CHAPTER 10

# Configuring Security on the GGSN

This chapter describes how to configure security features on the gateway GPRS support node (GGSN), including Authentication, Authorization, and Accounting (AAA), RADIUS, and on the Cisco 7200 series router platform, IP Security (IPSec).

The security configuration procedures and examples in this publication (aside from those related to GGSN-specific implementation) describe the basic commands that you can use to implement the security services.

For more detailed information about AAA, RADIUS, and IPSec security services in the Cisco IOS software, refer to the *Cisco IOS Security Configuration Guide* and *Cisco IOS Security Command Reference* publications. For information about IPSec security services on Catalyst 6500/Cisco 7600 platform, see the *IPSec VPN Acceleration Services Module Installation and Configuration Note*.

For a complete description of the GGSN commands in this chapter, refer to the *Cisco GGSN Release 6.0 Command Reference*. To locate documentation of other commands that appear in this chapter, use the command reference master index or search online.

This chapter includes the following sections:

# Overview of Security Support on the GGSN

The GGSN supports many of the same levels of security that are available through the Cisco IOS software on the router, including the following types of security:

- Authentication, authorization, and accounting (AAA) network security services and server groups
- RADIUS security services
- IP Security Protocol (IPSec)

In addition, the GGSN software provides the ability to configure additional security features such as the following:

- Address verification
- Traffic redirection
- IP access lists

AAA and RADIUS support provides the security services to authenticate and authorize access by mobile users to the GGSN and its access point names (APNs). IPSec support allows you to secure your data between the GGSN and its associated peers.

In some cases, such as with AAA and IPSec support (on the Cisco 7200 series router platform), the GGSN works with the standard Cisco IOS software configuration without requiring configuration of any additional GGSN commands.

**Note** On the Cisco 6500 series switch / Cisco 7600 series Internet router platform, IPSec is performed on the IPSec VPN Acceleration Services module.

In the case of RADIUS server configuration, the GGSN requires that you enable AAA security and establish RADIUS server communication globally on the router. From there, you can configure RADIUS security for all GGSN access points, or per access point, using new GGSN configuration commands.

**Note** In addition to the AAA, RADIUS, and IPSec security services, the GGSN also supports IP access lists to further control access to APNs. The Cisco IOS GGSN software implements the new **ip-access-group** access-point configuration command to apply IP access list rules at an APN.

## AAA Server Group Support

The Cisco GGSN supports authentication and accounting at APNs using AAA server groups. By using AAA server groups, you gain the following benefits:

- You can selectively implement groups of servers for authentication and accounting at different APNs.
- You can configure different server groups for authentication services and accounting services in the same APN.
- You can control which RADIUS services you want to enable at a particular APN, such as AAA accounting.

For GPRS tunneling protocol (GTP)-PPP termination and GTP-PPP regeneration on the GGSN, transparent access mode is used to allow PPP to perform the appropriate AAA functions; however, you can still configure AAA server groups to specify the corresponding server groups for AAA support.

The GGSN supports the implementation of AAA server groups at both the global and access-point configuration levels. You can minimize your configuration by specifying the configuration that you want to support across most APNs, at the global configuration level. Then, at the access-point configuration level, you can selectively modify the services and server groups that you want to support at a particular APN. Therefore, you can override the AAA server global configuration at the APN configuration level.

To configure a default AAA server group to be used for all APNs on the GGSN, use the **gprs default aaa-group** global configuration command. To specify a different AAA server group to be used at a particular APN for authentication or accounting, use the **aaa-group** access-point configuration command.

If authentication is enabled on the APN, then the GGSN first looks for an authentication server group at the APN. If an authentication server group is not found at the APN, then the GGSN looks for a globally configured, General Packet Radio Service/Universal Mobile Telecommunication System (GPRS/UMTS) default authentication server group.

If accounting is enabled on the APN, then the GGSN looks for an accounting server group at the APN or globally in the following order:

- First, at the APN for an accounting server group—configured in the **aaa-group accounting** command.
- Second, for a global GPRS/UMTS default accounting server group—configured in the **gprs default aaa-group accounting** command.
- Third, at the APN for an authentication server group—configured in the **aaa-group authentication** command.
- Last, for a global GPRS/UMTS default authentication server group—configured in the **gprs default aaa-group authentication** command.

To complete the configuration, you also must specify the following configuration elements on the GGSN:

- Configure the RADIUS servers by using the **radius-server host** command.
- Define a server group with the IP addresses of the AAA servers in that group, using the **aaa group server** global configuration command.
- Enable the type of AAA services (accounting and authentication) to be supported on the APN.
  - The GGSN enables accounting by default for non-transparent APNs.

    You can disable accounting services at the APN by using the **aaa-accounting disable** command.
  - You can enable authentication at the APN level by configuring the **access-mode non-transparent** command. When you enable authentication, the GGSN automatically enables accounting on the APN. There is no a global configuration command for enabling or disabling authentication.
- Configure AAA accounting and authentication using the **aaa accounting** and **aaa authentication** global configuration commands.

**Note** For more information about AAA and RADIUS global configuration commands, see the *Cisco IOS Security Command Reference.*

# Configuring AAA Security Globally

Authentication, authorization, and accounting (AAA) network security services provide the primary framework through which you set up access control on your GGSN. This section provides information about the basic commands used to implement AAA security on a Cisco router.

To enable AAA and configure authentication and authorization, use the following commands, beginning in global configuration mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router(config)# aaa new-model` | Enables AAA globally. |
| **Step 2** | `Router(config)# aaa authentication ppp {default \| list-name} method1 [method2...]` | Creates a local authentication method list, with the following options:<br>• **default**—Specifies that the authentication methods that follow this argument are the default list of authentication methods when a user logs in to the router.<br>• *method*—Specifies a valid AAA authentication method for PPP. For example, **group** (RADIUS) enables global RADIUS authentication. |
| **Step 3** | `Router(config)# aaa authorization {auth-proxy \| network \| exec \| commands level \| reverse-access} {default \| list-name} [method1 [method2...]]` | Creates an authorization method list for a particular authorization type and enables authorization. |
| **Step 4** | `Router(config)# aaa accounting {system default [vrf vrf-name] \| network {default \| none \| start-stop \| stop-only \| wait-start} group group-name` | Enables AAA accounting of requested services for billing or security purposes when you use RADIUS. |

For more information about configuring AAA, refer to the *Cisco IOS Security Configuration Guide* and *Cisco IOS Security Command Reference* publications.

# Configuring RADIUS Server Communication Globally

This section describes how to configure a global RADIUS server host that the GGSN can use to authenticate and authorize users. You can configure additional RADIUS server communication at the GGSN global configuration level.

To globally configure RADIUS server communication on the router, use the following commands, beginning in global configuration mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router(config)# radius-server host {hostname \| ip-address} [auth-port port-number] [acct-port port-number] [timeout seconds] [retransmit retries] [key string]` | Specifies the IP address or host name of the remote RADIUS server host. The following options are available:<br>• **auth-port**—Specifies the User Datagram Protocol (UDP) destination port for authentication requests.<br>• **acct-port**—Specifies the UDP destination port for accounting requests.<br>• **timeout**—Specifies the time interval (in the range 1 to 1000 seconds) that the router waits for the RADIUS server to reply before retransmitting. This setting overrides the global value of the **radius-server timeout** command. If no timeout value is specified, the global value is used.<br>• **retransmit**—Specifies the number of times (in the range 1 to 100) a RADIUS request is re-sent to a server, if that server is not responding or is responding slowly. This setting overrides the global value of the **radius-server retransmit** command.<br>• **key**—Specifies the authentication and encryption key used between the router and the RADIUS daemon running on this RADIUS server. This setting overrides the global value of the **radius-server key** command. |
| **Step 2** | `Router(config)# radius-server key string` | Specifies the shared secret text string used between the router and the vendor-proprietary RADIUS server. The router and the RADIUS server use this text string to encrypt passwords and exchange responses. |

For more information about configuring RADIUS security, refer to the *Cisco IOS Security Configuration Guide* and *Cisco IOS Security Command Reference* publications. For an example, see the "RADIUS Server Global Configuration Example" section on page 10-39.

**Note** Although you can configure the **radius-server host** command multiple times, the Cisco IOS software supports only one RADIUS server at the same IP address.

# Configuring RADIUS Server Communication at the GGSN Configuration Level

To complete the security configuration for the GGSN, you must configure non-transparent access for each access point. When you configure security at the GGSN global configuration level, you can also configure RADIUS server communication for all access points or for a specific access point.

Configuring RADIUS at the GGSN global configuration level includes the following tasks:

- Configuring Non-Transparent Access Mode, page 10-6 (Required)
- Specifying an AAA Server Group for All Access Points, page 10-7 (Optional)
- Specifying an AAA Server Group for a Particular Access Point, page 10-8 (Optional)
- Configuring AAA Accounting Services at an Access Point, page 10-8 (Optional)

## Configuring Non-Transparent Access Mode

To support RADIUS authentication on the GGSN, you must configure the GGSN access points for non-transparent access. You must configure non-transparent access for every access point at which you want to support RADIUS services. There is no way to globally specify the access mode.

**Note** For GTP-PPP termination and GTP-PPP regeneration on the GGSN, transparent access mode is used to allow PPP to perform the appropriate AAA functions; however, you can still configure AAA server groups to specify the corresponding server groups for AAA support.

To configure non-transparent access for a GGSN access point, use the following commands, beginning in global configuration mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router(config)# gprs access-point-list` *list-name* | Specifies the access-point list name, and enters access-point list configuration mode. |
| **Step 2** | `Router(config-ap-list)# access-point` *access-point-index* | Specifies the number associated with an existing access point definition (or creates a new access point), and enters access point configuration mode. |
| **Step 3** | `Router(config-access-point)# access-mode non-transparent` | Specifies that the GGSN requests user authentication at the access point to a PDN. |

For more information about configuring GGSN access points, see the "Configuring Access Points on the GGSN" section on page 7-10.

# Specifying an AAA Server Group for All Access Points

After you have configured RADIUS server communication at the global level, you can configure a default AAA server group to be used by all GGSN access points.

