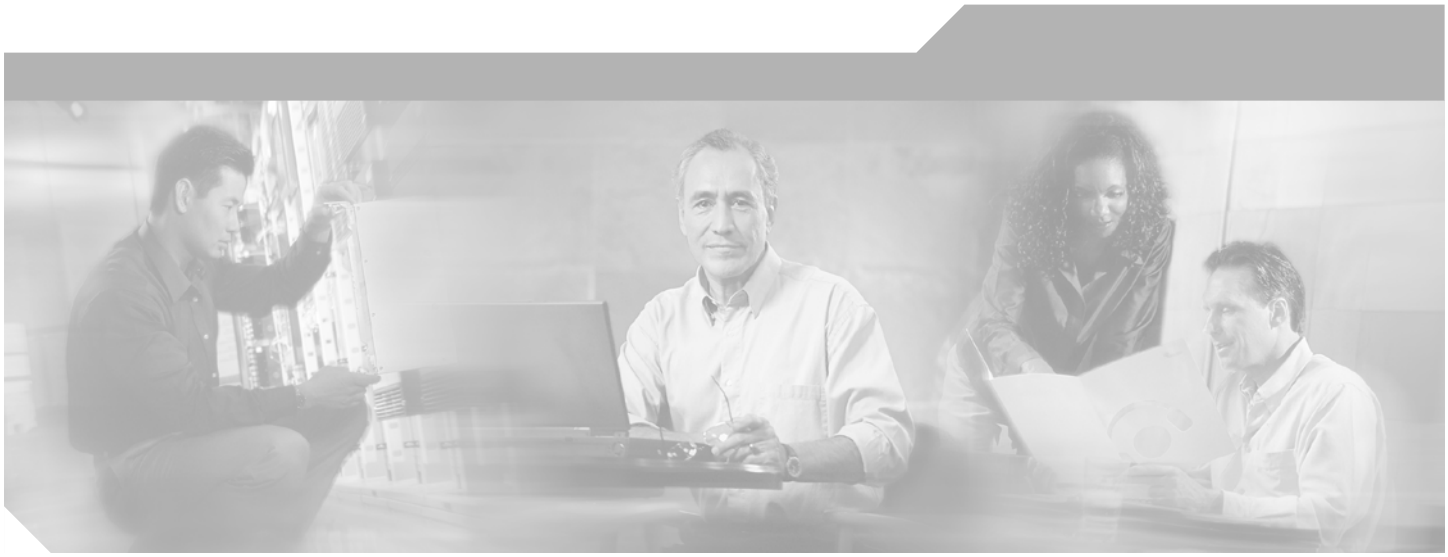

Cisco 10000 Series Router Service Selection Gateway Configuration Guide

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Cisco 10000 Series Router Service Selection Gateway Configuration Guide
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CONTENTS

About This Guide

This guide provides information about the Service Selection Gateway (SSG) features of the Cisco 10000 Series Router. The SSG features are supported in Cisco IOS Release 12.2(16)BX and later releases.

Audience

This guide is designed for system and network managers responsible for configuring Service Selection Gateway features on the Cisco 10000 router. The manager should be experienced using Cisco IOS software and be familiar with the operation of the Cisco 10000 router.

Document Organization

This guide contains the following chapters:

Chapter	Title	Description
Chapter 1	Service Selection Gateway Overview	Describes the Service Selection Gateway features, restrictions, and prerequisites. Also provides an architectural model.
Chapter 2	Scalability and Performance	Describes limitations and restrictions, of the Service Selection Gateway feature.
Chapter 3	SSG Logon and Logoff	Describes the SSG features for logon and logoff related functions.
Chapter 4	Authentication and Accounting	Describes the SSG features for authentication and accounting related functions.
Chapter 5	Service Selection Methods	Describes the service selection methods supported on the Cisco 10000 router.
Chapter 6	Service Connection	Describes the SSG features for service connection.
Chapter 7	Service Profiles and Cached Service Profiles	Describes service profiles and cached service profiles.
Chapter 8	SSG Hierarchical Policing	Describes the SSG Hierarchical Policing feature supported by the Cisco 10000 router.
Chapter 9	Interface Configuration	Describes the Transparent Passthrough and Multicast Protocols on SSG Interfaces features.

Chapter	Title	Description
Chapter 10	SSG TCP Redirect	Describes the TCP Redirect feature for SSG.
Chapter 11	Miscellaneous SSG Features	Describes the following features: • VPI/VCI Static Binding to a Service Profile • RADIUS Virtual Circuit Logging • AAA Server Group Support for Proxy Services • Packet Filtering • SSG Unconfig • SSG Enhancements for Overlapping Services
Chapter 12	Monitoring and Maintaining SSG	Provides **show** commands for monitoring and maintaining SSG, describes the per-service statistics feature, and provides commands for monitoring the Parallel Express Forwarding (PXF) engine.
Appendix A	Configuration Example for SSG	Provides a basic configuration example for SSG.

Note This guide also includes a glossary of terms used in the document and an index to help you locate topics.

Document Conventions

This guide uses the following conventions:

- **Bold** is used for commands, keywords, and buttons.
- *Italics* are used for command input for which you supply values.
- `Screen` font is used for examples of information that are displayed on the screen.
- **`Bold screen`** font is used for examples of information that you enter.
- Vertical bars (|) indicate separate alternative, mutually exclusive elements.
- Square brackets ([ ]) indicate optional elements.
- Braces ({}) indicate a required choice.
- Braces within square brackets ([{}]) indicate a required choice within an optional element.

Note Means *reader take note*. Notes contain helpful suggestions or references to material not covered in the guide.

Timesaver Means the *described action saves time*. You can save time by performing the action described in the paragraph.

Caution Means *reader be careful*. In this situation, you might do something that could result in equipment damage or loss of data.

Warning **Means *danger*. You are in a situation that could cause bodily injury. Before you work on any equipment, you must be aware of the hazards involved with electrical circuitry and familiar with standard practices for preventing accidents. To see translated versions of warnings, refer to the *Regulatory Compliance and Safety Information* document that accompanied the device.**

Related Documentation

The following documentation provides additional information about the Cisco 10000 router and its features:

- *Cisco 10000 Series Router Feature Map*
- *Cisco 10000 Series Router Software Configuration Guides*
- Cisco 10000 Series Router Hardware Documents
- *Technology of Edge Aggregation: Cisco 10000 Series Router*
- *Cisco 10000 Series Router Technical Reference*
- *Cisco 10000 Series Router Useful Links*
- Cisco 10000 Series Router MIB Documents

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Opening a TAC Case

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http://www.cisco.com/tac/caseopen

For P1 or P2 cases (P1 and P2 cases are those in which your production network is down or severely degraded) or if you do not have Internet access, contact Cisco TAC by telephone. Cisco TAC engineers are assigned immediately to P1 and P2 cases to help keep your business operations running smoothly.

To open a case by telephone, use one of the following numbers:

Asia-Pacific: +61 2 8446 7411 (Australia: 1 800 805 227)
EMEA: +32 2 704 55 55
USA: 1 800 553-2447

For a complete listing of Cisco TAC contacts, go to this URL:

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Priority 1 (P1)—Your network is “down” or there is a critical impact to your business operations. You and Cisco will commit all necessary resources around the clock to resolve the situation.

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Service Selection Gateway Overview

The Service Selection Gateway feature, available in Cisco IOS Release 12.2(16)BX or later, offers a switching solution to service providers. Working in conjunction with the Cisco Subscriber Edge Services Manager (SESM), SSG provides subscriber authentication, service selection, and service connection capabilities to subscribers of Internet services. Subscribers interact with the SESM web application using a standard Internet browser.

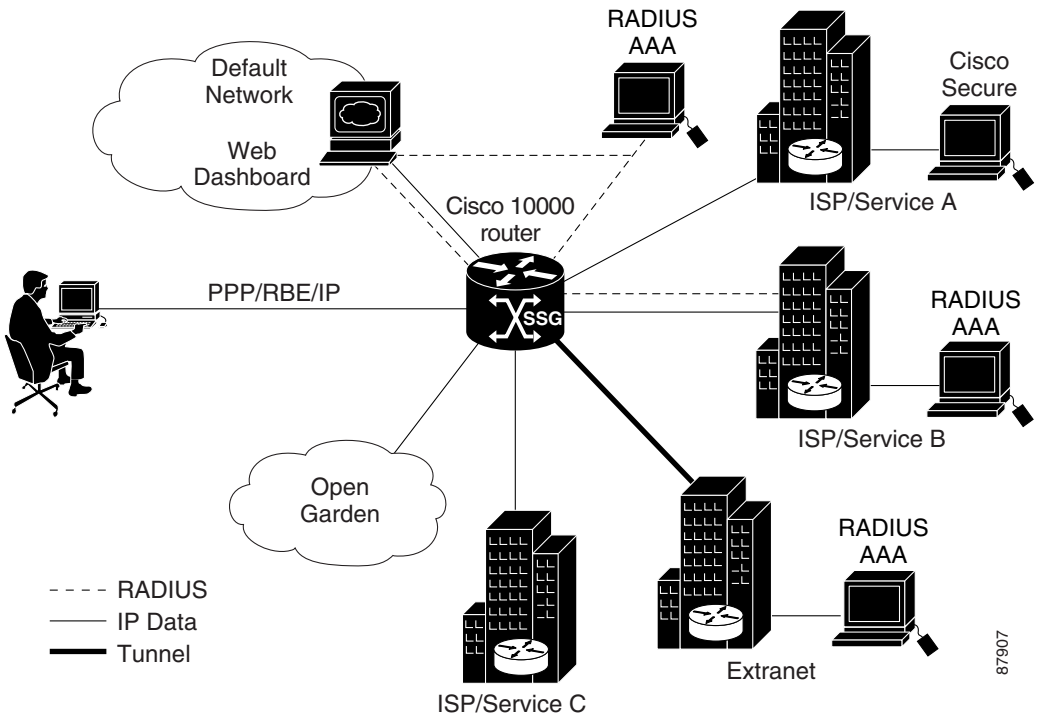
This chapter provides an overview of the Service Selection Gateway feature available on the Cisco 10000 series router.

Service Selection Gateway

The Cisco 10000 series router supports the Service Selection Gateway (SSG) feature in Cisco IOS Release 12.2(16)BX or later. SSG is a switching solution for service providers who offer intranet, extranet, and Internet connections to subscribers using broadband access technology such as digital subscriber lines (DSL) lines, cable modems, or wireless to allow simultaneous access to network services. SSG provides connectivity to corporate networks and differential service selection to users with access to multiple simultaneous services. Users can dynamically connect to and disconnect from any of the services available to them.

Figure 1-1 shows an example of an SSG topology. In the figure, a single user connects to the Cisco 10000 series router using an access protocol such as PPP, RBE, or IP. SSG resides in the router that serves as a broadband aggregator. The router acts as a central control point for Layer 2 and Layer 3 services, including services available through ATM virtual circuits (VCs), virtual private dial-up networks (VPDNs), and normal routing methods. The user can concurrently connect to a number of different services, which can be private or public services. Connections to the services are established using IP.

Figure 1-1 SSG Topology Example



Note The Cisco 10000 series router does not support tunneling of SSG users.

The Cisco 10000 series router adds the Open Garden and default networks to all SSG VRFs, providing reachability information to the Open Garden and default networks for all services both public and private. However, access is restricted for the following conditions:

- If the Open Garden and default network addresses overlap within the service definition, the traffic destined for either network is subject to the rules of the default network.
- If the Open Garden network is bound to a specific interface and a VRF is also applied to the interface, the Open Garden network is accessible to users whose sessions are established using the applied VRF.

The SSG feature communicates with the authentication, authorization, and accounting (AAA) management network that includes RADIUS and Dynamic Host Configuration Protocol (DHCP) servers. SSG connects to the service provider network, which can connect to the Internet service provider (ISP) network and corporate networks.

The Cisco 10000 series router supports the Cisco Subscriber Edge Services Manager (SESM), which provides subscriber authentication, service selection, and service connection capabilities to subscribers of Internet services. Subscribers interact with the SESM web application using a standard Internet browser. The SESM functionality provides a flexible and convenient graphical user interface (GUI) for subscribers and enables service providers to bill subscribers for connection time and services used, rather than charging a flat rate.

Default Network

The default network is a location that SSG allows unauthenticated users to access. The default network is a single IP address or subnet, typically the IP address of the SESM application although other types of servers can also be defined as the default network. The default network supports the port-bundle host key.

The default network enables special processing of traffic to and from the default network. Because traffic to and from SESM requires special processing and the Cisco 10000 series router cannot distinguish between SESM and non-SESM traffic, we recommend that you define the SESM server as the default network and place other servers in the Open Garden network.

Note Traffic to and from a non-SESM server does not require special processing.

The SSG typically forwards packets to and from the default network through the router's PXF forwarding engine. However, SSG also forwards default network traffic through the route processor (RP) as follows:

Packets from a User and Destined for the Default Network

If the port-bundle host key is:

- Enabled—SSG forwards the packets through the RP.
- Disabled—SSG forwards the packets through the PXF forwarding engine.

Packets from the Default Network and Destined for an SSG User

- SSG forwards the packets through the RP if either of the following conditions are met:
  - The port-bundle host key is enabled.
  - The port-bundle host key is disabled, TCP is the transport protocol, and the packets are associated with an active TCP redirect mapping.
- Otherwise, SSG forwards the packets through the PXF forwarding engine.

Access Protocols

On the subscriber side of the network, the Cisco 10000 series router supports SSG features for the following protocols and encapsulations:

- PPPoE
- PPPoA
- RBE
- RFC 2684 IP

On the network side, the router supports receiving SSG traffic on the following interface types:

- ATM PVCs and subinterfaces
- Ethernet interfaces and subinterfaces
- POS interfaces
- Serial and channelized interfaces

Supported SSG Features

The Cisco 10000 series router supports the following SSG features and functionality:

- SSG Logon and Logoff, page 3-1
- Authentication and Accounting, page 4-1
- Service Selection Methods, page 5-1
- Service Connection, page 6-1
- Service Profiles and Cached Service Profiles, page 7-1
- SSG Hierarchical Policing, page 8-1
- Interface Configuration, page 9-1
- SSG TCP Redirect, page 10-1
- VPI/VCI Static Binding to a Service Profile, page 11-1
- RADIUS Virtual Circuit Logging, page 11-2
- AAA Server Group Support for Proxy Services, page 11-2
- Packet Filtering, page 11-3
- SSG Unconfig, page 11-5

For more information about the SSG features, refer to the *Service Selection Gateway*, Release 12.2(15)B feature module.

For information about SSG features supported in a specific Cisco IOS release, refer to the *Cisco 10000 Series Router Feature Map*.

SSG Restrictions

The SSG feature has the following restrictions:

- When using SSG hierarchical policing on Cisco 10000 Series routers, a maximum of 8 policing rates can be used per uplink interface and R attribute combination. Of these 8 rates, 1 is reserved for "no policing", leaving 7 different police rates available per uplink interface and R attribute combination For example, if eight SSG services are bound to the same SSG next-hop and all eight services carry an R attribute of "R0.0.0.0;0.0.0.0", the ninth service will fail to acquire correct policing rates and this error message may appear:
  %GENERAL-3-EREVENT: C10KSSG: Vi2.8 svc_bitmap 0x2 Unable to set connection rate
- Network address translation (NAT) functionality is not supported. This means that the router does not support concurrent access to multiple services for which the services, not the access provider, must assign the user's IP address. For example, this restriction applies to concurrent access to a private service and SESM or the Open Garden network, or concurrent access to a tunnel service and SESM or the Open Garden network.
- The Cisco 10000 series router adds reachability information to the Open Garden and default networks for all services, both public and private. Because NAT is not supported, the addresses for the Open Garden and default networks cannot overlap addresses defined within the service definition.
- To restrict access to the Open Garden network by private services, you must specifically bind the Open Garden to the uplink interfaces. Do not bind the Open Garden to the interface used by the private service.

- The Cisco 10000 router's SSG software and forwarding software handle multiple users attached to a single Cisco IOS software interface in different ways, which could result in users receiving services that they did not select. After the first user logs on, all subsequent user logon attempts are rejected. Although the logon is rejected and thus the ability to select services, all users can access the services to which the first user is subscribed. User traffic is not rejected, only the user's authorization attempt. The traffic from all users is logged in the statistics of the first user. The traffic to the user is treated as transparent passthrough and is forwarded to the user, but it does not affect SSG accounting. If you enter the **ssg show host** command, statistics are displayed for the first user only.
- For users attached to multipoint interfaces on the access side, the Cisco 10000 router authorizes the first user and then rejects the authorization attempts of subsequent users. The router only rejects the authorization attempts, not the user traffic. The router treats all subsequent users as the first user logged on, allowing access to the services to which the first user is subscribed. However, subsequent users cannot select services. The traffic from all users is logged in the statistics of the first user. Traffic to the second and subsequent users is treated as transparent passthrough and is forwarded to these users, but it does not affect the SSG accounting. The **ssg show host** command displays the first user.
- Each private service is associated with its own VRF; global services are associated with the same VRF. The default network and Open Garden network are typically added to all VRFs, except if the network addresses overlap addresses in the private IP network or the Open Garden network is explicitly bound to an uplink interface. The default network addresses must also be associated with the global Cisco IOS VRF.
- You can apply a service to a next-hop address or to an interface. The interface must be a non-broadcast interface. For example, an interface with multipoint PVCs or Ethernet without VLANs is not supported.
- You can apply services with overlapping addresses to the same next-hop address. Services that have overlapping addresses cannot be bound to different next-hop addresses if the next-hop addresses resolve to the same interface.
- All services that share an uplink interface must not have overlapping addresses. Normally, a service defined to include a route of 0.0.0.0 with a subnet mask of 0.0.0.0 overlaps with any other possible service. Therefore, the Cisco 10000 series router treats the route 0.0.0.0 with a subnet mask of 0.0.0.0 as a default route.
- You cannot configure the following interface types as an SSG uplink interface:
  - Any interface requiring tunneling (for example, L2TP or GRE tunneling)
  - Multilink PPP (MLPPP) interfaces
  - Tag interfaces
  - Load balanced interfaces
- For RBE and IP users, the addresses of services that share an uplink interface cannot overlap.

