



CHAPTER 2

Planning to Configure the GGSN

This chapter provides information that you should know before configuring a gateway GPRS support node (GGSN).

This chapter includes the following sections:

- [Prerequisites, page 2-1](#)
- [Restrictions, page 2-9](#)
- [Additional References, page 2-11](#)

Prerequisites

Depending on the platform on which you are implementing a GGSN, the prerequisites vary. The sections below provide general guidelines to follow before configuring a GGSN in your network:

- [Before You Begin, page 2-1](#)
- [Platform Prerequisites, page 2-2](#)

Before You Begin

The Cisco GGSN Release 9.0 is supported on the Cisco Service and Application Module for IP (SAMI) for the Cisco 7600 series router platform.

Before you begin to configure a GGSN, you should know which networks your mobile users will be allowed to access using the GGSN. After you identify the networks, you can plan the interfaces to configure for the networks, and plan the associated access points to those networks and configure them on the GGSN.

For example, you might want to provide user access to the Internet through a public data network (PDN), plus access to two private corporate intranets. In this case, you need to set up three access points—one to enable user access to the PDN, and one for each of the two private intranets.

Platform Prerequisites

When configuring GGSNs on the Cisco 7600 series router platform, ensure that requirements outlined in the following sections are met:

- [Required Hardware and Software, page 2-2](#)
- [Required Base Configuration, page 2-3](#)

Required Hardware and Software

Implementing the Cisco GGSN Release 9.0 features on the Cisco 7600 series Internet router platform requires the following hardware and software:

- Any module that has ports to connect to the network.
- Cisco 7600 Series Supervisor Engine 720 (WS-SUP720-3BXL) with a Multilayer Switch Feature Card 3 (WS-SUP720)/Policy Feature Card 3 (WS-F6K-PFC3BXL) running Cisco IOS Release 12.2(33)SRC or later.

or

Cisco Supervisor Engine 32 with a Multilayer Switch Feature Card 2A (MSFC2A)/Policy Feature Card 3 (PFC3B) running Cisco IOS Release 12.2(33)SRC or later.

The Cisco Supervisor Engine 32 requires LCP ROMMON version 12.2[121] or later on the Cisco SAMI.

For details on upgrading the Cisco IOS release running on the supervisor engine, refer to the “Upgrading to a New Software Release” section in the Release Notes for Cisco IOS Release 12.2SR.

For details about verifying and upgrading the LCP ROMMON image on the Cisco SAMI, refer to the *Cisco Service and Application Module for IP User Guide*.

- Cisco Service and Application Module for IP (Cisco Product Number: WS-SVC-SAMI-BB-K9). The SAMI processors must be running Cisco IOS Release 12.4(22)YE1 or later.



Note The Cisco GGSN Release 9.0 software application ships preloaded on the Cisco SAMI processors and is automatically loaded onto each processor during an image upgrade. The Cisco GGSN Release 9.0 software application supports both the Cisco SAMI 1-GB memory default and the 2 GB memory option (Cisco Product Number: MEM-SAMI-6P-2GB[=]).

- IPSec VPN Services Module (for security).



Note

Certain GGSN features, such as enhanced service-aware billing and GTP-session redundancy, require additional hardware and software.

GTP-Session Redundancy

In addition to the required hardware and software above, implementing GTP-Session Redundancy (GTP-SR) requires at minimum:

- In a one-router implementation, two Cisco SAMIs in the Cisco 7600 series router, or
- In a two-router implementation, one Cisco SAMI in each of the Cisco 7600 series routers.

Enhanced Service-Aware Billing

In addition to the required hardware and software, implementing enhanced service-aware billi.

Enhanced Service-Aware Billing

In addition to the required hardware and software, implementing enhanced service-aware billing requires an additional Cisco SAMI running the Cisco Content Services Gateway - 2nd Generation software in each Cisco 7600 series router.

Required Base Configuration

After establishing connectivity from the switch to the various elements in your network, you must complete the following base configuration before implementing and customizing GGSNs on the Cisco SAMI.

