     -- See TS 24.008
     gsm0902MapErrorValue                    [1] INTEGER,
     -- Note: The value to be stored here corresponds to
     -- the local values defined in the MAP-Errors and
     -- MAP-DialogueInformation modules, for full details
```

```
     -- see TS 29.002
               itu-tQ767Cause                      [2] INTEGER,
     -- See ITU-T Q.767
               networkSpecificCause                [3] ManagementExtension,
     -- To be defined by network operator
               manufacturerSpecificCause     [4] ManagementExtension,
 -- To be defined by manufacturer
               positionMethodFailureCause [5] PositionMethodFailure-Diagnostic,
     -- see TS 29.002
               unauthorizedLCSClientCause [6] UnauthorizedLCSClient-Diagnostic
     -- see TS 29.002
}

IPAddress::= CHOICE
{
     iPBinaryAddress                         IPBinaryAddress,
     iPTextRepresentedAddress    IPTextRepresentedAddress
}

CPCIoTEPSOptimisationIndicator ::= BOOLEAN

IPBinaryAddress::= CHOICE
{
     iPBinV4Address     [0] OCTET STRING (SIZE(4)),
     iPBinV6Address     [1] OCTET STRING (SIZE(16))
}

IPTextRepresentedAddress::= CHOICE
{
 --
 -- IP address in the familiar "dot" notation
 --
     iPTextV4Address     [2] IA5String (SIZE(7..15)),
     iPTextV6Address     [3] IA5String (SIZE(15..45))
}

PositionMethodFailure-Diagnostic ::= ENUMERATED
{
                congestion                                              (0),
                insufficientResources                                   (1),
                insufficientMeasurementData                             (2),
                inconsistentMeasurementData                             (3),
                locationProcedureNotCompleted                           (4),
                locationProcedureNotSupportedByTargetMS                 (5),
                qoSNotAttainable                                        (6),
                positionMethodNotAvailableInNetwork                     (7),
                positionMethodNotAvailableInLocationArea                (8)
}

LocalSequenceNumber ::= INTEGER (0..4294967295)
 --
 -- Sequence number of the record in this node
 -- 0.. 4294967295 is equivalent to 0..2**32-1, unsigned integer in four octets


ManagementExtension ::= SEQUENCE
{
     identifier OBJECT IDENTIFIER,
     significance        [1]         BOOLEAN DEFAULT FALSE,
     information         [2]         ANY DEFINED BY identifier
}

ManagementExtensions ::= SET OF ManagementExtension
```

```
MSISDN::= ISDN-AddressString
                --
 -- See TS 23.003

MSTimeZone::= OCTET STRING (SIZE (2))
 --
 -- 1.Octet: Time Zone and 2. Octet: Daylight saving time, see TS 29.060


TimeStamp::= OCTET STRING (SIZE(9))
                --
                -- The contents of this field are a compact form of the UTCTime format
                -- containing local time plus an offset to universal time. Binary coded
                -- decimal encoding is employed for the digits to reduce the storage and
                -- transmission overhead
                -- e.g. YYMMDDhhmmssShhmm
                -- where
                -- YY     =            Year 00 to 99                    BCD encoded
                -- MM     =            Month 01 to 12                   BCD encoded
                -- DD     =            Day 01 to 31                       BCD encoded
                -- hh     =            hour 00 to 23                    BCD encoded
                -- mm     =            minute 00 to 59                BCD encoded
                -- ss     =            second 00 to 59                BCD encoded
                -- S      =            Sign 0 = "+", "-"             ASCII encoded
                -- hh     =            hour 00 to 23                    BCD encoded
                -- mm     =            minute 00 to 59                BCD encoded
                --

UELocalIPPortInfo   ::= SEQUENCE
{
    --
    -- The S2b user Local IP Port Information
    --
    uELocalIPAddress                            [0] IPAddress OPTIONAL,
    uDPSourcePort                               [1] INTEGER OPTIONAL
}