To specify a default AAA server group for all GGSN access points, use the following command in global configuration mode:

| Command | Purpose |
|---|---|
| `Router(config)# gprs default aaa-group {authentication \| accounting} server-group` | Specifies a default AAA server group and assigns the type of AAA services to be supported by the server group for all access points on the GGSN, where:<br>• **authentication**—Assigns the selected server group for authentication services on all APNs.<br>• **accounting**—Assigns the selected server group for accounting services on all APNs.<br>• *server-group*—Specifies the name of an AAA server group to be used for AAA services on all APNs.<br>**Note** The name of the AAA server group that you specify must correspond to a server group that you configure using the **aaa group server** command. |

# Specifying an AAA Server Group for a Particular Access Point

To override the default AAA server group configured for all access points, you can specify a different AAA server group for a particular access point. Or, if you choose not to configure a default AAA server group, you can specify an AAA server group at each access point.

To specify an AAA server group for a particular access point, use the following command in access-point configuration mode:

| Command | Purpose |
|---|---|
| `Router(config-access-point)# aaa-group {authentication \| accounting} server-group` | Specifies a default AAA server group and assigns the type of AAA services to be supported by the server group for a particular access point on the GGSN, where:<br>• **authentication**—Assigns the selected server group for authentication services on the APN.<br>• **accounting**—Assigns the selected server group for accounting services on the APN.<br>• *server-group*—Specifies the name of an AAA server group to be used for AAA services on the APN.<br>**Note** The name of the AAA server group that you specify must correspond to a server group that you configure using the **aaa group server** command. |

# Configuring AAA Accounting Services at an Access Point

The Cisco GGSN has different defaults for enabling and disabling accounting services for transparent and non-transparent access points:

- If you configure an APN for non-transparent access using the **access-mode** command, the GGSN automatically enables accounting with authentication at the APN.
- If you configure an APN for transparent access, which is the default access mode, the GGSN automatically disables accounting at the APN.

Therefore, if you have configured a transparent access APN and you want to provide accounting at that APN, you need to configure the **aaa-accounting enable** command at the APN.

However, for accounting to occur, you also must complete the configuration by specifying the following other configuration elements on the GGSN:

- Enable AAA services by using the **aaa new-model** global configuration command.
- Define a server group with the IP addresses of the RADIUS servers in that group by using the **aaa group server** global configuration command.

- Configure the following AAA services:
  - AAA authentication using the **aaa authentication** global configuration command
  - AAA authorization using the **aaa authorization** global configuration command
  - AAA accounting using the **aaa accounting** global configuration command
- Assign the type of services that the AAA server group should provide. If you want the server group to only support accounting services, then you need to configure the server for accounting only. You can assign the AAA services to the AAA server groups either at the GGSN global configuration level by using the **gprs default aaa-group** command, or at the APN by using the **aaa-group** command.
- Configure the RADIUS servers by using the **radius-server host** command.

**Note** For more information about AAA and RADIUS global configuration commands, see the *Cisco IOS Security Command Reference.*

To selectively disable accounting at specific APNs where you do not want that service, use the **aaa-accounting disable** access-point configuration command.

There is not a **no** form of this command.

#### Enabling and Disabling Accounting Services for an Access Point

The Cisco Systems GGSN has different defaults for enabling and disabling accounting services for transparent and non-transparent access points:

- If you configure an APN for non-transparent access using the **access-mode** command, the GGSN automatically enables accounting with authentication at the APN.
- If you configure an APN for transparent access, which is the default access mode, the GGSN automatically disables accounting at the APN.

To selectively disable accounting at specific APNs where you do not want that service, use the **aaa-accounting disable** access-point configuration command.

#### Configuring Interim Accounting for an Access Point

Using the **aaa-accounting interim** access-point configuration command, you can configure the GGSN to send Interim-Update Accounting requests to the AAA server when a routing area update (resulting in an SGSN change) or quality of service (QoS) change has occurred for a Packet Data Protocol (PDP) context. These changes are conveyed to the GGSN by an Update PDP Context request.

**Note** Interim accounting support requires that accounting services be enabled for the APN and that the **aaa accounting update newinfo** global configuration command be configured.

To configure accounting services at an access point, use the following command in access-point configuration mode:

| Command | Purpose |
|---|---|
| `Router(config-access-point)# aaa-accounting [enable \| disable \| interim update]` | Configures accounting services for an access point on the GGSN, with the following options:<br>• **enable**—(Optional) Enables accounting services for an access point on the GGSN.<br>• **disable**—(Optional) Disables accounting services for an access point on the GGSN.<br>• **interim update**—(Optional) Enables interim accounting records to be sent to an accounting server when a routing area update (resulting in a serving GPRS support node [SGSN] change) or QoS change has occurred. |

# Configuring Additional RADIUS Services

This section describes how to configure RADIUS security services that the GGSN can use to authenticate and authorize users.

This section includes the following tasks:



## Configuring RADIUS Attributes in Access Requests to the RADIUS Server

You configure the how the GGSN sends RADIUS attributes in access requests to the RADIUS server. This section includes the following tasks:

## Configuring the CHAP Challenge

To specify that the Challenge Handshake Authentication Protocol (CHAP) challenge always be included in the Challenge Attribute field (and not in the Authenticator field) in access requests to the RADIUS server, use the following command in global configuration mode:

| Command | Purpose |
|---|---|
| `Router(config)# gprs radius attribute chap-challenge` | Specifies that the CHAP challenge is always included in the challenge attribute in a RADIUS request. |

**Note** When the **gprs radius attribute chap-challenge** command is configured, the CHAP challenge is always sent in the Challenge Attribute field of an access request to the RADIUS server and not in the Authenticator field. When the command is not configured, the CHAP challenge is sent in the Authenticator field unless the challenge exceeds 16 bytes, in which case, it is sent in the Challenge Attribute field of the Access Request.

## Configuring the MSISDN IE

To specify that the first byte of the mobile station ISDN (MSISDN) information element (IE) is included in access requests to the RADIUS server, use the following command in global configuration mode:

| Command | Purpose |
|---|---|
| `Router(config)# gprs radius msisdn first-byte` | Specifies that the first byte of the MSISDN IE is included in access requests. |

## Configuring the NAS-Identifier

You can configure the GGSN to send the network access server (NAS)-Identifier (RADIUS attribute 32) in access requests to a RADIUS server at a global or APN level. The APN-level configuration overrides the global-level configuration.

To specify that the NAS-Identifier be included in all access requests, use the following command in global configuration mode:

| Command | Purpose |
|---|---|
| `Router(config)# radius-server attribute 32 include-in-access-req format` *format* | Specifies that the GGSN sends the RADIUS attribute 32 (NAS-Identifier) in access requests where *format* is a string sent in attribute 32 containing an IP address (%i), a hostname (%h), and a domain name (%d). |

To disable this global configuration, use the **no** form of this command while in global configuration mode.

To specify that the NAS-Identifier be included in all access requests at an APN, use the following command in access point configuration mode:

| Command | Purpose |
|---|---|
| `Router(config-access-point)# radius attribute nas-id format` | Specifies that the GGSN sends the NAS-Identifier in access requests at an APN where *format* is a string sent in attribute 32 containing an IP address (%i), a hostname (%h), and a domain name (%d). |

To disable this APN configuration, use the **no** form of this command while in access point configuration mode.

## Configuring the Charging ID in the Acct-Session-ID Attribute

To specify that the GGSN include the charging ID in the Acct-Session-ID (attribute 44) in accounting requests at an APN, use the following command in access-point configuration mode:

| Command | Purpose |
|---|---|
| `Router(config)# radius attribute acct-session-id charging-id` | Specifies that the charging ID in the Acct-Session-ID (attribute 44) is included in accounting requests. |

To disable this APN configuration, use the **no** form of this command while in access point configuration mode.

## Configuring the MSISDN in the User-Name Attribute

To specify that the GGSN include the MSISDN in the User-Name attribute (attribute 1) in access requests at an APN, use the following command in access-point configuration mode:

| Command | Purpose |
|---|---|
| `Router(config)# radius attribute user-name msisdn` | Specifies that the MSISDN is included in the User-Name (attribute 1) field in access requests. |

To disable this APN configuration, use the **no** form of this command while in access point configuration mode.

# Configuring the Vendor-Specific Attribute in Access Requests to the RADIUS Server

The Internet Engineering Task Force (IETF) draft standard specifies a method for communicating vendor-specific information to the RADIUS server by using the vendor-specific attribute (attribute 26). Vendor-specific attributes (VSAs) make a larger set of information available for communication by allowing vendors to support their own extended attributes not suitable for general use.

Table 10-1 lists and describes the Third Generation Partnership Project (3GPP) VSA sub-attributes that the GGSN can send in authentication and accounting requests to a RADIUS server when the attribute 26 is configured.

*Table 10-1 3GPP VSA Sub-Attributes*

| Number | Vendor-Proprietary Attribute | Description |
|---|---|---|
| 1 | 3GPP-IMSI | International Mobile Subscriber Identity (IMSI) number for a user.<br>This sub-attribute can be suppressed using the **radius attribute suppress imsi** command. |
| 2 | 3GPP-Charging-Id | Charging ID for this PDP context. |
| 3 | 3GPP-PDP-Type | Type of PDP context (for example, IP or PPP). |
| 4 | 3GPP-CG-Address | IP address of the current active charging gateway. If there is no current active charging gateway, GGSN sends 0.0.0.0. |
| 5 | 3GPP-GPRS-QoS-Profile | QoS negotiated values.<br>This sub-attribute can be suppressed using the **radius attribute suppress qos** command. |
| 6 | 3GPP-SGSN-Address | IP address of the SGSN that is used by the GTP control plane for handling control messages. This address might be used to identify the public land mobile network (PLMN) to which the user is attached.<br>This sub-attribute can be suppressed using the **radius attribute suppress sgsn-address** command. |
| 7 | 3GPP-GGSN-Address | IP address of the GGSN that is used by the GTP control plane for the context establishment. This address is the same as the GGSN IP address used in G-CDRs. |
| 8 | 3GPP-IMSI-MCC-MNC | Mobile country code (MCC) and mobile network code (MNC) extracted from the user's IMSI number (the first 5 or 6 digits depending on the IMSI).<br>This sub-attribute requires that the MCC and MNC values that the GGSN uses be configured using the **gprs mcc mnc** global configuration command. |
| 9 | 3GPP-GGSN-MCC-MNC | MCC and MNC of the network to which the GGSN belongs.<br>This sub-attribute requires that the MCC and MNC values that the GGSN uses be configured using the **gprs mcc mnc** global configuration command. |

*Table 10-1 3GPP VSA Sub-Attributes (continued)*

| Number | Vendor-Proprietary Attribute | Description |
|---|---|---|
| 12 | 3GPP-Selection-Mode | Selection mode for this PDP context received in the Create PDP Context request. |
| 18 | 3GPP-SGSN-MCC-MNC | Encoding of the Routing Area Identity (RAI) MCC-MNC values. |

To configure the GGSN to send and recognize VSAs as defined by RADIUS attribute 26, use the following command in global configuration mode:

| Command | Purpose |
|---|---|
| `Router(config)#radius-server vsa send [accounting \| authentication]` | (Optional) Enables the GGSN to send and recognized VSAs as defined by RADIUS IETF attribute 26. |

For more information on configuring the use of vendor-specific attributes, refer to the *Cisco IOS Security Configuration Guide* and *Cisco IOS Security Command Reference* publications.

