

## Configuring GDM

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This chapter describes how to configure a Cisco Systems router to provide GDM services. It provides information about configuring access from GDM to the Serving GPRS Support Node (SGSN) and Gateway GPRS Support Node (GGSN) in the General Packet Radio Service (GPRS) network, and configuring Domain Name System (DNS) services to support the GDM environment. It also provides basic configuration information about establishing a single Hot Standby Router Protocol (HSRP) group in an environment where multiple GDMs are implemented.

For a complete description of the GPRS commands in this chapter, refer to the *Cisco IOS Mobile Wireless Command Reference*. To locate documentation of other commands that appear in this chapter, you can use the command reference master index or search online. See the “Related Documents” section on page 251 for a list of the other Cisco IOS software documentation that might be helpful while configuring GDM.

This chapter includes the following sections:

- GDM Configuration Task List, page 253
- Verifying GDM Configuration, page 262
- GDM Configuration Example, page 263

## GDM Configuration Task List

To successfully configure GDM in the GPRS network, you not only need to configure the Cisco Systems router for GDM services, but you also need to configure several entities within the GPRS network to support proper communication with GDM. For example, you must establish routing between GDM and the SGSN and GGSN, and you must configure the DNS servers to return the appropriate IP addresses for the GDM environment.

To configure GDM, perform the following tasks:

- Configuring GDM Services, page 254 (Required)
- Configuring the Virtual Template Interface on GDM, page 254 (Required)
- Configuring the Physical Interfaces on GDM, page 255 (Required)
- Configuring Routes on GDM, page 256 (Required)
- Configuring HSRP on GDM, page 258 (Optional)
- Customizing GDM, page 261 (Optional)

## Configuring GDM Services

To enable the router to perform GDM functions, you must configure the router to support GTP director services.



### Note

A router cannot support both GGSN and GDM services simultaneously. Therefore, do not attempt to configure the **service gprs gtp-director** command on the same router that is configured with the **service gprs ggsn** command.

To configure GDM director services, use the following command beginning in global configuration mode:

Command	Purpose
Router(config)# <b>service gprs gtp-director</b>	Configures a router for GTP Director Module (GDM) functions.

## Configuring the Virtual Template Interface on GDM

The Cisco IOS software uses a logical interface called a virtual template to configure the router for GDM functions. The virtual template interface provides the required IP addressing and GTP encapsulation to support GDM services.

Be sure to meet the following requirements when you configure GDM on a Cisco Systems router:



- Configure only a single virtual template interface with GTP encapsulation on GDM.
- Configure the IP address of the virtual template for GDM on a different network than the physical interfaces that are configured on the router.



### Note

If you are implementing multiple GDMs in your network using HSRP, configure the same IP address for the virtual template interface on each router.

To configure the GDM virtual template interface, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	<code>router(config)# interface virtual-template number</code>	<p>Creates a virtual template interface, where <i>number</i> identifies the virtual template interface. This command enters you into interface configuration mode.</p> <p> <b>Note</b> The GGSN supports only a single virtual template for the GTP virtual interface.</p>
Step 2	<code>router(config-if)# ip address ip-address mask [secondary]</code>	<p>Specifies an IP address for the interface, where:</p> <ul style="list-style-type: none"> <li><i>ip-address</i>—Specifies the IP address of the interface in dotted decimal format.</li> </ul> <p> <b>Note</b> The IP address of the virtual template interface must be on a different network than the physical interfaces on GDM.</p> <ul style="list-style-type: none"> <li><i>mask</i>—Specifies a subnet mask in dotted decimal format.</li> <li><b>secondary</b>—Specifies that the configured address is a secondary IP address. If this keyword is omitted, the configured address is the primary IP address.</li> </ul>
Step 3	<code>router(config-if)# encapsulation gtp</code>	Specifies GTP as the encapsulation type for packets transmitted over the virtual template interface.

## Configuring the Physical Interfaces on GDM

To properly configure GDM, you must configure the physical interfaces that GDM uses to reach the networks on which the SGSN and GGSNs reside.

