



# CHAPTER 6

## Configuring Charging on the GGSN

This chapter describes how to configure the charging function on a gateway GPRS support node (GGSN). If at minimum, one charging gateway is configured, by default, charging processing is enabled on the GGSN. There are several ways to customize communication with a charging gateway. Many of the default values for the charging options will provide a satisfactory configuration until you become more familiar with your network and decide to customize the charging interface.

Cisco GGSN Release 9.0 and later supports two levels of charging configurations: global level and access-point level (granular charging).

With granular charging, up to 30 *charging groups* can be configured per GGSN. In each charging group, a unique primary, secondary, and tertiary charging gateway, and iSCSI target can be defined and associated with an APN. Charging groups enable you to send charging records belonging to different APNs to different destinations. For information about configuring granular charging see the [“Configuring Granular Charging and Storage” section on page 6-24](#).



### Note

The global charging commands described in this chapter are applicable, and take effect, for all charging groups configured on a GGSN, unless specified otherwise.

For complete descriptions of the GGSN commands in this chapter, refer to the *Cisco GGSN Command Reference* for the Cisco GGSN release you are using. To locate documentation of other commands that appear in this chapter, use the command reference master index or search online.

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# Configuring an Interface to the Charging Gateway

To establish access to an external charging gateway in the general packet radio service/Universal Mobile Telecommunication System (GPRS/UMTS) network, you must configure a interface on the GGSN to connect to the network of the charging gateway. In GPRS/UMTS, the interface between the GGSN and the charging gateway is referred to as the *Ga interface*. The Cisco GGSN supports both a 2.5G Ga interface and 3G Ga interface.

On the Cisco 7600 series router platform, this interface is logical one (on which IEEE 802.1Q-encapsulation has been configured) to the Layer 3 routed Ga VLAN configured on the supervisor engine.

For more information about the Ga VLAN on the supervisor engine, see [“Platform Prerequisites” section on page 2-2](#).

For more information about configuring interfaces, see the *Cisco IOS Interface Configuration Guide* and the *Cisco IOS Interface Command Reference*.

## Configuring 802.1Q-Encapsulated Subinterfaces

To configure a subinterface that supports IEEE 802.1Q encapsulation to the Ga VLAN, use the following commands, beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# <b>interface</b> gigabitethernet slot/port.subinterface-number	Specifies the subinterface on which IEEE 802.1Q will be used.
Step 2	Router(config-if)# <b>encapsulation dot1q</b> vlanid	Defines the encapsulation format as IEEE 802.1Q (dot1q), and specifies the VLAN identifier.
Step 3	Router(config-if)# <b>ip address</b> ip-address mask	Sets a primary IP address for an interface.

# Verifying Interface Configuration to the Charging Gateway

To verify the interface to the charging gateway (CG) you can first verify your GGSN configuration and then verify that the interface is available.

- Step 1

To verify that you have properly configured a Ga interface on the supervisor engine, use the **show running-config** command. The following example is a portion of the output from the command showing the Fast Ethernet 8/22 physical interface configuration as the Ga interface to the SGSN. The configuration of the Fast Ethernet 8/22 physical interface is shown in bold.

```
Sup# show running-config
Building configuration...

Current configuration :12672 bytes
!
version 12.2
...
interface FastEthernet8/22
```

```

no ip address
switchport
switchport access vlan 302
!
interface Vlan101
description Vlan to GGSN for GA/GN
ip address 10.1.1.1 255.255.255.0
!
interface Vlan302
ip address 40.0.2.1 255.255.255.0

```

- Step 2** To verify that the physical interface and the Ga VLAN are available, use the **show interface** command on the supervisor engine. The following example shows that the Fast Ethernet 8/22 physical interface to the charging gateway is up, and the Ga VLAN, VLAN 101:

```

Sup# show ip interface brief FastEthernet8/22
Interface                IP-Address      OK? Method Status      Protocol
FastEthernet8/22         unassigned      YES unset   up          up

```

```

Sup# show ip interface brief Vlan302
Interface                IP-Address      OK? Method Status      Protocol
Vlan302                  40.0.2.1        YES TFTP   up          up

```

Sup#

- Step 3** To verify the Ga VLAN configuration and availability, use the **show vlan name** command on the supervisor engine. The following example shows the Gn VLAN Gn\_1:

```

Sup# show vlan name Ga_1

VLAN Name                Status    Ports
-----
302  Ga_1                    active    Gi4/1, Gi4/2, Gi4/3, Gi7/1
                                   Gi7/2, Gi7/3, Fa8/22, Fa8/26

VLAN Type  SAID      MTU    Parent RingNo BridgeNo Stp    BrdgMode Trans1 Trans2
-----
302  enet    100302   1500    -      -      -      -      -      0      0

Remote SPAN VLAN
-----
Disabled

Primary Secondary Type          Ports
-----

```

- Step 4** On the GGSN, to verify that you have properly configured a Ga subinterface to the Ga VLAN, use the **show running-config** command. The following example is a portion of the output from the command which shows a Fast Ethernet 5/1 physical interface configuration as the Ga interface to the charging gateway:

```

GGSN# show running-config
Building configuration...

Current configuration :7390 bytes
!
! Last configuration change at 16:56:05 UTC Wed Jun 25 2003
! NVRAM config last updated at 23:40:27 UTC Fri Jun 13 2003
!
version 12.3
.....
interface GigabitEthernet0/0.2
description Ga/Gn Interface

```

```

encapsulation dot1Q 101
ip address 10.1.1.72 255.255.255.0
no cdp enable
!
.....
ip route 40.1.2.1 255.255.255.255 10.1.1.1

```

**Step 5** To verify that the subinterface is available, use the **show ip interface brief** command. The following example shows that the Gigabit Ethernet 0/0.2 subinterface to the Ga VLAN is in “up” status and the protocol is also “up”:

```

GGSN# show ip interface brief GigabitEthernet0/0.2
Interface                IP-Address      OK? Method Status      Protocol
GigabitEthernet0/0.2    10.1.1.72      YES NVRAM  up          up

```

# Configuring the Default Charging Gateway

You can configure a primary charging gateway that the GGSN uses, by default, to communicate charging information. In addition, you can specify a secondary and tertiary charging gateway as backups. All charging gateways share the same global charging parameters.



**Note**

With the introduction of Granular Charging in Cisco GGSN Release 9.0 and later, this set of default charging gateways are identified as charging group #0, the default charging group in the system.

To configure a default charging gateway for a GGSN, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>gprs default charging-gateway</b> { <i>ip-address</i>   <i>name</i> } [{ <i>ip-address</i>   <i>name</i> }] [{ <i>ip-address</i>   <i>name</i> }] [{ <i>ip-address</i>   <i>name</i> }]	<p>Specifies a primary charging gateway (and secondary and tertiary backups), where:</p> <ul style="list-style-type: none"> <li><i>ip-address</i>—Specifies the IP address of a charging gateway. The second (optional) <i>ip-address</i> argument specifies the IP address of a secondary charging gateway.</li> <li><i>name</i>—Specifies the host name of a charging gateway. The second (optional) <i>name</i> argument specifies the host name of a secondary charging gateway.</li> </ul>

# Configuring the GGSN to Switchover to the Highest Priority Charging Gateway

When priority switchover has been configured on the GGSN using the **gprs charging switchover priority** command, regardless of the state of the current active charging gateway, when a gateway of higher priority comes up, the GGSN will switch over and send G-CDRs to that charging gateway.

**Note**

This command applies to only the globally defined charging gateways that are a part of the default charging group (charging group 0). The switchover priority for charging groups 1 through 29 is configured under the charging group using the **switchover priority** charging group configuration command.