For information about the restrictions for a specific SSG feature, see the appropriate chapter in this guide.

SSG Prerequisites

The SSG feature has the following prerequisites:

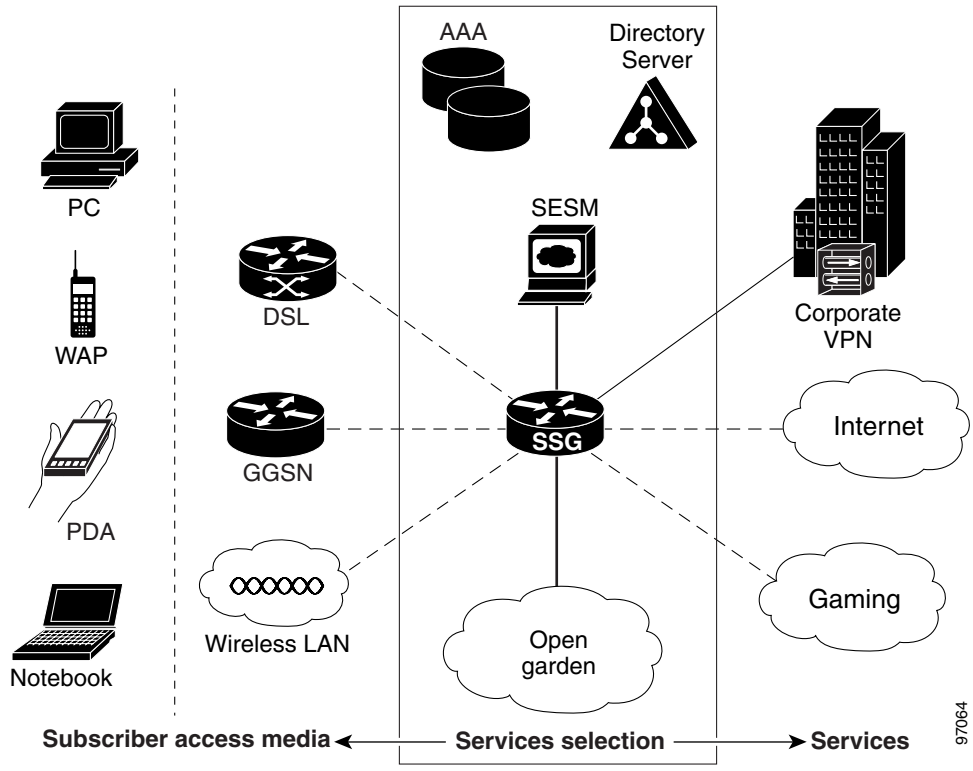
- The Cisco 10000 series router must be running Cisco IOS Release 12.2(16)BX or later.
- The performance routing engine (PRE), part number ESR-PRE2 must be installed in the router chassis. The PRE performs all Layer 2 and Layer 3 packet manipulation related to routing and forwarding operations. Use the **show version** command to verify that you have the correct PRE version installed.
- If you want to perform Layer 3 service selection, you must install and configure the Cisco Subscriber Edge Services Manager (SESM) as described in the *Cisco Subscriber Edge Services Manager and Subscriber Policy Engine Installation and Configuration Guide, Release 3.1(1)*.

For information about the prerequisites for a specific SSG feature, see the appropriate chapter in this guide.

SSG Architecture Model

Figure 1-2 shows a Service Selection Gateway (SSG) model.

Figure 1-2 Service Selection Gateway Topology



In Figure 1-2, subscribers access the SESM web portal application using any web browser on a variety of devices (such as a desktop computer over DSL). The Cisco 10000 series router (the SSG node) forwards unauthenticated SSG traffic from the subscriber to SESM, configured as the captive portal and default network. The SSG feature set of the router allows the service provider to design a service selection access network.

As the gateway to service selection, subscribers can use SESM to manager their accounts, subscribe to new services, and select those services that they want to use. Service providers can use SESM to offer and advertise value-added services and to associate these services with their brand identities.

CHAPTER 2

Scalability and Performance

The infrastructure of the service provider must be capable of supporting the services the enterprise customer or Internet service provider (ISP) wants to offer its subscribers. It must also be able to scale to an expanding subscriber base. You can configure the Cisco 10000 series router for high scalability.

Limitations and Restrictions

The Cisco 10000 series router has the following limitations and restrictions for the SSG:

- Users can connect to a maximum of seven different services, plus the Open Garden and default networks (a total of 9) at any one time.
- The Cisco 10000 series router supports mini-ACLs and turbo ACLs. Mini-ACLs are limited to eight or less access control entries (ACEs); turbo ACLs have more than eight ACEs. ACLs can be standard or extended ACLs. Non-SSG interfaces support both mini-ACLs and turbo ACLs. ACLs defined through SSG configuration (RADIUS) are restricted to mini-ACLs only. You can apply the same ACL to multiple hosts and connections.
- The SSG QoS features are limited to hierarchical policing and are not based on the modular QoS CLI (MQC).
- You cannot configure routing protocols in SSG VRFs. Therefore, RA-MPLS features are not supported for SSG hosts.
- The Cisco 10000 series router does not support load balancing on SSG uplink interfaces or redundant uplink interfaces to the same set of services.
- The Cisco 10000 series router does not support SSG services on tag interfaces.
- If you use the CLI to configure a VRF on an interface and you simultaneously configure the interface as an SSG uplink interface, the Cisco 10000 series router accepts the configuration but the SSG uplink configuration takes precedence and the router ignores the VRF configuration.
- You cannot configure overlapping IP addresses in the same VRF and you can associate a single interface with a single VRF. The router makes routing decisions based on the longest match.
- The services applied on an IP network or networks must not have conflicting features. For example, consider the following service definitions for the Best, Good, and Standard services. These service definitions are in conflict because network A is not policed while network B is policed and also restricted for some hosts.

  Best—Access to network A and access to network B at rate 2

  Good—Access to network A and access to network B at rate 1

  Standard—Access to network A but no access to network B

Now, consider the following revised service definitions in which two different services are defined. These service definitions allow all users to connect to the Standard service and allow some users to connect simultaneously to Good or Best services.

Best—Access to network B at rate 2

Good—Access to network B at rate 1

Standard—Access to network A

SSG Logon and Logoff

The Cisco 10000 series router supports the following SSG features for logon and logoff related functions:

This chapter describes each of SSG logon and logoff features.

Single Host Logon

The Single Host Logon feature enables users to enter authentication information only twice. To log on to a service through the SESM web application, a subscriber enters authentication information once for the PPP session and once for the service. The subscriber does not have to log on to the SESM. Instead, the SESM uses the PPP authenticated information from the SSG.

For non-PPP users, when a subscriber authenticates using the SESM application, the subscriber does not have to log on again for the remainder of the non-PPP session. However, the subscriber still has to log on to services. For more information, refer to *Cisco Subscriber Edge Services Manager and Subscriber Policy Engine Installation and Configuration Guide*.

Prerequisites for Single Host Logon

To use the Single Host Logon feature, you must install and configure Cisco SESM Release 3.1(1) or later.

SSG Autologoff

The SSG Autologoff feature enables SSG to verify connectivity with each host. SSG checks the status of the connection with each host at configured intervals. If SSG finds that a host is not reachable, SSG automatically initiates the logoff of that host. SSG has two methods of checking the connectivity of hosts: ARP ping and ICMP ping.

ARP ping

When autologoff is configured to use ARP ping, SSG periodically checks the ARP cache tables. If a table entry for a host is found, SSG forces ARP to refresh the entry and checks the entry again after a configured interval. If a table entry is not found, SSG initiates autologoff for the host. However, if any data traffic to or from the host occurred during the interval, SSG does not ping the host because the reachability of the host during that interval was established by the data traffic. ARP ping works in deployment scenarios in which all hosts are directly connected to the SSG through a broadcast interface such as an Ethernet interface or through a bridged interface such as an RBE interface.

ICMP ping

When SSG autologoff is configured to use ICMP ping, SSG pings the host to check connectivity until an ICMP response is obtained or the allowable number of tries is used up. If all the tries are used up and the ping was unsuccessful, then SSG initiates logoff for that host. SSG uses ICMP ping one time at each configured interval. If data traffic to or from the host is found during the interval, SSG does not ping the host because reachability was established by the data traffic. ICMP ping works in all types of deployment scenarios and supports overlapping IP users.

Restrictions for SSG Autologoff

The SSG Autologoff feature has the following restrictions:

- Use only one method of SSG autologoff at a time: ARP ping or ICMP ping.
- Use ARP ping only in deployment scenarios in which all hosts are directly connected to the SSG through a broadcast interface such as an Ethernet interface or through a bridged interface such as an RBE interface. ICMP ping works in all types of deployment scenarios.
- ARP ping works only on hosts that have a MAC address.
- ARP ping does not support overlapping IP addresses.
- SSG autologoff that uses ARP ping does not work for hosts with static ARP entries.
- If you configure both the idle timers and ICMP-based autologoff, you must set the autologoff interval to a value that is at least twice as long as the idle timeout interval. Otherwise, the ICMP messages reset the idle timer and the user is only logged out if the user does not respond to the ICMP ping.

Configuration of SSG Autologoff

To configure the SSG Autologoff feature, use the **ssg auto-logoff** command in global configuration mode. For more information, refer to the *SSG Autologoff*, Release 12.2(4)B feature module.

Configuration Example for SSG Autologoff

Example 3-1 shows how to enable autologoff with ARP ping.

Example 3-1 SSG Autologoff Using ARP Ping

```
ssg auto-logoff arp interval 60
```

Example 3-2 shows how to enable autologoff with ICMP ping.

Example 3-2 SSG Autologoff Using ICMP Ping

```
ssg auto-logoff icmp interval 60 packet 2 timeout 500
```

SSG Prepaid Idle Timeout

The SSG Prepaid Idle Timeout feature enhances the SSG and the SSG Prepaid feature by doing the following:

- Enables SSG to return residual quotas (allotments of prepaid credit) to the billing server from services that a user is logged into but not actively using. The quota that is returned to the billing center can be applied to the quota for the services the user is actively using.
- Enables a user's connection to services to be open even when the billing server returns a zero quota. The connection's status depends on the combination of the quota and the idle timeout value returned. Depending on the connection service, SSG requests the quota for a connection from the billing server at the following times:
  - After the user starts using a particular service
  - When the user runs out of quota
  - After the configured idle timeout value expires
- Enables SSG to reauthorize a user before the user completely consumes the allocated quota. You can also configure SSG to not pass traffic during reauthorization, thus preventing revenue leaks in the event the billing server returns a zero quota for the user.
- Enhances the handling of a returned zero quota from the billing server. If the billing server returns a zero quota and a nonzero idle timeout, the user has run out of credit for a service. When a user runs out of credit, the user is redirected to the billing server to replenish the quota. When the user is redirected to the billing server, the user's connection to the original service or services remains up, but any traffic passing through the connection is dropped. This enables the user to replenish the quota on the billing server without losing connections to services or having to perform additional service logons.
- Enables SSG to notify the billing server when a connection fails. This enables the billing server to free quota that was reserved for the failed connection and to apply the quota immediately to some other active connection.

Without the SSG Prepaid Idle Timeout feature, traffic passed during reauthorization represents a revenue leak if the billing server returns a zero quota for the user. A configurable threshold value is used to prevent this. This value causes SSG to reauthorize a user's connection before the user completely consumes the allocated quota for a service.

Service Authorization

SSG sends a service authorization request to the billing server upon initial service authorization. Explicit service authorization is required whenever a user attempts to connect to a prepaid service to ensure that the user has sufficient credit to connect to that service. The billing server responds with the available quota (allotment of prepaid credit) to SSG. If the returned available quota is greater than zero or not present, SSG allows the user to connect to the service and begins metering based on the allotted quota. For this authorization, an Access-Request is generated once the service is identified as a prepaid service. The Access-Request is generated for service authorization regardless of the service type (for example, virtual private dial-up network (VPDN), passthrough, proxy, or tunnel).

The billing server responds to the service authorization Access-Request with an Access-Accept that defines the quota parameters for the connection. Authorization for a service is provided based on the presence and content of the Quota (Attribute 26) and the Idle Timeout (Attribute 28) vendor-specific attributes (VSAs) in the Access-Accept.

Service Reauthorization

SSG sends a service reauthorization request to the billing server at the following times:

- When a prepaid user's quota is consumed
- After the configured idle timeout expires
- When the user's remaining quota reaches the configured threshold value

The SSG Prepaid Idle Timeout feature enables you to configure how traffic is handled during reauthorization. By default, traffic continues during reauthorization. If the billing server returns a zero quota in the reauthorization response, SSG disconnects the connection but the data that was in progress during the reauthorization goes through and is not accounted. You can configure SSG to either drop or forward traffic during reauthorization. You can also configure a threshold value, which configures SSG to reauthorize a connection with the billing server before a prepaid user's allocated quota is completely consumed.

By configuring the **ssg prepaid reauthorization drop-packet** command, SSG drops the traffic on a connection during reauthorization and the time used during the reauthorization is not accounted to that connection. SSG deducts the reauthorization times from the total session duration time and sends the Account Session Time (Attribute 46) in the Accounting Stop and Update packets.

If the billing server responds with a time-based connection to redirect the traffic, then SSG redirects TCP traffic. The time of the TCP redirection is also not accounted to the user's connection.

The reauthorization request for SSG Prepaid Idle Timeout is similar to the reauthorization request for SSG Prepaid. However, the SSG Prepaid Idle Timeout reauthorization request contains an additional attribute: Reauthorization Reason. If the Reauthorization Reason attribute is not present, the billing server assumes that the reason for the reauthorization request is Primary Quota Consumed. The values of the Reauthorization Reason attribute are the following:

- Quota Consumed (QR0)
- Idle Timer Expired (QR1)

For more information, refer to the *SSG Prepaid Idle Timeout*, Release 12.2(15)B feature module.

Restrictions for SSG Prepaid Idle Timeout

The SSG Prepaid Idle Timeout feature has the following restrictions:

- The Cisco 10000 router supports only time-based SSG Prepaid for a service connection. Quotas are measured in seconds. You cannot change the unit of measure.
- The Cisco 10000 router does not support returning a quota when the connection is idle.
- After a user runs out of quota and then replenishes the quota at the billing server, SSG receives the updated quota and resumes the connection only after the next reauthorization.

Prerequisites for SSG Prepaid Idle Timeout

The SSG Prepaid Idle Timeout feature requires the following:

- You must enable SSG accounting before you can use the SSG Prepaid feature. SSG accounting is enabled by default. If it has been disabled, reenable it by using the **ssg accounting** command in global configuration mode.
- The SSG Prepaid feature requires the AAA server to support prepaid billing.
- You must configure the SSG to send Attribute 55 in accounting requests.

Configuration of SSG Prepaid Idle Timeout

To configure the SSG Prepaid Idle Timeout feature, configure the SSG Prepaid and SSG TCP Redirect features. For more information, refer to the *SSG Prepaid*, Release 12.2(4)B feature module and the *SSG TCP Redirect for Services*, Release 12.2(4)B feature module.

Configuration Example for SSG Prepaid Idle Timeout

Example 3-3 shows how to configure the SSG Prepaid feature to provide the prepaid billing server with session ID and time-stamp information.

Example 3-3 SSG Prepaid Service

```
radius-server attribute 44 include-in-access-req
radius-server attribute 55 include-in-acct-req
```

Example 3-4 shows how to configure the SSG TCP Redirect feature. The commands configure a captive portal group called "DefaultRedirectGroup," add two servers to "DefaultRedirectGroup," and redirect prepaid users to the newly created captive portal.

Example 3-4 SSG TCP Redirect

```
ssg enable
ssg tcp-redirect
 server-group DefaultRedirectGroup
  server 10.0.0.1 8080
  server 10.0.0.20 80
  end
redirect prepaid-user to DefaultRedirectGroup
```

Example 3-5 shows how to configure the SSG TCP Redirect feature for a specific service. The commands redirect all prepaid service traffic to the captive portal group called "InternetRedirectGroup" and configure the captive portal group as the server group used for redirecting prepaid traffic.

Example 3-5 SSG Service-Specific TCP Redirect

```
ssg enable
ssg tcp-redirect
 server-group InternetRedirectGroup
  server 10.0.0.1 8080
  server 10.0.0.20 80
  end
```

The service profile for InternetRedirectGroup is shown here:

```
ServiceInfo="Z"
```

(Optional) You can configure SSG to reauthorize a prepaid user's connection before the user has completely consumed the allotted quota for a service. To do this, enter the global-configuration commands shown below to configure a time-based or a volume-based threshold value. Example 3-6 shows how to configure a threshold time value of 10 seconds. Example 3-7 shows how to configure threshold volume value of 2000 bytes.

Example 3-6 SSG Threshold Time

```
ssg prepaid threshold time 10
```

Example 3-7 SSG Threshold Volume

```
ssg prepaid threshold volume 2000
```

SSG Session and Idle Timeout

In a dial-up networking or bridged (non-PPP) network environment, a user can disconnect from the network access server (NAS) and release the IP address without logging out from the SSG. When this happens, the SSG continues to allow traffic to pass from that IP address, which can create a problem if the another user obtains the same IP address. SSG provides two mechanisms to prevent this problem from occurring:

- Session-Timeout RADIUS attribute—Specifies the maximum length of time for which a host or connection object can remain continuously active.
- Idle-Timeout RADIUS attribute—Specifies the maximum length of time for which a session or connection can remain idle before it is disconnected.

The Session-Timeout and Idle-Timeout attributes are used in either a user or service profile. In a user profile, the attribute applies to the user session. In a service profile, the attribute applies individually to each service connection.

CHAPTER 4

Authentication and Accounting

The Cisco 10000 series router supports the following SSG features for authentication and accounting related functions:

This chapter describes the SSG features for authentication and accounting.

SSG Full Username RADIUS Attribute

The Full Username RADIUS attribute allows SSG to include the user's full username and domain (user@service) in the RADIUS authentication and accounting requests.