Supervisor Engine Configuration

On the supervisor engine, ensure that:

1. A Layer 3–routed VLAN for each GGSN interface is created. For example, create a VLAN for the following interfaces:
 - Gn VLAN—Interconnects the Gn interfaces.
 - Ga VLAN—Interconnects the Ga interfaces.
 - AAA/OAM/DHCP VLAN—Interconnects the GGSN interfaces used for authentication, authorization, and accounting (AAA), Operation, Administration, and Maintenance (OAM), and DHCP functions.
 - One VLAN per APN Gi interface

You can configure the VLANs from VLAN database mode or global configuration mode. You cannot configure extended-range VLANs in VLAN database mode. You can configure extended-range VLANs only in global configuration mode.



Note RPR+ redundancy does not support configurations entered in VLAN database mode. If you have a high-availability configuration with redundant Supervisor modules using RPR(+), configure the VLANs in global configuration mode, not in VLAN database mode; otherwise, the VLAN information will not be synchronized to the redundant Supervisor module.

To configure a VLAN from global configuration mode:

```
Sup#conf terminal
Enter configuration commands, one per line. End with CNTL/Z.
Sup(config)#vlan 222
Sup(config-vlan)#end
Sup#
```

In the preceding example, VLAN 222 is a Layer 2–switched VLAN. The subnet associated with it is not known by the supervisor engine routing table. To configure VLAN 222 as a Layer 3–switched VLAN (or routed VLAN), configure a VLAN 222 interface on the supervisor engine and assign an IP address to the interface:

```
Sup# configure terminal
Sup(config)# interface vlan222
Sup(config-if)# ip address n.n.n.n mask
Sup(config-if)# no ip redirects
```

The following is an example of the VLAN configuration on the supervisor engine:

```
Sup# show running-config
!
. . .
vlan 103,110,160,200,300-301,310
!
!
interface Vlan103
 description Gn VLAN
 ip address 10.20.21.1 255.255.255.0
 no ip redirects
!
interface Vlan110
 description OAM/AAA/DHCP VLAN
 ip address 10.20.50.1 255.255.255.0
 no ip redirects
!
interface Vlan200
 description Ga Charging VLAN
 no ip address
 no ip redirects
!
interface Vlan310
 description VLAN for APN Internet
 ip address 10.20.51.1 255.255.255.0
```

For detailed information on configuring VLANs, see the *Cisco 7600 Series Cisco IOS Software Configuration Guide*.

2. The Cisco IOS software server load balancing (SLB) feature is installed and configured for GTP load balancing. For more information, see the *IOS Server Load Balancing* feature module and [Chapter 13, “Configuring Load Balancing on the GGSN.”](#)
3. Permit traffic to the SAMI by enabling multiple switch virtual interfaces (SVIs), assigning the VLANs to a VLAN group, and then assigning the VLAN groups to the SAMI using the following commands:

```
!
...
!
svclc multiple-vlan-interfaces
svclc module 7 vlan-group 71, 73
svclc vlan-group 71, 71
svclc vlan-group 73, 95, 100, 101
!
...
!
```



Note VLAN IDs must be consistent be the same in the supervisor engine and Cisco SAMI configurations. For more information about configuring the Cisco SAMI, refer the *Cisco Service and Application Module for IP User Guide*.

4. A static route is configured to each GGSN instance configured on the Cisco SAMI:

```
!
...
!
ip route 10.20.30.1 255.255.255.255 10.20.21.20
ip route 10.20.30.2 255.255.255.255 10.20.21.21
ip route 10.20.30.3 255.255.255.255 10.20.21.22
```

```

ip route 10.20.30.4 255.255.255.255 10.20.21.23
ip route 10.20.30.5 255.255.255.255 10.20.21.24
!
...

```

GGSN Configuration

On each GGSN instance on the Cisco SAMI, ensure that:

1. A static route is configured to the supervisor engine.

```

!
...
!
ip route 0.0.0.0 0.0.0.0 10.20.21.1
...
!

```

2. A subinterface, on which 802.1Q encapsulation is enabled, is configured to each VLAN that you created on the supervisor engine.

The following is an example of a Ga/Gn subinterface configuration on the GGSN to VLAN 103 configured on the supervisor engine:

```

!
...
interface GigabitEthernet0/0.2
description Ga/Gn Interface
encapsulation dot1Q 101
ip address 10.1.1.72 255.255.255.0
no cdp enable
...
!

```

For detailed information on configuring, see the following:

- Ga subinterfaces—“[Configuring an Interface to the Charging Gateway](#)” section on page 6-2.
- Gn subinterfaces—“[Configuring an Interface to the SGSN](#)” section on page 8-1.
- Gi subinterfaces—“[Configuring an Interface to a PDN](#)” section on page 8-12.