To configuring priority switchover on the GGSN for the default charging group, use the following command in global configuration mode:

	Command	Purpose
Step 1	Router(config)# <b>gprs charging switchover priority</b>	Configures the GGSN to switch over to the gateway of higher priority when that gateway becomes active.

## Changing the Default Charging Gateway

To change the default charging gateway of a GGSN, use the following commands, beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# <b>gprs default charging-gateway</b> 10.9.0.2	Specifies a primary charging gateway at IP address 10.9.0.2.
Step 2	Router(config)# <b>no gprs default charging-gateway</b> 10.9.0.2	Removes the primary charging gateway at IP address 10.9.0.2.
Step 3	Router(config)# <b>gprs default charging-gateway</b> 10.9.0.3	Specifies the new default primary charging gateway at IP address 10.9.0.3.

## Configuring a Charging Source Interface

By default, the global GTP virtual template interface is used for all charging messages. With Cisco GGSN Release 8.0 and later, you can configure a *charging source interface* to use for charging messages.

The charging source interface is a loopback interface that the GGSN has been configured to use for charging traffic using the **gprs charging interface source loopback** command in global configuration mode. Once a loopback interface has been configured as the charging source interface, all charging messages will use the IP address of that loopback interface as their source address.

This feature enables you to separate charging traffic. Optionally, VRF can be configured on the loopback interface, which enables charging traffic to be separated onto a private VLAN.

When configuring a charging source interface, note the following:

- Once configured, the loopback interface cannot not be modified without removing the charging source interface configuration. All charging messages will use the new end points from the path structure.
- A charging source interface cannot be unconfigured while there are active PDPs or CDRs.

To configure a charging source interface, complete the following tasks, beginning in global configuration mode:

	Command	Purpose
Step 4	Router(config)# <b>interface loopback</b> <i>number</i>	Creates a loopback interface. A loopback interface is a virtual interface that is always up.
Step 5	Router(config-if)# <b>ip address</b> <i>ip-address mask</i>	Assigns an IP address to the loopback interface.
Step 6	Router(cfg-acct-mlist)# <b>exit</b>	Exits from accounting method list mode.

To configure the GGSN to use the loopback interface for charging traffic, use the following command while in global configuration mode:

Command	Purpose
Router(config)# <b>gprs charging interface source loopback</b> <i>number</i>	Specifies the loopback interface to be used by the GGSN for charging messages.
	<b>Note</b> The charging source interface must be a loopback interface, and the interface must be configured using a valid IP address. Optionally, a VRF can be configured on the interface.

## Configuring the GGSN Memory Threshold

The GGSN memory protection feature prevents processor memory from being drained during periods of abnormal conditions (such as when all charging gateways are down and the GGSN is buffering CDRs into memory). By default, the memory threshold is 10% of the total memory available when GGSN services are enabled using the **gprs ggsn service** command in global configuration mode. You can use the **gprs memory threshold** command in global configuration mode to configure the threshold according to the router and memory size.

When the amount of memory remaining on the system reaches the defined threshold, the memory protection feature activates and the GGSN performs the following actions to keep the processor memory from falling below the threshold:

- Rejects new create PDP requests with the cause value “No Resource.”
- Drops any existing PDPs for which an update is received with the cause value “Management Intervention.”
- Drops any PDPs for which a volume trigger has occurred.



### Note

While the memory protection feature is active, byte counts will be maintained and reported after the GGSN recovers. However, because some change conditions are not handled, some counts will not reflect the accurate charging condition (for example, QoS and tariff conditions).

To configure the memory threshold that when reached, activates the memory protection feature on the GGSN, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>gprs memory threshold threshold</b>	Configures the memory threshold on the GGSN. The valid range is 0 to 1024. The default is 10% of the total memory available when GGSN services are enabled.

## Configuring the Transport Protocol for the Charging Gateway

You can configure a GGSN to support either Transport Control Protocol (TCP) or User Datagram Protocol (UDP) as the transport path protocol for communication with the charging gateway.

The GGSN default configuration specifies UDP, which is a connectionless protocol that is considered an unreliable transport method but can yield greater performance.

### Configuring TCP as the Charging Gateway Path Protocol

TCP is a connection-based protocol that provides reliable transmission through packet acknowledgment. To specify TCP as the transport path protocol, use the following commands, beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# <b>gprs charging cg-path-requests 1</b>	Specifies the number of minutes that the GGSN waits before trying to establish the TCP path to the charging gateway when TCP is the specified path protocol. The default is 0 minutes, which disables the timer.
Step 2	Router(config)# <b>gprs charging path-protocol tcp</b>	Specifies that the TCP networking protocol is used by the GGSN to transmit and receive charging data.

### Configuring UDP as the Charging Gateway Path Protocol

The GGSN default configuration specifies UDP as the transport path protocol to the charging gateway. If you need to reconfigure the charging gateway for UDP transport, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>gprs charging path-protocol udp</b>	Specifies that the UDP networking protocol is used by the GGSN to transmit and receive charging data. The default value is UDP.

## Configuring the Charging Release

The Cisco GGSN supports both 2.5G and 3G Ga interfaces and GPRS (R97/R98) and UMTS (R99) Quality of Service (QoS) profile formats. The Cisco GGSN can be configured to comply with 3GPP TS 32.215 Release 4 or Release 5.

Depending on the CG and GGSN configuration, when specifying the 99 or 98 keyword, the following actions take place:

- If the GGSN is configured to present R97/R98 CDRs (**gprs charging release 98** is configure):
  - If the PDP context is R98, the GGSN presents an R97/R98 G-CDR.
  - If the PDP context is R99, the GGSN presents an R97/R98 G-CDR by converting the R99 QoS profile to an R97/R98 QoS profile.
- If the GGSN is configured to present R99 CDRs (**gprs charging release 99** is configure):
  - If the PDP context is R99, the GGSN presents an R99 G-CDR.
  - If the PDP context is R98, the GGSN presents an R99 CDR by converting the QoS profile.

To configure the charging release with which the GGSN complies when presenting G-CDRs, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>gprs charging release {99   98   4   5   7}</b>	<p>Configures the format presented by the GGSN in CDRs.</p> <ul style="list-style-type: none"> <li>• <b>99</b>—R97, R98, and R99 QoS profile formats are presented.</li> <li>• <b>98</b>—R97/R98 QoS profile formats are presented.</li> <li>• <b>4</b>—GGSN complies with 3GPP TS 32.215 Release 4.</li> <li>• <b>5</b>—GGSN complies with 3GPP TS 32.215 Release 5.</li> <li>• <b>7</b>—GGSN complies with 3GPP TS 32.215 Release 7.</li> </ul> <p>The default value is 99.</p> <p><b>Note</b> When 99 is configured, the Charging Characteristics parameter is included in G-CDRs. When 4 or 5 is configured, the Charging Characteristics Selection Mode IE is included.</p>

## Configuring Charging for Roamers

A GGSN can be configured to generate G-CDRs for roaming mobile subscribers.

When the charging for roamers feature is enabled on the GGSN, when the GGSN receives a PDP context request, it first checks to see if both the GGSN and serving GPRS support node (SGSN) public land mobile network (PLMN) IDs are present and match (via the Routing Area Identity [RAI] field information element [IE]).

If not both are not present and match, the GGSN matches the IE containing the SGSN Signaling Address field against a list of PLMN IP address ranges that have been defined using the **gprs plmn ip address** command with the **sgsn** keyword option specified.



**Note**

To use the RAI IE in Create PDP Context requests to detect roamers, a valid home PLMN must be configured on the GGSN using the **gprs mcc mn** command in global configuration mode. When a valid home PLMN is configured, or valid trusted PLMNs, a CDR will not be generated if the RAI matches the configured home (or trusted) PLMN. A CDR will be created for all PDPs with RAIs that do not match a home or trusted PLMN.