Restrictions for SSG Full Username RADIUS Attribute

The size of the full username is limited to the smaller of the following values:

- 246 bytes (10 bytes less than the standard RADIUS protocol limitation)
- 10 bytes less than the maximum size of the RADIUS attribute supported by your proxy

Configuration Examples for SSG Full Username RADIUS Attribute

Example 4-1 RADIUS Freeware Format Example

```
Service-Info = "X"
```

Example 4-2 CiscoSecure ACS for UNIX Example

```
9,251 = "X"
```

RADIUS Accounting Records

SSG sends accounting records with the associated attributes to the RADIUS accounting server when the following events occur:

Account Login and Logout

SSG sends a RADIUS accounting-request record to the local RADIUS server when a user logs in to or out of the SSG. The Acct-Status-Type attribute included in the accounting-request record indicates if the accounting-request marks the start of the user service or the end of the service.

When a user logs in, SSG sends an accounting-start record to RADIUS. When a user logs out, SSG sends an accounting-stop record.

Configuration Examples for Account Login and Logout

Example 4-3 shows the information contained in a RADIUS accounting-start record.

Example 4-3 RADIUS Accounting-Start Record

```
Acct-Status-Type = Start
NAS-IP-Address = ip_address
User-Name = "username"
Acct-Session-Id = "session_id"
Framed-IP-Address = user_ip
Proxy-State = "n"
```

Example 4-4 shows the information contained in a RADIUS accounting-stop record.

Example 4-4 RADIUS Accounting-Stop Record

```
Acct-Status-Type = Stop
NAS-IP-Address = ip_address
User-Name = "username"
Acct-Session-Time = time
Acct-Terminate-Cause = cause
Acct-Session-Id = "session_id"
Framed-IP-Address = user_ip
Proxy-State = "n"
```

The Acct-Session-Time attribute indicates the length of session, expressed in seconds. The Acct-Terminate-Cause attribute indicates the reason for account termination, which can be due to the following events:

- User-Request
- Session-Timeout
- Idle-Timeout
- Lost-Carrier

Service Connection and Termination

SSG also sends a RADIUS accounting-request record to the local RADIUS server when a user accesses or terminates a service. The Acct-Status-Type attribute included in the accounting-request record indicates whether the accounting-request marks the start of the user service or the end of the service.

When a user accesses a service, SSG sends an accounting-start record to RADIUS. When a user terminates a service, SSG sends an accounting-stop record.

Configuration Examples for Service Connection and Termination

Example 4-5 shows the information contained in an accounting-start record for service access.

Example 4-5 RADIUS Accounting-Start Record for Service Access

```
User-Name = "username"
     Acct-Status-Type = Start
     Acct-Authentic = RADIUS
     Service-Type = Framed
     Acct-Session-Id = "00000010"
     Framed-Protocol = PPP
     Service-Info = "Nisp-name.com"
     Service-Info = "Uusername"
     Service-Info = "TP"
     Acct-Delay-Time = 0
```

The following list describes some of the attributes included in the record. For more information, refer to the *Service Section Gateway*, Release 12.2(15)B feature module.

- Acct-Status-Type—Indicates that the accounting-request marks the start of the user service.
- Service-Type—Indicates the type of service requested or the type of service to be provided. PPP and SLIP connections use the service type.
- Service-Info—Indicates the following:
  - N*name*—Indicates the name of the service profile.
  - U*name*—Indicates the username used to authenticate the user with the remote RADIUS server. This attribute is used for proxy services.
  - T*type*—Indicates whether the connection is proxy (X), tunnel (T), or passthrough (P).

Example 4-6 shows the information contained in an accounting-stop record for service termination.

Example 4-6 RADIUS Accounting-Stop Record for Service Termination

```
NAS-IP-Address = 192.168.2.48
NAS-Port = 0
NAS-Port-Type = Virtual
User-Name = "zeus"
Acct-Status-Type = Stop
Service-Type = Framed-User
Acct-Session-Id = "00000002"
Acct-Terminate-Cause = User-Request
Acct-Session-Time = 84
Acct-Input-Octets = 0
Acct-Output-Octets = 649
Acct-Input-Packets = 0
Acct-Output-Packets = 17
Framed-Protocol = PPP
Framed-IP-Address = 201.168.101.10
Control-Info = "I0;0"
Control-Info = "O0;649"
Service-Info = "Ninternet"
Service-Info = "Uzeus"
Service-Info = "TP"
Acct-Delay-Time = 0
```

The following describes some of the attributes included in the record. For more information, refer to the *Service Section Gateway*, Release 12.2(15)B feature module.

- Acct-Status-Type—Indicates that the accounting-request marks the end of the user service.
- Service-Type—Indicates the type of service.
- Acct-Session-Time—Indicates how long the user has been receiving service and is expressed in seconds.
- Acct-Terminate-Cause—Indicates the reason for service termination, which can be due to the following events:
  - User-Request
  - Lost-Carrier
  - Lost-Service
  - Session-Timeout
  - Idle-Timeout

Service Selection Methods

The Cisco 10000 series router supports the following service selection methods:

This chapter describes the service selection methods.

PPP Terminated Aggregation

PPP terminated aggregation (PTA) is a PPP selection method in which service selection is based on a structured domain name (for example, username@service.com). PTA terminates the PPP session into a single routing domain. Users can only access one service and users do not have access to the default network or SESM.

The PTA-MD exclusion list allows you to create a set of domains that you want to exclude from SSG processing. When a PPP user attempts to establish a PPP session using a domain that is included in the exclusion list, the traffic is treated as non-SSG traffic and is processed by Cisco IOS software. The system does not apply SSG features and processing to the traffic.

PTA-Multidomain

PTA-Multidomain (PTA-MD) is a PPP selection method in which service selection is based on a structured domain name (for example, username@service.com). PTA-MD terminates the PPP sessions into multiple IP routing domains. SSG features and processing are applied to the user traffic and users can access one or more services at a time. PTA-MD service selection supports a wholesale VPN model where each domain is isolated from the other and has the capability to support overlapping IP addresses.

The Cisco 10000 series router implements PTA-MD service selection in the following way:

- The access provider terminates the user PPP sessions and logically associates each session with a particular service.
- Network side interfaces are associated with a service. SSG binds the user session and its service to the appropriate network side interface.
- SSG binds the network side interface associated with a service to a virtual routing and forwarding (VRF) instance. All users who subscribe to that service are also bound to that same VRF. Packets to and from the user and to and from the network side interface are routed within the same VRF.

Restrictions for PTA-MD

A user cannot connect to multiple services that are simultaneously in different VRFs.

Web Service Selection

Web service selection enables users to concurrently access multiple on-demand services from a list of personalized services. The Cisco 10000 series router supports the Cisco Subscriber Edge Services Manager (SESM) application for web service selection.

The SESM application provides subscriber authentication, service selection, and service connection capabilities to subscribers of Internet services. Subscribers interact with the SESM web application using a standard Internet browser. They do not need to download any software or plug-ins to use the SESM web pages. After a subscriber successfully authenticates, the SESM web application presents a list of services that the subscriber is currently authorized to use. The subscriber can gain access to one or more of those services by selecting them from a web page. Alternatively, an automatic connection feature might provide automatic connection to services.

SESM works in conjunction with other network components to provide extremely robust, highly scalable connection management to Internet services. Internet service providers (ISPs) and network access providers (NAPs) deploy SESM to provide their subscribers with a web interface for accessing multiple Internet services. The ISPs and NAPs can customize and brand the content of the web pages and thereby control the user experience for different categories of subscribers.

SESM Release 3.1(1) or later is a solution composed of a number of applications built on a core set of software components. ISPs and NAPs can use these core components to further develop and customize SESM web applications, if required. The *Cisco Subscriber Edge Services Manager Web Developer Guide*, Release 3.1(7) describes how to develop SESM applications.

SESM web applications (Release 3.1(1) or later) deployed in Directory Enabled Service Selection/Subscription (DESS) mode incorporate the use of the Cisco Subscriber Policy Engine (SPE) Release 1.0. The SPE allows subscribers to perform account maintenance and self-care activities, such as subscribing to new services, creating subaccounts (for other members of the family, for example), and changing basic account information, such as address, phone number, and e-mail.

For subscribers of Internet services, the SESM web application offers flexibility and convenience, including the ability to access multiple services simultaneously.

For Internet service providers, the SESM web application provides a way to control the subscriber experience and promote customer loyalty. Service providers can change the look and feel of their SESM web application, brand the application, and control the content of the pages displayed to their subscribers.

For more information, refer to the SESM documentation.

SESM and SSG Performance

Packets sent between the SSG and the SESM might require processing by the Cisco 10000 router Route Processor (RP), instead of the parallel express forwarding (PXF) engine.

The following conditions require RP processing of packets:

- When the SESM interface is connected to the network management (NME) port of the performance routing engine (PRE, Part Number ESR-PRE2), all traffic between the SSG and the SESM is passed to the RP for processing.
- When the SESM is connected to one of the line card interfaces and the Port-Bundle Host Key feature is configured on the SSG, all packets sent to and from the SESM are passed to the RP for processing.
- When the SESM is connected to one of the line card interfaces and TCP redirect is enabled, all TCP packets from the SESM to the SSG are passed to the RP for processing.

Note The RP does not have as much forwarding capacity as the PXF.

CHAPTER 6

Service Connection

The Cisco 10000 series router supports the following SSG features for service connection:

This chapter describes the SSG features for service connection.

SSG AutoDomain

The SSG AutoDomain feature allows users to automatically connect to a service based on the domain part of the structured username specified in an Access-Request. When SSG AutoDomain is configured, user authentication is performed at the service (for example, at the AAA server within a corporate network), instead of at the network access server (NAS).

The domain portion of the structured username is the portion after the @ in the username. For example, the domain in the username “abc@cisco.com” is “cisco.com”. Users can bypass the Service Selection Dashboard (SSD) and access a service, such as a corporate intranet. SSG AutoDomain on the Cisco 10000 router supports login operations from the Subscriber Edge Services Manager (SESM) application.

AutoDomain uses a heuristic to determine the service into which the user is logged. The host object is not activated until successfully authenticated with the service. If the autoservice connection fails for any reason, the user login is rejected.

The AutoDomain service first checks for a structured username. If AutoDomain is enabled and the received Access-Request specifies a structured username, the username is used for AutoDomain selection. If the Access-Request does not specify a username or the specified username is a member of the domain name exclusion list, then no AutoDomain is selected and normal SSG user login proceeds. You can define the domain name exclusion list by using the **exclude** command in SSG-auto-domain configuration mode.

When you enable AutoDomain, an AutoDomain profile is downloaded from the local AAA server. This profile specifies an outbound service and the password is the globally configured service password.

You can configure SSG AutoDomain in basic or extended mode. In basic mode, the AutoDomain profile downloaded from the AAA server is a service profile. This service profile is a proxy or VPDN service. If the AutoDomain service profile is a proxy service, SSG authenticates the user to the appropriate domain AAA server with the authentication information found in the Access-Request received from the RADIUS client. If the downloaded AutoDomain service profile is a tunnel service, a PPP session is regenerated into an L2TP tunnel for the selected service. If the returned SSG-specific attributes do not indicate the type of service required, SSG treats this service as a VPDN service.

In extended AutoDomain mode, the downloaded profile is a "virtual user" profile that contains one autoservice to an authenticated service such as a proxy or VPDN. The host object is not activated until the user is authenticated at the proxy or VPDN service. If the "virtual user" profile does not have exactly one autoservice or the autoservice is not authenticated, the AutoDomain login is rejected.

If you configure basic SSG AutoDomain with a nonauthenticated service type (for example, passthrough), SSG rejects the login request because AutoDomain bypasses user authentication at the local AAA server and requires that authentication be performed elsewhere.

For more information, refer to the *SSG AutoDomain*, Release 12.2(4)B feature module.

Restrictions for SSG AutoDomain

SSG AutoDomain has the following restrictions:

- Restricted DHCP support—DHCP requests for IP address assignment must be done before RADIUS negotiation.
- Passthrough services—Because local authentication at the network access server (NAS) is bypassed, AutoDomain is available only for services that perform authentication (for example, proxy or VPDN services).
- "Virtual-user" profiles can contain only one AutoLogon service.
- If an Access-Request does not contain an IP address, you must configure a local per-domain or global IP address pool.

Configuration of SSG AutoDomain

To enable SSG AutoDomain and enter SSG autodomain configuration mode, use the **ssg auto-domain** command in global configuration mode. To verify the configuration, use the **show running-config** command in privileged EXEC mode.

For more information, refer to the *SSG AutoDomain*, Release 12.2(4)B feature module.

Configuration Example for SSG AutoDomain

Example 6-1 shows a sample configuration for SSG AutoDomain. In the example, AutoDomain is configured for extended-mode, and the called-station-id(APN) is used to select the AutoDomain service. If the service assigns an IP address, then SSG performs Network Address Translation (NAT) on the connection.

The example creates an AutoDomain exclude list by downloading the profile "ssg-auto-domain-exclude-profile" from the AAA server (the download password is "cisco"). The configuration also includes two exclude entries: cisco (exclude APN), and motorola (exclude domain name).

Example 6-1 SSG AutoDomain

```
ssg auto-domain
  mode extended
  select called-station-id
  nat user-address
  download exclude-profile ssg-auto-domain-exclude-profile cisco
  exclude apn cisco
  exclude domain motorola
```

Example 6-2 shows the format for defining a new vendor-specific attribute, SSG Control-Info VSA(253), which is required for the AutoDomain exclude profile on the AAA server.

Example 6-2 AutoDomain Exclude Profile SSG VSA Format

```
code: 253, 'X'
     len: > 4
     +-+-+-+-+-+-+-+-+-+-+...-+
     |a|b|  c  |d|e|f|p|  g   |
     +-+-+-+-+-+-+-+-+-+-+...-+
     a = 26  (Radius attribute for vendor specific)
     b = len (length of the Radius vendor-specific)
     c = 9 (Cisco vendor ID)
     d = 253 (sub-attribute ID for Service-Info)
     e = len (length of the vendor-specific filter)
     p = 'X' (Excluded Name List Entry Flag)
     g = "A<apn-name>" or (Add this name to APN exclude list)
           "D<domain-name>" (Add this name to Domain name exclude list)
```

Example 6-3 shows a sample configuration for an AutoDomain exclude file.

Example 6-3 AutoDomain Exclude File Format

```
user = ssg-auto-domain-exclude-profile{
 radius=SSGDictionary {
 check_items= {
 2=cisco
 }
 reply_attributes= {
 9,253="XDcisco"
 9,253="XDmotorola"
 9,253="XAalcatel"
 9,253="XAnokia"
 }
 }

 }
```

SSG Prepaid

The SSG Prepaid feature allows a user to connect to a service if the user has prepaid for the service. SSG checks a subscriber's available credit to determine whether to connect the subscriber to the service and how long the connection can last. The billing server administers the subscriber's credit as a series of quotas. These quotas are allotments of available credit and represent the duration of use, expressed in seconds.

Note The Cisco 10000 series router does not support quotas that are based on allowable data volume. The router supports only time-based quotas.

To obtain the first quota for a connection, SSG submits an authorization request to the AAA server. The AAA server contacts the prepaid billing server, which forwards the quota values to SSG. SSG then monitors the connection to track the quota usage. When the quota runs out, SSG performs reauthorization. During reauthorization, the billing server can provide SSG with an additional quota if there is available credit. If no further quota is provided, SSG logs off the user.

For more information, refer to the *SSG Prepaid*, Release 12.2(4)B feature module.

Restrictions for SSG Prepaid

The SSG Prepaid feature has the following restrictions:

- Quotas are measured in seconds. You cannot change the unit of measure.
- The Cisco 10000 router supports only time-based SSG Prepaid for a service connection.

Configuration of SSG Prepaid

To configure SSG to provide the prepaid billing server with session ID and time-stamp information, use the **radius-server attribute** command in global configuration mode. The command syntax is:

```
radius-server attribute 44 include-in-access-req (Accounting Session ID)
radius-server attribute 55 include-in-acct-req (Event-Timestamp)
```

To configure a global prepaid server group for authorization, use the **aaa group server radius** command in global configuration mode and then use the **ssg aaa group prepaid** command in global configuration mode to attach the global prepaid server group to the SSG. The command syntax is:

```
aaa group server radius group-name
ssg aaa group prepaid group-name
```

For more information, refer to the *SSG Prepaid*, Release 12.2(4)B feature module.

Configuration Example for SSG Prepaid

Example 6-4 configures a global prepaid server group named *ssg_prepaid* and attaches the server group to the SSG.

Example 6-4 Attaching a Global Prepaid Server Group to the SSG

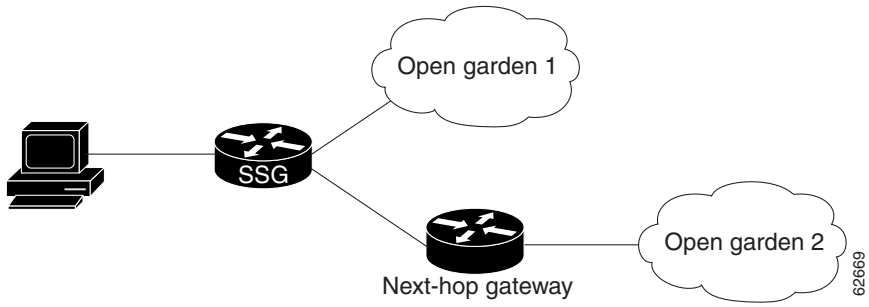
```
Router(config)# aaa group server radius ssg_prepaid
Router(config-sg)# server 1.2.3.4 auth-port 1645 acct-port 1646
Router(config-sg)# exit
Router(config)# ssg aaa group prepaid ssg_prepaid
```

SSG Open Garden

An Open Garden is a collection of networks or web sites that subscribers can access as long as they have physical access to the network. Subscribers do not have to provide authentication information before accessing the networks in an Open Garden. The network is not restricted by service selection, subscription, or policing.

Figure 6-1 shows a network topology that includes Open Garden networks.

Figure 6-1 Open Garden Network Topology



If SSG receives a packet from a subscriber that is destined for the Open Garden, SSG forwards the packet even if the subscriber is not authenticated. SSG forwards all packets destined for the Open Garden whether or not the subscriber is authenticated.

If SSG receives a packet from a subscriber that is not destined for the Open Garden and the subscriber is not authenticated, SSG drops the packet. If the subscriber is authenticated, SSG forwards the packet.

While most SSG services must be bound to an interface or next-hop address, it is not necessary to bind Open Garden services that are directly connected to the SSG router. Service binding is mandatory, however, for Open Garden services that are routed through a next-hop address.