The type of physical interface that you configure on GDM depends on whether you are supporting an SGSN or GGSN that is collocated with GDM, or an SGSN or GGSN that is connected remotely through a WAN interface.

For example, when GDM is collocated with the SGSN or GGSN, the physical interface is frequently configured for Fast Ethernet. The supported WAN interfaces for a remote SGSN or GGSN include T1/E1, T3/E3, and Frame Relay.

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

To configure a physical interface to the SGSN or GGSN that supports Fast Ethernet on a Cisco 7200 series router, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# <b>interface</b> <i>type slot/port</i>	Defines a physical interface on GDM, where <i>type</i> is <b>fastethernet</b> , and <i>slot/port</i> is the hardware slot and port on the interface.
Step 2	Router(config-if)# <b>ip address</b> <i>ip-address mask</i> [ <b>secondary</b> ]	Specifies an IP address for the interface, where: <ul style="list-style-type: none"> <li>• <i>ip-address</i>—Specifies the IP address of the interface in dotted decimal format.</li> <li>• <i>mask</i>—Specifies a subnet mask in dotted decimal format.</li> <li>• <b>secondary</b>—Specifies that the configured address is a secondary IP address. If this keyword is omitted, the configured address is the primary IP address.</li> </ul>

## Configuring Routes on GDM

To communicate with the SGSN and the GGSNs, you can use static routes or a routing protocol, such as Open Shortest Path First (OSPF). GDM may or may not reside on the same subnet as the SGSN or GGSNs, so you need to adjust your routing configuration according to your particular network configuration and requirements.



### Note

For the SGSN to communicate successfully with GDM, the SGSN must also configure a static route, or be able to dynamically route to the IP address of the GDM *virtual template*, not the IP address of an GDM physical interface. For more information about the configuration requirements in the other parts of the GPRS PLMN, see the Chapter , “Planning to Configure GDM.”

The following sections provide some basic commands that you can use to configure a static route or enable OSPF routing on GDM. For more information about configuring IP routes and OSPF, see the *Cisco IOS IP Configuration Guide* and *Cisco IOS IP Command References*.

The following topics are included in this section:

- Configuring a Static Route on GDM, page 256
- Configuring OSPF on GDM, page 257

## Configuring a Static Route on GDM

A static route establishes a fixed route that is stored in the routing table. If you are not implementing a routing protocol, such as OSPF, then you can configure a static route from GDM to the SGSN, or from GDM to the GGSNs, to establish the route that GDM uses to reach these network devices.

When you define a static route from GDM to the SGSN, you need to create the route between a *physical* interface on GDM to the SGSN. However, for the SGSN to properly communicate with GDM, the SGSN must be able to route to the *logical* interface—the virtual template interface—on GDM. For more information about configuring a route from the SGSN to GDM, see the “Configuring a Route From the SGSN to GDM” section on page 249.

To configure a static route from a physical interface on GDM to the SGSN or GGSN, use the following command beginning in global configuration mode:

Command	Purpose
<pre>Router(config)# <b>ip route</b> prefix mask {ip-address   interface-type interface-number} [distance] [<b>tag</b> tag] [<b>permanent</b>]</pre>	<p>Configures a static IP route, where:</p> <ul style="list-style-type: none"> <li>• <i>prefix</i>—Specifies the IP route prefix for the destination.</li> <li>• <i>mask</i>—Specifies the prefix mask for the destination.</li> <li>• <i>ip-address</i>—Specifies the IP address of the next hop that can be used to reach the destination network.</li> <li>• <i>interface-type interface-number</i>—Specifies the network interface type and interface number that can be used to reach the destination network.</li> <li>• <i>distance</i>—Specifies an administrative distance for the route.</li> <li>• <b>tag tag</b>—Specifies a tag value that can be used as a “match” value for controlling redistribution via route maps.</li> <li>• <b>permanent</b>—Specifies that the route will not be removed, even if the interface shuts down.</li> </ul>

## Configuring OSPF on GDM

As with other routing protocols, enabling OSPF requires that you create an OSPF routing process, specify the range of IP addresses to be associated with the routing process, and assign area IDs to be associated with that range of IP addresses.