**Note**

If the RAI field is not present in a Create PDP Context, and an address range has not been configured using the **gprs plmn ip address** command with the **sgsn** keyword option specified, the PDP will be classified as “unknown” and treated as a roamer.

If the GGSN determines that the SGSN that sent the Create PDP Context request is not located within the same PLMN as it is, the GGSN generates a call detail record (CDR). If the GGSN determines that the SGSN is located in the same PLMN, it will not generate a CDR until it receives notification that the SGSN has changed location to another PLMN.

To enable charging for roamers on the GGSN using the **gprs charging roamers** command, you should first define a set of IP address ranges for a PLMN, using the **gprs plmn ip address** command.

**Note**

It is important that you configure the **gprs plmn ip address** and **gprs charging roamers** commands in their proper order. After you configure the IP address range for a PLMN, use the **gprs charging roamers** command to enable the charging for roamers feature on the GGSN. You can change the IP address range by reissuing the **gprs plmn ip address** command.

To verify your configuration, use the **show gprs charging parameters** command to see if the charging for roamers feature is enabled. To verify your PLMN IP address ranges, use the **show gprs plmn ip address** command.

## Configuring PLMN IP Address Ranges

Depending on how the PLMN IP address ranges have been defined using the **gprs plmn ip address start\_ip end\_ip [sgsn]** command, the charging for roamers feature operates as follows:

- If no PLMN IP address ranges are configured using the **gprs plmn ip address start\_ip end\_ip [sgsn]** command, the GGSN generates CDRs for all initiated PDP contexts regardless of whether the GGSN and SGSN are located within the same PLMN.
- If a list of PLMN IP address ranges has been configured using the **gprs plmn ip address start\_ip end\_ip [sgsn]** command, and one or more of those ranges has been defined using the **sgsn** key word, the GGSN uses those ranges defined with the **sgsn** keyword to determine whether an SGSN is located within the same PLMN.

With this configuration, the following scenarios outline how the charging for roamers feature will function:

- MS1 is subscribed to PLMN1 and attaches to an SGSN in PLMN2. From PLMN2, MS1 initiates a PDP context with the GGSN in PLMN1. In this case, MS1 is a roamer and the GGSN generates a CDR because it determines that the SGSN is located in a different PLMN.
- MS1 is subscribed to PLMN1 and attaches to an SGSN in PLMN2. From PLMN2, MS1 initiates a PDP context with the GGSN in PLMN2. In this case, MS1 is not a roamer because the SGSN and GGSN are in the same PLMN. The GGSN does not create a G-CDR.

To configure PLMN IP address ranges, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>gprs plmn ip address</b> <i>start_ip end_ip</i> [ <b>sgsn</b> ]	Specifies the IP address range of a PLMN. Optionally, specifies that only the PLMN IP address ranges defined with the <b>sgsn</b> keyword specified be used to determine if an SGSN is located in a PLMN other than the GGSN.

## Enabling Charging for Roamers

To enable the charging for roamers feature on a GGSN, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>gprs charging roamers</b>	Enables charging for roamers on a GGSN.

## Customizing the Charging Options

For the GGSN charging options, the default values represent recommended values. Other optional commands are also set to default values; however, we recommend modifying these commands to optimize your network as necessary, or according to your hardware.

The GGSN uses echo timing to maintain the path between SGSNs and external charging gateways. However, the GGSN can implement only a single method of echo timing for all the paths that it needs to maintain. To learn more about echo timing on the GGSN, or to modify the echo timing feature, see the [“Configuring Echo Timing on a GGSN” section on page 3-4](#) in the [“Configuring GTP Services on the GGSN” chapter](#).

Use the following commands in global configuration mode to fine-tune charging processing on the GGSN:

Command	Purpose
Router(config)# <b>gprs charging cdr-aggregation-limit</b> <i>CDR_limit</i>	Specifies the maximum number of CDRs that a GGSN aggregates in a charging data transfer message to a charging gateway. The default is 255 CDRs.
Router(config)# <b>gprs charging cdr-option apn</b> [ <b>virtual</b> ]	Specifies that the APN IE be included or not included in G-CDRs. Optionally, specify the <b>virtual</b> keyword to include the virtual APN in G-CDRs, accounting records, and credit control requests (CCRs).
Router(config)# <b>gprs charging cdr-option apn-selection-mode</b>	Enables the GGSN to provide the reason code for access point name (APN) selection in G-CDRs. This is disabled by default.
Router(config)# <b>gprs charging cdr-option camel-charge-info</b>	Specifies that a copy of the tag and length of the Customized Application for Mobile Enhanced Logic (CAMEL) from the SGSN’s CDR be included in G-CDRs.
Router(config)# <b>gprs charging cdr-option chch-selection-mode</b>	Specifies that the charging characteristics selection mode parameter be included or not included in G-CDRs.

Command	Purpose
Router(config)# <b>gprs charging cdr-option dynamic-address</b>	Specifies that the dynamic address flag IE be included or not included in G-CDRs.
Router(config)# <b>gprs charging cdr-option imeisv</b>	Specifies that the International Mobile Equipment Identity (IMEI) software version (IMEISV) IE be included in G-CDRs. The IMEISV identifies the mobile equipment used by the subscriber.
Router(config)# <b>gprs charging cdr-option local-record-sequence-number</b>	Enables the GGSN to use the local record sequence number IE in G-CDRs. This is disabled by default.
Router(config)# <b>gprs charging cdr-option ms-time-zone</b>	<p>Specifies that the MS Time Zone (MSTZ) IE be included in G-CDRs. The MSTZ IE indicates the offset between universal time and local time.</p> <p>A change of the MSTZ in an update request results in a CDR closure and the opening of a new CDR (as specified in R7 32.251). Additionally, an interim accounting record is generated when the MSTZ change occurs in an update request.</p>
Router(config)# <b>gprs charging cdr-option nip</b>	Specifies that the Network-Initiated PDP IE be included in G-CDRs.
Router(config)# <b>gprs charging cdr-option no-partial-cdr-generation [all]</b>	<p>Disables the GGSN from creating fully-qualified partial G-CDRs.</p> <p>Optionally, specify the <b>all</b> keyword option to configure the GGSN to copy the SGSN list for charging releases before Release 4 when an SGSN change limit trigger is configured as well.</p> <p>The default is fully-qualified partial CDR creation is enabled.</p> <p><b>Note</b> Enable this feature only when there are no active PDP contexts. Enabling this feature will affect all subsequent PDP contexts.</p>
Router(config)# <b>gprs charging cdr-option node-id</b>	Enables the GGSN to specify the node that generated the CDR in the node ID field in G-CDRs. This is disabled by default.
Router(config)# <b>gprs charging cdr-option packet-count</b>	Enables the GGSN to provide uplink and downlink packet counts in the optional record extension field in G-CDRs. This is disabled by default.
Router(config)# <b>gprs charging cdr-option pdp-address</b>	Specifies that the PDP address IE be included or not included in G-CDRs.
Router(config)# <b>gprs charging cdr-option pdp-type</b>	Specifies that the PDP type IE be included or not included in G-CDRs.
Router(config)# <b>gprs charging cdr-option rat-type</b>	<p>Specifies that the radio access technology (RAT) IE be included in G-CDRs. The RAT indicates whether the SGSN serves the user equipment (UE) by Universal Terrestrial Radio Access Network (UTRAN) or GSM/EDGE RAN (GERAN).</p> <p>A change of the RAT in an update request results in a CDR closure and the opening of a new CDR (as specified in R7 32.251). Additionally, an interim accounting record is generated when the RAT change occurs in an update request.</p>
Router(config)# <b>gprs charging cdr-option served-msisdn</b>	Enables the GGSN to provide the mobile station ISDN (MSISDN) number from the Create PDP Context request in G-CDRs. This is disabled by default.