UELocalIPAddress::= IPAddress
UDPSourcePort           ::= INTEGER


UnauthorizedLCSClient-Diagnostic ::= ENUMERATED
{
                noAdditionalInformation                                         (0),
                clientNotInMSPrivacyExceptionList                               (1),
                callToClientNotSetup                                            (2),
                privacyOverrideNotApplicable                                    (3),
                disallowedByLocalRegulatoryRequirements                         (4),
                unauthorizedPrivacyClass                                        (5),
                unauthorizedCallSessionUnrelatedExternalClient                  (6),
                unauthorizedCallSessionRelatedExternalClient                    (7)
}

CSGAccessMode ::= ENUMERATED
{
                 closedMode  (0),
                 hybridMode  (1)
}
CSGId         ::= OCTET STRING (SIZE(4))
                --
                -- Defined in 23.003. Coded according to TS 29.060 for GTP, and in TS
29.274
                -- for eGTP.
                -- 24.008
```

```
                --
UserCSGInformation          ::= SEQUENCE
{
                cSGId                                           [0] CSGId,
                cSGAccessMode                                   [1] CSGAccessMode,
                cSGMembershipIndication                         [2] NULL OPTIONAL
}
TBCDSTRING ::= OCTET STRING
ISDN-AddressString ::= OCTET STRING
IMEI ::= TBCDSTRING (SIZE(8))
IMSI ::= TBCDSTRING (SIZE(3..8))
maxAddressLength    INTEGER ::= 20
AddressString ::= OCTET STRING (SIZE (1..maxAddressLength))
END
```

SGW Charging OAM Support

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

Bulk Statistics

SGW Charging CDR Statistics

sgw_charging_cdr counter

```
sgw_charging_cdr{action="close_final",app_name="SMF",cause="abnormalRelease",
cluster="Local",data_center="DC",event="AbnormalRelease",gr_instance_id="1",instance_id="0",
pdn_plmn_type="visitor",pdn_type="ipv4v6",service_name="sgw-service"} 1
sgw_charging_cdr{action="close_final",app_name="SMF",cause="normalRelease",
cluster="Local",data_center="DC",event="NormalRelease",gr_instance_id="1",instance_id="0",
pdn_plmn_type="visitor",pdn_type="ipv4v6",service_name="sgw-service"} 22
sgw_charging_cdr{action="close_final",app_name="SMF",cause="sGWChange",
cluster="Local",data_center="DC",event="SGWChange",gr_instance_id="1",instance_id="0",
pdn_plmn_type="visitor",pdn_type="ipv4v6",service_name="sgw-service"} 3
sgw_charging_cdr{action="close_interim",app_name="SMF",cause="maxChangeCond",
cluster="Local",data_center="DC",event="QoSChange",gr_instance_id="1",instance_id="0",
pdn_plmn_type="visitor",pdn_type="ipv4v6",service_name="sgw-service"} 3
sgw_charging_cdr{action="close_interim",app_name="SMF",cause="maxChangeCond",
cluster="Local",data_center="DC",event="ServingNodeChange",gr_instance_id="1",instance_id="0",
pdn_plmn_type="visitor",pdn_type="ipv4v6",service_name="sgw-service"} 5
sgw_charging_cdr{action="close_interim",app_name="SMF",cause="timeLimit",
cluster="Local",data_center="DC",event="TimeLimit",gr_instance_id="1",instance_id="0",
pdn_plmn_type="visitor",pdn_type="ipv4v6",service_name="sgw-service"} 56
sgw_charging_cdr{action="close_interim",app_name="SMF",cause="volumeLimit",
cluster="Local",data_center="DC",event="VolumeLimit",gr_instance_id="1",instance_id="0",
pdn_plmn_type="visitor",pdn_type="ipv4v6",service_name="sgw-service"} 3
sgw_charging_cdr{action="open",app_name="SMF",cause="",cluster="Local",
data_center="DC",event="QoSChange",gr_instance_id="1",instance_id="0",pdn_plmn_type="visitor",
pdn_type="ipv4v6",service_name="sgw-service"} 3
sgw_charging_cdr{action="open",app_name="SMF",cause="",cluster="Local",
data_center="DC",event="SGWChange",gr_instance_id="1",instance_id="0",pdn_plmn_type="visitor",
pdn_type="ipv4v6",service_name="sgw-service"} 3
sgw_charging_cdr{action="open",app_name="SMF",cause="",cluster="Local",
data_center="DC",event="ServingNodeChange",gr_instance_id="1",instance_id="0",pdn_plmn_type="visitor",
```