# Suppressing Attributes for RADIUS Authentication

You can configure the GGSN to suppress certain attributes in its access requests to a RADIUS server. The following sections describe the attributes you can suppress and how to do so.

The following topics are included in this section:



## Suppressing the MSISDN Number for RADIUS Authentication

Some countries have privacy laws that prohibit service providers from identifying the MSISDN number of mobile stations in authentication requests. Use the **msisdn suppression** command to specify a value that the GGSN sends instead of the MSISDN number in its authentication requests to a RADIUS server. If no value is configured, then no number is sent to the RADIUS server.

To use the **msisdn suppression** command, you must configure a RADIUS server either globally or at the access point and specify non-transparent access mode.

To specify that the GGSN override or suppress the MSISDN number in its access-requests sent to the RADIUS server, use the following command in access-point configuration mode:

| Command | Purpose |
|---|---|
| `Router(config-access-point)# msisdn suppression [value]` | (Optional) Specifies that the GGSN overrides the MSISDN number with a preconfigured value in its access requests. |

To disable this APN configuration, use the **no** form of this command while in access point configuration mode.

## Suppressing the 3GPP-IMSI VSA Sub-Attribute for RADIUS Authentication

To configure the GGSN to suppress the Third Generation Partnership Project (3GPP) vendor-specific attribute (VSA) 3GPP-International Mobile Subscriber Identity (3GPP-IMSI) number in its authentication and accounting requests to a RADIUS server, use the **radius attribute suppress imsi** access point configuration command.

To configure the GGSN to suppress the 3GPP VSA 3GPP-IMSI number in its authentication and accounting requests to a RADIUS server, use the following command in access-point configuration mode:

| Command | Purpose |
|---|---|
| `Router(config-access-point)# radius attribute suppress imsi` | (Optional) Configures the GGSN to suppress the 3GPP-IMSI number in its authentication and accounting requests to a RADIUS server. |

To disable this APN configuration, use the **no** form of this command while in access point configuration mode.

## Suppressing the 3GPP-GPRS-QoS Profile VSA Sub-Attribute for RADIUS Authentication

To configure the GGSN to suppress the 3GPP-GPRS-Qos Profile in its authentication and accounting requests to a RADIUS server, use the **radius attribute suppress qos** access point configuration command.

To configure the GGSN to suppress the 3GPP-GPRS-Qos Profile in its authentication and accounting requests to a RADIUS server, use the following command in access-point configuration mode:

| Command | Purpose |
|---|---|
| `Router(config-access-point)# radius attribute suppress qos` | (Optional) Specifies that the GGSN suppresses the 3GPP-GPRS-Qos Profile in its authentication and accounting requests to a RADIUS server. |

### Suppressing the 3GPP-GPRS-SGSN-Address VSA Sub-Attribute for RADIUS Authentication

To configure the GGSN to suppress the 3GPP-GPRS-SGSN-Address in its authentication and accounting requests to a RADIUS server, use the **radius attribute suppress sgsn-address** access point configuration command.

To specify that the GGSN suppress the 3GPP-GPRS-SGSN-Address in its authentication and accounting requests to a RADIUS server, use the following command in access-point configuration mode:

| Command | Purpose |
|---|---|
| `Router(config-access-point)# radius attribute suppress sgsn-address` | (Optional) Specifies that the GGSN suppresses the 3GPP-GPRS-SGSN-Address in its requests. |

## Obtaining DNS and NetBIOS Address Information from a RADIUS Server

To obtain Domain Name System (DNS) address and Network Basic Input/Output System (NetBIOS) address information from a RADIUS server, configure the GGSN to send and recognize VSAs as defined by RADIUS attribute 26 using the following command in global configuration mode:

| Command | Purpose |
|---|---|
| `Router(config)# radius-server vsa send [accounting \| authentication]` | (Optional) Enables the GGSN to send and recognize VSAs as defined by RADIUS IETF attribute 26. |

**Note** For the DNS and NetBIOS address information to be sent to an MS, the dynamic address allocation method using an IP address pool supplied by a RADIUS server must be configured for the access point by using the **ip-address-pool radius-client** command. For more information about configuring an access point, see the "Configuring Access Points on the GGSN" section on page 7-10.

## Configuring the RADIUS Packet of Disconnect

The RADIUS Packet of Disconnect (POD) feature is a method for terminating a user session after the session has been established. The POD is a RADIUS Disconnect-Req packet that is intended to be used in situations when an authenticating agent server wants to disconnect a user after a session has been accepted by the RADIUS Access-Accept packet. For example, in the case of pre-paid billing, a typical use of this feature would be for the pre-paid billing server to send a POD when the quota expires for a pre-paid user.

Upon receiving a POD, the GGSN performs the following actions:

- Identifies the PDP context for which the POD was generated by the attribute information present in the POD.

  The VSA sub-attributes 3GPP-IMSI and 3GPP-NSAPI uniquely identify a PDP context, and the presence of these sub-attributes in a POD also identifies that the POD is for a GPRS user session.
- Sends a Delete PDP Context request to the SGSN.
- Sends a Disconnect ACK or Disconnect NAK to the device that generated the POD.

The GGSN sends a Disconnect ACK when it is able to terminate a user session and sends a Disconnect NAK when it is unable to terminate a user session. The Disconnect ACK/NAK requests are RADIUS packets that contain no attributes.

**Note** For the POD feature to function properly on the GGSN, ensure that the IMSI attribute has not been suppressed using the **radius attribute suppress imsi** command.

To configure a POD on the GGSN, use the following command in global configuration mode:

| Command | Purpose |
|---|---|
| `Router(config)# aaa pod server [port port-number] [auth-type {any\| all\| session-key}] server-key [encryption-type] string` | Enables inbound user sessions to be disconnected when specific session attributes are presented.<br>• **port** *port-number*—(Optional) Network access server User Datagram Protocol (UDP) port to use for POD requests. Default value is 1700.<br>This is the port on which GGSN listens for the POD requests.<br>• **auth-type**—(Optional) Type of authorization required for disconnecting sessions.<br>– **any**—Session that matches all of the attributes sent in the POD packet is disconnected. The POD packet may contain one or more of four key attributes (user-name, framed-IP-address, session-ID, and session-key).<br>– **all**—Session that matches all of the four key attributes is disconnected. All is the default.<br>– **session-key**—Session with a matching session-key attribute is disconnected. All other attributes are ignored.<br>**Note** When configuring a POD on the GGSN, we recommend that you do not configure the **auth-type** keyword option.<br>• **server-key**—Configures the shared-secret text string.<br>• *encryption-type*—(Optional) Single-digit number that defines whether the text immediately following is encrypted, and, if so, what type of encryption is used. Defined encryption types are 0, which means that the text immediately following is not encrypted, and 7, which means that the text is encrypted using an encryption algorithm defined by Cisco.<br>• *string*—Shared-secret text string that is shared between the network access server and the client workstation. This shared-secret string must be the same on both systems. |

# Configuring the GGSN to Wait for a RADIUS Response

Use the **gtp response-message wait-accounting** command to configure the GGSN to wait for a RADIUS accounting response from the RADIUS accounting server before sending a Create PDP Context response to the SGSN.

If the GGSN does not receive a response from the RADIUS accounting server when you have configured the **gtp response-message wait-accounting** command, it rejects the PDP context request.

When broadcast accounting is used (accounting requests are sent to multiple RADIUS servers), if a RADIUS server responds with an accounting response, the GGSN sends a create PDP context response and does not wait for the other RADIUS servers to respond.

The GGSN supports configuration of RADIUS response message waiting at both the global and access-point configuration levels. You can minimize your configuration by specifying the configuration that you want to support across most APNs, at the global configuration level. Then, at the access-point configuration level, you can selectively modify the behavior that you want to support at a particular APN. Therefore, at the APN configuration level, you can override the global configuration of RADIUS response message waiting.

To configure the GGSN to wait for a RADIUS accounting response as the default behavior for all APNs, use the **gprs gtp response-message wait-accounting** global configuration command. To disable this behavior for a particular APN, use the **no gtp response-message wait-accounting** access-point configuration command.

To verify whether RADIUS response message waiting is enabled or disabled at an APN, you can use the **show gprs access-point** command and observe the value reported in the wait_accounting output field.

To configure the GGSN to wait for a RADIUS accounting response globally, use the following command in global configuration mode:

| Command | Purpose |
|---|---|
| `Router(config)# gprs gtp response-message wait-accounting` | Configures the GGSN to wait for a RADIUS accounting response before sending a Create PDP Context response to the SGSN, for Create PDP Context requests received across all access points. |

To configure the GGSN to wait for a RADIUS accounting response for a particular access point, use the following command in access-point configuration mode:

| Command | Purpose |
|---|---|
| `Router(config-access-point)# gtp response-message wait-accounting` | Configures the GGSN to wait for a RADIUS accounting response before sending a Create PDP Context response to the SGSN, for Create PDP Context requests received at a particular access point. |

# Configuring Access to a RADIUS Server Using VRF

The Cisco IOS GGSN software supports access to a RADIUS server using VRF. This Cisco IOS software feature is called *Per VRF AAA* and using this feature, Internet service providers (ISPs) can partition AAA services based on VRF. This permits the GGSN to communicate directly with the customer RADIUS server associated with the customer Virtual Private Network (VPN) without having to go through a RADIUS proxy. Thus, ISPs can scale their VPN offerings more efficiently because they no longer need to proxy AAA to provide their customers the flexibility demanded.