Command	Purpose
Router(config)# <b>gprs charging cdr-option service-record</b> <i>[value]</i>	Enables the GGSN to generate per-service records. Optionally, the maximum number of services records in a CDR can be specified. When the limit is reached, the current G-CDR is closed and a new partial CDR is opened. If a maximum number is not specified, the default (5) is used.
Router(config)# <b>gprs charging cdr-option sgsn-plmn</b>	Configures the GGSN to include the SGSN PLMN ID in G-CDRS. This is disabled by default.
Router(config)# <b>gprs charging cdr-option user-loc-info</b>	Specifies that the user location information (ULI) IE be included in G-CDRs. The ULI provides the cell global identity (CGI) and service area identity (SAI) of the subscriber location.
Router(config)# <b>gprs charging cg-path-requests</b> <i>minutes</i>	Specifies the number of minutes that the GGSN waits before trying to establish the TCP path to the charging gateway when TCP is the specified path protocol. The default is 0 minutes, which disables the timer.
Router(config)# <b>gprs charging container change-limit</b> <i>number</i>	Specifies the maximum number of charging containers within each G-CDR from the GGSN. The default is 5.
Router(config)# <b>gprs charging container sgsn-change-limit</b> <i>number</i>	Specifies the maximum number of SGSN changes that can occur before closing a G-CDR for a particular PDP context. The default is 0, which disables the timer.
Router(config)# <b>gprs charging container time-trigger</b> <i>number</i>	Specifies a global time limit, that when exceeded by a PDP context causes the GGSN to close and update the G-CDR for that particular PDP context. The default is 0, which disables the timer.
Router(config)# <b>gprs charging container volume-threshold</b> <i>threshold_value</i>	Specifies the maximum number of bytes that the GGSN maintains in a user's charging container before closing it and updating the G-CDR. The default is 1,048,576 bytes (1 MB).
Router(config)# <b>gprs charging disable</b>	Disables charging transactions on the GGSN. Charging is enabled by default.
Router(config)# <b>gprs charging flow-control private-echo</b>	Implements an echo request with private extensions for maintaining flow control on packets transmitted to the charging gateway. This is disabled by default.
Router(config)# <b>gprs charging header short</b>	Enables the GGSN to use the GPRS tunneling protocol (GTP) short header (6-byte header) instead of the GTP long header. This is disabled by default.
Router(config)# <b>gprs charging map data tos</b> <i>tos_value</i>	Specifies an IP type of service (ToS) mapping for GPRS charging packets. The default is 3.
Router(config)# <b>gprs charging message transfer-request possibly-duplicate</b>	Specifies for the GGSN to retransmit Data Record Transfer Request messages (sent to a previously active charging gateway) with the value of the Packet Transfer Request IE set to Send Possibly Duplicate Data Record Packet (2).
Router(config)# <b>gprs charging packet-queue-size</b> <i>queue_size</i>	Specifies the maximum number of unacknowledged charging data transfer requests that the GGSN maintains in its queue. The default is 128 packets.
Router(config)# <b>gprs charging path-protocol</b> { <b>udp</b>   <b>tcp</b> }	Specifies the protocol that the GGSN uses to transmit and receive charging data. The default is UDP.

Command	Purpose
Router(config)# <b>gprs charging port</b> <i>port-num</i>	Configures the destination port of the charging gateway. The default is 3386.
Router(config)# <b>gprs charging send-buffer</b> <i>bytes</i>	Configures the size of the buffer that contains the GTP PDU and signaling messages on the GGSN. The default is 1460 bytes.
Router(config)# <b>gprs charging server-switch-timer</b> <i>seconds</i>	Specifies a timeout value that determines when the GGSN attempts to find an alternate charging gateway after a destination charging gateway cannot be located or becomes unusable. The default is 60 seconds.
Router(config)# <b>gprs charging tariff-time</b> <i>time</i>	Specifies a time of day when GPRS/UMTS charging tariffs change. There is no default tariff time.  <b>Note</b> If the system software clock is manually set using the <b>clock set</b> privileged EXEC command at the supervisor console prompt, the time a tariff change will occur must be reconfigured.
Router(config)# <b>gprs charging message transfer-request</b> <i>command-ie</i>	Specifies for the GGSN to include the Packet Transfer Command information element (IE) in Data Record Transfer Response messages.  <b>Note</b> Even though GGSN 4.0 and later supports the Packet Transfer Command IE, only the “Send Data Record Packet” value is used, even though the packet might be duplicated. The Cisco GGSN does not support the “Send Possibly Duplicated Data Record Packet,” “Cancel Data Record Packet,” or “Release Data Record Packet” values. Therefore, the CG or billing servers must have the ability to eliminate duplicate CDRs.
Router(config)# <b>gprs charging message transfer-response</b> <i>number-responded</i>	Specifies for the GGSN to use the Number of Requests Responded field instead of the Length field in the Requests Responded IE of Data Record Transfer Response messages. This is disabled by default.
Router(config)# <b>gprs charging reconnect</b> <i>minutes</i>	Configures the GGSN to periodically attempt to reconnect to a CG that is unreachable to determine when the link is back up.  <b>Note</b> Configuring the GGSN to automatically attempt to reconnect to a unreachable CG is necessary only when UDP is used as the charging transport protocol and the charging gateway does not support echo requests.
Router(config)# <b>gprs charging transfer interval</b> <i>seconds</i>	Specifies the number of seconds that the GGSN waits before it transfers charging data to the charging gateway. The default is 105 seconds.

For information about configuring GGSN GTP options, see the “[Customizing the GGSN Configuration](#)” section on page 3-14 in the “[Configuring GTP Services on the GGSN](#)” chapter.

# Disabling Charging Processing

**Caution**

The **gprs charging disable** command removes charging data processing on a GGSN, which means that the data required to bill customers for network usage is neither being collected by the GGSN nor being sent to the charging gateway. We recommend that you avoid using this command in production GPRS/UMTS network environments. When it is necessary to use this command, use it with extreme care and reserve its usage only under nonproduction network conditions.

You can disable charging on the GGSN only after all the open CDRs have been processed and sent to the charging gateway. To clear the current GGSN CDRs, use the **clear gprs charging cdr** privileged EXEC command.

To disable charging processing on a GGSN, use the following command, beginning in global configuration mode:

Command	Purpose
Router(config)# <b>gprs charging disable</b>	Disables charging transactions on the GGSN.

## Using Charging Profiles

You can apply different charging methods on a per-PDP basis using *charging profiles* that you create, customize, and specify as the default charging method to use for a specific type of user at an APN level and global level. Charging profiles provide the ability to offer flexible services that are customized to subscriber preferences.

When using charging profiles, note the following:

- The GGSN must be configured to include the charging characteristics selection mode parameter in CDRs using the **gprs charging cdr-option chch-selection-mode** command in global configuration mode.
- The GGSN must be configured to receive the charging characteristics selection mode IE in CDRs by using the **gprs charging release** command in global configuration mode.

To apply charging methods on a per-PDP basis using GGSN charging profiles, you must complete the tasks outline in the following sections:

- [Configuring a Charging Profile, page 6-15](#)
- [Defining the Charging Characteristics and Triggers of the Charging Profile, page 6-16](#)
- [Applying a Default Charging Profile to an APN, page 6-18](#)
- [Applying a Global Default Charging Profile, page 6-19](#)
- [Configuring How the GGSN Handles PDPs with Unmatched Charging Profiles, page 6-19](#)

## Configuring a Charging Profile

Charging profiles define the charging method to apply to a specific type of user (home, roamer, visitor). The GGSN supports up to 256 charging profiles numbered 0 to 255.