To configure OSPF, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# <b>router ospf</b> <i>process-id</i>	Enables OSPF routing, and enters router configuration mode, where <i>process-id</i> specifies an internally used identification parameter for an OSPF routing process.  The <i>process-id</i> is locally assigned and can be any positive integer. A unique value is assigned for each OSPF routing process.
Step 2	Router(config-router)# <b>network</b> <i>ip-address</i> <i>wildcard-mask</i> <b>area</b> <i>area-id</i>	Defines an interface on which OSPF runs and defines the area ID for that interface, where: <ul style="list-style-type: none"> <li>• <i>ip-address</i>—Specifies the IP address to be associated with the OSPF network area.</li> <li>• <i>wildcard-mask</i>—Specifies the IP address mask that includes “don't care” bits for the OSPF network area.</li> <li>• <i>area-id</i>—Specifies the area that is to be associated with the OSPF address range. It can be specified as either a decimal value or as an IP address. If you intend to associate areas with IP subnets, you can specify a subnet address as the <i>area-id</i>.</li> </ul>

## Configuring HSRP on GDM

To provide increased network availability, a backup GDM router can be configured to automatically switch over and become the primary GDM router using HSRP. The backup GDM router can provide access to the GGSNs if the primary GDM router, or even a critical interface on the primary GDM router, becomes unavailable.

When configuring GDM for HSRP, be aware of the following restrictions:

- GDM supports a single HSRP group only. Therefore, an GDM router cannot be configured to support more than one HSRP group.
- When you configure the virtual template interface on each GDM router, use the same IP address.
- Configure the same standby IP address on each GDM using the **standby ip** interface configuration command and be sure that the SGSN can route the IP address of the virtual template interface through that LAN segment where you are running HSRP.

You need to configure HSRP on the physical interface of both the primary and backup GDM routers. Typically, these physical interfaces are on the same network, and the **standby ip** address is also on the same network.

For an example of HSRP configuration on GDM, see the “GDM Configuration Example” section on page 263.

This section describes some of the basic commands that you can use to implement HSRP on GDM. For more information about HSRP configuration, see the *Cisco IOS IP Configuration Guide*, and *Cisco IOS IP Command Reference, Volume 1 of 3*.

To configure HSRP on GDM, use the following commands beginning in interface configuration mode:

Command	Purpose
<b>Step 1</b> Router(config-if)# <b>standby</b> [ <i>group-number</i> ] <b>ip</b> [ <i>ip-address</i> [ <b>secondary</b> ]]	Activates HSRP on the interface, where: <ul style="list-style-type: none"> <li>• <i>group-number</i>—Specifies the HSRP group number for which HSRP is being activated. The default group is 0.</li> <li>• <i>ip-address</i>—Specifies the IP address of the Hot Standby router interface.</li> <li>• <b>secondary</b>—Indicates the IP address is a secondary Hot Standby router interface. Useful on interfaces with primary and secondary addresses; you can configure primary and secondary HSRP addresses.</li> </ul>
<b>Step 2</b> Router(config-if)# <b>standby</b> [ <i>group-number</i> ] <b>priority</b> <i>priority</i>	Specifies the HSRP priority, which determines which router becomes the active router, where: <ul style="list-style-type: none"> <li>• <i>group-number</i>—Specifies the HSRP group number to which the priority applies. The default group is 0.</li> <li>• <i>priority</i>—Specifies a value (between 1 and 255) that prioritizes the router for hot standby. The default value is 100.</li> </ul>