Configuration Examples

The following are base configuration examples for the supervisor engine and the GGSN instance running on the Cisco SAMI.

Supervisor Engine

```

hostname 7600-a
!
boot system flash
boot device module 7 cf:4
!
svclm multiple-vlan-interfaces
svclm module 7 vlan-group 71, 73
svclm vlan-group 71, 71
svclm vlan-group 73, 95, 100, 101
vtp mode transparent
redundancy
mode rpr-plus
main-cpu
auto-sync running-config
auto-sync standard
!

```

```

power redundancy-mode combined
!
vlan 1
  vlan1 1002
  vlan2 1003
!
vlan 2
  name SNIFFER
!
vlan 71,95
!
vlan 100
  name Internal_Gi_for_GGSN-SAMI
!
vlan 101
  name Internal_Gn/Ga
!
vlan 165
!
vlan 302
  name Gn_1
!
vlan 303
  name Ga_1
!
vlan 1002
  vlan1 1
  vlan2 1003
!
vlan 1003
  vlan1 1
  vlan2 1002
  parent 1005
  backupcrf enable
!
vlan 1004
  bridge 1
  stp type ibm
!
vlan 1005
  bridge 1
!
interface FastEthernet8/22
  description To SGSN
  no ip address
  switchport
  switchport access vlan 302
!
interface FastEthernet8/23
  description To CGF
  no ip address
  switchport
  switchport access vlan 302
!
interface FastEthernet8/26
  description To DHCP/RADIUS Servers
  no ip address
  switchport
  switchport access vlan 95
!
interface FastEthernet8/31
  description To BackBone
  no ip address
  switchport

```

```

    switchport access vlan 71
    !
interface FastEthernet9/32
    description To CORPA
    no ip address
    switchport
    switchport access vlan 165
    no cdp enable
    !
!interface Vlan1
    no ip address
    shutdown
    !
interface Vlan71
    description VLAN to tftpserver
    ip address 1.7.46.65 255.255.0.0
    !
interface Vlan95
    description VLAN for RADIUS and DHCP
    ip address 10.2.25.1 255.255.255.0
    !
interface Vlan100
    description Internal VLAN SUP-to-SAMI Gi
    ip address 10.1.2.1 255.255.255.0
    !
interface Vlan101
    description VLAN to GGSN for GA/GN
    ip address 10.1.1.1 255.255.255.0
    !
interface Vlan165
    description VLAN to CORPA
    ip address 165.1.1.1 255.255.0.0
    !
interface Vlan302
    ip address 40.0.2.1 255.255.255.0
    !
interface Vlan303
    ip address 40.0.3.1 255.255.255.0
    !
router ospf 300
    log-adjacency-changes
    summary-address 9.9.9.0 255.255.255.0
    redistribute static subnets route-map GGSN-routes
    network 40.0.2.0 0.0.0.255 area 300
    network 40.0.3.0 0.0.0.255 area 300
    !
ip classless
ip route 9.9.9.72 255.255.255.255 10.1.1.72
ip route 9.9.9.73 255.255.255.255 10.1.1.73
ip route 9.9.9.74 255.255.255.255 10.1.1.74
ip route 9.9.9.75 255.255.255.255 10.1.1.75
ip route 9.9.9.76 255.255.255.255 10.1.1.76
ip route 110.72.0.0 255.255.0.0 10.1.1.72
ip route 110.73.0.0 255.255.0.0 10.1.1.73
ip route 110.74.0.0 255.255.0.0 10.1.1.74
ip route 110.75.0.0 255.255.0.0 10.1.1.75
ip route 110.76.0.0 255.255.0.0 10.1.1.76
    !
access-list 1 permit 9.9.9.0 0.0.0.255
    !
route-map GGSN-routes permit 10
    match ip address 1
    !