Profile 0 is a set profile that always exists on the GGSN. It is not created by a GGSN operator, however, it can be modified using the charging-related global configuration commands. Profiles 1 to 255 are user-defined and customized using charging profile configuration commands.

When a Create PDP Context request is received, an appropriate charging profile is selected based on the following sources of input:

- SGSN/HLR via the charging characteristics IE.
- Local defaults.
- Charging profile index AAA attribute.

**Note**

The charging profile index received from AAA will take effect only if service-awareness has been configured globally on the GGSN (using the **gprs service-aware** command in global configuration mode), and at the APN level (using the **service-aware** access-point configuration command).

For information on configuring a service-aware GGSN, see the “Configuring Enhanced Service-Aware Billing” chapter of the Cisco GGSN Configuration Guide.

The order in which a charging profile is selected for a PDP context, is as follows:

1. Charging profile index in the override rule on the APN—If a default charging profile has been configured at both the APN and global level to override the SGSN specification, the APN default charging profile is used first.
2. Charging profile index in the override rule on the box (global default charging profile)—If there is no default charging profile default configured at the APN, the default charging profile configured globally is use.
3. Charging profile index from AAA.
4. Charging profile index from SGSN/HLR
5. Charging profile index from the non-override rule on the APN.
6. Charging profile index from non-override rule on the box (global default charging profile).

If none of the above applies, the PDP context is rejected if the **gprs charging characteristics reject** global configuration command is configured and the create request is GTP v1. If the **gprs charging characteristics reject** command is not configured, the GTPv1 PDP context is created using charging profile 0.

**Note**

The default charging profile, i.e. charging profile 0, is not supported for service-aware PDPs. These PDP create requests will be rejected with error code 199.

**Note**

Charging profiles cannot be removed, and the DCCA profile under the charging profile cannot be modified (using the **content dcca profile** charging profile command) if the profile is being used by PDP contexts or rules. If the profile is being used by rules, it must be disassociated with the APN before making such configuration changes.

To create or modify a charging profile and enter charging profile configuration mode, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>gprs charging profile</b> <i>chp-num</i>	Creates a new charging profile (or modifies an existing one), and enters charging profile configuration mode. The valid values are 1 to 15.

## Defining the Charging Characteristics and Triggers of the Charging Profile

To configure the charging methods and triggers of a charging profile, use the following commands in charging profile configuration mode:

Command	Purpose
Router(ch-prof-conf)# <b>category</b> { <b>hot</b>   <b>flat</b>   <b>prepaid</b>   <b>normal</b> }	Identifies the category of subscriber to which a charging profile applies.
Router(ch-prof-conf)# <b>cdr suppression</b>	Specifies that CDRs be suppressed.
Router(ch-prof-conf)# <b>cdr suppression prepaid</b>	Specifies that CDRs be suppressed for prepaid users.
Router(ch-prof-conf)# <b>content dcca profile</b> <i>profile-name</i>	Specifies the profile to use to communicate with a DCCA server.  <b>Note</b> This command cannot be modified if the profile is being used by PDP contexts or rules. If the profile is being used by rules, it must be disassociated with the APN before making such configuration changes.
Router(ch-prof-conf)# <b>content postpaid</b> { <b>plmn-change</b>   <b>qos-change</b>   <b>rat-change</b>   <b>sgsn-change</b>   <b>user-loc-info-change</b> }	Configures a condition in a charging profile for postpaid users, that when it occurs, triggers the GGSN to request quota reauthorization for a PDP context.  <ul style="list-style-type: none"> <li>• <b>plmn-change</b>—Configures a public land mobile network (PLMN) change to trigger a quota reauthorization request.</li> <li>• <b>qos-change</b>—Configures a Quality of Service (QoS) change to trigger a quota reauthorization request.</li> <li>• <b>rat-change</b>—Configures a radio access technology (RAT) change to trigger a quota reauthorization request.</li> <li>• <b>sgsn-change</b>—Configures a SGSN change to trigger a quota reauthorization request.</li> <li>• <b>user-loc-info-change</b>—Configures a user location information change to trigger a quota reauthorization.</li> </ul> <b>Note</b> The <b>plmn-change</b> , <b>rat-change</b> , and <b>user-loc-info-change</b> keyword options require that the GGSN has been configured to include these fields in the service-record IE in CDRs using the <b>gprs charging service record include</b> command in global configuration mode.



Command	Purpose
Router(ch-prof-conf)# <b>content postpaid time</b> <i>number</i>	Configures, as a trigger condition for postpaid users when service aware billing is enabled, the time duration limit that when exceeded, causes the GGSN to collect upstream and downstream traffic byte counts and close and update the G-CDR for a particular PDP context.
Router(ch-prof-conf)# <b>content postpaid validity</b> <i>seconds</i>	Configures, as a trigger condition in a charging profile for postpaid users when service-aware billing is enabled, the amount of time quota granted to a user is valid.
Router(ch-prof-conf)# <b>content postpaid volume</b> <i>threshold</i>	Configures, as a trigger condition for postpaid users when service aware billing is enabled, the maximum number of bytes that the GGSN maintains across all containers for a particular PDP context before closing and updating the G-CDR.
Router(ch-prof-conf)# <b>content rulebase</b> <i>id</i>	Defines a default rulebase ID to apply to PDP contexts.
Router(ch-prof-conf)# <b>description</b>	Specifies the name or a brief description of a charging profile.
Router(ch-prof-conf)# <b>limit volume</b> <i>number</i> [ <b>reset</b> ]	<p>Configures the maximum number of bytes that can be reported in each CDR from an active PDP context before the GGSN closes and updates the CDR, and opens a partial CDR for the PDP context while it remains in session on the GGSN.</p> <p>If the <b>reset</b> keyword option is configured, the volume trigger is reset if the CDR is closed by any other trigger. If the <b>reset</b> keyword is not specified, the volume trigger will not be reset when the time trigger expires (<b>limit duration</b> command), but it will be reset when any other trigger expires.</p>
Router(ch-prof-conf)# <b>limit duration</b> <i>number</i> [ <b>reset</b> ]	<p>Configures, as a trigger condition, the time duration limit (in minutes) that when exceeded causes the GGSN to collect upstream and downstream traffic byte counts and close and update the G-CDR for a particular PDP context.</p> <p>If the <b>reset</b> keyword option is configured, the time trigger is reset if the CDR is closed by any other trigger. If the <b>reset</b> keyword is not specified, the time trigger will not be reset when the volume trigger expires (<b>limit volume</b> command), but it will be reset when any other trigger expires.</p>
Router(ch-prof-conf)# <b>tariff-time</b>	Specifies that a charging profile use the global tariff change time configured using the <b>gprs charging tariff-time</b> command in global configuration mode.
Router(ch-prof-conf)# <b>limit sgsn-change</b>	Specifies that a charging profile use the global tariff changes configured using the <b>gprs charging tariff-time</b> command in global configuration mode.

## Applying a Default Charging Profile to an APN

To configure a default charging profile to use for a specific type of user at an APN, use the following access-point configuration command:

Command	Purpose
Router(config-access-point)# <b>charging profile</b> { <b>home</b>   <b>roaming</b>   <b>visiting</b>   <b>any</b> } [ <b>trusted</b> ] <i>chp_num</i> [ <b>override</b> ]	Configures a default charging profile to be used for a specific type of user at an APN.

## Applying a Global Default Charging Profile

Default charging profiles configured at the global level are used when a default charging profile has not been specified for an APN.

To configure a default charging profile to use for a specific type of user globally, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>gprs charging profile default</b> { <b>home</b>   <b>roaming</b>   <b>visiting</b>   <b>any</b> } [ <b>trusted</b> ] <i>chp_num</i> [ <b>override</b> ]	Applies a global default charging profile for a specific type of user.