Command	Purpose
<b>Step 3</b> Router(config-if)# <b>standby</b> [ <i>group-number</i> ] <b>preempt</b> [ <b>delay</b> [ <i>minimum</i>   <b>sync</b> ] <i>delay</i> ]	<p>Configures HSRP preemption and preemption delay, which means that when the local router has a Hot Standby priority higher than the current active router, the local router should attempt to assume control as the active router.</p> <p>If the preempt keyword is not configured, the local router assumes control as the active router only if it receives information indicating that there is no router currently in the active state (acting as the designated router).</p> <p>The following options are available:</p> <ul style="list-style-type: none"> <li>• <i>group-number</i>—Specifies the HSRP group number to which the preemption applies. The default group is 0.</li> <li>• <b>delay minimum</b> <i>delay</i>—Specifies that the local router postpones taking over the active role for <i>delay</i> (minimum) seconds since that router was last restarted. The range is from 0 to 3600 seconds (1 hour). The default is 0 seconds (no delay).</li> <li>• <b>delay sync</b> <i>delay</i>—Specifies the maximum synchronization period in seconds.</li> </ul>
<b>Step 4</b> Router(config-if)# <b>standby</b> [ <i>group-number</i> ] <b>track</b> <i>interface-type interface-number</i> [ <i>interface-priority</i> ]	<p>Configures an interface so that the Hot Standby priority changes based on the availability of other interfaces, where:</p> <ul style="list-style-type: none"> <li>• <i>group-number</i>—Specifies the HSRP group number to which the tracking applies. The default group is 0.</li> <li>• <i>interface-type</i>—Specifies the interface type (combined with interface number) that will be tracked.</li> <li>• <i>interface-number</i>—Specifies the interface number that will be tracked.</li> <li>• <i>interface-priority</i>—Specifies the amount by which the Hot Standby priority for the router is decremented (or incremented) when the interface goes down (or comes back up). The default value is 10.</li> </ul>



## Customizing GDM

This section describes options that you can modify to customize your GDM configuration. It includes the following topic:

- Configuring the Retry Timeout Period on GDM, page 261

### Configuring the Retry Timeout Period on GDM

You can specify the length of time during which GDM forwards all retries of create PDP context requests for a specific TID from an SGSN to the same GGSN. The retry-timeout value represents the maximum period of time during which GDM expects the real GGSN to establish or reject the PDP context request. The default value is 30 seconds.

It is recommended that the retry-timeout value be specified according to the following formula:

$$T \geq (N3 \cdot T3 + B),$$

where:

- T is the GDM retry-timeout. This is the value that you need to determine for the **gprs gtp-director retry-timeout** command on the GDM router.
- N3 is the retry count that is configured on the SGSN.
- T3 is the retry timer that is configured on the SGSN.
- B is some integer that you choose as a buffer factor. The buffer factor is suggested to allow sufficient time for routing and processing the request by the real GGSN.



#### Note

You can configure the **gprs gtp-director retry-timeout** command in real time for GDM. The new value will be used for create PDP context requests coming in for any new TIDs. The new value is not retroactive for existing TIDs. Therefore, the old value is used for any PDP context requests for an existing TID.

To configure the retry timeout period on GDM, use the following command beginning in global configuration mode:

Command	Purpose
Router(config)# <b>gprs gtp-director retry-timeout</b> <i>seconds</i>	Specifies the amount of time during which GDM forwards all retries of create PDP context requests for a specific TID from an SGSN to the same GGSN.

## Verifying GDM Configuration

To verify GDM configuration, you can use the **show running-config** privileged EXEC command. The following sample output shows the configuration of a router named “adm1” with HSRP configured. Some of the commands most relevant to the GDM configuration are shown in bold.

Observe that your configuration contains similar output fields as those highlighted in bold in the output below. If you are not using HSRP, then the standby interface configuration commands are not needed:

```
GDM1# show running-config
Building configuration...

Current configuration : 2875 bytes
!
version 12.2
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
service gprs gtp-director
!
hostname adm1
!
ip cef
ip subnet-zero
!
ip domain round-robin
ip domain-name my.gprs.com
ip name-server 172.16.43.11
!
interface FastEthernet0/0
  description Interface to Backup GDM2 and SGSN
  ip address 10.10.1.3 255.255.255.0
  no ip mroute-cache
  duplex full
  standby ip 10.10.1.10
  standby priority 105
  standby preempt
  standby track FastEthernet2/0
!
interface FastEthernet2/0
  description Interface to GGSN
  ip address 10.10.2.1 255.255.255.0
  no ip mroute-cache
  duplex full
!
interface FastEthernet6/0
  ip address 172.16.43.243 255.255.255.240
  no ip mroute-cache
  duplex half
!
interface Virtual-Template1
  ip address 10.11.11.1 255.255.255.0
  encapsulation gtp
!
router ospf 200
  log-adjacency-changes
  network 10.10.0.0 0.0.255.255 area 0
!
ip default-gateway 172.16.43.241
ip classless
ip route 10.22.22.1 255.255.255.255 FastEthernet2/0
ip route 192.64.0.0 255.0.0.0 172.16.43.241
```