For more information, refer to the *SSG Open Garden*, Release 12.2(4)B feature module.

Restrictions for SSG Open Garden

The SSG Open Garden feature has the following restrictions:

- RADIUS accounting records are not created for Open Garden services.
- The Cisco 10000 router supports the creation of Open Garden services by using local profiles only; you cannot use RADIUS profiles.
- The Cisco 10000 router does not support overlapping Open Garden service networks.

Configuration of SSG Open Garden

To designate a service as an Open Garden service, use the **ssg open-garden** command in global configuration mode. For more information on configuring an Open Garden, refer to the *SSG Open Garden*, Release 12.2(4)B feature module.

Configuration Example for SSG Open Garden

The following example defines two services named *og1* and *og2* and adds them to the Open Garden.

```
!
ssg open-garden og1
ssg open-garden og2
!
local-profile og1
attribute 26 9 251 "Oopengarden1.com"
attribute 26 9 251 "D10.13.1.5"
attribute 26 9 251 "R10.1.1.0;255.255.255.0
local-profile og2
attribute 26 9 251 "Oopengarden2.com"
attribute 26 9 251 "D10.14.1.5"
attribute 26 9 251 "R10.2.1.0;255.255.255.0"
attribute 26 9 251 "R10.3.1.0;255.255.255.0"
!
ssg bind service og2 10.5.5.1
```

SSG Port-Bundle Host Key

The SSG Port-Bundle Host Key feature enhances communication and functionality between SSG and SESM by introducing a mechanism that uses the host source IP address and source port to identify and monitor subscribers.

With the SSG Port-Bundle Host Key feature, SSG performs port-address translation (PAT) and network-address translation (NAT) on the HTTP traffic between the subscriber and the SESM server. When a subscriber sends an HTTP packet to the SESM server, SSG creates a port map that changes the source IP address to a configured SSG source IP address and changes the source TCP port to a port allocated by SSG. SSG assigns a bundle of ports to each subscriber because one subscriber can have several simultaneous TCP sessions when accessing a web page. The assigned host key, or combination of port-bundle and SSG source IP address, uniquely identifies each subscriber. The host key is carried in RADIUS packets sent between the SESM server and SSG in the Subscriber IP vendor-specific attribute (VSA). When the SESM server sends a reply to the subscriber, SSG translates the destination IP address and destination TCP port according to the port map.

For each TCP session between a subscriber and the SESM server, SSG uses one port from the port bundle as the port map. Port mappings are flagged as eligible for reuse on the basis of inactivity timers, but are not explicitly removed once assigned. The number of port bundles is limited, but you can assign multiple SSG source IP addresses to accommodate more subscribers.

SSG assigns the base port of the port bundle to a port map only if SSG has no state information for the subscriber or if the state of the subscriber has changed. When the SESM server sees the base port of a port bundle in the host key, SESM queries SSG for new subscriber state information.

For more information, refer to the *SSG Port-Bundle Host Key*, Release 12.2(4)B feature module.

Restrictions for SSG Port-Bundle Host Key

The SSG Port-Bundle Host Key feature has the following restrictions:

- You must separately enable the SSG Port-Bundle Host Key feature at the SESM and at all connected SSG nodes.
- To enable the SSG Port-Bundle Host Key feature, you must reload SSG and restart the SESM.
- When you change the port-bundle length, the change does not take effect until after the router reloads.
- All SSG source IP addresses configured using the **ssg port-map source ip** command must be routable in the management network where the SESM resides.
- For each SESM server, all connected SSG nodes must have the same port-bundle length.
- RFC 1483, local bridged, or routed clients cannot have overlapping IP addresses, even across different interfaces.
- Enabling the SSG Port-Bundle Host Key feature requires additional PXF processing.
- The Cisco 10000 router's SSG software and forwarding software handle multiple users attached to a single Cisco IOS interface in different ways, which could result in users receiving services that they did not select. After the first user logs on, all subsequent user logon attempts are rejected. Although the logon is rejected and thus the ability to select services, all users can access the services to which the first user is subscribed. User traffic is not rejected, only the user's authorization attempt. The traffic from all users is logged in the statistics of the first user. Traffic to the second and subsequent user(s) is treated as transparent passthrough and is forwarded to these users, but it does not affect the SSG accounting. The **ssg show host** command displays the first user.
- For users attached to multipoint interfaces on the access side, the Cisco 10000 router authorizes the first user and then rejects the authorization attempts of subsequent users. The router only rejects the authorization attempts, not the user traffic. The router treats all subsequent users as the first user logged on, allowing access to the services to which the first user is subscribed. However, subsequent users cannot select services. The traffic from all users is logged in the statistics of the first user. Traffic to the second and subsequent user(s) is treated as transparent passthrough and is forwarded to these users, but it does not affect the SSG accounting. The **ssg show host** command displays the first user.

Prerequisites for SSG Port-Bundle Host Key

The SSG Port-Bundle Host Key feature has the following requirements:

- The Cisco 10000 router supports the SSG Port-Bundle Host Key feature for Cisco SESM Release 3.1(1) or later.
- A default network must be configured and routable from SSG.

Configuration of SSG Port-Bundle Host Key

The port-bundle host key is disabled by default. To enable the host key and enter the SSG port map configuration mode, use the **ssg port-map enable** command in global configuration mode.

After you enable the host key, perform the following configuration tasks:

- Specify the subscriber traffic to be port-mapped by using the following command in SSG port configuration mode:

```
Router(config-ssg-port)# destination range start-port to end-port [ip A.B.C.D]
```

- Specify the SSG source IP addresses by using the following command in SSG port configuration mode:

```
Router(config-ssg-port)# source ip {interface | ip-address}
```

- Specify the length of the port bundle by using the following command in SSG port configuration mode:

```
Router(config-ssg-port)# length port-bundle length
```

For more information on configuring the SSG Port-Bundle Host Key feature, refer to the *SSG Port-Bundle Host Key*, Release 12.2(4)B feature module.

Exclude Networks

The Exclude Networks feature allows you to specify networks to which users cannot automatically log on. To add names to the autodomain download exclusion list, use the **download exclude-profile** command in SSG autodomain configuration mode.

For more information, refer to the *SSG AutoDomain*, Release 12.2(4)B feature module.

Mutually Exclusive Service Selection

The Mutually Exclusive Service Selection feature restricts a subscriber to accessing only one service at a time in a specified group of services.

A service group is a collection of services defined in a service group profile. A subscription to a service group implies subscription to all of the services in the group. It also implies the ability to select all of the services in the group. However, when a group is defined as mutually exclusive, SESM limits service selection to one service at a time within the group.

A SESM configuration option controls the SESM action when a subscriber is already logged into one service and then selects another service in the group:

- SESM can automatically request SSG to disconnect the first service and connect the new service.
- SESM can prompt the subscriber to log off the first service. After the subscriber logs off, SESM requests the connection to the other service.

Note SESM waits for the first service to be disconnected before requesting connection to the new service. If the connection to the new service fails, the subscriber is not connected to either service.

Configuration of Mutually Exclusive Service Selection

You define a mutually exclusive service group in a service group profile by using the Account-Info attribute. The value *TE* indicates that the service group is mutually exclusive.

For more information, refer to the "Configuring Service Group Profiles" section in Appendix D, Configuring RADIUS in the *Cisco Subscriber Edge Services Manager and Subscriber Policy Engine Installation and Configuration Guide*, Release 3.1(3).

Configuration Example for Mutually Exclusive Service Selection

Example 6-5 shows a mutually exclusive service group configuration that uses a Merit RADIUS format.

Example 6-5 Configuring a Mutually Exclusive Service Selection Group

```
MutexGrp1 Password = "groupcisco", Service-Type = Outbound
Account-Info = "IBandwidth-QoS",
Account-Info = "Nbw-gold",
Account-Info = "Nbw-silver",
Account-Info = "Nbw-bronze",
Account-Info = "TE"
```

Service Profiles and Cached Service Profiles

The RADIUS server or the SESM downloads service profiles to the Cisco 10000 series router (SSG node) as needed. Typically, the SSG removes the service profile from memory after the user logs off. Therefore, each time the user attempts to access services, RADIUS or the SESM downloads the service profile, creating unnecessary traffic. The Cached Service Profiles feature is designed to eliminate this inefficient overhead.

This chapter describes the service profiles and cached service profiles supported by the Cisco 10000 series router:

Service Profiles

Service profiles define the services that subscribers can select. Each service that is accessible has a profile that defines the attributes of the service. Service profiles are configured on the RADIUS server or directly on the Cisco 10000 series router. The RADIUS server or SESM downloads the service profiles to the router as needed.

Service profiles include the following information: password, service type (outbound), type of service (passthrough or proxy), service access mode (sequential or concurrent), DNS server IP address, networks that exist in the service domain, access control lists, and timeouts. The following sections describe the attributes included in RADIUS service profiles. For more information, refer to the "Service Selection Gateway" chapter in the *Cisco 6400 Feature Guide*, Release 12.2(2)B.

Downstream Access Control List

Specifies either an IOS standard access control list or an extended access control list to be applied to downstream traffic going to the user.

Cisco-AVpair = "ip:outacl [**#***number*]**=**{*standard-access-control-list* | *extended-access-control-list*}**"**

Upstream Access Control List

Specifies either an IOS standard access control list or an extended access control list to be applied to upstream traffic coming from the user.

Cisco-AVpair = "ip:inacl[**#***numbe***r**]**=**{*standard-access-control-list* | *extended-access-control-lis***t**}"

Domain Name

(Optional) Specifies domain names that get DNS resolution from the DNS server(s) specified by the DNS server address.

Service-Info = "*Oname*1[*;name2]...[;name*X]**"**

Full Username

Indicates that RADIUS authentication and accounting requests use the full username (user@service).

Service-Info = "X"

MTU Size

Specifies the PPP MTU size of the SSG as a LAC. By default, the PPP MTU size is 1500 bytes.

Service-Info = "*Bsize***"**

Note In Directory Enabled Service Selection Subscription (DESS) mode, SESM does not support the use of this attribute.

RADIUS Server

Specifies the remote RADIUS servers that SSG uses to authenticate, authorize, and perform accounting for a service logon for a proxy service type. This attribute is only used in proxy service profiles and is required.

You can configure each remote RADIUS server with timeout and retransmission parameters. SSG will perform failover among the servers.

Service-Info =
"*SRadius-server-address***;***auth-port***;***acct-port***;***secret-key*[**;***retrans***;***timeout***;***deadtime*]**"**

Service Authentication Type

Specifies whether the SSG uses the CHAP or PAP protocol to authenticate users for proxy services.

Service-Info = "*Aauthen-type***"**

Service-Defined Cookie

Enables you to include user-defined information in RADIUS authentication and accounting requests.

Service-Info = "*Vstring***"**

Note

- SSG does not parse or interpret the value of the Service-Defined Cookie. You must configure the proxy RADIUS server to interpret this attribute.
- SSG supports only one Service-Defined Cookie per RADIUS service profile.

Service Description

(Optional) Describes the service.

Service-Info = "*Idescription***"**

Service Mode

(Optional) Defines whether the user is able to log on to this service while simultaneously connected to other services (concurrent mode) or whether the user cannot access any other services while using this service (sequential mode). The default is concurrent mode.

Service-Info = "*Mmode***"**

Service Next-Hop Gateway

(Optional) Specifies the next-hop key for this service. Each SSG uses its own next-hop gateway table to associate this key with an actual IP address.

Service-Info = "*Gkey***"**

Service Route

Specifies networks available to the user for this service.

Service-Info = "*Rip_address;mask***"**

Service URL

(Optional) Specifies the URL that is displayed in the SESM HTTP address field when the service opens.

Service-Info = "*Hurl***"**

or

Service-Info = "*Uurl***"**

If the SESM web application is designed to use HTML frames, then this attribute also specifies whether the service is displayed in a new browser window or in a frame in the current (SESM) window, as follows:

- *Hurl*—URL for a service displayed in a frame in the SESM browser window.
- *Uurl*—URL for a service displayed in its own browser window.

Type of Service

(Optional) Indicates whether the service is proxy, tunnel, or passthrough.

Service-Info = "*Ttype***"**

Service Profile Example

Example 7-1 is a service profile formatted for use with a freeware RADIUS server:

Example 7-1 Service Profile

```
service1.com Password = "cisco", Service-Type = outbound,
Idle-Timeout = 1800,
Service-Info = "R192.168.1.128;255.255.255.192",
Service-Info = "R192.168.2.0;255.255.255.192",
Service-Info = "R192.168.3.0;255.255.255.0",
Service-Info = "Gservice1",
Service-Info = "D192.168.2.81",
Service-Info = "MC",
Service-Info = "TP",
Service-Info = "ICompany Intranet Access",
Service-Info = "Oservice1.com"
```

Cached Service Profiles

The Cached Service Profiles feature enables SSG to use a cached copy of a service profile instead of downloading the profile from RADIUS every time a user logs on to the service.

SSG downloads service profiles when an IP user logs on to a service through SESM, or when a PPP user logs on to SSG through a structured username. SSG then downloads the service profile from the RADIUS server based on the service name. SSG retrieves the parameters that are specific to the service from the service profile and stores them locally. SSG authenticates the user based on the type of service and the AAA servers configured for that service. Upon successful authentication, the user is connected to the service. SSG downloads the service profile every time a user logs on to that service. This creates unnecessary traffic between the SSG and RADIUS.

The Cached Service Profiles feature eliminates the inefficiency of downloading the service profile each time a user logs on to a service. Instead, SSG caches the service profile and uses this cached profile when the user attempts to log on to the service again. If another user attempts to log on to the service, SSG uses the cached profile to process the service connection.

The following describes how service profiles are cached:

- A user selects a service on the service logon page that SESM displays.
- SSG receives the service logon request and looks up the service profile using the service name.

- If the service profile exists and it is active, SSG uses the service profile to process the logon request.
- If the service profile exists, but it is inactive (for example, SSG is currently downloading the profile), SSG queues the logon request and processes the request after the service profile is downloaded.
- If SSG does not find Service-Info attributes in the service profile, SSG creates an inactive service profile and processes any logon requests after downloading the service profile.
- After the service profile is downloaded, the inactive service profile is updated with the Service-Info attributes from RADIUS. SSG uses these attributes to process connections for incoming users and any pending connection requests.
- The RADIUS packet has an MD5 signature that uniquely identifies the service profile. SSG stores this service profile ID in the service profile.

If the profile changes on the RADIUS server, the SSG timer process periodically updates the cached profile to ensure that the service information is current.

If the service profile fails to update, SSG retains the cached service profile. When a new user connects to the SSG, SSG downloads the service profile again. If SSG cannot download the service profile, the user is not allowed to log on to the service.

Configuration of Cached Service Profiles

To enable cached service profiles, use the **ssg service-cache enable** command in global configuration mode. Cached service profiles are enabled by default.

To set the refresh-interval time, which sets the length of time after which all the existing service profiles are downloaded, use the **ssg service-cache refresh-interval** command in global configuration mode. The refresh time is two hours by default.

To refresh the service profile, even when the timer has not yet expired, use the **ssg service-cache refresh** command in privileged EXEC mode. You can use this command to refresh a specific service name or to refresh all services. If the service with that service name is not in use when you enter the **ssg service-cache** command, the command does not attempt to download the service profile.

SSG Hierarchical Policing

The SSG Hierarchical Policing feature ensures that a subscriber does not utilize additional bandwidth for overall service or for a specific service that is outside the bounds of the subscriber's contract with the service provider.

This chapter describes the SSG Hierarchical Policing feature supported by the Cisco 10000 series router.

SSG Hierarchical Policing Overview

The traffic policing feature limits the transmission rate of traffic entering or leaving a node. In SSG, traffic policing can be used to allocate bandwidth between subscribers and between services to a particular subscriber to ensure all types of services are allocated a proper amount of bandwidth. SSG uses per-user and per-service policing to ensure bandwidth is distributed properly between subscribers (per-user policing) and between services to a particular subscriber (per-session policing). Because these policing techniques are hierarchical in nature (bandwidth can be first policed between users and then policed again between services to a particular user), the feature is called SSG Hierarchical Policing.

Per-user policing is used to police the aggregated traffic destined to or sent from a particular subscriber and can only police the bandwidth allocated to a subscriber. Per-user policing cannot identify services to a particular subscriber and police bandwidth between these services.

Per-session policing is used to police the types of services available to a subscriber. Per-session policing is useful when an SSG subscriber is subscribed to multiple services and the services are allocated different amounts of bandwidth. For example, a subscriber pays separately for Internet access and video service but receives both services from the same service provider. The video service would likely be allocated more bandwidth than the Internet access service and would likely cost more to the subscriber. Per-session policing provides a mechanism for identifying the types of services (such as the video service or Internet access in the example) and ensuring that users do not exceed the allocated bandwidth for the service.

SSG Hierarchical Policing Token Bucket Scheme

The SSG Hierarchical Policing token bucket scheme uses an algorithm to police the use of bandwidth. The parameters that the algorithm uses to allocate bandwidth are user-configurable; however, other unpredictable variables (such as time between packets and packet sizes) ultimately determine whether a packet is transmitted or dropped.

For more information, refer to the *Service Selection Gateway Hierarchical Policing*, Release 12.2(4)B feature module.