## Configuring How the GGSN Handles PDPs with Unmatched Charging Profiles

The GGSN can be configured to reject or accept GTPv1 Create PDP Context requests for which a profile cannot be matched. If configured to accept these PDP context requests, the charging method defined by charging profile 0 is applied. By default, the Create PDP Context requests are accepted and the charging method defined in charging profile 0 is applied.

The following restrictions apply to charging profiles selected for service-aware PDPs:

- All PDP s belonging to the same user must use the same charging profile as that of the primary PDP.
- The default charging profile, i.e. charging profile 0, is not supported for service-aware PDPs. These PDP create requests will be rejected with error code 199.

To configure a GGSN to reject Create PDP Context requests for which a charging profile cannot be matched, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>gprs charging characteristics reject</b>	Configures the GGSN to reject GTPv1 Create PDP Context requests for which a charging profile cannot be selected.

## Configuring G-CDR Backup and Retrieval using iSCSI

The Cisco GGSN Release 8.0 and later utilizes the Cisco IOS software Small Computer Systems Interface over IP (iSCSI) support, as defined in RFC 3720, to enable G-CDR storage and retrieval from storage target on a Storage Area Network (SAN).

This section contains the following topics on iSCSI support on the GGSN:

- [iSCSI Overview, page 6-20](#)
- [Configuring iSCSI Backup and Storage on the GGSN, page 6-20](#)
- [Monitoring and Maintaining iSCSI G-CDR Backup and Storage, page 6-23](#)

## iSCSI Overview

The iSCSI transport protocol operates over TCP/IP, enabling mobile operators and service providers to use their SAN connected to an iSCSI interface to save complete DTR messages containing closed CDRs.

SAN technology, which enables customers to build scalable storage solutions, is comprised of the following primary elements:

- **SCSI**—An interface standard which enables multiple devices to be installed on a system, attached to cable to form a chain of devices. Each device is assigned a unique ID, which is expressed as a number, that identifies that device on the bus. SCSI IDs can be broken into Logical Unit Numbers (LUNs), enabling a number of devices to share a single SCSI ID. Devices from which I/O requests originate are called initiators, and devices from which responses originate are called targets.
- **SAN**—Technology that involves moving network storage to a separate network of its own. Disk, tape, and optical storage can then be attached to the storage network that is based on a fabric of switches and hubs that connects storage devices to a heterogeneous set of servers.

A SAN system provides block-level access to data residing on shared storage arrays through dedicated storage networks.

- **iSCSI**—Transport protocol that maps SCSI requests and responses over TCP and provides block-level data transfer between the SCSI initiator (the Cisco GGSN in this example), and the target (the storage device on the SAN). The initiator sends I/O requests and the target sends I/O responses.

A SAN topology is distinguished by the following features

- Storage is not directly connected to network clients
- Storage is not directly connected to servers
- Storage devices are interconnected
- Multiple servers can share multiple storage devices

## Configuring iSCSI Backup and Storage on the GGSN

In the SCSI environment, the GGSN functions as an iSCSI initiator.

To enable G-CDR backup storage on an iSCSI device, you must first configure an iSCSI target profile on the GGSN that includes the name and IP address of the target, and the TCP port on which to “listen” for iSCSI traffic. Once the profile has been configured, you then configure the GGSN to use the interface for record storage when a charging gateway is not available.

With Cisco GGSN Release 9.0 and later, up to 30 iSCSI target profiles can be configured and associated with a set of unique charging gateways within a charging group.

As an alternative, an iSCSI target profile can be configured as the primary storage for CDRs by only configuring an iSCSI target profile and no charging gateway at the global level (default charging group 0), or at the APN level by defining only an iSCSI target in the charging group associated with an APN (charging groups 1 to 29).

The I/O requests sent by the GGSN are converted into SCSI requests and transported over TCP/IP to the remote storage target.

### Choosing the Record Format when Writing to iSCSI

By default, when writing DTRs to iSCSI, the format for storing records is “GTP,” wherein the complete DTR is written to the iSCSI target. As an alternative, the iSCSI record format can be configured as ASN.1 using the **gprs charging iscsi rec-format** command in global configuration mode and specifying the **asn.1** keyword option. When ASN.1 is configured as the record format, the GGSN writes only the raw ASN1-encoded CDRs into iSCSI without embedding the DTR information element into the records. This format is useful when the records are retrieved from iSCSI using FTP.

To configure the record format, use the **gprs charging iscsi rec-format** command in global configuration mode.

### Writing DTRs when iSCSI is used as Backup Storage

- Once iSCSI backup storage configuration is in place, when a charging gateway is not reachable, the writing towards the iSCSI is initiated. The complete DTR message is sent to the iSCSI target defined in the target profile.
- The recommended iSCSI record format when using iSCSI as backup is GTP (the default format). If the iSCSI auto-retrieval (**gprs auto-retrieve** global configuration command) is enabled, the record format must be configured as GTP.
- When iSCSI auto-retrieval is enabled, along with sending the complete DTR message, the GGSN adds a 12-byte header in front of the message before storing it to SAN. This header is used when the DTRs are retrieved and sent to the charging gateway. (In addition, the RSM-layer adds a 12-byte header and 4-byte trailer to the message before it is stored).



**Note** If the DTRs are retrieved directly from the SAN through other means such as FTP, then each record must skip the 10-byte header to get to the actual DTR containing encoded CDRs.

### Writing DTRs when iSCSI is used as Primary Storage

- When there are no charging gateways configured, and only an iSCSI target profile is defined at the global charging level (charging group 0), or granular charging level (charging groups 1 to 29), the iSCSI is the primary storage for writing charging records.
- Although any iSCSI record format can be used, the ASN.1 iSCSI record format would enable the user to store raw ASN.1 encoded CDRs into iSCSI without any additional headers.



**Note**

The records in ASN.1 format are generated only when **gprs auto-retrieve** is disabled on the GGSN, which is the default behavior. The ASN.1 format should be used only when the iSCSI target is used as the primary storage for charging records (no charging gateways are configured).

### Reading CDRs

- Once the iSCSI backup storage configuration is in place, when a charging gateway comes up, the iSCSI initiator (GGSN) will request for any iSCSI records to be received from the iSCSI target.
- Once the GGSN receives a record, the 12-byte header added by the GGSN when the write process is removed and the complete DTR is sent to the charging gateway.

If the DTRs are to be marked for possibly duplicate before sending to the charging gateway, GGSN has to be configured with the following charging config command.

- **gprs charging message transfer-request command-ie**
- **gprs charging message transfer-request possibly-duplicate**

### iSCSI Restrictions

When configuring iSCSI G-CDR backup and storage on the GGSN, note the following:

- Currently, iSCSI targets cannot be dynamically discovered.
- The number of TCP connections per iSCSI session is limited to one.
- The iSCSI target device should be preformatted. Each LUN must have only one FAT32 partition.
- Maximum of size of a LUN must not be more than 2TB, which is the maximum disk size supported by a FAT32 file system.

When configuring iSCSI G-CDR Backup and Storage on the GGSN, complete the tasks in the following sections:

- [Configuring an iSCSI Target Profile, page 6-22](#)
- [Associating an iSCSI Target Profile, page 6-23](#)
- [Verifying the iSCSI Session, page 6-23](#)

## Configuring an iSCSI Target Profile



### Note

Up to 30 iSCSI profiles can be configured on the GGSN, however, only one target can be defined per profile, and only one profile at a time can be associated with the GGSN to use the iSCSI interface using the **gprs iscsi** command in global configuration mode.