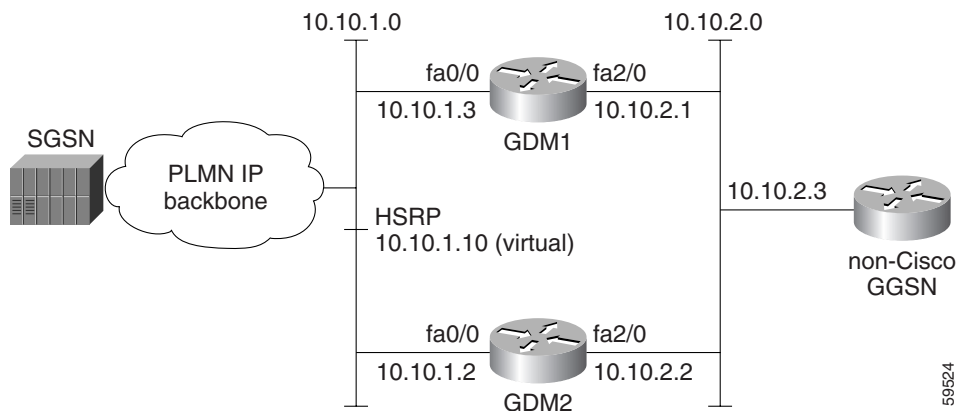
```
ip route 172.16.0.0 255.255.0.0 172.16.43.241
no ip http server
no ip pim bidir-enable
!
dialer-list 1 protocol ip permit
dialer-list 1 protocol ipx permit
!
gprs gtp-director retry-timeout 60
!
call rsvp-sync
!
mgcp profile default
!
gatekeeper
 shutdown
!
line con 0
 exec-timeout 0 0
 length 0
line aux 0
line vty 0 4
 password lab
 login
line vty 5 15
 login
!
!
end
```

## GDM Configuration Example

The following GDM configuration example shows two routers configured for GDM services using HSRP. Although GDM will likely be used to support multiple GGSNs for load balancing, only a single GGSN is shown in this example for simplicity.

Each GDM router configures the same IP address of 10.11.11.1 for the virtual template interface. In this example, the DNS query by the SGSN should return the IP address of 10.11.11.1 for the GDM router associated with the implemented real or virtual APNs. However, the SGSN must route the address 10.11.11.1 through the LAN segment in use by HSRP (the 10.10.1.0 subnet). The address 10.10.1.10 is the standby IP address that GDM1 and GDM2 routers configure for HSRP support using the **standby ip** interface configuration command.

Because the FastEthernet2/0 interface is the single point of failure to the GGSN in this example, each GDM tracks the status of this interface for HSRP support using the **standby track** interface configuration command.



### GDM1 Configuration

```

Current configuration : 2875 bytes
!
version 12.2
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
! Enable the router for GDM services
!
service gprs gtp-director
!
hostname adm1
!
ip subnet-zero
ip cef
!
ip domain round-robin
ip domain-name my.gprs.com
ip name-server 172.16.43.11
!
! Configure the physical interface on
! the network to support HSRP and
! also reachable by GDM2 and the SGSN
!
interface FastEthernet0/0
 ip address 10.10.1.3 255.255.255.0
 no ip mroute-cache
 duplex full
!
! Configure HSRP on same network
! reachable by GDM2 and the SGSN
! The standby ip address is the
! same as the address configured on GDM2
!
standby ip 10.10.1.10
standby priority 105
standby preempt
!
! Monitor the availability of
! the FastEthernet2/0 interface
! to the GGSN for standby support
!
standby track FastEthernet2/0