Restrictions for SSG Hierarchical Policing

The SSG Hierarchical Policing feature has the following restrictions:

- When using SSG hierarchical policing on Cisco 10000 Series routers, a maximum of 8 policing rates can be used per uplink interface and R attribute combination. Of these 8 rates, 1 is reserved for "no policing", leaving 7 different police rates available per uplink interface and R attribute combination For example, if eight SSG services are bound to the same SSG next-hop and all eight services carry an R attribute of "R0.0.0.0;0.0.0.0", the ninth service will fail to acquire correct policing rates and this error message may appear:
  %GENERAL-3-EREVENT: C10KSSG: Vi2.8 svc_bitmap 0x2 Unable to set connection rate
- The Cisco 10000 router supports per-session and per-interface quality of service (QoS). This type of QoS is available on non-SSG interfaces and is applied to the sessions or interfaces using modular QoS CLI (MQC) service policies.
- SSG interfaces do not use MQC service policies and cannot use the more complete set of classification rules and QoS actions available through MQC. QoS support for SSG interfaces is limited to first classifying to a per-user level and then to a per-session level. At each level, the only action supported is applying a policed rate that either drops the packet or allows the packet to continue to be processed. You cannot mark or queue the packet in a specific manner. You also cannot use an ACL to classify packets for a QoS class.
- The upstream and downstream policing rates at the per-session level must be specified in pairs. You cannot individually specify the upstream and downstream policing rates to a particular service.
- If you configure an inbound or outbound MQC service policy on a downlink SSG interface, SSG ignores the service policy.
- You must configure the committed rate parameter at 8000 or larger. If you set the committed rate lower than 8000, it is automatically configured at 8000.
- If the normal burst parameter is less than the IP maximum transmission unit (MTU) of an interface, the normal burst parameter is set equal to the IP MTU of the interface.
- Only packets destined to subscribed services are policed. The following packets are not policed:
  - Multicast packets
  - Open Garden packets
  - Default network packets

SSG Hierarchical Policing Configuration

The configuration of SSG Hierarchical Policing requires you to:

- Modify user profiles and service profiles in RADIUS.
- Enable per-user and per-session policing using the **ssg qos police** command in global configuration mode.

For more information, refer to the *Service Selection Gateway Hierarchical Policing*, Release 12.2(4)B feature module.

Configuration Examples for SSG Hierarchical Policing

Example 8-1 Configuring a RADIUS Service Profile for Per-Session Policing

```
Router(config)# local-profile cisco.com
Router(config-prof)# attribute 26 9 1 "QU16000:3000:4000:D24000:4000:8000"
```

Example 8-2 Enabling Per-Session Policing on a Router

```
Router(config)# ssg qos police session
```

For more information, refer to the *Service Selection Gateway Hierarchical Policing*, Release 12.2(4)B feature module.

CHAPTER 9

Interface Configuration

When an interface is configured as an SSG uplink or downlink interface, non-SSG traffic is not allowed to pass through the interface. You configure interfaces that are connected to services as uplink interfaces by using the **ssg direction uplink** command in interface configuration mode. If you use PPP to connect subscribers to SSG, you do not have to configure any downlink interfaces. If you use non-PPP connections, such as bridging or LAN, you must configure at least one downlink interface by using the **ssg direction downlink** command in interface configuration mode.

For more information, refer to the *Service Selection Gateway*, Release 12.2(15)B feature module.

The Cisco 10000 series router supports the following features for interfaces:

This chapter describes the SSG features for interfaces.

Transparent Passthrough

The Transparent Passthrough feature allows unauthenticated traffic to pass through an interface. Interfaces configured as transparent passthrough are treated as Cisco IOS interfaces and not SSG interfaces. The Cisco 10000 series router can receive transparent passthrough traffic on both the access side and the network side. When an interface is configured as transparent passthrough, SSG does not process the traffic to and from the interface or apply SSG features. Instead, Cisco IOS software processes the traffic and applies Cisco IOS features.

Note The transparent passthrough feature is supported only for traffic to the host. The feature is not supported for traffic from the host; instead, you can configure an Open Garden network to allow SSG hosts access to certain networks. The default is to allow non-SSG hosts (on non-SSG interfaces) access to Internet services that are reachable through an uplink interface.

Access Side Interfaces

For access side interfaces, the interface type determines the method used to indicate an interface as SSG or transparent passthrough. If you enable SSG globally, SSG automatically configures PPP users as SSG downlink users. To configure a PPP user as a transparent passthrough user, configure the Cisco 10000 router in one of the following ways:

- Do not enable SSG globally on the router. If SSG is not globally enabled, traffic is routed through normal Cisco IOS processing.
- Configure the router as a LAC. The LAC uses L2TP to directly tunnel PPP traffic to the LNS. The LAC does not terminate the PPP traffic; it uses normal Cisco IOS processing to forward the traffic. The LAC uses the following mechanisms to determine that a session should be LAC switched:
  - The VPI/VCI can be configured with a specific domain. Using a conventional Cisco IOS configuration, the domain indicates how to LAC switch the session.
  - If no domain information is configured specifically on the VC, RADIUS authentication is attempted. If the RADIUS server does not return any SSG vendor specific attributes (VSAs), then normal Cisco IOS processing occurs.
  - If the user signals a domain, but that domain is part of a PTA-MD exclusion list, the session is processed by the VPDN software.
  - A specific domain can be installed on the VPI/VCI by using the VPI/VCI Index to a Service Profile feature. This domain must be on the PTA-MD exclusion list.
- Configure the router as an LNS. The LNS terminates the PPP traffic on the LNS side of the tunnel and uses normal Cisco IOS processing to forward the traffic. This configuration requires that you use a PTA-MD exclusion list.

To configure a non-PPP user as an SSG user, bind the interface as downlink or uplink by using the **ssg direction** command in subinterface configuration mode. The command syntax is:

```
ssg direction {uplink | downlink}
```

For example:

```
Router(config)# interface atm 5/0/1.15
Router(config-subif)# ssg direction downlink
Router(config-subif)# interface atm 5/0/1.16
Router(config-subif)# ssg direction uplink
```

Note The **ssg direction** command also applies to **range** commands.

When you bind an interface to a direction, traffic is routed through SSG features and processing. If you do not bind an interface to a direction, the interface is a transparent passthrough interface and traffic is routed through normal Cisco IOS features processing.

Network Side Interfaces

For network side interfaces, SSG uplink interfaces can accept and forward both SSG traffic and transparent passthrough traffic. The SSG software classifies the traffic as transparent passthrough. An interface that is not configured as an SSG uplink can receive transparent passthrough traffic or traffic destined for Cisco IOS interfaces. The traffic is handled using normal Cisco IOS processing.

Typically, SSG uses transparent passthrough access control lists (ACLs) to allow unauthenticated traffic to be routed through normal Cisco IOS processing. However, the Cisco 10000 series router does not require transparent passthrough ACLs (see the "Restrictions of Transparent Passthrough" section on page 9-3).

The following Cisco-AV pair attributes are used to configure transparent passthrough ACLs:

- Downstream Access Control List (outacl)—Specifies either a Cisco IOS standard ACL or an extended ACL to be applied to downstream traffic going to the user.
- Upstream Access Control List (inacl)—Specifies either a Cisco IOS standard ACL or an extended ACL to be applied to upstream traffic coming from the user.

For more information about transparent passthrough ACLs, refer to the *Service Selection Gateway*, Release 12.2(15)B feature module.

Restrictions of Transparent Passthrough

SSG uplink interfaces can accept and forward both SSG traffic and transparent passthrough traffic. Typically, transparent passthrough ACLs are used to prevent downstream SSG traffic from being forwarded by Cisco IOS software. However, the Cisco 10000 series router does not require transparent passthrough ACLs; therefore, SSG hosts that have not been authorized for specific services might be able to receive traffic from those services. If the host attempts to send traffic, the packets are dropped until authentication occurs.

Configuration of Transparent Passthrough

Transparent passthrough is always enabled for SSG VRFs for uplink interfaces.

Multicast Protocols on SSG Interfaces

SSG supports multicast traffic, which includes normal multicast packets and Internet Group Management Protocol (IGMP) packets. The multicast traffic is separate from the SSG traffic and is routed through normal Cisco IOS processing and features; it is not routed through SSG authentication or features such as per-service statistics or hierarchical policing.

SSG interfaces can simultaneously receive multicast traffic and normal SSG traffic such as traffic to and from the default network, Open Garden network, and service networks. The normal SSG traffic is routed through SSG features and processing.

Configuration of Multicast Protocols on SSG Interfaces

For SSG to forward multicast packets to the Cisco IOS routing engine, configure the following:

- Configure the interface where multicast packets are received as an uplink or downlink interface, or bind a service to the interface.
- Enable SSG multicast by using the **ssg multicast** command in global configuration mode. When multicast is enabled, the SSG forwards to the Cisco IOS routing engine any multicast packets received on an uplink or downlink interface with a service bound to it.

Note If you do not enable multicast, multicast packets received on the interface are dropped.

- Enable IP multicast routing by using the **ip multicast-routing** command in global configuration mode. For more information about the IP Multicast feature, refer to the *Cisco 10000 Series Router Broadband Aggregation, Leased-Line, and MPLS Configuration Guide*.

For more information about multicast protocols on SSG interfaces, refer to "Service Selection Gateway" in the *Cisco 6400 Feature Guide*, Release 12.2(2)B.

CHAPTER 10

SSG TCP Redirect

The SSG TCP Redirect feature redirects certain user packets to an alternative location that can handle the packets in a suitable manner. This feature works in conjunction with the SESM web interface. SSG TCP Redirect forces subscribers to authenticate before accessing the network or specific services and ensures that subscribers are only allowed to access the services that the service provider wants them to.

The SSG TCP Redirect feature always sends redirected packets to a captive portal group. Any server that is programmed to respond to the redirected packets can be a captive portal. A captive portal group consists of one or more servers. SSG TCP Redirect identifies a captive portal group by its unique name. Each server in a captive portal group is identified by its IP address and TCP port. SSG selects one server from the group in a round-robin fashion to receive the redirected packets. Servers can be in the SSG Open Garden or default network.

If SESM is used as a captive portal, unauthenticated users can be sent automatically to the SESM logon page when they start a browser session. Captive portal applications can also redirect to service logon pages, advertising pages, and message pages. The SESM captive portal application can also capture a URL in a user request and redirect the browser to the originally requested URL after successful authentication.

The SSG feature does not require that you configure all service definitions manually, using the command line interface (CLI). Some, and possibly all service definitions, can come from RADIUS. The download of definitions is triggered when a user attempts to send a packet to a network that is not defined in the SSG VRF table. If this occurs and redirection is enabled, SSG redirects the packet to SESM, which then triggers RADIUS to download the service definition. SSG forwards subsequent packets without redirection.

The Cisco 10000 series router supports the following types of redirection:

Redirection for Unauthenticated Users

Redirection for unauthenticated users redirects packets from a user if the user has not authorized with the service provider. When an unauthorized subscriber attempts to connect to a service on a TCP port (for example, to www.cisco.com), SSG TCP Redirect redirects the packet to the captive portal (SESM or a group of SESM devices). SESM issues a redirect to the browser to display the logon page. The subscriber logs in to SESM and is authenticated and authorized. SESM then presents the subscriber with a personalized home page, the service provider home page, or the original URL.

The SSG TCP Redirect feature always sends redirected packets to a captive portal group that consists of one or more servers. SSG selects one server from the group in a round-robin fashion to receive the redirected packets. For upstream packets, SSG modifies the destination IP address and TCP port to reflect the destination captive portal. For downstream packets, SSG returns the source IP address and port to the original packet's destination. SSG uses the same redirect server if multiple TCP sessions from the same user are redirected. When the TCP session terminates or is idle for more than 60 seconds, SSG clears translations of packets made before being sent to the captive portal. In host-key mode with overlapping user IP addresses, redirection works only for host-keyed servers.

Note This feature applies only to non-PPP users. PPP users are always authenticated as part of the PPP negotiation process. PPP users logging off from SESM are also redirected.

The following describes the behavior of redirection for unauthorized users:

- If a user is subject to redirection or captivation, then packets from the user that match the protocol and ports configured as the redirection and captivation filter are sent to SESM. If the user packet does not match the filter, SSG drops the packet.
- SSG drops all packets to the user, unless the packet arrives from the SESM or the Open Garden network.

Redirection for Unauthorized Services

Redirection for unauthorized services redirects TCP sessions from authenticated users who have not been authorized to access service networks. SSG TCP Redirect redirects the packets to a captive portal, such as SESM. SESM can then prompt for the service logon.

SSG can redirect unauthorized TCP sessions for different networks to different servers. For network-based redirection, a list of networks are used for unauthorized service redirect. The network list is associated with a group of servers. Only one network list can be associated with a server group.

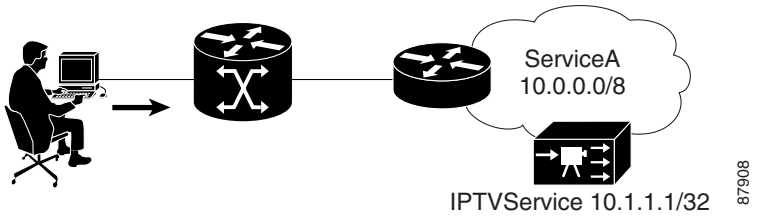
The server group can also be associated with a port or a list of ports. Servers handle particular captive portal applications as defined by the port that they use. TCP sessions redirected to servers can be restricted based on a port or port list. A port list defines a named list of interesting destination TCP ports. The port list is associated with a server group and is used to restrict the applications redirected to a server group. Only one port list or port can be associated with a server group.

If none of the destination networks matches the networks in the network list, you can set up a default server group to receive redirected packets by using the **redirect unauthorized-service** command.

[**no**] **redirect unauthorized-service** [**destination network-list** *network-listname*] **to** *group-name*

SSG TCP Redirect also restricts access to certain networks that are part of another authorized service. For example, in Figure 10-1 the user is allowed to access ServiceA. IPTVService is part of ServiceA, but the user is not authorized to access IPTVService. SSG redirects TCP sessions from the user to IPTVService (10.1.1.1/32), but allows access to anywhere else in ServiceA (10.0.0.0/8).

Figure 10-1 Restricting Access to Networks within Authorized Services



The following describes the behavior of redirection for unauthorized services:

- If a packet arrives from an unauthorized SSG user or it is destined to an unauthorized service, SSG redirects the packet if the packet matches the protocol and ports configured as the redirection filter. If the packet does not match the filter, SSG drops the packet.
- If a packet arrives from an unauthorized service or is destined to an unauthorized SSG user, SSG drops the packet.
- If a user's connection is subject to redirection or captivation, SSG redirects to SESM any packets from the connection that match the protocol and ports for redirection and captivation.
- If packets from the connection do not match the protocol and ports configured as a filter, SSG drops the packets.

Initial Captivation

Initial captivation redirects certain packets from users for a specific period of time. After a user logs on, packets to certain TCP ports are redirected to a server for advertisements and branding. SSG captivates the user by redirecting all user packets to those TCP ports regardless of the destination address. Captivation is active for a specified duration, starting from the first redirected session.

If you configure initial captivation globally by using the CLI, captivation applies to all authenticated users. You can also enable initial captivation in the RADIUS user profile as an Account-Info attribute to override the CLI setting.

The user profile contains the following information for initial captivation:

- Server group name

Note Use the CLI to configure the server group and associate a port or port list to the server group.

- Duration of captivation
- Service name (optional)

Note If you specify the optional service name, captivation activates only when logon to that service occurs.

Typically, if a service is connected, SSG forwards packets to a user and packets from a user even if the packets do not match the protocol and TCP ports specified for redirection. However, the behavior of initial captivation on the Cisco 10000 series router differs in the following ways:

- When a packet arrives from an SSG user and the packet matches the protocol and TCP ports configured as the redirection filter, the packet is subject to initial captivation and is redirected. If the packet does not match the redirection filter, it is not subject to initial captivation and the packet is dropped.
- When a packet arrives from a service destined for an SSG user that is subject to initial captivation, the packet is dropped.

Restrictions for SSG TCP Redirect

The SSG TCP Redirect feature has the following restrictions:

- The server(s) defined in a server group must be globally routable.
- Traffic from hosts with overlapping IP addresses can be redirected only to SESMs with port-bundle host keys.
- When overlapping IP address support is enabled (the host key feature is enabled), a host can reach the SSG only by a particular interface on the router. All packets between the host and the SSG use this interface and you should not change the route between SSG and the host.
- After you configure the servers in a group, the routes to those servers should not change. SSG TCP Redirect does not work if packets from servers that need to be redirected are received on a non-SSG interface.
- TCP sessions that can remain idle for more than one minute are not supported.

Prerequisites for SSG TCP Redirect

Cisco SESM Release 3.1(1) or later is required to handle unauthenticated redirections. For other types of redirection, SESM Release 3.1.1 or later is required.

Configuration of SSG TCP Redirect

To configure SSG TCP Redirect, perform the following tasks:

- Enable SSG TCP Redirect.
- Define the captive portal server groups.
- Specify the redirect server groups for unauthenticated user redirection.
- Define network lists.
- Define port lists.
- Associate network and port lists with server groups.
- Specify the default groups for captivation.

The following sections describe these tasks in more detail:

Configuration Considerations for SSG TCP Redirect

When you configure SSG TCP Redirect, consider the following:

- Where to redirect—Determine the server group to which you want to redirect.
- When to redirect—Determine if you want to redirect for unauthenticated, unauthorized, or initial packets.
- What to redirect—Determine if you want to redirect by networks or ports, and then decide the networks to include in a network list and the ports to include in a port list.

Configuring Port-Based Redirection for Unauthenticated Users

To apply SSG TCP Redirect to unauthenticated users based on a TCP port, bind the unauthenticated user redirect server group to a port using the **redirect port** command in SSG redirect configuration mode.

Example 10-1 binds the server group named *userRedirect1* to port 80 for unauthenticated user redirection.

Example 10-1 Binding a Server Group to a Port

```
Router(config)# ssg tcp-redirect
Router(config-ssg-redirect)# server-group userRedirect1
Router(config-ssg-redirect-group)# server 10.0.1.4 8090
Router(config-ssg-redirect)# redirect unauthenticated-user to userRedirect1
Router(config-ssg-redirect)# redirect port 80 to userRedirect1
```

Limiting Redirection for Unauthenticated Users

To limit the number of TCP sessions from an unauthenticated user that are redirected to a particular server group, use the **max-sessions** command in the SSG redirect group configuration mode:

```
server-group group-name
    max-sessions host number
```

Example 10-2 limits the number of TCP sessions from user4. In this example, SSG redirects a maximum of 15 sessions from user4 to the server group named *new-users1*.