To support this configuration, AAA must be VRF aware. ISPs must define multiple instances of the same operational parameters—such as AAA server groups, method lists, system accounting, and protocol-specific parameters—and secure the parameters to the VRF partitions.

**Note** VRF is not supported on the Catalyst 6500/Cisco 7600 Supervisor II / MSFC2; therefore, if using the Supervisor II, you must tunnel encapsulated VRF traffic through the Supervisor via a GRE tunnel between the GGSN to RADIUS server. For more information on configuration a GRE tunnel, see "Configuring Access to a RADIUS Server With a Tunnel" section on page 10-26.

The Catalyst 6500/Cisco 7600 Sup720 supports VRF.

If an AAA configuration, such as a method list, is uniquely defined many times, the specification of an AAA server that is based on IP addresses and port numbers might create an overlapping of private addresses between VRFs. Securing AAA method lists to a VRF can be accomplished from one or more of the following sources:

- Virtual Template—Used as a generic interface configuration.
- Service Provider AAA server—Used to associate a remote user with a specific VPN based on the domain name or Dialed Number Identification Service (DNIS). The server then provides the VPN-specific configuration for the virtual access interface, which includes the IP address and port number of the customer AAA server.
- Customer VPN AAA server—Used to authenticate the remote user and to provide user-specific configurations for the virtual access interface.

**Note** Global AAA accounting configurations and some AAA protocol-specific parameters cannot be logically grouped under the Virtual Template configuration.

When configuring the Per VRF feature, keep in mind the following:

- To prevent possible overlapping of private addresses between VRFs, AAA servers must be defined in a single global pool that is to be used in the server groups.
- Servers can no longer be uniquely identified by IP addresses and port numbers.
- "Private" servers (servers with private addresses within the default server group that contains all the servers) can be defined within the server group and remain hidden from other groups. The list of servers in server groups includes references to the hosts in the global configuration as well as the definitions of private servers.

**Note** If private server parameters are not specified, global configurations are used. If global configurations are not specified, default values are used.

- All server operational parameters can be configured per host, per server group, or globally. Per-host configurations have precedence over per-server group configurations. Per-server group configurations have precedence over global configurations.

**Note** For complete information on configuring access to a RADIUS server using VRF, refer to the *Per VRF AAA* feature module.

This section describes configuring and establishing access to a private RADIUS server using VRF. For global RADIUS services, ensure that you have configured a globally located server.

To configure access to a RADIUS server using VRF, complete the following tasks:

- Enabling AAA Globally, page 10-20 (Required)
- Configuring a VRF-Aware Private RADIUS Server Group, page 10-21 (Required)
- Configuring Authentication, Authorization, and Accounting Using Named Method Lists, page 10-22 (Required)
- Configuring a VRF Routing Table, page 10-22 (Required)
- Configuring VRF on an Interface, page 10-22 (Required)
- Configuring VRF Under an Access Point for Access to the Private RADIUS Server, page 10-24 (Required)
- Configuring a Route to the RADIUS Server Using VRF, page 10-28 (Optional)

## Enabling AAA Globally

If AAA has not been enabled globally on the GGSN, you will need to enable it before configuring access to a private RADIUS server via VRF.

To enable AAA globally, use the following command in global configuration mode:

| | Command | Purpose |
|---|---|---|
| Step 1 | `Router(config)# aaa new-model` | Enables AAA globally. |

## Configuring a VRF-Aware Private RADIUS Server Group

To configure private server operational parameters, use the following commands, beginning in global configuration mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router(config)# aaa group server radius group-name` | Groups different RADIUS server hosts into distinct lists and distinct methods.<br>• *group-name*—Character string used to name the group of servers. |
| **Step 2** | `Router(config-sg-radius)# server-private ip-address auth-port port_num acct-port port_num key string` | Configures the IP address of the private RADIUS server for the group server.<br>• *ip-address*—Specifies the IP address of the private RADIUS server host.<br>• **auth-port** *port_num*—Specifies a port solely for authentication.<br>• **acct-port** *port_num*—Specifies a port solely for accounting.<br>• *string*—(Optional) Specifies the authentication and encryption key for all RADIUS communications between the router and the RADIUS server.<br>**Note** If private server parameters are not specified, global configurations are used. If global configurations are not specified, default values are used. |
| **Step 3** | `Router(config-sg-radius)# ip vrf forwarding vrf-name` | Configures the VRF reference of the AAA RADIUS server group.<br>• *vrf-name*—Name assigned to a VRF. |

## Configuring Authentication, Authorization, and Accounting Using Named Method Lists

To configure AAA using named method lists, perform the following tasks, beginning in global configuration mode:

| | | |
|---|---|---|
| **Step 1** | `Router(config)# aaa authentication ppp {default \| list-name} method1 [method2...]` | Creates a local authentication method list, with the following options:<br>• **default**—Specifies that the authentication methods that follow this argument are the default list of authentication methods when a user logs in to the router.<br>• *method*—Specifies a valid AAA authentication method for PPP. For example, **group RADIUS** enables global RADIUS authentication. |
| **Step 2** | `Router(config)# aaa authorization {auth-proxy \| network \| exec \| commands level \| reverse-access} {default \| list-name} [method1 [method2...]]` | Creates an authorization method list for a particular authorization type and enables authorization. |
| **Step 3** | `Router(config)# aaa accounting {system default [vrf vrf-name] \| network {default \| none \| start-stop \| stop-only \| wait-start} group group-name` | Enables AAA accounting of requested services for billing or security purposes when you use RADIUS. |

## Configuring a VRF Routing Table

To configure a VRF routing table on the GGSN for access to the private RADIUS server, use the following commands, beginning in global configuration mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router(config)# ip vrf vrf-name` | Configures a VRF routing table, and enters VRF configuration mode. |
| **Step 2** | `Router(config-vrf)# rd route-distinguisher` | Creates routing and forwarding tables for a VRF and specifies the default route distinguisher for a VPN. |

## Configuring VRF on an Interface

To access the private RADIUS server, VRF must be configured on the interface to the server.

On the Cisco 7200 series router platform, this interface is physical. On the Catalyst 6500 series switch / Cisco 7600 series Internet router platform, this interface is a logical one (on which IEEE 802.1Q-encapsulation has been configured) to a Layer 3 routed VLAN configured on the Supervisor/MSFC2.

For more information about required VLANs on the Supervisor/MSFC2, see the "Catalyst 6500/Cisco 7600 Series Platform Prerequisites" section on page 2-2.

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

### Configuring Physical Interfaces

To configure a physical interface using Fast Ethernet over the interface, use the following commands, beginning in global configuration mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router(config)# interface type slot/port` | Defines a physical interface on the GGSN, where *type* is **fastethernet**, and *slot/port* is the hardware slot and port on the interface. |
| **Step 2** | `Router(config-if)# ip vrf forwarding vrf-name` | Associates a VRF with an interface or subinterface.<br>**Note** The *vrf-name* argument should match the name of the VRF that you configured using the **ip vrf** command in the "Configuring Authentication, Authorization, and Accounting Using Named Method Lists" section on page 10-22.<br>**Note** The IP address defined on the interface will get removed when you associate a VRF with the interface. Therefore, you will need to reconfigure the IP address for the interface. |
| **Step 3** | `Router(config-if)# ip address ip-address mask [secondary]` | Specifies an IP address for the interface, where:<br>• *ip-address*—Specifies the IP address of the interface in dotted decimal format.<br>• *mask*—Specifies a subnet mask in dotted decimal format.<br>• **secondary**—Specifies that the configured address is a secondary IP address. If this keyword is omitted, the configured address is the primary IP address. |

### Configuring 802.1Q-Encapsulated Subinterfaces

To configure a subinterface that supports IEEE 802.1Q encapsulation to the associated VLAN on the Supervisor/MSFC2, use the following commands, beginning in global configuration mode:

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

## Configuring VRF Under an Access Point for Access to the Private RADIUS Server

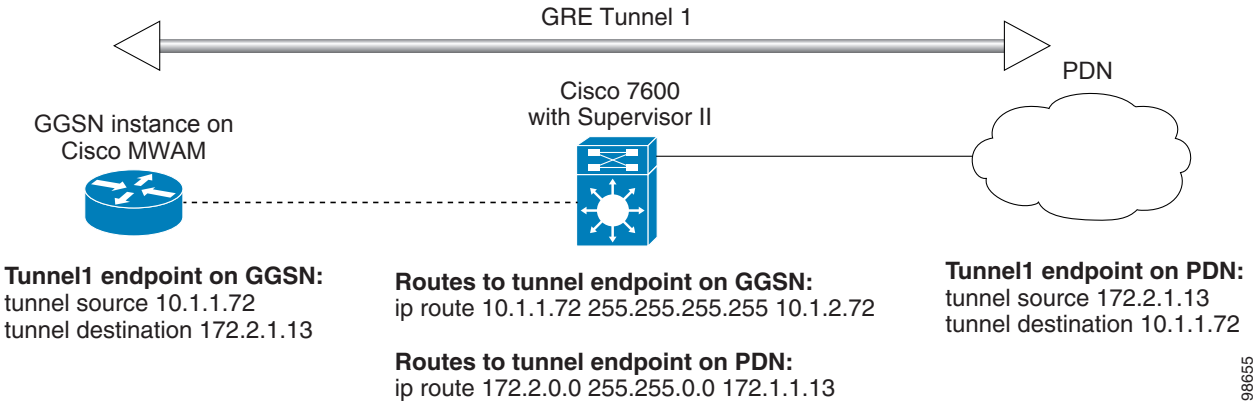
After you have completed the prerequisite configuration tasks on the Cisco 7200 platform, you can configure access to a RADIUS server with a tunnel or without a tunnel.

VRF is not supported on the Catalyst 6500/Cisco 7600 Supervisor II / MSFC2; therefore, if using the Supervisor II, you must tunnel encapsulated VRF traffic through the Supervisor via a GRE tunnel between the GGSN to RADIUS server.

**Note** The Catalyst 6500/Cisco 7600 Sup720 supports VRF.

Figure 10-1 is a logical view of a GRE tunnel configured between the VRF-aware GGSN and RADIUS server, which tunnels the encapsulated VRF traffic through the VRF-unaware Supervisor II / MSFC2.