To configure the iSCSI target profile on the GGSN, complete the following tasks, beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# <b>ip iscsi target-profile</b> <i>target_profile_name</i>	Creates an iSCSI target profile for the target and enters iSCSI interface configuration mode on the GGSN.
Step 2	Router(config-iscsi)# <b>name</b> <i>target name</i>	(Required) Name of the iSCSI target.
Step 3	Router(config-iscsi)# <b>ip</b> <i>ip_address</i>	(Required) IP address of the iSCSI target.
Step 4	Router(config-iscsi)# <b>port</b> <i>tcp port</i>	(Required) Number of the TCP “listening” port on the target. The default is 3260.
Step 5	Router(config-iscsi)# <b>source-interface</b> <i>loopback_interface_number</i>	(Optional) Number of the loopback interface if iSCSI traffic is to use a different source interface.
Step 6	Router(config-iscsi)# <b>vrf</b> <i>vrf_name</i>	(Optional) Name of the VRF instance if iSCSI traffic needs a VPN.
Step 7	Router(config-iscsi)# <b>exit</b>	Exits from iSCSI interface configuration mode.



### Note

The **name**, **ip**, and **port** iSCSI interface sub configurations are required. For a complete list of optional configurations that you can configure under a target profile, issue the “?” command while in iSCSI interface configuration mode or see the **ip iscsi target-profile** command description in the *Cisco GGSN Release 9.0 Command Reference*.

## Associating an iSCSI Target Profile

To configure the GGSN to use the iSCSI interface for G-CDR storage when no charging gateway is available, use the following command in global configuration mode:

Command	Purpose
Router(config)# <b>gprs iscsi</b> <i>target_profile_name</i>	Configures the GGSN to use a iSCSI profile for record storage.
	<b>Note</b> Only one profile can be defined at a time.
	<b>Note</b> The profile name specified must be the same as the one configured using the <b>ip iscsi target-profile</b> command.

## Verifying the iSCSI Session

To verify that the iSCSI session is up, use the following command in privileged EXEC mode:

Command	Purpose
Router# <b>show ip iscsi session</b>	Displays the status of iSCSI session.

## Monitoring and Maintaining iSCSI G-CDR Backup and Storage

The following is a list of commands that you can use to monitor and maintain the iSCSI backup and storage functions on the GGSN:

Command	Purpose
Router# <b>clear gprs iscsi statistics</b>	Clears GGSN iSCSI processing statistics.
Router# <b>clear ip iscsi statistics</b>	Clears iSCSI processing statistics.
Router# <b>clear record-storage-module</b>	Clears record storage module statistics.
Router# <b>show ip iscsi name</b>	Displays the name of the iSCSI initiator.
Router# <b>show ip iscsi session</b>	Displays the status of an iSCSI session.
Router# <b>show ip iscsi stats</b>	Displays the iSCSI and SCSI layer statistics.
Router# <b>show ip iscsi target</b>	Displays the iSCSI target details.
Router# <b>show record-storage-module stats</b>	Displays record storage module statistics.
Router# <b>show record-storage-module target-info</b> [ <b>all</b>   <b>target-profile</b> <i>profile_name</i> ]	Displays all disks available and their status, or the disk defined by a target profile.

# Configuring Granular Charging and Storage

The Cisco GGSN supports an access-point level charging configuration (granular charging) in addition to the default global charging configuration.

With granular charging, up to 30 *charging groups* can be configured per GGSN. In each charging group, a unique primary, secondary, and tertiary charging gateway, and iSCSI target can be defined and associated with an APN. Charging groups enable you to send charging records belonging to different APNs to different destinations.

If no charging group is associated with an APN, the default charging group (the primary, secondary, and tertiary charging gateways, iSCSI target, switchover priority, etc., configured at the global level) is used.

Charging group 0 is the default charging group defined at the global level. Charging groups 1 to 29 can be configured and associated with an APN.

## Usage Notes

When configuring granular charging and storage, note the following:

- Up to 30 charging groups can be configured per GGSN and associated with APNs. The 0 value is reserved for the default charging group that contains the global charging gateway and global iSCSI target, if configured. Values 1 to 29 can be used to define other charging groups.
- By default, all APNs use the default charging gateways defined at the global level (charging group 0), unless a charging group (charging group 1 to 29) is associated with the APN.
- The same charging group can be associated with multiple APNs, but only one charging group can be assigned per APN.
- A charging gateway can only be associated with a single charging group, it cannot be shared across groups regardless of whether it is defined as the primary, secondary, or tertiary gateway.
- An iSCSI target can only be associated with a single charging group, it cannot be shared across groups.
- The charging gateway switchover inside one charging group retains the same precedence as the global configuration (charging group 0)—primary charging gateway, to secondary charging gateway, to tertiary charging gateway, to iSCSI target.
- Once an APN is associated with a charging group, the APN will only switchover inside the charging group, it will not fall back to the globally configured charging gateways or iSCSI target.
- If an APN is associated with an empty charging group (a group for which the charging gateways or iSCSI target have not been defined), CDRs for that APN will not be generated unless the charging group has been placed in maintenance mode using the **gprs auto-retrieve** command.
- If only an iSCSI target is defined in a charging group, there is no fallback to the globally configured iSCSI target.
- If an charging group in which an iSCSI target has not been defined is associated to an APN, that APN cannot fallback to the globally configured iSCSI profile, therefore, to enable iSCSI backup and storage for an APN, ensure that the iSCSI target is defined in the charging group associated with the APN.
- To use an iSCSI target as the primary storage device for charging records for an APN, and not just as a backup device, define only an iSCSI target in the charging group associated with the APN.
- Auto-retrieval (the **gprs auto-retrieve** global configuration command) is not supported at the APN charging group level (groups 1 to 29), only at the global level (default charging group 0).



- When the iSCSI record format is set in the GGSN as ASN.1 or GTP, the configuration applies to all charging groups.
- Each charging group can be individually placed in maintenance mode and operational mode. Before modifying a charging group (adding or deleting charging gateways or the iSCSI target), put the group in maintenance mode using the **service-mode** charging group configuration command.
- When a charging group is in maintenance mode, pending charging messages (DTRs) from the group are moved to the group's charging maintenance queue. When the charging group is returned to operational mode, pending messages present in the group maintenance queue, or open CDRs present for the APNs using the charging group are moved to the charging path or iSCSI queue based on the following sequence:
  - If charging gateways are configured in the charging group, pending messages/open CDRs are moved to the path of the charging gateway with the highest priority.
  - If no charging gateways are configured, but an iSCSI target is, pending messages/open CDRs are moved to the iSCSI write queue.
  - If neither a charging gateway or an iSCSI target is configured in the charging group, the group cannot be moved to operational mode if there are any pending messages/open CDRs for the group.

**Note**

CDRs are not generated for a charging group only when the group is in operational mode and is empty.