Example 10-2 Limiting Redirected TCP Sessions

```
Router(config)# ssg tcp-redirect
Router(config-ssg-redirect)# server-group new-users1
Router(config-ssg-redirect-group)# server 10.0.1.4 8090
Router(config-ssg-redirect-group)# max-sessions user4 15
```

Configuring SSG TCP Redirect

To configure SSG TCP Redirect, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	`Router(config)# ip cef`	Enables Cisco Express Forwarding (CEF).
Step 2	`Router(config)# ssg enable`	Enables SSG functionality.
Step 3	`Router(config)# ssg tcp-redirect`	Enables the SSG TCP Redirect feature.
Step 4	`Router(config-ssg-redirect)# server-group group-name`	Defines the captive portal group.
	`Router(config-ssg-redirect-group)# server ip-address`	Adds a server to a captive portal group.
Step 5	`Router(config-ssg-redirect)# redirect unauthenticated-user to group-name`	Selects a captive portal group for redirection of traffic from unauthenticated users.
Step 6	`Router(config-ssg-redirect)# port-list port-listname`	Defines a port list.
	`Router(config-ssg-redirect-port)# port port-number`	Adds a port to the port list.
	`Router(config-ssg-redirect)# redirect port port-number to group-name`	Configures a TCP port for SSG TCP redirection.
	`Router(config-ssg-redirect)# redirect port-list port-listname to group-name`	Configures a TCP port list for SSG TCP redirection.
Step 7	`Router(config-ssg-redirect)# redirect captivate initial default group group-name duration seconds`	Selects the default captive portal group for initial captivation of users upon initialization.
Step 8	`Router(config-ssg-redirect)# network-list network-listname`	Defines a network list.
	`Router(config-ssg-redirect-network)# network ip-address`	Adds a network IP address to the network list.
Step 9	`Router(config-ssg-redirect)# redirect unauthorized-service [destination network-list network-listname] to group-name`	Specifies a list of destination IP networks to be redirected by the captive portal group.

For more detailed information, refer to the *SSG TCP Redirect for Services*, Release 12.2(4)B feature module.

Configuration Examples for SSG TCP Redirect

This section provides the following example configurations:

For more configuration examples, refer to the *SSG TCP Redirect for Services*, Release 12.2(4)B feature module.

Configuration Example for Server Groups

Example 10-3 shows how to configure a server group for user, service, and initial captivation redirection. The server with IP address 10.0.1.4 is the captive portal for all three types of redirection. Port 8090 is used for user redirection; port 8094 is used for service redirection; and port 8091 is used for initial captivation.

Example 10-3 Defining a Captive Portal Server Group

```
Router(config)# ssg enable
Router(config)# ssg tcp-redirect
Router(config-ssg-redirect)# server-group userRedirect
Router(config-ssg-redirect-group)# server 10.0.1.4 8090
Router(config-ssg-redirect-group)# server-group serviceRedirect1
Router(config-ssg-redirect-group)# server 10.0.1.4 8094
Router(config-ssg-redirect-group)# server-group initialCaptivate
Router(config-ssg-redirect-group)# server 10.0.1.4 8091
```

Configuration Example for Network Lists

Example 10-4 defines three network lists. The list named *serviceNetwork1* includes network 10.1.1.0; the list named *serviceNetwork2* includes network 10.2.2.0; and the list named *serviceNetwork3* includes network 10.3.3.0.

Example 10-4 Defining Network Lists

```
Router(config)# ssg tcp-redirect
Router(config-ssg-redirect)# network-list serviceNetwork1
Router(config-ssg-redirect-network)# network 10.1.1.0 255.255.255.0
Router(config-ssg-redirect-network)# network-list serviceNetwork2
Router(config-ssg-redirect-network)# network 10.2.2.0 255.255.255.0
Router(config-ssg-redirect-network)# network-list serviceNetwork3
Router(config-ssg-redirect-network)# network 10.3.3.0 255.255.255.0
```

Configuration Example for Port Lists

Example 10-5 shows how to configure a port list named *ports* for TCP redirection of HTTP packets and associate the port list to the server groups named *serviceRedirect1* and *initialCaptivate*.

Example 10-5 Defining Port Lists

```
Router(config)# ssg tcp-redirect
Router(config-ssg-redirect)# port-list ports
Router(config-ssg-redirect-port)# port 80
Router(config-ssg-redirect-port)# port 8080
Router(config-ssg-redirect-port)# port 443
Router(config-ssg-redirect-port)# exit
Router(config-ssg-redirect)# redirect port-list ports to serviceRedirect1
Router(config-ssg-redirect)# redirect port-list ports to initialCaptivate
```

CHAPTER 11

Miscellaneous SSG Features

This chapter describes the following SSG features:

VPI/VCI Static Binding to a Service Profile

The VPI/VCI Static Binding to a Service Profile feature allows users accessing SSG through a VPI/VCI or a range of VPI/VCIs to access the server. When a user session arrives on a VPI/VCI or a VPI/VCI range and the session specifies the username but does not specify the domain name, SSG maps the user session to the service to which the VPI/VCI or VPI/VCI range is bound.

For more information, refer to the"Configuring VPI/VCI Indexing to Service Profile" section in the *Node Route Processor—Service Selection Gateway Enhancements*, Release 12.0(5)DC feature module.

Restrictions for VPI/VCI Static Binding to a Service Profile

The VPI/VCI Static Binding to a Service Profile feature has the following restrictions:

- The feature applies only to PPP sessions.
- You must statically configure the feature.
- SESM cannot map the VC to the service.

Configuration of VPI/VCI Static Binding to a Service Profile

To map a VC to a service, use the **ssg vc-service-map** command in global configuration mode. For more information, refer to the "Broadband Access: Service Selection Gateway Commands" section in the *Cisco IOS Wide-Area Networking Command Reference*, Release 12.2T.

RADIUS Virtual Circuit Logging

RADIUS Virtual Circuit (VC) Logging extends and modifies the RADIUS network access server (NAS) port field to carry VPI/VCI information. With RADIUS VC Logging enabled, the Cisco 10000 router (the SSG node) can send NAS port information to the RADIUS server, accurately recording the virtual path interface (VPI) and virtual circuit interface (VCI) of an incoming user or subscriber session. The VPI/VCI of the incoming permanent virtual circuit (PVC) is recorded at the point of entry on SSG, which offers the RADIUS client a unique VPI/VCI for each incoming PVC. This information is logged in the RADIUS accounting record that was created at session startup.

RADIUS VC Logging allows SSG to send NAS port information for an IP user on an ATM point-to-point VC or an Ethernet VLAN. SSG can also send NAS port information for PPPoX users.

For more information, refer to the *RADIUS Virtual Circuit Logging*, Release 11.3DB9 feature module.

Configuration of RADIUS Virtual Circuit Logging

To enable RADIUS VC Logging on the Cisco 10000 series router, use the following command in global configuration mode:

```
radius-server attribute nas-port format d
```

This command selects the ATM VC extended format for the NAS port field.

For more information, refer to the *RADIUS Virtual Circuit Logging*, Release 11.3DB9 feature module.

AAA Server Group Support for Proxy Services

The AAA Server Group Support for Proxy Services feature allows you to configure multiple AAA servers for redundancy. The RADIUS Server attribute enables AAA server group support for proxy services. Each group is associated with a service that requires proxy RADIUS AAA. You can configure each remote RADIUS server with timeout and retransmission parameters. When necessary, the SSG performs failover among the servers in the predefined group.

The RADIUS Server attribute specifies the remote RADIUS servers that SSG uses to authenticate, authorize, and perform accounting for a service login for a proxy service type. This attribute is used only in service profiles and is required. SSG automatically creates an AAA server group that contains the remote RADIUS server for this service profile.

For more information, refer to the *Service Selection Gateway*, Release 12.2(15)B feature module.

Restrictions for AAA Server Group Support for Proxy Services

The AAA Server Group Support for Proxy Services feature has the following restriction:

- The RADIUS Server attribute is supported only by SSG with SESM in RADIUS mode.

Configuration of AAA Server Group Support for Proxy Services

To configure AAA Server Group Support for Proxy Services, use the RADIUS Server attribute. This Service-Info vendor-specific attribute (VSA) is used to specify the remote RADIUS servers that SSG uses to authenticate and authorize a service login for a proxy service type.

The RADIUS Server attribute has the following syntax:

```
Service-Info =
"SRadius-server-address;auth-port;acct-port;secret-key[;retrans;timeout;deadtime]"
```

For more information, refer to the *Service Selection Gateway*, Release 12.2(15)B feature module.

Configuration Example for AAA Server Group Support for Proxy Services

The following example shows how to configure the RADIUS Server attribute to specify the remote RADIUS servers SSG uses for authentication and authorization of service login for a proxy service type:

```
Service-Info = "S192.168.1.1;1645;1646;cisco"
```

Packet Filtering

The Cisco 10000 series router supports per-user access control lists (ACLs) to prevent users from accessing specific IP addresses and ports. When an ACL attribute is added to a user profile, the attribute applies globally to all the user's traffic.

User profiles define the services and service groups to which a user is subscribed. RADIUS user profiles contain a password, a list of subscribed services and groups, access control lists, and timeouts. User profiles are configured on the RADIUS server or directly on the Cisco 10000 series router. The RADIUS server or SESM downloads the user profiles to the router. For more information about RADIUS user profiles and the attributes included in them, refer to the *Service Selection Gateway*, Release 12.2(15)B feature module.

SSG accepts Cisco IOS ACLs and SSG ACLs. SSG ACLs take precedence over Cisco IOS ACLs when both Cisco IOS and SSG ACLs are configured on the same SSG interface. The following Cisco-AV pair attributes are used to specify either a Cisco IOS standard ACL or an extended ACL to be applied to either downstream or upstream traffic:

- Downstream Access Control List—outacl, page 11-4
- Upstream Access Control List—inacl, page 11-4

Downstream Access Control List—outacl

Specifies either a Cisco IOS standard ACL or an extended ACL to be applied to downstream traffic going to the user.

Cisco-AVpair = "ip:outacl[**#***number*]={*standard-access-control-list* | *extended-access-control-list*}**"**

Upstream Access Control List—inacl

Specifies either a Cisco IOS standard ACL or an extended ACL to be applied to upstream traffic coming from the user.

Cisco-AVpair = "ip:inacl[**#***number*]={*standard-access-control-list* | *extended-access-control-list*}"

Restrictions for Packet Filtering

Packet filtering for SSG has the following restrictions:

- SSG accepts only the permit and deny actions for a per-user ACL. You can place ACLs on user traffic for both the input and output directions that are similar to existing Cisco IOS ACLs; however, the **log** option is not accepted.
- SSG supports mini-ACLs with eight or less access control entries (ACEs). The ACEs can be extended ACEs.
- SSG does not support turbo ACLs applied to SSG users. Turbo ACLs have more than eight ACEs defined.
- To support some SSG features, SSG prepends ACEs on user ACLs. Because the number of ACEs is restricted to a maximum of eight, the number of ACEs that you can define is therefore reduced in some cases. For example, for the Port-Bundle Host Key feature, an ACE is required on both the host input and output ACL. This allows seven ACEs that you can define.
- SSG does not support the ability to apply per-service (connection level) ACLs. ACLs for QoS classification are not applicable to SSG host interfaces.
- SSG ACLs take precedence over Cisco IOS ACLs. If you configure a Cisco IOS ACL on an SSG interface by using the **ip access-group** command, the router applies the ACL as long as an SSG ACL is not applied to the interface in the same direction. If an SSG ACL is applied to the interface in the same direction, the router applies the SSG ACL.

Configuration of Packet Filtering

To configure SSG ACLs, use the following Cisco-AV pair attributes:

- Downstream Access Control List (outacl)

  Cisco-AVpair = "ip:outacl[**#***number*]**=**{*standard-access-control-list* | *extended-access-control-list*}**"**

- Upstream Access Control List (inacl)

  Cisco-AVpair = "ip:inacl[**#***number*]**=**{*standard-access-control-list* | *extended-access-control-list*}"

For more information, refer to the *Service Selection Gateway*, Release 12.2(15)B feature module.

Configuration Example for Packet Filtering

The following is an example of a downstream ACL (outacl):

```
Cisco-AVpair = "ip:outacl#101=deny tcp 192.168.1.0 0.0.0.255 any eq 21"
```

The following is an example of an upstream ACL (inacl):

```
Cisco-AVpair = "ip:inacl#101=deny tcp 192.168.1.0 0.0.0.255 any eq 21"
```

SSG Unconfig

The SSG Unconfig feature enhances your ability to disable SSG at any time and releases the data structures and system resources created by SSG when SSG is unconfigured.

SSG Unconfig removes SSG allocated resources when you globally disable SSG after it was enabled. When you enable SSG, the SSG subsystem in the Cisco IOS software acquires system resources that are never released, even after you disable SSG. The SSG Unconfig feature enables you to release and clean up system resources when SSG is not in use by entering the **no ssg enable force-cleanup** command.

The SSG Unconfig feature also enhances several IOS commands to allow you to delete all host objects, a range of host objects, or all service objects (connection objects). Enhancements to the **show ssg host** command allow you to display information about an interface and its IP address when you enable host-key mode on that interface. For more information about the SSG commands, refer to the *Cisco 10000 Series Routers Command Quick Reference Guide*.

For more information about the SSG Unconfig feature, refer to the *SSG Unconfig*, Release 12.2(15)B feature module and the *Service Selection Gateway*, Release 12.2(15)B feature module.

Restrictions for SSG Unconfig

SSG Unconfig clears all SSG resources on the system. Therefore, if you no longer need to run SSG features on the router, instead of using SSG Unconfig enter the **no ssg enable force-cleanup** command after all users are logged out.

Prerequisites for SSG Unconfig

You must enable SSG before you configure SSG Unconfig.

Configuration of SSG Unconfig

To configure SSG Unconfig, perform any of the following optional tasks:

- Unconfigure SSG and release system resources by entering the **no ssg enable force-cleanup** command in global configuration mode.
- Remove one or more SSG host objects by entering the **clear ssg host** command in privileged EXEC configuration mode.
- Remove one or more SSG service objects by entering the **clear ssg service** command in privileged EXEC configuration mode.

For more information, refer to the *SSG Unconfig*, Release 12.2(15)B feature module.

Configuration Examples for SSG Unconfig

Example 11-1 shows how to unconfigure SSG and release system resources.

Example 11-1 Unconfiguring SSG and Releasing System Resources

```
Router(config)# no ssg enable force-cleanup

04:35:02: Delete all active host objects. It may take some time, please wait.
04:35:-02: ssg_unconfig_proc: UNCONFIGURATION COMPLETE
```

Example 11-2 shows how to remove all host objects associated with a downlink interface and then verify that all host objects on that interface are removed.

Example 11-2 Removing Host Objects on an Interface

```
Router# clear ssg host range 0.0.0.0 255.255.255.255 FastEthernet0/1
Router# show ssg host FastEthernet0/1

##Total HostObject Count:0
```

For more configuration examples, refer to the *SSG Unconfig*, Release 12.2(15)B feature module.

SSG Enhancements for Overlapping Services

Overlapping services are services for which the route prefix of one service matches or is contained within the route prefix of another service. For example, the service definition 172.16.253.0/24 overlaps with the service definition 172.16.0.0/16 because the prefix 172.16 is contained in both definitions. The definition 0.0.0.0/0 overlaps all other possible services.

In releases prior to Cisco IOS Release 12.2(16)BX2, the Cisco 10000 router does not allow users to be subscribed to a service if that service overlaps another service to which a different user is subscribed.

To enable service providers to use existing overlapping definitions, the Cisco 10000 router provides the following SSG enhancements:

- Service Translation—Translates overlapping service definitions to a set of non-overlapping service definitions.
- Expansion of Service IDs—Expands the number of service IDs supported from seven to 15. The router uses service IDs to determine which services a user is subscribed to and how to police the user traffic.

For more information, see the following sections:

- Service Translation, page 11-7
- Expansion of Service IDs, page 11-11

Service Translation

The service translation mechanism translates overlapping service definitions to a set of non-overlapping service definitions that are used internally to the router. Instead of using the service definitions that the Cisco Subscriber Edge Services Manager (SESM) downloads, the router uses the translated network sets to provide the desired behavior. A network set can contain a single unique prefix or multiple unique prefixes.

To further clarify service translation for the Cisco 10000 router, consider the following example in which services that are defined in SESM are converted to sets (for example, service networks). The Cisco 10000 router uses these sets internally to provide the desired behavior. The following services are defined in the example:

```
ssg bind service Default_256 <next hop ssg>
    0.0.0.0/0.0.0.0

ssg bind service Bronze_256 <next hop ssg>
    10.58.253.0/255.255.255.0
    10.58.254.0/255.255.255.0

ssg bind service Silver_512 <next hop ssg>
    10.58.253.0/255.255.255.0
    10.58.254.0/255.255.255.0
    10.58.102.6/255.255.255.255

ssg bind service Gold_2048 <next hop ssg>
    10.58.253.0/255.255.255.0
    10.58.254.0/255.255.255.0
    10.58.102.6/255.255.255.255

ssg bind service Platinum_1024 <next hop ssg>
    10.58.253.0/255.255.255.0
```

Because network sets for services must be unique, the following network sets are defined internally:

Set1
0.0.0.0/0.0.0.0

Set2
10.58.253.0/255.255.255.0

Set3
10.58.254.0/255.255.255.0

Set4
10.58.102.6/255.255.255.255

The service translation mechanism then internally converts the services to the following sets:

Service Default_256
Set1

Service Bronze_256
Set2 and set3

Service Silver_512
Set2, set3, and set4

Service Gold_2048
Set2, set3, and set4

Service Platinum_1024
Set2

Policing of user traffic is based on the service to which the user is assigned. For example, using the services and sets defined above, if user A is subscribed to Default_256 at 256 Kbps, user A traffic is policed at 256 Kbps for all services. If user B is subscribed to Default_256 at 256 Kbps and Platinum_1024 at 1024 Kbps, user B traffic to the service 10.58.253.0/255.255.255.0 is policed at 1024 Kbps, but all other user B traffic is policed at 256 Kbps.