***Figure 10-1 GRE Tunnel Configuration from the GGSN to RADIUS Server through the Catalyst 6500/Cisco 7600 Supervisor/MSFC2***




The following sections describe the different methods you can use to configure access a RADIUS server:

- Configuring Access to a RADIUS Server Without a Tunnel
- Configuring Access to a RADIUS Server With a Tunnel

### Configuring Access to a RADIUS Server Without a Tunnel

On the Cisco 7200 platform, to configure access to the RADIUS server without a tunnel, you need to configure the **vrf** access point configuration command.

**Note** The Catalyst 6500/Cisco 7600 Supervisor/MSFC2 does not support VRR; therefore, you must tunnel VRF traffic through the Supervisor via a GRE tunnel as described in the "Configuring Access to a RADIUS Server With a Tunnel" section on page 10-26.

To configure access to a RADIUS server in the GPRS access point list, use the following commands, beginning in global configuration mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router(config)# gprs access-point-list` *list-name* | Specifies a name for a new access point list, or references the name of the existing access point list, and enters access-point list configuration mode. |
| **Step 2** | `Router(config-ap-list)# access-point` *access-point-index* | Specifies an index number for a new access point definition, or references an existing access point definition, and enters access point configuration mode. |
| **Step 3** | `Router(config-access-point)# access-point-name` *apn-name* | Specifies the network (or domain) name for a PDN that users can access from the GGSN at a defined access point.<br>**Note** The *apn-name* must match the APN that has been provisioned at the MS, HLR, and DNS server. |
| **Step 4** | `Router(config-access-point)# aaa-group authentication` *server-group* | Specifies a default AAA server group and assigns the type of AAA services to be supported by the server group for a particular access point on the GGSN, where:<br>• **authentication**—Assigns the selected server group for authentication services on the APN.<br>• *server-group*—Specifies the name of a AAA server group to be used for AAA services on the APN.<br>**Note** The name of the AAA server group that you specify must correspond to a server group that you configure using the **aaa group server** command. |
| **Step 5** | `Router(config-access-point)# access-mode non-transparent` | Specifies for the GGSN to act as a proxy for authentication. |
| **Step 6** | `Router(config-access-point)# ip-address-pool radius-client` | Specifies for the RADIUS server to provide the IP address pool for the current access point.<br>**Note** If you are using a dynamic address allocation method, then you must configure this command according to the appropriate IP address pool source. |

| | Command | Purpose |
|---|---|---|
| **Step 7** | `Router(config-access-point)# vrf vrf-name` | Configures VPN routing and forwarding at a GGSN access point, and associates the access point with a particular VRF instance.<br>**Note** The *vrf-name* argument should match the name of the VRF that you configured using the **ip vrf** command in the "Configuring Authentication, Authorization, and Accounting Using Named Method Lists" section on page 10-22. |
| **Step 8** | `Router(config-access-point)# exit` | Exits access point configuration mode. |

## Configuring Access to a RADIUS Server With a Tunnel

If you have only a single interface to a RADIUS server from which you need to access one or more private RADIUS servers, or if you are configuring access to a RADIUS server via VRF on the Catalyst 6500/Cisco 7600 platform, you can configure an IP tunnel to access those private servers. On the Catalyst 6500/Cisco 7600 platform, you configure the tunnel to tunnel the VRF traffic through the Supervisor/MSFC2, which does not support VRF.

To configure access to the RADIUS server using a tunnel, perform the following tasks:

- Configuring the Private RADIUS Server Access Point (Required)
- Configuring the IP Tunnel (Required)

### *Configuring the Private RADIUS Server Access Point*

To configure access to a private RADIUS server in the GPRS access point list, use the following commands, beginning in global configuration mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router(config)# gprs access-point-list list-name` | Specifies a name for a new access point list, or references the name of the existing access point list, and enters access-point list configuration mode. |
| **Step 2** | `Router(config-ap-list)# access-point access-point-index` | Specifies an index number for a new access point definition, or references an existing access point definition, and enters access point configuration mode. |
| **Step 3** | `Router(config-access-point)# access-point name apn-name` | Specifies the access point network ID, which is commonly an Internet domain name.<br>**Note** The *apn-name* must match the APN that has been provisioned at the mobile station (MS), home location register (HLR), and DNS server. |

| | Command | Purpose |
|---|---|---|
| **Step 4** | `Router(config-access-point)# access-mode {transparent \| non-transparent}` | (Optional) Specifies whether the GGSN requests user authentication at the access point. The available options are:<br>• **transparent**—No security authorization or authentication is requested by the GGSN for this access point. This is the default value.<br>• **non-transparent**—GGSN acts as a proxy for authenticating. |
| **Step 5** | `Router(config-access-point)# access-type real` | Specifies an APN type that corresponds to an interface to an external network on the GGSN. Real is the default value. |
| **Step 6** | `Router(config-access-point)# ip-address-pool {dhcp-proxy-client \| radius-client \| local` *pool-name* `\| disable}` | (Optional) Specifies a dynamic address allocation method using IP address pools for the current access point. The available options are:<br>• **dhcp-proxy-client**—DHCP server provides the IP address pool.<br>• **radius-client**—RADIUS server provides the IP address pool.<br>• **local**—Specifies that a local pool provides the IP address. This option requires that the address range be configured using the **aggregate** access point configuration command and that a local pool has been configured using the **ip local pool** global configuration command.<br>• **disable**—Turns off dynamic address allocation.<br>**Note** If you are using a dynamic address allocation method, then you must configure this command according to the appropriate IP address pool source. |
| **Step 7** | `Router(config-access-point)# vrf` *vrf-name* | Configures VPN routing and forwarding at a GGSN access point and associates the access point with a particular VRF instance. |
| **Step 8** | `Router(config-access-point)# exit` | Exits access point configuration mode. |

#### *Configuring the IP Tunnel*

When you configure a tunnel, you might consider using loopback interfaces as the tunnel endpoints instead of real interfaces because loopback interfaces are always up.

To configure an IP tunnel to a private network, use the following commands, beginning in global configuration mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router(config)# interface tunnel` *number* | Configures a logical tunnel interface number. |
| **Step 2** | `Router(config-if)# ip vrf forwarding` *vrf-name* | Associates a VRF instance with the interface. |

| | Command | Purpose |
|---|---|---|
| **Step 3** | `Router(config-if)# ip address ip-address mask [secondary]` | Specifies an IP address for the tunnel interface.<br>**Note** This IP address is not used in any other part of the GGSN configuration. |
| **Step 4** | `Router(config-if)# tunnel source {ip-address \| type number}` | Specifies the IP address (or interface type and port or card number) of the interface to the RADIUS server or a loopback interface. |
| **Step 5** | `Router(config-if)# tunnel destination {hostname \| ip-address}` | Specifies IP address (or host name) of the private network that you can access from this tunnel. |

## Configuring a Route to the RADIUS Server Using VRF

Be sure a route exists between the VRF instance and the RADIUS server. You can verify connectivity by using the **ping** command from the VRF to the RADIUS server. To configure a route, you can use a static route or a routing protocol.

### Configuring a Static Route Using VRF

To configure a static route using, use the following command, beginning in global configuration mode:

| Command | Purpose |
|---|---|
| `Router(config)# ip route vrf vrf-name prefix mask [next-hop-address] [interface {interface-number}] [global] [distance] [permanent] [tag tag]` | Configures a static IP route, where:<br>• *vrf-name*—Specifies the name of the VPN routing/forwarding (VRF) instance for the static route.<br>• *prefix*—Specifies the IP route prefix for the destination.<br>• *mask*—Specifies the prefix mask for the destination.<br>• *next-hop-address*—Specifies the IP address of the next hop that can be used to reach the destination network.<br>• *interface interface-number*—Specifies the network interface type and interface number that can be used to reach the destination network.<br>• **global**—Specifies that the given next hop address is in the non-VRF routing table.<br>• *distance*—Specifies an administrative distance for the route.<br>• **permanent**—Specifies that the route will not be removed, even if the interface shuts down.<br>• **tag** *tag*—Specifies a tag value that can be used as a "match" value for controlling redistribution via route maps. |

#### Verifying a Static Route Using VRF

To verify the static VRF route that you configured, use the **show ip route vrf** privileged EXEC command as shown in the following example:

```
GGSN# show ip route vrf vpn1 static

      172.16.0.0/16 is subnetted, 1 subnets
C       172.16.0.1 is directly connected, Ethernet5/1
C       10.100.0.3/8 is directly connected, Virtual-Access5
```

### Configuring an OSPF Route Using VRF

To configure an OSPF route using VRF, use the following command, beginning in global configuration mode:

| Command | Purpose |
|---|---|
| `Router(config)# router ospf process-id [vrf vrf-name]` | Enables OSPF routing, and enters router configuration mode, where,<br>• *process-id*—Specifies an internally used identification parameter for an OSPF routing process. The *process-id* is locally assigned and can be any positive integer. A unique value is assigned for each OSPF routing process.<br>• **vrf** *vrf-name*—Specifies the name of the VPN routing/forwarding instance. |

# Configuring IPSec Network Security

In Cisco IOS Release 12.1(5)T and later, the GGSN software on the Cisco 7200 series router platform supports the IPSec for data authentication, confidentiality, encryption and integrity.

# IPSec Network Security on the Catalyst 6500/Cisco 7600 Series Platform

IPSec on the Catalyst 6500 series switch / Cisco 7600 series Internet router platform is performed on the IPSec VPN Acceleration Services module and requires no configuration on the GGSNs running on the Cisco MWAM.

For information about configuring IPSec on the Catalyst 6500 series switch / Cisco 7600 series Internet router platform, refer to the *IPSEC VPN Acceleration Services Module Installation and Configuration Not*e.

# Configuring IPSec Network Security on the Cisco 7200 Series Platform

On the Cisco 7200 series platform, IPSec data security can be implemented between the GGSN and another router on the PDN.

**Note** To support IPSec on the GGSN on the Cisco 7200 platform, you must install a Cisco VPN Acceleration Module 2 (VAM2). card on your router.