To configure granular charging, complete the tasks in the following sections:

- [Configuring a Charging Group, page 6-25](#)
- [Associating a Charging Group with an Access Point, page 6-26](#)
- [Modifying a Charging Group, page 6-28](#)
- [Monitoring and Maintaining Granular Charging, page 6-28](#)

To configure granular charging and storage, complete the tasks in the following sections:

- [Configuring a Charging Group, page 6-25](#)
- [Associating a Charging Group with an Access Point, page 6-26](#)
- [Modifying a Charging Group, page 6-28](#)

## Configuring a Charging Group

To configure a charging group, complete the following tasks, beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# <b>gprs charging group</b> <i>group-number</i>	Defines or modifies a charging gateway group, where <i>group-number</i> is a value between 1 and 29.  <b>Note</b> The value of 0 is reserved for the default charging group that contains the global charging gateway and global iSCSI target, if configured. Values 1 to 29 can be used to define other charging groups.
Step 2	Router(config-chrg-group)# <b>description</b> <i>description</i>	Charging gateway group definition.
Step 3	Router(config-chrg-group)# <b>primary</b> { <i>ip-address</i>   <i>name</i> }	Specifies the primary charging gateway for the group, where: <ul style="list-style-type: none"><li>• <i>ip-address</i>—Specifies the IP address of a primary charging gateway.</li><li>• <i>name</i>—Specifies the host name of a charging gateway.</li></ul>
Step 4	Router(config-chrg-group)# <b>secondary</b> { <i>ip-address</i>   <i>name</i> }	Specifies the secondary charging gateway for the group, where: <ul style="list-style-type: none"><li>• <i>ip-address</i>—Specifies the IP address of a primary charging gateway.</li><li>• <i>name</i>—Specifies the host name of a charging gateway.</li></ul>
Step 5	Router(config-chrg-group)# <b>tertiary</b> { <i>ip-address</i>   <i>name</i> }	Specifies the secondary charging gateway for the group, where: <ul style="list-style-type: none"><li>• <i>ip-address</i>—Specifies the IP address of a primary charging gateway.</li><li>• <i>name</i>—Specifies the host name of a charging gateway.</li></ul>
Step 6	Router(config-chrg-group)# <b>switchover priority</b>	Configures the GGSN to switch over to the gateway of higher priority in the charging group when that gateway becomes active.
Step 7	Router(config-chrg-group)# <b>iscsi</b> <i>iscsi-profile-name</i>	Specifies an iSCSI target for CDR backup when the charging gateways are down.
Step 8	Router(config-chrg-group)# <b>service-mode</b> [ <b>maintenance</b>   <b>operational</b> ]	Places the charging group into maintenance mode or operational mode. The default is operational.
Step 9	Router(config-chrg-group)# <b>exit</b>	Exits charging gateway group configuration mode.

## Associating a Charging Group with an Access Point

Once you have configured the charging group, associate it with the APN.

To associate a charging group with an APN, use the following command in access-point configuration mode:

Command	Purpose
Router(config-access-point)# <b>charging group</b> <i>chrg-group-number</i>	Associates an existing charging group with an APN, where <i>group-number</i> is a number 1 through 29.

## Modifying a Charging Group

Before modifying a charging group, place the charging group in maintenance mode.

To place a charging group in maintenance mode, use the following command in charging group configuration mode:

Command	Purpose
Router(config-chrg-group)# <b>service-mode maintenance</b>	Places the charging group in maintenance mode.

To return the charging group to operational mode after modifying it, use the following command in charging group configuration mode:

Command	Purpose
Router(config-chrg-group)# <b>service-mode operational</b>	Places the charging group in operational mode.

## Monitoring and Maintaining Granular Charging

The following is a list of commands that you can use to monitor and maintain granular charging on the GGSN:

Command	Purpose
Router# <b>clear gprs charging cdr charging-group</b>	Clears GPRS call detail records (CDRs).
Router# <b>clear gprs iscsi statistics</b>	Clears the current GPRS-related iSCSI statistics.
Router# <b>show gprs access-point</b>	Displays information about access points on the GGSN.
Router# <b>show gprs charging parameters charging-group</b>	Displays cumulative charging statistics for the GGSN.
Router# <b>show gprs charging statistics</b>	Displays current charging statistics for the GGSN.
Router# <b>show gprs charging status</b>	Displays current charging statistics for the GGSN.
Router# <b>show gprs charging summary</b>	Displays a summary of all charging groups defined on the GGSN.



### Note

Many of the **clear** and **show** commands above have been enhanced with a **charging-group** keyword option for clearing and showing information specific to a charging group.

# Monitoring and Maintaining the Charging Function on the GGSN

This section provides a summary list of the **show** commands that you can use to monitor charging functions on the GGSN.

The following privileged EXEC commands are used to monitor and maintain charging on the GGSN:

Command	Purpose
Router# <b>show gprs charging parameters</b>	Displays information about the current GGSN charging configuration.
Router# <b>show gprs service-mode</b>	Displays the current global service mode state of the GGSN and the last time it was changed.
Router# <b>show gprs charging statistics</b>	Displays cumulative statistics about the transfer of charging packets between the GGSN and charging gateways.

## Configuration Examples

The following are examples of charging configurations implemented on the GGSN.

### Global Charging Configuration

#### GGSN Configuration

```
Router# show running-config
Building configuration...

Current configuration :7390 bytes
!
! Last configuration change at 16:56:05 UTC Wed Jun 25 2003
! NVRAM config last updated at 23:40:27 UTC Fri Jun 13 2003
!
version 12.3
.....
interface GigabitEthernet0/0.2
 description Ga/Gn Interface
 encapsulation dot1Q 101
 ip address 10.1.1.72 255.255.255.0
 no cdp enable
!
.....
ip route 40.1.2.1 255.255.255.255 10.1.1.1
!
gprs access-point-list gprs
 access-point 1
 access-point-name auth-accounting
 access-mode non-transparent
 aaa-group authentication first
 aaa-group accounting second
 ip-address-pool dhcp-proxy-client
 dhcp-server 10.60.0.1
 dhcp-gateway-address 10.60.0.1
 exit
!
. . .
```

```

!
gprs default charging-gateway 10.9.0.2
gprs charging send-buffer 1000
gprs charging container volume-threshold 500000
gprs charging container change-limit 3
gprs charging cdr-aggregation-limit 10
gprs charging cdr-option apn-selection-mode
gprs charging cdr-option served-msisdn
!
gprs memory threshold 512
!
. . .
!
end

```

### Supervisor Engine Configuration

```

Sup# show running-config
Building configuration...

Current configuration :12672 bytes
!
version 12.2
...
interface FastEthernet8/22
 no ip address
 switchport
 switchport access vlan 302
!
interface Vlan101
 description Vlan to GGSN for GA/GN
 ip address 10.1.1.1 255.255.255.0
!
interface Vlan302
 ip address 40.0.2.1 255.255.255.0

```

## Charging Profile Configuration

The following partial configuration example shows two charging profiles (charging profile 1 and charging profile 2) configured on the GGSN, with charging profile 1 being configured as the global default charging profile to be used for “any” type of user if a charging profile is not specified at the APN:

```

Router# show running-config
Building configuration...

Current configuration :7390 bytes
!
! Last configuration change at 16:56:05 UTC Wed Jun 25 2003
! NVRAM config last updated at 23:40:27 UTC Fri Jun 13 2003
!
version 12.3
....
interface GigabitEthernet0/0.2
 description Ga/Gn Interface
 encapsulation dot1Q 101
 ip address 10.1.1.72 255.255.255.0
 no cdp enable
!
....
ip route 40.1.2.1 255.255.255.255 10.1.1.1
!

```

```

!
. . .
!
gprs charging profile default any 1

gprs charging profile 1
description "roamer_profile"
limit volume 500000 reset
limit duration 30 reset
!
gprs charging profile 2
description "any_unmatched"
limit volume 1000000 reset
limit duration 60 reset
. . .
!
. . .
!
end

```

## Granular Charging and Storage Configuration

The following partial configuration example shows two charging groups (charging group 1 and charging group 2) configured on the GGSN, with an iSCSI target defined in charging group 1. Charging group 1 is associated with access point 4 and access point 5:

```

Router# show running-config
Building configuration...

Current configuration :7390 bytes
.....
!
gprs access-point-list gprs
access-point 4
access-point-name test2
charging group 1
!
access-point 5
access-point-name pppregen
charging group 1
ppp-regeneration
!
!
!
gprs charging group 2
primary 66.66.66.1
secondary 66.66.66.2
tertiary 66.66.66.3
!
gprs charging group 1
primary 55.55.55.1
secondary 55.55.55.2
tertiary 55.55.55.3
iscsi ISCSI_TARGET1
switchover priority
!
gprs iscsi TARGET_LINUX

```