In the previous example, each set contains a single prefix. However, network sets can also contain multiple prefixes. For example, consider the following service definitions:

ssg bind service Bronze_256 <next hop ssg>
10.58.253.0/255.255.255.0
10.58.254.0/255.255.255.0

ssg bind service Default_256 <next hop ssg>
10.58.253.0/255.255.255.0
10.58.254.0/255.255.255.0
10.58.102.6/255.255.255.255
10.58.102.7/255.255.255.255

Based on the service definitions, the service translation mechanism internally defines the following network sets:

Set1
10.58.253.0/255.255.255.0
10.58.254.0/255.255.255.0

Set2
10.58.102.6/255.255.255.255
10.58.102.7/255.255.255.255

The service translation mechanism then internally converts the services to the following sets:

Service Bronze_256
    Set1

Service Silver_512
    Set1 and set2

The service translation mechanism also provides for the translation of services that are complete subsets of one another. For example, consider the following service definitions:

ssg bind service A_1 <next hop ssg>
    10.58.253.0/255.255.255.0

ssg bind service B_256 <next hop ssg>
    10.58.0.0/255.255.0.0

Based on the service definitions, service A_1 is a subset of service B_256. Therefore, the service translation mechanism creates the following two sets and internally converts the services to sets:

Set1
    10.58.253.0/255.255.255.0

Set2
    10.58.0.0/255.255.0.0

Service A_1
    Set1

Service B_256
    Set1 and set2

Assume that user1 is subscribed to service B_256 at 256 Kbps and user2 is subscribed to service A_1 at 1 Mbps. Internally, user1 is subscribed to both set1 and set2. However, policing of the aggregate traffic to either set1 or set2 is at an aggregate rate of 256 Kbps because policing of user traffic is based on the service to which the user is assigned. User1 is subscribed to service B_256; therefore, policing is at a rate of 256 Kbps.

Restrictions for Service Translation

Service translation has the following restrictions:

- Network sets for services must be unique.
- If the service definitions from SESM change, the user must be disconnected and then reconnected before the service translation mechanism can properly translate the new service definitions.

Prerequisites for Service Translation

Enable service translation before SESM downloads overlapping service definitions.

Configuration of Service Translation

To enable service translation on the router, enter the following command in global configuration mode:

Command	Purpose
`Router(config)# ssg service-overlap`	Enables service translation and indicates to the router to use the translated sets to provide the desired network behavior.

Configuration Example for Service Translation

The following example shows how the service translation mechanism translates the services defined in SESM to sets (for example, service networks). The router uses the sets internally to provide the desired behavior.

Service Definitions

ssg bind service DEF_256 <next hop ssg>
    0.0.0.0/0.0.0.0

ssg bind service A_256 <next hop ssg>
    10.16.25.0/255.255.255.0
    10.16.26.0/255.255.255.0

ssg bind service B_512 <next hop ssg>
    10.16.25.0/255.255.255.0
    10.16.26.0/255.255.255.0
    10.16.102.1/255.255.255.0

ssg bind service C_2048 <next hop ssg>
    10.16.25.0/255.255.255.0
    10.16.26.0/255.255.255.0
    10.16.102.1/255.255.255.0

ssg bind service D_1024 <next hop ssg>
    10.16.25.0/255.255.255.0

Internal Network Sets

Set1
    0.0.0.0/0.0.0.0

Set2
    10.16.25.0/255.255.255.0

Set3
    10.16.26.0/255.255.255.0

Set4
    10.16.102.1/255.255.255.0

Services-to-Sets Conversion

Service DEF_256
    Set1

Service A_256
    Set2 and Set3

Service B_512
Set2, set3, and set4

Service C_2048
Set2, set3, and set4

Service D_1024
Set2

Expansion of Service IDs

The Cisco 10000 router uses service IDs to determine which services a user is subscribed to and how to police the user traffic. A user can be subscribed to a maximum of seven services. However, service translation can result in more than seven network sets. To support the service translation mechanism, the expansion of service IDs enhancement expands the number of service IDs supported from seven to 15.

Restrictions for Expansion of Service IDs

The expansion of service IDs enhancement has the following restrictions:

- When service translation is used, the Cisco 10000 router supports a maximum of 15 sets per SSG VRF. If all of the users are configured in the same VRF, the router supports a maximum of 15 network sets per system.
- A user can be subscribed to a maximum of seven services and a maximum of 15 network sets.

Configuration Example for Expansion of Service IDs

The following example shows how service IDs are expanded to allow a user to be subscribed to more than seven sets. In this example, the user is subscribed to five services, which is within the seven-services limit. After service translation, the user is subscribed to eight sets, which is within the expanded service IDs limit of 15 network sets.

Service Definitions:

ssg bind service Rate-1 <next hop ssg>
0.0.0.0/0.0.0.0

ssg bind service Rate-2 <next hop ssg>
10.58.252.0/255.255.255.0
10.58.253.0/255.255.255.0
10.58.254.0/255.255.255.0
10.58.102.6/255.255.255.255

ssg bind service Rate-3 <next hop ssg>
10.58.251.0/255.255.255.0

ssg bind service Rate-4 <next hop ssg>
10.58.250.0/255.255.255.0

ssg bind service Rate-5 <next hop ssg>
10.58.249.0/255.255.255.0

Network Sets:

Set1
0.0.0.0/0.0.0.0

Set2
10.58.252.0/255.255.255.0

Set3
10.58.253.0/255.255.255.0

Set4
10.58.254.0/255.255.255.0

Set5
10.58.102.6/255.255.255.255

Set6
10.58.251.0/255.255.255.0

Set7
10.58.250.0/255.255.255.0

Set8
10.58.249.0/255.255.255.0

CHAPTER 12

Monitoring and Maintaining SSG

To monitor and maintain SSG, use the following commands in privileged EXEC mode:

Command	Purpose
Router# **show ssg interface** [*interface-number* | **brief**]	Displays a list of all SSG interfaces, the bind direction, and the binding type.
Router# **show ssg summary**	Displays a summary of the SSG features configured on the router and the active services.
Router# **show ssg connection** *ip-address service-name*	Displays the connections of the specified host and service name.
Router# **clear ssg connection** *ip-address service-name*	Removes the connections of the specified user and service name.
Router# **show ssg pass-through-filter**	Displays the downloaded filter for transparent passthrough.
Router# **clear ssg pass-through-filter**	Removes the downloaded filter for transparent passthrough. To remove the filter from NVRAM, use the **no** form of the **ssg pass-through** command in global configuration mode.
Router# **show ssg host** [*ip-address*] [*username*]	Displays information about a subscriber and the current connections of the subscriber.
Router# **clear ssg host** *ip-address*	Removes the specified host or subscriber.
Router# **show ssg direction**	Displays the direction of all interfaces for which a direction has been specified. **Note** The **show ssg direction** command is no longer supported. Instead, use the **show ssg interface** command.
Router# **show ssg pending-command**	Displays current pending commands.
Router# **clear ssg pending-command**	Removes all pending commands.
Router# **show ssg next-hop**	Displays the next-hop table.
Router# **clear ssg next-hop**	Removes the next-hop table. To remove the next-hop table from NVRAM, enter the **no** form of the **ssg next-hop** command in global configuration mode.
Router# **show ssg binding**	Displays service names that have been bound to interfaces and the interfaces to which they have been bound.
Router# **show ssg service** *service-name*	Displays the information for a service, including QoS parameters if policing is configured.

Command	Purpose
Router# **clear ssg service** *service-name*	Removes the specified service.
Router# **debug ssg ctrl-errors**	Displays all error messages for control modules.
Router# **debug ssg ctrl-events**	Displays all event messages for control modules.
Router# **debug ssg ctrl-packets**	Displays packet contents handled by control modules.
Router# **debug ssg data**	Displays all data-path packets.
Router# **debug ssg data access-list** *number*	Displays all data-path packets for the specified access list.
Router# **debug ssg errors**	Displays all error messages for system modules.
Router# **debug ssg events**	Displays event messages for system modules.
Router# **debug ssg packets**	Displays packet contents handled by system modules.

Troubleshooting RADIUS

To troubleshoot communication between the RADIUS server and SSG, enter the **debug radius** command in privileged EXEC mode.

Per-Service Statistics

The Cisco 10000 series router collects statistics about router interfaces and the connections to them in both the input and output directions. Cisco CLI commands, such as **show interface**, are used to display information about the interfaces. SSG commands, such as **show ssg connection**, are used to display information about the connection to the router.

Restrictions for Per-Service Statistics

The Per-Service Statistics feature has the following restrictions:

- The Cisco 10000 series router does not collect connection level statistics for the default or Open Garden network.
- You cannot display the aggregate statistics for a user.
- For PPP-based users, any link level control traffic, such as keepalives, are counted separately from the data traffic to support idle timeouts.

Monitoring the Parallel Express Forwarding Engine

To monitor the parallel express forwarding (PXF) engine, use the following commands in privileged EXEC mode:

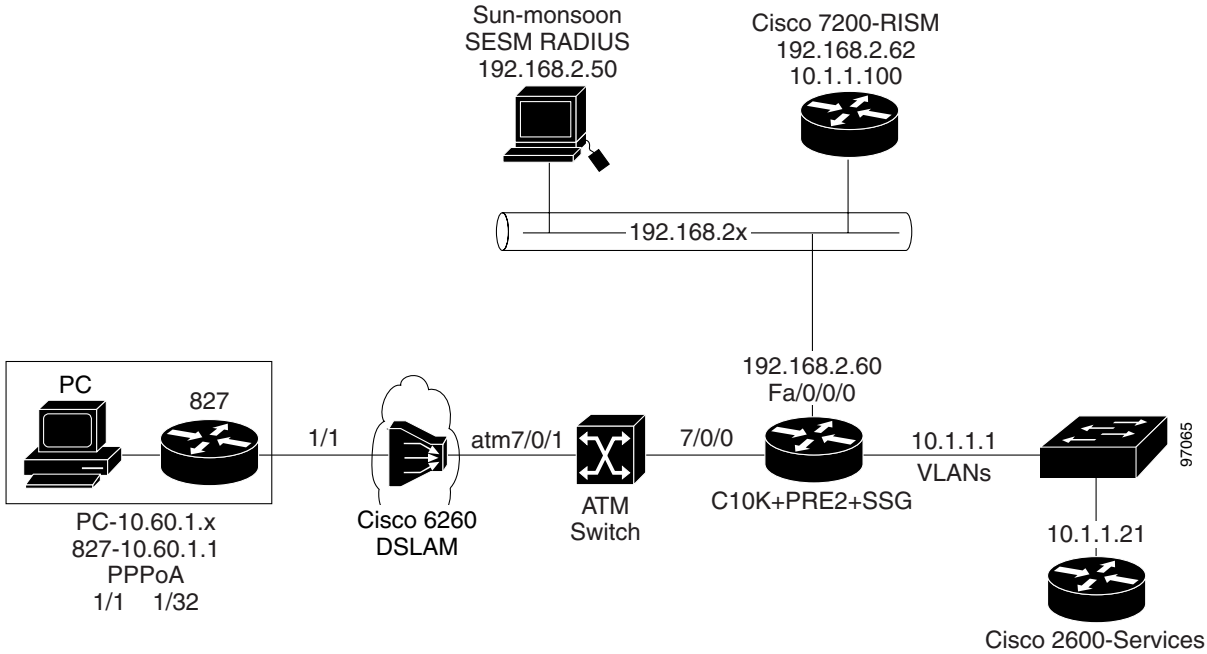
Command	Purpose
`Router# clear pxf interface [interface | rp]`	Clears PXF counters for the specified interface or for the route processor (RP). If you do not specify an interface, the PXF counters for all interfaces are cleared.
`Router# clear pxf statistics {ip | drop | diversion}`	Clears the specified PXF statistics.
`Router# show pxf cpu access-lists [security | QoS]`	Displays memory information for ACLs.
`Router# show pxf cpu buffers`	Displays the number of output buffers of each size available for the PXF engine.
`Router# show pxf cpu cef ip-prefix [mask]`	Displays the current Cisco Express Forwarding (CEF) table stored in PXF memory.
`Router# show pxf cpu cef memory`	Displays the PXF memory usage of the current CEF table.
`Router# show pxf cpu context`	Displays the current and historical loads on the PXF engine. The first section displays the number of contexts of each type that have entered the PXF engine since it was last reloaded.
`Router# show pxf cpu mroute`	Displays the current multicast routing table stored in PXF memory.
`Router# show pxf cpu queue interface`	Displays the output queue statistics for an interface. If you do not specify an interface, the route processor queue statistics display.
`Router# show pxf cpu schedule`	Displays the rates at which each interface gets packets from the PXF engine.
`Router# show pxf cpu statistics [drop | diversion | ip]`	Displays statistical information about the PXF engine, since the engine was most recently loaded. If you do not specify a parameter, information is displayed for all parameters.
`Router# show pxf cpu subblocks interface`	Displays the status and PXF-related parameters for the interface.
`Router# show pxf interface [interface | rp] [detail]`	Displays PXF counters for a specific interface or the route processor (RP). If you do not specify an interface, PXF counters are displayed for all interfaces.
`Router# show pxf microcode`	Displays the version of microcode that is running on the PXF engine and how long it has been running.
`Router# show pxf statistics {ip | diversion | drop [detail]}`	Displays PXF statistics that you specify.

For more information about PXF commands, refer to the *Cisco 10000 Series Router Command Quick Reference Guide*.

SSG Configuration Example

Example A-1 is a sample SSG configuration for the Cisco 10000 series router based on the topology in Figure A-1. The configuration includes AAA, PPP, SSG, and RADIUS. The SSG configuration enables the Port-Bundle Host Key, captive portal, QoS, and Open Garden features.

Figure A-1 SSG Example Topology



Example A-1 Cisco 10000 Router SSG Configuration

```
!
version 12.2
no service pad
service timestamps debug datetime msec localtime show-timezone
service timestamps log datetime msec localtime show-timezone
no service password-encryption
!
hostname c10k-ssg
!
boot system disk0:c10k2-p11-mz.bilgepump
logging buffered 4096 debugging
no logging rate-limit
no logging console
enable password mrrbu
!
username cisco password 0 cisco
clock timezone PST -8
clock summer-time PST recurring
facility-alarm intake-temperature major 49
no facility-alarm intake-temperature minor
facility-alarm core-temperature major 53
facility-alarm core-temperature minor 45
!
!
card 1/0 1gigethernet-1
card 8/0 4oc3atm-1
aaa new-model
!
!
aaa group server radius SSG-RADIUS
  server 192.168.2.62 auth-port 1812 acct-port 1813
!
aaa group server radius SSG-RADIUS-RISM
  server-private 192.168.2.62 auth-port 1812 acct-port 1813 key cisco
!
aaa authentication banner CCC !!! Cisco C10K PRE2 SSG !!!
aaa authentication fail-message CC !!! Unauthorized Access Is Not Permitted !!!
aaa authentication password-prompt Password:
aaa authentication username-prompt Username:
aaa authentication login default local group SSG-RADIUS
aaa authentication login console local
aaa authentication ppp default group SSG-RADIUS
aaa authorization exec vty none
aaa authorization network default group SSG-RADIUS
aaa accounting network default start-stop group SSG-RADIUS
aaa nas port extended
aaa session-id common
ip subnet-zero
ip host-routing
ip ftp username cisco
ip ftp password cisco
no ip domain lookup
ip domain name cisco.com
ip host rism 192.168.2.62
ip host sesm 192.168.2.50
ip name-server 172.16.168.183
ip name-server 172.31.226.120
!
mpls ldp log-neighbor-changes
!
!
ssg enable
```

```
ssg accounting interval 300
ssg profile-cache
ssg default-network 192.168.2.50 255.255.255.255
ssg service-password servicecisco
ssg radius-helper auth-port 1812 acct-port 1813
ssg radius-helper key cisco
ssg maxservice 20
ssg port-map enable
ssg port-map destination range 80 to 80 ip 192.168.2.50
ssg port-map source ip 192.168.2.60
ssg bind service video-prepaid 10.1.1.51
ssg bind service zap-com 10.1.1.51
ssg bind service opengarden-helpdesk 10.1.5.51
ssg bind service video-silver 10.1.1.51
ssg bind service proxy-service 10.1.1.51
ssg bind service video-gold 10.1.1.51
ssg bind service internet 10.1.1.51
ssg bind service video-bronze 10.1.1.51
ssg bind direction uplink GigabitEthernet1/0/0.4
ssg bind direction uplink GigabitEthernet1/0/0.5
ssg bind direction uplink GigabitEthernet1/0/0.1
ssg bind direction uplink GigabitEthernet1/0/0.2
ssg bind direction uplink GigabitEthernet1/0/0.3
ssg open-garden opengarden-helpdesk
ssg qos police user
ssg qos police session
ssg tcp-redirect
 network-list service-networks
 network 192.168.20.0 255.255.255.0
 network 192.168.10.0 255.255.255.0
!
port-list user-tcp-ports
 port 80
 port 8080
 port 443
!
server-group captive-portal
 server 192.168.2.50 80
!
redirect port-list user-tcp-ports to captive-portal
redirect unauthorized-service destination network-list service-networks to captive-portal
!
server-group RECHARGE
  server 192.168.2.50 80
!
redirect unauthenticated-user to captive-portal
redirect unauthorized-service to captive-portal
redirect prepaid-user to RECHARGE
ssg service-search-order local remote
!
local-profile opengarden-helpdesk
  attribute 26 9 251 "Omobile.users.com"
  attribute 26 9 251 "R35.1.5.1;255.255.255.255"
!
!
buffers small permanent 1500
buffers middle permanent 12000
buffers big permanent 8000
!
interface Loopback1
  description LOOPBACK for DSL/PPPoA/PAT users
  ip address 192.168.201.1 255.255.255.255
!
```

```
interface FastEthernet0/0/0
  description Connected to LAB Backbone
  ip address 192.168.2.60 255.255.255.0
  no ip route-cache cef
  full-duplex
!
interface GigabitEthernet1/0/0
  no ip address
  no negotiation auto
!
interface GigabitEthernet1/0/0.1
  description SSG Service internet
  encapsulation dot1Q 10
  ip address 10.1.1.1 255.255.255.0
!
interface GigabitEthernet1/0/0.2
  encapsulation dot1Q 2
  ip address 10.1.2.1 255.255.255.0
!
interface GigabitEthernet1/0/0.3
  encapsulation dot1Q 3
  ip address 10.1.3.1 255.255.255.0
!
interface GigabitEthernet1/0/0.4
  encapsulation dot1Q 4
  ip address 10.1.4.1 255.255.255.0
!
interface GigabitEthernet1/0/0.5
  encapsulation dot1Q 5
  ip address 10.1.5.1 255.255.255.0
!
interface GigabitEthernet1/0/0.6
  encapsulation dot1Q 6
  ip address 10.1.6.1 255.255.255.0
!
interface GigabitEthernet1/0/0.7
  encapsulation dot1Q 7
  ip address 10.1.7.1 255.255.255.0
!
interface GigabitEthernet1/0/0.8
  encapsulation dot1Q 8
  ip address 10.1.8.1 255.255.255.0
!
interface GigabitEthernet1/0/0.9
 encapsulation dot1Q 9
 ip address 10.1.9.1 255.255.255.0
!
interface GigabitEthernet1/0/0.10
 description SSG OpenGarden Service Interface
 encapsulation dot1Q 11
 ip address 10.1.10.1 255.255.255.0
!
interface ATM8/0/0
 no ip address
 load-interval 30
 no atm ilmi-keepalive
!
interface ATM8/0/0.1 point-to-point
 pvc 1/32
  encapsulation aal5mux ppp Virtual-Template1
!
!
```

```
interface ATM8/0/1
 no ip address
 shutdown
 no atm ilmi-keepalive
!
interface ATM8/0/2
 no ip address
 shutdown
 no atm ilmi-keepalive
!
interface ATM8/0/3
 no ip address
 shutdown
 no atm ilmi-keepalive
!
interface Virtual-Template1
 ip unnumbered Loopback1
 peer default ip address pool SSG-POOL
 ppp authentication pap chap
 ppp ipcp address accept
!
ip local pool SSG-POOL 10.60.1.1 10.60.1.100
ip classless
ip route 0.0.0.0 0.0.0.0 192.168.2.1
ip route 10.80.1.1 255.255.0.0 11.1.1.51
no ip http server
!
!
ip radius source-interface FastEthernet0/0/0
!
logging trap debugging
logging facility local6
logging 192.168.2.50
access-list 101 permit ip 10.0.0.0 0.255.255.255 172.25.0.0 0.0.255.255
access-list 102 permit ip host 192.168.2.50 any
access-list 102 permit ip any host 192.168.2.50
access-list 103 permit ip host 10.60.1.2 any
access-list 104 permit tcp any any
access-list 105 permit ip 10.60.1.0 0.0.0.255 any
arp 10.27.1.3 3434.3434.3434 ARPA
snmp-server community public RW
snmp-server enable traps snmp authentication linkdown linkup coldstart warmstart
snmp-server enable traps tty
snmp-server enable traps alarms
!
radius-server host 192.168.2.62 auth-port 1812 acct-port 1813 key cisco
radius-server retransmit 5
radius-server timeout 15
radius-server attribute nas-port format d
radius-server key cisco
radius-server authorization permit missing Service-Type
radius-server vsa send accounting
radius-server vsa send authentication
alias exec cpu show proc cpu history
alias exec dcopy copy running-config disk0:ssg-c10k.txt
alias exec zcopy copy running-config tftp://192.168.2.50/rohit/ssg-c10k.txt
!
line con 0
 exec-timeout 0 0
line aux 0
line vty 0 4
 exec-timeout 0 0
 password cisco
line vty 5 99
```

```
 exec-timeout 0 0
 password lab
!
ntp clock-period 17181406
ntp update-calendar
end
```