```

```
!
! Configure physical interface
! to reach the GGSN network
!
interface FastEthernet2/0
 ip address 10.10.2.1 255.255.255.0
 no ip mroute-cache
 duplex full
!
interface FastEthernet6/0
 ip address 172.16.43.243 255.255.255.240
 no ip mroute-cache
 duplex half
!
! Configure the virtual template interface
! to support GTP encapsulation.
! You must configure the same virtual-template
! IP address on both GDM1 and GDM2
! for successful HSRP support
!
interface Virtual-Template1
 ip address 10.11.11.1 255.255.255.0
 encapsulation gtp
!
router ospf 200
 log-adjacency-changes
 network 10.10.0.0 0.0.255.255 area 0
!
ip default-gateway 172.16.43.241
ip classless
ip route 10.22.22.1 255.255.255.255 FastEthernet2/0
ip route 192.64.0.0 255.0.0.0 172.16.43.241
ip route 172.16.0.0 255.255.0.0 172.16.43.241
no ip http server
no ip pim bidir-enable
!
dialer-list 1 protocol ip permit
dialer-list 1 protocol ipx permit
!
! Configure GDM to forward retries of
! create PDP context requests from an
! SGSN for 1 minute
!
gprs gtp-director retry-timeout 60
!
call rsvp-sync
!
mgcp profile default
!
gatekeeper
 shutdown
!
line con 0
 exec-timeout 0 0
 length 0
line aux 0
line vty 0 4
 password lab
 login
line vty 5 15
 login
!
!
end
```

**GDM2 Configuration**

```

Current configuration : 2452 bytes
!
version 12.2
no service pad
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
! Enable the router for GDM services
!
service gprs gtp-director
!
hostname adm2
!
ip cef
ip subnet-zero
!
ip domain-name my.gprs.com
ip name-server 172.16.43.11
!
! Configure the physical interface on
! the network to support HSRP and
! also reachable by GDM1 and the SGSN
!
interface FastEthernet0/0
 ip address 10.10.1.2 255.255.255.0
 no ip mroute-cache
 duplex half
!
! Configure HSRP on same network
! reachable by GDM1 and the SGSN
! The standby ip address is the
! same as the address configured on GDM1
!
 standby ip 10.10.1.10
 standby priority 100
 standby preempt
!
! Monitor the availability of
! the FastEthernet2/0 interface
! to the GGSN for standby support
!
 standby track FastEthernet2/0
!
! Configure physical interface
! to reach the GGSN network
!
interface FastEthernet2/0
 ip address 10.10.2.2 255.255.255.0
 no ip mroute-cache
 duplex half
!
interface FastEthernet6/0
 ip address 172.16.43.249 255.255.255.240
 no ip mroute-cache
 duplex half
!
! Configure the virtual template interface
! to support GTP encapsulation
! You must configure the same virtual-template
! IP address on both GDM1 and GDM2
! for successful HSRP support

```

```
!  
interface Virtual-Template1  
  ip address 10.11.11.1 255.255.255.0  
  encapsulation gtp  
!  
router ospf 300  
  log-adjacency-changes  
  network 10.10.0.0 0.0.255.255 area 0  
!  
ip default-gateway 172.16.43.241  
ip classless  
ip route 10.22.22.1 255.255.255.255 FastEthernet2/0  
ip route 192.64.0.0 255.255.0.0 172.16.43.241  
no ip http server  
no ip pim bidir-enable  
!  
dialer-list 1 protocol ip permit  
dialer-list 1 protocol ipx permit  
!  
call rsvp-sync  
!  
mgcp profile default  
!  
gatekeeper  
  shutdown  
!  
line con 0  
  exec-timeout 0 0  
line aux 0  
line vty 0 4  
  login  
!  
!  
end
```