Configuring IPSec network security includes the following tasks:

- Configuring an IKE Policy, page 10-30 (Required)
- Configuring Pre-Shared Keys, page 10-32 (Required, when pre-shared authentication is configured)
- Configuring Transform Sets, page 10-32 (Optional)
- Configuring IPSec Profiles, page 10-34 (Optional, and the recommended configuration for VRF-aware GRE tunnel interfaces)
- Configuring Crypto Map Entries That Use IKE to Establish Security Associations, page 10-34 (Optional)

For more information about configuring IPSec, refer to the *Cisco IOS Security Configuration Guide* and *Cisco IOS Security Command Reference* publications.

For an example, see the "IPSec Configuration Examples" section on page 10-42.

## Configuring an IKE Policy

You can create multiple Internet Key Exchange (IKE) policies, each with a different combination of parameter values. For each policy that you create, you assign a unique priority (1 through 10,000, with 1 being the highest priority).

You can configure multiple policies on each peer—but at least one of these policies must contain exactly the same encryption, hash, authentication, and Diffie-Hellman parameter values as one of the policies on the remote peer. For example, you can configure multiple policies on the GGSN to correlate with the policies for different PDNs.

To configure an IKE policy on the GGSN and corresponding PDN, use the following commands, beginning in global configuration mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router(config)# crypto isakmp policy` *priority* | Identifies the IKE policy, where *priority* is an integer (from 1 to 10,000) that uniquely identifies the policy. This command enters you into Internet Security Association and Key Management Protocol (ISAKMP) policy configuration mode. |
| **Step 2** | `Router(config-isakmp)# encryption des` | Specifies the encryption algorithm, where:<br>• **des**—Specifies 56-bit Data Encryption Standard (DES)-Cipher Block Chaining (CBC). This is the default value.<br>**Note** Triple DES, or 168-bit DES encryption, is supported in the Cisco IOS software. It can be configured by using this command and specifying the **3des** optional keyword. GGSN Release 1.4 in Cisco IOS Release 12.2 does not support the **3des** optional keyword. |
| **Step 3** | `Router(config-isakmp)# hash {sha \| md5}` | Specifies the hash algorithm, where:<br>• **sha**—Specifies the Secure Hash Algorithm (SHA)-1. This is the default value.<br>• **md5**—Specifies the Message Digest 5 (MD5) hash algorithm. |
| **Step 4** | `Router(config-isakmp)# authentication {rsa-sig \| rsa-encr \| pre-share}` | Specifies the authentication method, where:<br>• **rsa-sig**—Specifies the public key encryption system developed by Ron Rivest, Adi Shamir, and Leonard Adleman (RSA), which provides non-repudiation. This is the default value.<br>• **rsa-encr**—Specifies RSA encrypted nonces, which provide repudiation.<br>• **pre-share**—Specifies a pre-shared key that does not require use of a certification authority. Pre-shared keys might be easier to configure in a small network with less than 10 nodes. RSA signatures can be considered more secure than pre-shared keys. If you configure **pre-share** authentication, then you must configure the pre-shared keys on both the local and remote peer (GGSN and PDN). |

| | Command | Purpose |
|---|---|---|
| **Step 5** | `Router(config-isakmp)# group {1 \| 2}` | Specifies the Diffie-Hellman group identifier, where:<br>• **1**—Specifies 768-bit Diffie-Hellman. This is the default value.<br>• **2**—Specifies 1024-bit Diffie-Hellman.<br>**Note** The 1024-bit Diffie-Hellman option is harder to crack, but requires more CPU time to execute. |
| **Step 6** | `Router(config-isakmp)# lifetime seconds` | Specifies the security association's lifetime (in seconds). The default value is 86,400 seconds (1 day). |

For more information about IKE policy parameters, refer to the *Cisco IOS Security Configuration Guide* and *Cisco IOS Security Command Reference* publications.

## Configuring Pre-Shared Keys

When you configure the **pre-share** authentication method for your IKE policy, you also must configure the pre-shared keys on the GGSN and remote peer, or PDN.

To configure pre-shared keys on the GGSN and corresponding PDN, use one of the following commands, beginning in global configuration mode:

| Command | Purpose |
|---|---|
| `Router(config)# crypto isakmp key keystring address peer-address`<br>or<br>`Router(config)# crypto isakmp key keystring hostname peer-hostname` | Specifies the shared key to be used between a local peer (GGSN) and particular remote peer (PDN).<br>If the remote peer, or PDN, specifies the ISAKMP identity with an address, use the **address** keyword; otherwise, use the **hostname** keyword.<br>When configuring the pre-shared keys on the GGSN, use the address or host name of the PDN. When configuring the pre-shared keys on the PDN, use the address or host name of the GGSN. |

## Configuring Transform Sets

A transform set represents a certain combination of security protocols and algorithms. During the IPSec security association negotiation, the peers agree to use a particular transform set for protecting a particular data flow.

To configure a transform set on the GGSN and corresponding PDN, use the following commands, beginning in global configuration mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router(config)# crypto ipsec transform-set transform-set-name transform1 [transform2 [transform3]]` | Defines a transform set, and enters crypto transform configuration mode.<br>Complex rules define which entries you can use for the transform arguments. For more information, refer to the *Cisco IOS Security Configuration Guide* and *Cisco IOS Security Command Reference* publications. |
| **Step 2** | `Router(config-crypto-transform)# mode [tunnel \| transport]` | (Optional) Changes the mode associated with the transform set. The following options are available:<br>• **tunnel**—Protects (encrypts, authenticates) and encapsulates the entire original IP packet<br>• **transport**—Protects (encrypts, authenticates) and encapsulates the payload or data portion of the IP packet.<br>**Note** The mode setting is applicable only to traffic whose source and destination addresses are the IPSec peer addresses; it is ignored for all other traffic. |

## Configuring IPSec Profiles

Using an IPSec profile configuration is the recommended configuration for IPSec on VRF-aware generic routing encapsulation (GRE) tunnel interface between the GGSN and a PDN.

The IPSec profile shares most of the same commands with the crypto map configuration, but only a subset of the commands are valid in an IPSec profile. Only commands that pertain to an IPSec policy can be issued under an IPSec profile; you cannot specify the IPSec peer address or the access control list (ACL) to match the packets that are to be encrypted.

The following valid commands can be configured under an IPSec profile:

- **set-transform-set**—Specifies a list of transform sets in order of priority.
- **set pfs**—Specifies perfect forward secrecy (PFS) settings.
- **set security-association**—Defines security association parameters.
- **set-identity**—Specifies identity restrictions.

**Note** After enabling this command, the transform set parameter must be defined using the **set transform-set** command.

To define the IPSecurity (IPSec) parameters that are to be used for IPSec encryption between the GGSN and PDN, use the following commands, beginning in global configuration mode:

To configure an IPSec profile on the GGSN and corresponding PDN, use the following commands, beginning in global configuration mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router(config)# crypto ipsec profile name` | Defines the IPSec parameters that are to be used for IPSec encryption between two IPSec routers. |
| **Step 2** | `Router(config-crypto-map)# set transform-set transform-set-name1 [transform-set-name2...transform-set-name6]` | (Required) Specifies which transform sets are allowed for this IPSec profile. List multiple transform sets in order of priority (highest priority first). |
| **Step 3** | `Router(config)# interface tunnel100` | Accesses the tunnel interface to which you want to apply the IPSec profile. |
| **Step 4** | `Router(config-if)# tunnel protection ipsec-profile name [shared]` | Applies the IPSec profile to the GRE tunnel interface. |

To delete an IPSec profile, use the **no** form of this command.

## Configuring Crypto Map Entries That Use IKE to Establish Security Associations

When you use IKE to establish security associations, you can use a crypto map entry to specify a list of acceptable settings to be used during IPSec peer negotiation.

To configure crypto map entries on the GGSN and corresponding PDN, use the following commands, beginning in global configuration mode:

| | Command | Purpose |
|---|---|---|
| **Step 1** | `Router(config)# crypto map map-name seq-num ipsec-isakmp` | Creates or modifies a crypto map entry, and enters crypto map configuration mode. |
| **Step 2** | `Router(config-crypto-map)# match address access-list-id` | Names an extended access list. This access list determines which traffic should be protected by IPSec and which traffic should not be protected by IPSec in the context of the current crypto map entry. |
| **Step 3** | `Router(config-crypto-map)# set peer {hostname \| ip-address}` | Specifies a remote IPSec peer. This is the peer to which IPSec-protected traffic can be forwarded. |
| **Step 4** | `Router(config-crypto-map)# set transform-set transform-set-name1 [transform-set-name2...transform-set-name6]` | Specifies which transform sets are allowed for this crypto map entry. List multiple transform sets in order of priority (highest priority first). |
| **Step 5** | `Router(config-crypto-map)# set security-association lifetime seconds seconds`<br>and/or<br>`set security-association lifetime kilobytes kilobytes` | (Optional) Specifies a security association lifetime for the crypto map entry, if you want the security associations for the current crypto map entry to be negotiated using different IPSec security association lifetimes than the global lifetimes. |
| **Step 6** | `Router(config-crypto-map)# set security-association level per-host` | (Optional) Specifies that separate security associations should be established for each source/destination pair.<br>**Note** Use this command with care, as multiple streams between given subnets can rapidly consume resources. |
| **Step 7** | `Router(config-crypto-map)# set pfs [group1 \| group2]` | (Optional) Specifies that IPSec should ask for perfect forward secrecy (PFS) when requesting new security associations for the current crypto map entry, or should demand PFS in requests received from the IPSec peer. |
| **Step 8** | `Router(config-crypto-map)# exit` | Exits crypto map configuration mode. |
| **Step 9** | `Router(config)# interface fastethernet slot/port` | Accesses the Gi interface to which you want to apply the crypto map. |
| **Step 10** | `Router(config-if)# crypto map map-name` | Applies the crypto map set to the interface. |

# Securing the GGSN Mobile (Gn) Interface

The following features provide additional security for the GGSN mobile interface against attacks that can lead to illegal access to a network or even network downtime: address verification and mobile-to-mobile traffic redirection. The following tasks are necessary for configuring these features:

- Configuring Address Verification, page 10-36
- Configuring Mobile-to-Mobile Traffic Redirection, page 10-37
- Redirecting All Traffic, page 10-37

## Configuring Address Verification

Use the **security verify source** access point configuration command to configure the GGSN to verify the source IP address of an upstream TPDU against the address previously assigned to an MS.