```

GGSN Instance on a Cisco SAMI Processor

```

service gprs ggsn
!
hostname 7600-7-2
!
ip cef
!
interface Loopback0
description USED FOR DHCP gateway
ip address 110.72.0.2 255.255.255.255
!
interface Loopback100
description GPRS GTP V-TEMPLATE IP ADDRESS
ip address 9.9.9.72 255.255.255.0
!
interface GigabitEthernet0/0
no ip address
!
interface GigabitEthernet0/0.1
description Gi
encapsulation dot1Q 100
ip address 10.1.2.72 255.255.255.0
!
interface GigabitEthernet0/0.2
description Ga/Gn Interface
encapsulation dot1Q 101
ip address 10.1.1.72 255.255.255.0
no cdp enable
!
interface GigabitEthernet0/0.71
description TFTP or Backbone
encapsulation dot1Q 71
ip address 1.7.46.72 255.255.0.0
!
interface GigabitEthernet0/0.95
description CNR and CAR
encapsulation dot1Q 95
ip address 10.2.25.72 255.255.255.0
!
interface Virtual-Template1
description GTP v-access
ip unnumbered Loopback100
encapsulation gtp
gprs access-point-list gprs
!
ip classless
ip route 0.0.0.0 0.0.0.0 10.1.2.1
ip route 40.1.2.1 255.255.255.255 10.1.1.1
ip route 40.1.3.10 255.255.255.255 10.1.1.1
ip route 40.2.2.1 255.255.255.255 10.1.1.1
ip route 40.2.3.10 255.255.255.255 10.1.1.1
ip route 40.3.2.3 255.255.255.255 10.1.1.1
ip route 40.4.2.3 255.255.255.255 10.1.1.1
!
gprs access-point-list gprs
access-point 1
access-point-name CORPA.com
ip-address-pool dhcp-proxy-client
aggregate auto
dhcp-server 10.2.25.90
dhcp-gateway-address 110.72.0.2
!

```


Restrictions

When configuring a Cisco GGSN, note the following:

- The Cisco GGSN does not support the Cisco Express Forwarding (CEF) neighbor resolution optimization feature, which is enabled by default. Therefore, to avoid the possibility of incomplete adjacency on VLAN interfaces for the redirected destination IP address and an impact to the upstream traffic flow for PDP sessions upon startup, ensure that you configure the **no ip cef optimize neighbor resolution** command.
- The number of PDP contexts supported on a GGSN is dependent on the memory and platform in use and the GGSN configuration (for example, whether or not a method of Point to Point Protocol [PPP] has been configured to forward packets beyond the terminal equipment and mobile termination, whether Dynamic Feedback Protocol [DFP] is being used or the memory protection feature is enabled, and what rate of PDP context creation will be supported).



Note DFP weighs PPP PDPs against IP PDPs. One PPP PDP is equal to eight IP PDPs, and one IPv6 PDP equals 8 IPv4 PDPs.

Table 2-1 lists the maximum number of PDP contexts the Cisco SAMI with the 1 GB memory option can support. Table 2-2 lists the maximum number the Cisco SAMI with the 2 GB memory option can support.:

Table 2-1 Number of PDPs Supported in 1 GB SAMI

| PDP Type | Maximum Number per GGSN | Maximum Number per SAMI ¹ |
|------------------|-------------------------|--------------------------------------|
| IPv4 | 66,000 | 400,000 |
| IPv6 | 8,000 | 48,000 |
| PPP Regeneration | 16,000 | 96,000 |
| PPP | 8,000 | 48,000 |

1. Maximum number per SAMI on which six GGSNs are configured.

Table 2-2 Number of PDPs Supported in 2 GB SAMI

| PDP Type | Maximum Number per GGSN | Maximum Number per SAMI ¹ |
|------------------|-------------------------|--------------------------------------|
| IPv4 | 136,000 | 816,000 |
| IPv6 | 16,000 | 96,000 |
| PPP Regeneration | 32,000 | 192,000 |
| PPP | 16,000 | 96,000 |

1. Maximum number per SAMI on which six GGSNs are configured.

- To avoid issues with high CPU usage, we recommend the following configurations:
 - To reduce the CPU usage during startup, disable logging to the console terminal by configuring the **no logging console** command in global configuration mode.
 - To ensure that the HSRP interface does not declare itself active until it is ready to process a peer's Hello packets, configure the delay period before the initialization of HSRP groups with the **standby delay minimum 100 reload 100 interface** configuration command under the HSRP interface.
 - To minimize issues with high CPU usage for additional reasons, such as periods of high PPP PDP processing (creating and deleting), use the **no logging event link-status** interface command to disable the notification of interface data link status changes on all virtual template interfaces of the GGSN .

```

!
interface Virtual-Template1
description GGSN-VT
ip unnumbered Loopback0
encapsulation gtp
no logging event link-status
gprs access-point-list gprs
end