```
pdn_type="ipv4v6",service_name="sgw-service"} 5
sgw_charging_cdr{action="open",app_name="SMF",cause="",cluster="Local",
data_center="DC",event="StartAccounting",gr_instance_id="1",instance_id="0",pdn_plmn_type="visitor",
pdn_type="ipv4v6",service_name="sgw-service"} 26
sgw_charging_cdr{action="open",app_name="SMF",cause="",cluster="Local",
data_center="DC",event="TimeLimit",gr_instance_id="1",instance_id="0",pdn_plmn_type="visitor",
pdn_type="ipv4v6",service_name="sgw-service"} 56
sgw_charging_cdr{action="open",app_name="SMF",cause="",cluster="Local",
data_center="DC",event="VolumeLimit",gr_instance_id="1",instance_id="0",pdn_plmn_type="visitor",
pdn_type="ipv4v6",service_name="sgw-service"} 3
```

SGW Charging CDR Container Statistics

sgw_charging_cdr_container counter

```
sgw_charging_cdr_container{action="close",app_name="SMF",change_condition="qoSChange",
cluster="Local",data_center="DC",event="QoSChange",gr_instance_id="1",instance_id="0",
pdn_plmn_type="visitor",pdn_type="ipv4v6",service_name="sgw-service"} 6
sgw_charging_cdr_container{action="close",app_name="SMF",change_condition="recordClosure",
cluster="Local",data_center="DC",event="AbnormalRelease",gr_instance_id="1",instance_id="0",
pdn_plmn_type="visitor",pdn_type="ipv4v6",service_name="sgw-service"} 1
sgw_charging_cdr_container{action="close",app_name="SMF",change_condition="recordClosure",
cluster="Local",data_center="DC",event="NormalRelease",gr_instance_id="1",instance_id="0",
pdn_plmn_type="visitor",pdn_type="ipv4v6",service_name="sgw-service"} 22
sgw_charging_cdr_container{action="close",app_name="SMF",change_condition="recordClosure",
cluster="Local",data_center="DC",event="SGWChange",gr_instance_id="1",instance_id="0",
pdn_plmn_type="visitor",pdn_type="ipv4v6",service_name="sgw-service"} 3
sgw_charging_cdr_container{action="close",app_name="SMF",change_condition="recordClosure",
cluster="Local",data_center="DC",event="ServingNodeChange",gr_instance_id="1",instance_id="0",
pdn_plmn_type="visitor",pdn_type="ipv4v6",service_name="sgw-service"} 5
sgw_charging_cdr_container{action="close",app_name="SMF",change_condition="recordClosure",
cluster="Local",data_center="DC",event="TimeLimit",gr_instance_id="1",instance_id="0",
pdn_plmn_type="visitor",pdn_type="ipv4v6",service_name="sgw-service"} 56
sgw_charging_cdr_container{action="close",app_name="SMF",change_condition="recordClosure",
cluster="Local",data_center="DC",event="VolumeLimit",gr_instance_id="1",instance_id="0",
pdn_plmn_type="visitor",pdn_type="ipv4v6",service_name="sgw-service"} 3
sgw_charging_cdr_container{action="open",app_name="SMF",change_condition="",cluster="Local",
data_center="DC",event="QoSChange",gr_instance_id="1",instance_id="0",pdn_plmn_type="visitor",
pdn_type="ipv4v6",service_name="sgw-service"} 6
sgw_charging_cdr_container{action="open",app_name="SMF",change_condition="",cluster="Local",
data_center="DC",event="SGWChange",gr_instance_id="1",instance_id="0",pdn_plmn_type="visitor",
pdn_type="ipv4v6",service_name="sgw-service"} 3
sgw_charging_cdr_container{action="open",app_name="SMF",change_condition="",cluster="Local",
data_center="DC",event="ServingNodeChange",gr_instance_id="1",instance_id="0",pdn_plmn_type="visitor",
pdn_type="ipv4v6",service_name="sgw-service"} 5
sgw_charging_cdr_container{action="open",app_name="SMF",change_condition="",cluster="Local",
data_center="DC",event="StartAccounting",gr_instance_id="1",instance_id="0",pdn_plmn_type="visitor",
pdn_type="ipv4v6",service_name="sgw-service"} 26
sgw_charging_cdr_container{action="open",app_name="SMF",change_condition="",cluster="Local",
data_center="DC",event="TimeLimit",gr_instance_id="1",instance_id="0",pdn_plmn_type="visitor",
pdn_type="ipv4v6",service_name="sgw-service"} 56
sgw_charging_cdr_container{action="open",app_name="SMF",change_condition="",cluster="Local",
data_center="DC",event="VolumeLimit",gr_instance_id="1",instance_id="0",pdn_plmn_type="visitor",
pdn_type="ipv4v6",service_name="sgw-service"}
```

SGW Sx Report Statistics

sgw_sx_session_report_stats counter