When the **security verify source** command is configured on an APN, the GGSN verifies the source address of a TPDU before GTP will accept and forward it. If the GGSN determines that the address differs from that previously assigned to the MS, it drops the TPDU and regards it as an illegal packet in its PDP context and APN. Configuring the **security verify source** access point configuration command protects the GGSN from faked user identities.

Use the **security verify destination** access point configuration command to have the GGSN verify the destination addresses of upstream TPDUs against global lists of PLMN addresses specified using the **gprs plmn ip address** command. If the GGSN determines that a destination address of a TPDU is within the range of a list of addresses, it drops the TPDU. If it determines that the TPDU contains a destination address that does not fall within the range of a list, it forwards the TPDU to its final destination.

**Note** The **security verify destination** command is not applied to APNs using VRF. In addition, the verification of destination addresses does not apply to GTP-PPP regeneration or GTP-PPP with L2TP.

To configure address verification for a GGSN access point, use the following commands, beginning in access-point configuration mode:

| Command | Purpose |
|---|---|
| `Router(config-access-point)# security verify {source \| destination}` | (Optional) Specifies that the GGSN verify the source or destination address in TPDUs received from a Gn interface. |

**Note** Both the verification of destination addresses and source addresses can be configured on an APN.

# Configuring Mobile-to-Mobile Traffic Redirection

Mobile-to-mobile traffic enters and exits through a Gn interface. Therefore, it is switched by the GGSN without ever going through a Gi interface on the network side. Because of this, firewalls deployed on the network side of a GGSN do not have an opportunity to verify this level of traffic.

Use the **redirect intermobile ip** access-point command to redirect mobile-to-mobile traffic to an external device (such as an external firewall) for verification.

| Command | Purpose |
|---|---|
| `Router(config-access-point)# redirect intermobile ip` *ip address* | (Optional) Specifies that mobile-to-mobile traffic be redirected to an external device. |

**Note** On the Catalyst 6500 series switch / Cisco 7600 series internet router platform, the mobile-to-mobile redirection feature requires that policy based routing (PBR) is configured on the MSFC2 and incoming VLAN interface from the Cisco MWAM, and that the next hop to route the packets that match the criteria is set using the **set ip next-hop** command.

**Note** Redirection of intermobile traffic does not occur on an ingress APN unless the TPDUs are exiting the same APN. In addition, redirection of TPDUs tunneled by L2TP from the ingress APN to the LNS of the PDN does not occur.

# Redirecting All Traffic

The redirect all traffic feature enables you to do the following:

- Redirect all packets to a specified destination regardless of whether the destination address belongs to a mobile station (MS) on the same GGSN or not. If redirecting traffic using the Mobile-to-Mobile Redirect feature, only packets for which the destination address belongs to an MS that is active on the same GGSN can be redirected. If the receiving MS has no PDP context in the GGSN where the sending MS PDP context is created, the packets are dropped.
- Redirect all traffic to a specific destination when aggregate routes are configured.

To redirect all traffic to a specific IP address, issue the following command while in access-point configuration mode:

| Command | Purpose |
|---|---|
| `Router(config-access-point)# redirect all ip` *ip address* | Specifies that all traffic be redirected to an external device. |

# Configuration Examples

This section includes the following configuration examples for security on the GGSN:



## AAA Security Configuration Example

The following example shows how to enable AAA security globally on the router and how to specify global RADIUS authentication and authorization:

```
! Enables AAA globally
aaa new-model
!
! Creates a local authentication list for use on
! serial interfaces running PPP using RADIUS
!
aaa authentication ppp foo group foo
!
! Enables authorization and creates an authorization
! method list for all network-related service requests
! and enables authorization using a RADIUS server
!
aaa authorization network network foo group foo
```

For more information about configuring AAA, refer to the *Cisco IOS Security Configuration Guide* and *Cisco IOS Security Command Reference* publications.

# RADIUS Server Global Configuration Example

The following example shows how to globally configure RADIUS server communication on the router:

```
! Specifies a global RADIUS server host at IP address 10.100.0.2
! Port 1645 is destination port for authentication requests
! Port 1646 is the destination port for accounting requests
! Specifies the key "foo" for this radius host only
!
radius-server host 10.100.0.2 auth-port 1645 acct-port 1646 key foo
!
! Sets the authentication and encryption key to mykey for all
! RADIUS communications between the router and the RADIUS daemon
!
radius-server key mykey
```

**Note** Although you can configure the **radius-server host** command multiple times, the Cisco IOS software supports only one RADIUS server at the same IP address.

For more information about configuring RADIUS security, refer to the *Cisco IOS Security Configuration Guide* and *Cisco IOS Security Command Reference* publications.

# RADIUS Server Group Configuration Example

The following configuration example defines four AAA server groups on the GGSN: foo, foo1, foo2, and foo3, shown by the **aaa group server** commands.

Using the **gprs default aaa-group** command, two of these server groups are globally defined as default server groups: foo2 for authentication, and foo3 for accounting.

At access-point 1, which is enabled for authentication, the default global authentication server group of foo2 is overridden and the server group named foo is designated to provide authentication services on the APN. Notice that accounting services are not explicitly configured at that access point, but are automatically enabled because authentication is enabled. Because there is a globally defined accounting server-group defined, the server named foo3 will be used for accounting services.

At access-point 4, which is enabled for accounting using the **aaa-accounting enable** command, the default accounting server group of foo3 is overridden and the server group named foo1 is designated to provide accounting services on the APN.

Access-point 5 does not support any AAA services because it is configured for transparent access mode.

```
! Enables AAA globally
!
aaa new-model
!
! Defines AAA server groups
!
aaa group server radius foo
 server 10.2.3.4 auth-port 1645 acct-port 1646
 server 10.6.7.8 auth-port 1645 acct-port 1646
aaa group server radius foo1
 server 10.10.0.1 auth-port 1645 acct-port 1646
aaa group server radius foo2
 server 10.2.3.4 auth-port 1645 acct-port 1646
 server 10.10.0.1 auth-port 1645 acct-port 1646
aaa group server foo3
 server 10.6.7.8 auth-port 1645 acct-port 1646
 server 10.10.0.1 auth-port 1645 acct-port 1646
```

```
!
! Configures AAA authentication
! and authorization
!
aaa authentication ppp foo group foo
aaa authentication ppp foo2 group foo2
aaa authorization network foo group foo
aaa accounting network foo start-stop group foo
aaa accounting network foo1 start-stop group foo1
aaa accounting network foo2 start-stop group foo2
aaa accounting network foo3 start-stop group foo3
!
gprs access-point-list gprs
 access-point 1
  access-mode non-transparent
  access-point-name www.pdn1.com
!
! Specifies a RADIUS server group
! for use by the GGSN to authenticate
! mobile users at this access point
!
  aaa-group authentication foo
!
 access-point 4
  access-point-name www.pdn2.com
!
! Enables AAA accounting services
!
  aaa-accounting enable
!
! Specifies a RADIUS server group
! for use by the GGSN for accounting
! services at this access point

  aaa-group accounting foo1
!
 access-point 5
  access-point-name www.pdn3.com
!
! Configures default AAA server
! groups for the GGSN for authentication
! and accounting services
!
gprs default aaa-group authentication foo2
gprs default aaa-group accounting foo3
!
! Configures global RADIUS server hosts
! and specifies destination ports for
! authentication and accounting requests
!
radius-server host 10.2.3.4 auth-port 1645 acct-port 1646 non-standard
radius-server host 10.6.7.8 auth-port 1645 acct-port 1646 non-standard
radius-server host 10.10.0.1 auth-port 1645 acct-port 1646 non-standard
radius-server key ggsntel
```

**Note** Although you can configure the **radius-server host** command multiple times, the Cisco IOS software supports only one RADIUS server at the same IP address.

# RADIUS Response Message Configuration Example

The following example globally configures the GGSN to wait for a RADIUS accounting response from the RADIUS server before sending a Create PDP Context response to the SGSN. The GGSN waits for a response for PDP context requests received across all access points, except access-point 1. RADIUS response message waiting has been overridden at access-point 1 by using the **no gtp response-message wait-accounting** command:

```
! Enables AAA globally
!
aaa new-model
!
! Defines AAA server group
!
aaa group server radius foo
 server 10.2.3.4 auth-port 1645 acct-port 1646
 server 10.6.7.8 auth-port 1645 acct-port 1646
!
! Configures AAA authentication
! and authorization
!
aaa authentication ppp foo group foo
aaa authorization network foo group foo
aaa accounting network foo start-stop group foo
!
gprs access-point-list gprs
 access-point 1
  access-mode non-transparent
  access-point-name www.pdn1.com
  aaa-group authentication foo
!
! Disables waiting for RADIUS response
! message at APN 1
!
  no gtp response-message wait-accounting
  exit
access-point 2
 access-mode non-transparent
 access-point-name www.pdn2.com
 aaa-group authentication foo
!
! Enables waiting for RADIUS response
! messages across all APNs (except APN 1)
!
gprs gtp response-message wait-accounting
!
! Configures global RADIUS server hosts
! and specifies destination ports for
! authentication and accounting requests
!
radius-server host 10.2.3.4 auth-port 1645 acct-port 1646 non-standard
radius-server host 10.6.7.8 auth-port 1645 acct-port 1646 non-standard
radius-server key ggsntel
```

# IPSec Configuration Examples

**Note** On the Catalyst 6500/Cisco 7600 platform, IPSec is performed on the IPSec VPN Acceleration Services Module and requires no configuration on the GGSN instances on the Cisco MWAM. For information about configuring IPSec on the Catalyst 6500 series switch / Cisco 7600 series Internet router platform, see the *IPSEC VPN Acceleration Services Module Installation and Configuration Not*e.

IP Security Protocol is configured between two peers to establish data security services. For GPRS/UMTS, IPSec configuration is applicable between the GGSN and a router on a PDN.