```

For implementation of a service-aware GGSN, the following additional important notes, limitations, and restrictions apply:

- RADIUS accounting is enabled between the CSG2 and GGSN to populate the Known User Entries Table (KUT) entries with the PDP context user information.
- CSG2 must be configured with the quota server addresses of all the GGSN instances.
- Service IDs on the CSG2 are configured as numeric strings that match the category IDs on the Diameter Credit Control Application (DCCA) server.
- If RADIUS is not being used, the Cisco CSG2 is configured as a RADIUS endpoint on the GGSN.
- On the SGSN, the values configured for the number GTP N3 requests and T3 retransmissions must be larger than the sum of all possible server timers (RADIUS, DCCA, and CSG2).

Specifically the SGSN $N3 * T3$ must be greater than:

$$2 \times \text{RADIUS timeout} + N \times \text{DCCA timeout} + \text{CSG2 timeout}$$

where:

- 2 is for both authentication and accounting.
- N is for the number of Diameter servers configured in the server group.



Note Configuring a $N3 * T3$ lower than the default might impact slow TCP-based charging paths.

Additional References

For additional information related to implementing basic connectivity, see the following sections:

- [Related Documents, page 2-11](#)
- [Standards, page 2-11](#)
- [MIBS, page 2-12](#)
- [RFCs, page 2-12](#)
- [Technical Assistance, page 2-12](#)

Related Documents

- *Release Notes for Cisco GGSN Release 9.0 on the Cisco SAMI, Cisco IOS Release 12.4(22)YE1*
- *Cisco Service and Application Module for IP User Guide*
- *Cisco IOS Network Management Configuration Guide*
- *Release Notes for Cisco IOS Release 12.2SR for the Cisco 7600 Series Routers*
- *Cisco 7600 Series Cisco IOS Software Configuration Guide*
- *Cisco 7600 Series Cisco IOS Command Reference*
- *Cisco IOS Quality of Service Solutions Configuration Guide, Cisco IOS Release 12.4*
- *Cisco IOS Configuration Guides and Command References, Release 12.4*

Standards

Cisco GGSN Release 9.0 supports the following Third Generation Partnership Program (3GPP) standards and is backward compatible with prior 3GPP Technical Specifications (TS):

Table 2-3 Third Generation Partnership Program (3GPP) Standards Supported by Cisco GGSN Release 9.0

| 3G TS# | Title | Release | GGSN Release 9.0 |
|--------|-----------------------|---------|------------------|
| 29.060 | GTP across Gn and Gp | 7 | 8.1.0 |
| 29.061 | Interworking with PDN | 7 | 7.5.0 |
| 32.015 | Charging | 99 | 3.12.0 |
| 32.215 | Charging | 5 | 5.9.0 |
| 32.251 | Charging | 7 | 7.5.1 |



Note

Cisco GGSN Release 9.0 provides limited support on some sections of the TSs listed above.

The GGSN interfaces comply with the following SMG (Special Mobile Group) standards:

- Ga interface—SMG#28 R99
- Gn interface—SMG#31 R98

MIBS

- CISCO-GGSN-EXT-MIB
- CISCO-GGSN-MIB
- CISCO-GGSN-QOS-MIB
- CISCO-GGSN-SERVICE-AWARE-MIB
- CISCO-GPRS-ACC-PT-MIB
- CISCO-GPRS-CHARGING-MIB
- CISCO-GPRS-GTP-CAPABILITY-MIB
- CISCO-GTP-MIB
- CISCO-ISCSI

For information about MIBs, see:

<http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml>

RFCs

- RFC 1518, *An Architecture for IP Address Allocation with CIDR*
- RFC 1519, *Classless Inter-Domain Routing (CIDR): an Address Assignment and Aggregation Strategy*
- RFC 1661, *The Point-to-Point Protocol (PPP)*
- RFC 2461, *Neighbor Discovery for IP Version 6 (IPv6)*
- RFC 2462, *IPv6 Stateless Address Autoconfiguration*
- RFC 2475, *An Architecture for Differentiated Services*
- RFC 3162, *RADIUS and IPv6*
- RFC 3588, *Diameter Base Protocol*
- RFC 3720, *Internet Small Computer Systems Interface (iSCSI)*
- RFC 4006 *Diameter Credit-Control Application*

Technical Assistance

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