```
sgw_sx_session_report_stats{app_name="SMF",cluster="Local",data_center="DC",
gr_instance_id="1",instance_id="0",service_name="sgw-service",status="success",
sx_session_report_type="USAR"} 55
```

sgw_sx_usage_report_stats counter

```
sgw_sx_usage_report_stats{app_name="SMF",cluster="Local",data_center="DC",
gr_instance_id="1",instance_id="0",service_name="sgw-service",status="success"}
95
```

GTPP-EP Statistics

gtpp_received_cdrs_total counter

```
gtpp_received_cdrs_total{app_name="SMF",cluster="Local",data_center="DC",dictionary="custom24",
gtpp_profile="pf1",instance_id="0",service_name="gtpp-ep"} 7
```

gtpp_processed_cdrs_total counter

```
gtpp_processed_cdrs_total{app_name="SMF",cluster="Local",data_center="DC",dictionary="custom24",
gtpp_profile="pf1",instance_id="0",service_name="gtpp-ep",status="success"} 7
```

gtpp_batched_cdrs_total gauge

```
gtpp_batched_cdrs_total{app_name="SMF",cluster="Local",data_center="DC",dictionary="custom24",
gtpp_profile="pf1",instance_id="0",service_name="gtpp-ep",status="batch_success"}
 2
```

gtpp_batch_flush_millis_total counter

```
gtpp_batch_flush_millis_total{app_name="SMF",cluster="Local",data_center="DC",dictionary="custom24",
gtpp_profile="pf1",instance_id="0",service_name="gtpp-ep",status="batch_success"}
 1126.000588626
```

gtpp_batch_flush_duration_histogram_total counter

```
gtpp_batch_flush_duration_histogram_total{app_name="SMF",bin=">5000ms",cluster="Local",data_center="DC",
dictionary="custom24",gtpp_profile="pf1",instance_id="0",service_name="gtpp-ep",status="batch_success"}
 6
```

gtpp_asn1field_encoding_failures_total

```
gtpp_asn1field_encoding_failures_total{app_name="SMF",cluster="Local",data_center="DC",gtpp_profile="pf1",
dictionary="custom24",asn1_field="ServedIMSI",reason="Constraint
Violation",gr_instance_id="1",service_name="gtpp-ep"}1
```