The following examples show methods of IPSec configurations:


- IPSec Configuration using Crypto Map Entries, page 10-42
- IPSec Configuration using VRF and IPSec Profile, page 10-44


## IPSec Configuration using Crypto Map Entries

The following example shows configuration of IPSec on the GGSN on the Cisco 7200 series router platform and an associated PDN, including the complete global and GGSN configuration commands, using crypto map entries:

### GGSN configuration

```
!
hostname ggsn1
!
! IPSec configuration for GGSN
crypto isakmp policy 1
  authentication pre-share
  group 2
!
! 10.58.0.8 is address of peer, or PDN
!
crypto isakmp key sharedkey address 10.58.0.8
crypto ipsec transform-set auth2 esp-des esp-sha-hmac
crypto map test 10 ipsec-isakmp
  set peer 10.58.0.8
  set transform-set auth2
  match address 133
!
! Cisco VAM2 card is required for IPSec support
!
controller VAM2 1/1
!
interface loopback 1
  ip address 10.7.7.7 255.255.255.0
!
interface FastEthernet0/0
  description CONNECT TO sgsn-a
  ip address 10.56.0.7 255.255.0.0
!
interface FastEthernet4/0
  description CONNECT TO Gi
  ip address 10.58.0.7 255.255.0.0
  crypto map test
!
interface Virtual-Template1
  ip unnumber loopback 1
```

```
  encapsulation gtp
  ip mroute-cache
  gprs access-point-list gprs
!
router eigrp 10
  network 10.56.0.0
  network 10.58.0.0
!
!  10.2.0.0 is the network for Mobile Nodes
!
access-list 133 permit ip 10.2.0.0 0.0.255.255 10.59.0.0 0.0.255.255
!
!
gprs access-point-list gprs
  access-point 1
    access-point-name gprs.cisco.com
  exit
```

### PDN configuration

```
!
hostname pdn1a
!
!
! IPSec configuration on the PDN
!
crypto isakmp policy 1
  authentication pre-share
  group 2
!
! 10.58.0.7 is address of peer, or GGSN
!
crypto isakmp key sharedkey address 10.58.0.7
crypto ipsec transform-set auth2 esp-des esp-sha-hmac
crypto map test 10 ipsec-isakmp
  set peer 10.58.0.7
  set transform-set auth2
  match address 144
!
!
controller VAM2 1/1
!
interface FastEthernet0/0
  description CONNECT TO Intranet
  ip address 10.59.0.8 255.255.0.0
!
interface FastEthernet4/0
  description CONNECT TO Gi
  ip address 10.58.0.8 255.255.0.0
  crypto map test
!
!
! VAM2 card is required for IPSec support
router eigrp 10
  network 10.2.0.0
  network 10.58.0.0
  network 10.59.0.0
!
!
access-list 144 permit ip 10.59.0.0 0.0.255.255 10.2.0.0 0.0.255.255
!
!
```

## IPSec Configuration using VRF and IPSec Profile

The following example shows configuration of IPSec on the GGSN on the Cisco 7200 series router platform and an associated PDN, including the complete global and GGSN configuration commands, using VRF and IPSec profiles:

### GGSN configuration

```
!
hostname ggsn1
!
! IPSec configuration for GGSN
crypto isakmp policy 1
authentication pre-share
group 2
!
! 10.58.0.8 is address of peer, or PDN
!
crypto isakmp key sharedkey address 10.58.0.8
crypto ipsec transform-set auth2 esp-des esp-sha-hmac
crypto ipsec profile tunnel
set transform-set auth2
!
! VAM2 card is required for IPSec support
!
controller VAM2 1/1
!
interface Tunnel100
ip vrf forwarding vpn1
ip address 10.58.0.7 255.255.0.0
tunnel source FastEthernet2/0
tunnel destination 14.0.0.3
tunnel protection ipsec profile tunnel
router eigrp 10
network 10.56.0.0
network 10.58.0.0
!
!
```

### PDN configuration

```
!
hostname pdn1a
!
!
! IPSec configuration on the PDN
!
crypto isakmp policy 1
authentication pre-share
group 2
!
! 10.58.0.7 is address of peer, or GGSN
!
crypto isakmp key sharedkey address 10.58.0.7
crypto ipsec transform-set auth2 esp-des esp-sha-hmac
crypto ipsec profile tunnel
set transform-set auth2
!
controller VAM2 1/1
!
!
interface Tunnel100
ip address 1.1.1.5 255.255.255.0
```

```
tunnel source FastEthernet2/0
tunnel destination 14.0.0.1
tunnel protection ipsec profile tunnel
!
! VAM2 card is required for IPSec support
!
router eigrp 10
network 10.2.0.0
network 10.58.0.0
network 10.59.0.0
!
```

# Address Verification and Mobile-to-Mobile Traffic Redirection Example

The following examples show how to enable address verification and specify that mobile-to-mobile traffic be redirected to an external device.

### Cisco 7200 Platform

```
! Defines PLMN address ranges
gprs plmn ip address 1.1.1.1 1.1.1.99
gprs plmn ip address 1.1.2.1 1.1.2.49
!
! Enters access-point configuration mode
! and turns on source and destination address
! verification and mobile-to-mobile traffic redirection
!
gprs access-point-list gprs
     access-point 1
         access-point-name www.abc.com
         security verify source
         security verify destination
         redirection intermobile ip 10.1.1.1
!
```

### Catalyst 6500/Cisco 7600 Platform

On the GGSN:

```
service gprs ggsn
!
hostname t6500-7-2
!
ip cef
!
ip vrf vpn4
 description abc_vrf
 rd 104:4
!
!
interface Loopback2
 description USED FOR DHCP2 - range IN dup prot range
 ip address 111.72.0.2 255.255.255.255
!
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 GigabitEthernet0/0.2
 description Ga/Gn Interface
 encapsulation dot1Q 101
 ip address 10.1.1.72 255.255.255.0
 no cdp enable
!
interface GigabitEthernet0/0.3
 encapsulation dot1Q 103
 ip vrf forwarding vpn4
 ip address 10.1.3.72 255.255.255.0
 no cdp enable
!
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
!
! In case the ms is on another MWAM GGSN
ip route vrf vpn4 0.0.0.0 0.0.0.0 10.1.3.1
!
gprs access-point-list gprs
  access-point 7
   access-point-name ms_redirect.com
   ip-address-pool dhcp-proxy-client
   aggregate auto
   dhcp-server 10.2.25.90
   dhcp-gateway-address 111.72.0.2
   vrf vpn4
   ! In case the ms is on this GGSN.
   redirect intermobile ip 10.1.3.1
   !
```

Related configuration on the Supervisor/MSFC2:

```
hostname 6500-a

interface FastEthernet9/15
 description OUT to Firewall
 no ip address
 duplex half
 switchport
 switchport access vlan 162
!
interface FastEthernet9/16
 description In from Firewall
 no ip address
 switchport
 switchport access vlan 163
!
interface Vlan103
 description Vlan to GGSN redirect to FW
 ip address 10.1.3.1 255.255.255.0
 ip policy route-map REDIRECT-TO-FIREWALL
!
interface Vlan162
 ip address 162.1.1.1 255.255.255.0
!
interface Vlan163
 ip address 163.1.1.1 255.255.255.0
!
ip route 111.72.0.0 255.255.0.0 10.1.3.72
ip route 111.73.0.0 255.255.0.0 10.1.3.73
ip route 111.74.0.0 255.255.0.0 10.1.3.74
ip route 111.75.0.0 255.255.0.0 10.1.3.75
ip route 111.76.0.0 255.255.0.0 10.1.3.76
!
access-list 102 permit ip any any
!
route-map REDIRECT-TO-FIREWALL permit 10
 match ip address 102
 set ip next-hop 162.1.1.11
!
```

# Access to a Private RADIUS Server Using VRF Configuration Example

The following examples shows an example of configuring access to a private RADIUS server using VRF.

### Cisco 7200 Platform

```
! Enables AAA globally
aaa new-model
!
! Configures a VRF-Aware Private RADIUS Server Group named vrf_aware_radius
!
aaa group server radius vrf_aware_radius
 server-private 99.100.0.2 auth-port 1645 acct-port 1646 key cisco
 ip vrf forwarding vpn4
!
! Configures Authentication, Authorization, and Accounting using named method lists
!
aaa authentication ppp vrf_aware_radius group vrf_aware_radius
aaa authorization network default local group radius
aaa authorization network vrf_aware_radius group vrf_aware_radius
aaa accounting network vrf_aware_radius start-stop group vrf_aware_radius
```

```
aaa session-id common
!
! Configures a VRF routing table
!
ip vrf vpn4
 rd 104:1
!
! Configures VRF on an interface
!
interface FastEthernet0/0
 ip vrf forwarding vpn4   <=== new
 ip address 99.108.0.4 255.255.255.0
!
! Configures VRF on an access point for access to the server
!
access-point 17
   access-point-name radius_vrf
   access-mode non-transparent
   aaa-group authentication vrf_aware_radius
   aaa-group accounting vrf_aware_radius
   ip-address-pool radius-client
   vrf vpn4
   exit
```

### Catalyst 6500/Cisco 7600 Plaform

On the GGSN:

```
aaa new-model
!

aaa group server radius vrf_aware_radius
 server-private 99.100.0.2 auth-port 1645 acct-port 1646 key cisco
 ip vrf
!
aaa authentication ppp vrf_aware_radius group vrf_aware_radius
aaa authorization network default local group radius
aaa authorization network vrf_aware_radius group vrf_aware_radius
aaa accounting network vrf_aware_radius start-stop group vrf_aware_radius
aaa session-id common

!
ip vrf vpn2
 rd 101:1
!
interface Loopback1
 ip address 150.1.1.72 255.255.0.0
!
interface Tunnel2
 ip vrf forwarding vpn2
 ip address 80.80.72.72 255.255.255.0
 tunnel source 150.1.1.72
 tunnel destination 167.2.1.12
!
ip local pool vpn2_pool 100.72.0.1 100.72.255.255 group vpn2
ip route vrf vpn2 0.0.0.0 0.0.0.0 Tunnel2
!
gprs access-point-list gprs
  access-point 1
   access-point-name apn.vrf2.com
   access-mode non-transparent
   aaa-group authentication vrf_aware_radius
   aaa-group accounting vrf_aware_radius
```

```
   ip-address-pool local vpn2_pool
   aggregate 100.72.0.0 255.255.0.0
   vrf vpn2
   !
```

Related configuration on the Supervisor / MSFC2:

```
...
!
interface FastEthernet9/5
 switchport
 switchport access vlan 167
!

interface Vlan167
 ip address 167.1.1.1 255.255.0.0
!
ip route 150.1.1.72 255.255.255.255 10.1.1.72
ip route 167.2.0.0 255.255.0.0 167.1.1.12
!
...
```