SSG Implementation Notes

Table B-1 provides information about how SSG is implemented on the Cisco 10000 series router. For additional information about general SSG limitations, see the "SSG Restrictions" section on page 1-4, the "SSG Prerequisites" section on page 1-6, and also see Chapter 2, "Scalability and Performance."

Table B-1 SSG Implementation Notes for the Cisco 10000 Router

SSG Feature	Implementation Notes
ACLs and QoS	ACL and QoS are applied even if the traffic is to or from an Open Garden or the default network (when port-bundle host key is not enabled). Service ACLs cannot be applied to a connection. The connection will remain active, but the ACLs will have no effect. Modular QoS CLI (MQC) is not supported on SSG interfaces. If an MQC service policy is configured on an SSG interface, SSG ignores the policy. See the "Restrictions for SSG Hierarchical Policing" section on page 8-2 for additional implementation information.
AutoDomain	You must enable Cisco Express Forwarding (CEF) before you enable SSG functionality. Passthrough services are available only for services that perform authentication (for example, proxy or VPDN services). This is because AutoDomain bypasses the local authentication that is performed at the network access server (NAS). DHCP requests for IP address assignment must be done before RADIUS negotiation. If an Access-Request does not contain an IP address, you must configure a local per-domain or global IP address pool. "Virtual-user" profiles can contain only one AutoLogon service.
L2TP	Not supported. SSG attempts to set up the tunnel, but does not set up the VRF for tunnel services. Therefore, traffic is not forwarded to the tunnel. The same applies to L2TP dialout.
Logon	A user cannot log on to services on different uplink interfaces. All services that the user connects to must be on the same interface. This is because a user can connect to only one VRF, and in SSG one VRF is used for each uplink interface. To connect to a different service, the user has to logoff from the current service, and log on to the other service.

Table B-1 SSG Implementation Notes for the Cisco 10000 Router (continued)

SSG Feature	Implementation Notes
Local Forwarding	Cannot be enabled or disabled through the CLI. Only seven services (network sets) can be bound to an uplink interface. If a service cannot be created on the toaster, then no connection is created. A service cannot be bound by interface to a broadcast interface. If such a service is configured, the toaster does not see this network in the VRF and might drop traffic to the service. Binding to a next-hop on a broadcast interface is allowed. If two users are connected to services on the same uplink interface, traffic between the users is allowed and all host features are applied (which are the "in" features of the first user and the "out" features of the second user). If an ACL contains more than eight ACEs, the toaster does not apply the ACL; however, the segment continues to exist.
MPLS	Disabled on SSG interfaces.
Open Garden	Service bindings not required for services directly connected to the router. Service bindings are required for any services routed through a next-hop address. RADIUS accounting records not created for Open Garden services. Open Garden services must be created through local profiles, RADIUS profiles are not supported. Overlapping of Open Garden networks is not supported.
Per Service Statistics	Connection-level statistics are not collected for the default network or for Open Garden networks. You cannot display aggregate statistics for a user. For PPP-based users, any link-level control traffic (such as keepalives) are counted separately from the data traffic to support idle timeouts.
Port-Bundle Host Key	The router supports this feature for Cisco SESM Release 3.1(1) or later. The feature is disabled by default. A default network must be configured and routable from SSG. To enable this feature, you must reload SSG and restart SESM. You must separately enable this feature at SESM and at all connected SSG nodes. For each SESM server, all connected SSG nodes must have the same port-bundle length. When you change the port-bundle length, the change does not take effect until after the router reloads. All SSG source IP addresses configured using the **ssg port-map source ip** command must be routable in the management network where SESM resides. See the "Restrictions for SSG Port-Bundle Host Key" section on page 6-7 for additional implementation notes.
PPPoA Connections	The router supports only one host per interface. The customer premises equipment (CPE) must be configured for PAT.
Prepaid Services	Only time-based quotas are supported. Quotas are always measured in seconds. Quotas based on data volume are not supported. If configured, traffic might exceed the quota.

Table B-1 SSG Implementation Notes for the Cisco 10000 Router (continued)

SSG Feature	Implementation Notes
RADIUS Proxy	Not Supported.
Service Profiles	MTU Size Attribute—In Directory Enabled Service Selection Subscription (DESS) mode, SESM does not support the use of the MTU Size attribute. Service-Defined Cookie Attribute—SSG does not parse or interpret the value of this attribute. You must configure the proxy RADIUS server to interpret this attribute. A RADIUS service profile supports only one Service-Defined Cookie.
SMTP Redirect	Not supported, even if it is configured.
TCP Redirect	Supported to default network only. User traffic to services might be dropped, even if it does not match a redirect port. Network-specific redirects do not work unless the network is part of an exclude network or part of an active service. As a workaround, use redirects based on service name. The authentication feature applies only to non-PPP users. PPP users are always authenticated as part of the PPP negotiation process. PPP users logging off from SESM are also redirected. Initial Captivation—If the packet matches the redirection filter, the packet is subject to initial captivation and is redirected. If the packet does not match the redirection filter, the packet is not subject to initial captivation and is dropped. Also see the "Restrictions for SSG TCP Redirect" section on page 10-4.
Transparent Passthrough	Supported only for traffic to the user (host). Not supported for traffic from the user (host). Use Open Garden to allow SSG hosts access to certain networks. Unauthorized downstream traffic is always allowed, but unauthorized upstream traffic from an SSG host is dropped.
Unsupported Features	If an unsupported feature (such as NAT) is applied to an SSG connection, the router does not reject the connection; however, the feature is not applied to traffic over the connection.
VPI/VCI Static Binding to a Service Profile	The feature applies only to PPP sessions. You must statically configure the feature. SESM cannot map the VC to the service.

A

authentication A security feature that allows access to information to be granted on an individual basis.

B

bandwidth The range of frequencies a transmission line or channel can carry. The greater the bandwidth, the greater the information-carrying capacity of a channel. For a digital channel this is defined in bits. For an analog channel it is dependent on the type and method of modulation used to encode the data.

broadcast A packet delivery system where a copy of a given packet is given to all hosts attached to the network. For example: Ethernet.

C

captive portal A server that is programmed to respond to redirected packets. Captive portals enable service providers to capture a subscriber's attention with targeted messages such as authentication, requests for per-service payment, and blocked access to a particular service. A captive portal group consists of one or more servers. A captive portal group is identified by its unique name. Each server in a captive portal group is identified by its IP address and TCP port. SSG selects one server from the group in a round-robin fashion to receive the redirected packets. Servers can be in the SSG Open Garden or default network.

CEF Cisco Express Forwarding. An advanced Layer 3 IP switching technology. CEF optimizes network performance and scalability for networks with large and dynamic traffic patterns such as the Internet, on networks characterized by intensive Web-based applications, or interactive sessions.

D

DSL Digital Subscriber Line.

E

encapsulation The technique used by layered protocols in which a layer adds header information to the protocol data unit (PDU) from the layer above.

Ethernet One of the most common local area network (LAN) wiring schemes, Ethernet has a transmission rate of 10, 100, or 1000 Mbps.

H

host key Combination of port bundle and SSG source IP address that uniquely identifies a subscriber.

I

Internet Protocol (IP) The network layer protocol for the Internet protocol suite.

ISP Internet service provider. A company that allows home and corporate users to connect to the Internet.

M

mini-ACL Access control list (ACL) with eight or less access control entries (ACEs). ACLs with more than eight entries are referred to as turbo ACLs.

Modular QoS Command-line interface See MQC.

MQC Modular QoS Command-line interface. Also referred to as Modular CLI. A platform independent CLI for configuring QoS features on Cisco products.

multicast Single packets copied by the network and sent to a specific subset of network addresses. These addresses are specified in the Destination Address Field.

O

OAP Overlapping Address Pool. An IP address group that supports multiple IP address spaces and still allows for the verification of nonoverlapping IP address pools within a pool group.

Open Garden Collection of websites or networks that users can access without having to provide authentication information.

P

permanent virtual circuit — A fixed virtual circuit between two users. The public data network equivalent of a leased line. No call setup or clearing procedures are needed.

point-to-point subinterface — With point-to-point subinterfaces, each pair of routers has its own subnet. If you put the PVC on a point-to-point subinterface, the router assumes that there is only one point-to-point PVC configured on the subinterface. Therefore, any IP packets with a destination IP address in the same subnet are forwarded on this VC. This is the simplest way to configure the mapping and is, therefore, the recommended method.

port — The abstraction used by Internet transport protocols to distinguish among multiple simultaneous connections to a single destination host.

PPP — Point-to-Point Protocol. The successor to SLIP, PPP provides router-to-router and host-to-network connections over both synchronous and asynchronous circuits.

PPPoA — PPP over ATM. Enables a high-capacity central site router with an Asynchronous Transfer Mode (ATM) interface to terminate multiple remote PPP connections.

PPPoE — PPP over Ethernet. Allows a PPP session to be initiated on a simple bridging Ethernet connected client. Refers to a signaling protocol defined within PPPoE as well as the encapsulation method. See also RFC 2516.

PPPoEoA — PPP over Ethernet over ATM. Allows tunneling and termination of PPP sessions over Ethernet links and allows for Ethernet PPP connections over ATM links.

PPPoEoE — PPP over Ethernet over on Ethernet. Allows tunneling and termination of PPP sessions over Ethernet links and allows for Ethernet PPP connections over Ethernet links.

PPPoEo802.1Q VLAN — PPP over Ethernet over IEEE 802.1Q VLANs. Allows tunneling and termination of Ethernet PPP sessions across VLAN links. IEEE 802.1Q encapsulation is used to interconnect a VLAN-capable router with another VLAN-capable networking device. The packets on the 802.1Q link contain a standard Ethernet frame and the VLAN information associated with that frame.

PPPoX — PPP over PPPoA or PPPoE or both.

PTA — PPP terminated aggregation. A method of aggregating IP traffic by terminating PPP sessions and aggregating the IP traffic into a single routing domain.

PTA-MD — PTA-Multidomain. A method of aggregating IP traffic by terminating PPP sessions and aggregating the IP traffic into a VPN or multiple IP routing domains. For an ISP, the aggregated traffic either remains in the ISP network or routes to the Internet. For a wholesale provider, the aggregated IP traffic is forwarded to different destinations or domains depending on the service selected; thus the term PTA-Multidomain.

PVC — Permanent virtual circuit or connection. Virtual circuit that is permanently established. PVCs save bandwidth associated with circuit establishment and tear down in situations where certain virtual circuits must exist all the time. In ATM terminology, called a permanent virtual connection. Compare with SVC. See also virtual circuit (VC).

PVP Permanent virtual path. Virtual path that consists of PVCs.

PXF Parallel Express Forwarding. Also referred to as *fast forwarder.* A pipelined, multiprocessor parallel packet engine, optimized for fast packet forwarding.

R

RADIUS Remote Authentication Dial-In User Service (RADIUS). A client/server security protocol created by Livingston Enterprises. Security information is stored in a central location, known as the RADIUS server.

RBE Routed bridge encapsulation. The process by which a stub-bridged segment is terminated on a point-to-point routed interface. Specifically, the router is routing on an IEEE 802.3 or Ethernet header carried over a point-to-point protocol such as PPP, RFC 1483 ATM, or RFC 1490 Frame Relay.

S

SESM Subscriber Edge Services Manager (SESM). Successor product to the Cisco SSD. The SESM is part of a Cisco solution that allows subscribers of digital subscriber line (DSL), cable, wireless, and dialup to simultaneously access multiple services provided by different Internet service providers, application service providers, and corporate access servers.

SESM works with the Cisco 10000 router (as the SSG node) to provide subscriber authentication, service selection, and service connection capabilities to subscribers of Internet services. Subscribers interact with the SESM web application using a standard Internet browser. The SESM functionality provides a flexible and convenient graphical user interface (GUI) for subscribers and enables service providers to bill subscribers for connection time and services used, rather than charging a flat rate.

SSD Service Selection Dashboard. The SSD is a customizable web-based application that works with the Cisco SSG to allow end customers to log in to and disconnect from proxy and passthrough services through a standard web browser. After the customer logs in to the service provider's network, an HTML dashboard is populated with the services authorized for that user. See also SESM.

SSG Service Selection Gateway. SSG is a switching solution for service providers who offer intranet, extranet, and Internet connections to subscribers using broadband access technology such as digital subscriber lines (DSL) lines, cable modems, or wireless to allow simultaneous access to network services. SSG provides subscriber authentication, service selection, and service connection capabilities to subscribers of Internet services. SSG provides connectivity to corporate networks and differential service selection to users with access to multiple simultaneous services. Users can dynamically connect to and disconnect from any of the services available to them.

SVC Switched virtual circuit. Virtual circuit that is dynamically established on demand and is torn down when transmission is complete. SVCs are used in situations where data transmission is sporadic. Called a switched virtual connection in ATM terminology. Compare with PVC.

T

TCP Connection-oriented transport layer protocol that provides reliable full-duplex data transmission. TCP is part of the TCP/IP protocol stack.

turbo access control list A function of the PXF pipeline that determines whether a packet matches a list in a fixed, predictable period of time, usually regardless of the number of entries in a list. Turbo ACLs enable more expedient packet classification and access checks when the router is evaluating ACLs. The Turbo ACL feature compiles the ACLs into a set of lookup tables, while maintaining the first match requirements. Packet headers are used to access these tables in a small, fixed number of lookups, independently of the existing number of ACL entries.

V

VC Virtual Circuit. Also referred to as Virtual Channel. Used in ATM applications. A link that seems and behaves like a dedicated point-to-point line or a system that delivers packets in sequence, as happens on an actual point-to-point network. In reality, the data is delivered across a network via the most appropriate route. The sending and receiving devices do not have to be aware of the options and the route is chosen only when a message is sent. There is no pre-arrangement, so each virtual circuit exists only for the duration of that one transmission.

VCI Virtual channel identifier. A 16-bit field in the header of an ATM cell. The VCI, together with the VPI, is used to identify the next destination of a cell as it passes through a series of ATM switches on its way to its destination. ATM switches use the VPI/VCI fields to identify the next network VCL that a cell needs to transmit on its way to its final destination. The function of the VCI is similar to that of the DLCI in Frame Relay.

VLAN Virtual LAN. Group of devices on one or more LANs that are configured (using management software) so that they can communicate as if they were attached to the same wire, when in fact they are located on a number of different LAN segments. Because VLANs are based on logical instead of physical connections, they are extremely flexible.

VPI Virtual path identifier. An 8-bit field in the header of an ATM cell. The VPI, together with the VCI, is used to identify the next destination of a cell as it passes through a series of ATM switches on its way to its destination. ATM switches use the VPI/VCI fields to identify the next VCL that a cell needs to transmit on its way to its final destination. The function of the VPI is similar to that of the DLCI in Frame Relay.

VRF Virtual routing and forwarding instance. A VRF consists of an IP routing table, a derived forwarding table, a set of interfaces that use the forwarding table, and a set of rules and routing protocols that determine what goes into the forwarding table. In general, a VRF includes the routing information that defines a customer VPN site that is attached to a PE router.

VSA Vendor-Specific Attribute. An attribute that has been implemented by a particular vendor. It uses the attribute Vendor-Specific to encapsulate the resulting AV pair: essentially, Vendor-Specific = protocol:attribute = value.

X

xDSL Various types of digital subscriber lines. Examples include ADSL, HDLS, and VDSL.

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