



# Configuring ISG Access for IP Subscriber Sessions

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Intelligent Services Gateway (ISG) is a Cisco IOS software feature set that provides a structured framework in which edge devices can deliver flexible and scalable services to subscribers. ISG supports IP sessions for subscribers who connect to ISG from Layer 2 or routed Layer 3 access networks. This module describes how to configure ISG to bring up IP subscriber sessions, manage subscriber IP addressing, and configure dynamic Virtual Private Network (VPN) selection.



**Note**

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This document assume that network address translation (NAT) is performed on a Layer 3 gateway other than the ISG.

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## Finding Feature Information

Your software release may not support all the features documented in this module. For the latest feature information and caveats, see the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the Feature Information Table at the end of this document.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to [www.cisco.com/go/cfn](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

## Prerequisites for ISG Access for IP Subscriber Sessions

The Dynamic Host Configuration Protocol (DHCP) server must support the DHCP lease protocol.

For ISG to use DHCP to assign IP addresses:

- The subscriber must be Layer 2 connected.
- ISG must be in the path of DHCP requests, serving as a DHCP server or relay.
- The appropriate IP subnets must be configured on the subscriber interface.

## Restrictions for ISG Access for IP Subscriber Sessions

### Overlapping IP Address Restrictions

Overlapping IP addresses in the same virtual routing and forwarding (VRF) instance are not supported.

Overlapping IP subscribers in different VRFs are not supported on the same interface for static IP subscriber sessions and routed IP subscriber sessions. Overlapping IP subscribers in different VRFs are supported on the same interface for Layer 2 connected DHCP subscriber sessions.

### IP Subnet Session Restrictions

IP subnet sessions are not supported on an interface configured with the **ip subscriber l2-connected** command. IP subnet sessions are supported only when the **ip subscriber routed** command is configured on the interface.

### ISG DHCP Restrictions

ISG cannot relay DHCP requests when a Layer 3 DHCP relay agent is between the ISG device and subscriber devices.

DHCP Lease Query supports Cisco 7600 and 7200 series routers and Cisco 10000 series routers.

### Dynamic VPN Selection Restrictions

Dynamic VPN selection is not supported for IP interface sessions, IP subnet sessions, and subscribers coming in on nonglobal VRF interfaces.

Dynamic VPN selection is not supported for subscribers with a static VPN configuration on the access interface.

Dynamic VPN selection with address reassignment is not supported for routed IP subscriber sessions that are initiated by DHCP. IP addresses of routed IP subscribers must be routable in the access network. Because Internet service provider (ISP)- or VRF-owned private addresses could overlap or be unroutable in the network between subscribers and the ISG device, it is not possible to assign IP addresses to those subscribers.

IP interface sessions do not support dynamic VRF; only static VRF is supported. If an interface is configured with the **ip subscriber interface** command, dynamic VRF through a RADIUS VSA is not supported, only static VRF is supported.

### General IP Session Restrictions

Network Address Translation (NAT) configuration is not supported on the access side of ISG.

IP subscriber sessions are not supported on ambiguous IEEE 802.1QinQ (QinQ) or IEEE 802.1Q (Dot1Q) subinterfaces.

IP subscriber sessions are not supported on interfaces that receive Multiprotocol Label Switching (MPLS) packets.

Modular quality of service (QoS) CLI (MQC) shaping and queuing is supported in the egress direction in the default class for IP subscriber sessions.

Configuring features on static IP sessions is not supported.

ISG IP subscriber functionality is not supported on the following types of access interfaces:

- Gigabit EtherChannel (Port Channel)
- Generic routing encapsulation (GRE)
- PPP (virtual-template)
- Layer 2 Tunnel Protocol (L2TP)

Interface statistics are not generated for ISG multiservice interfaces.

Stateful switchover (SSO) and In Service Software Upgrade (ISSU) are not supported for any features on ISG IP subscriber sessions or traffic class sessions. Upon switchover, an IP session must be re-created or restarted (for DHCP sessions) when the session becomes active again.

The following subscriber features are not supported on IPoE sessions:

- Per-session firewall
- Per-session NAT
- Per-session PBR
- Per-session NBAR
- Per-session netflow
- Per-session multicast

The following PPP session features are not supported on IP sessions:

- Session limit per system, VLAN, or MAC
- Dual stack session (single PPP session carrying both IPv4 and IPv6 traffic)
- Packet of Disconnect (PoD)

### Multiservice Interface Restrictions

IP interface features (such as QoS and access lists) are not supported on multiservice interfaces.

Only one multiservice interface can belong to a single VRF. For example, the following configuration will not work:

```
interface multiservice 1
 ip vrf forwarding VRF_A
!
interface multiservice 2
 ip vrf forwarding VRF_A
```

### Cisco 10000 Series Internet Router Restrictions

On the Cisco 10000 series Internet router, ISG does not support IP subscriber sessions that are initiated by RADIUS packets.

IP interface sessions are not supported on ATM main interfaces and ATM multipoint subinterfaces on the Cisco 10000 series Internet router.

IP subscriber sessions and PPP over ATM or PPP over Ethernet (PPPoX) sessions are not supported on the same ATM main interface or subinterface. Either IP subscriber sessions or PPPoX sessions can be configured on ATM main interfaces or subinterfaces at one time.

IP subscriber sessions are not supported on the following interfaces:

- Multilink interfaces
- Tunnel interfaces
- Virtual-template interfaces
- IPsec tunnels

For DHCP-initiated IP sessions, you must explicitly configure access lists to permit DHCP control packets (bootps and bootpc packets). If access lists are not configured to permit DHCP control packets, ISG features that are applied to IP sessions might drop these packets, resulting in unexpected or erroneous ISG behavior. For example, DHCP renew packets, which keep the DHCP-initiated IP session alive, might be dropped by security access lists that are applied to IP sessions.

On the Cisco 10000 series router, unicast Reverse Path Forwarding (uRPF) is not supported in the Parallel eXpress Forwarding (PXF) path if ISG is also configured on the same interface. For example, uRPF is supported in the PXF path with this configuration:

```
interface GigabitEthernet7/0/0
ip address 10.10.10.1 255.255.255.252
ip verify unicast reverse-path
```

However uRPF is not supported in the PXF path with this configuration:

```
interface GigabitEthernet7/0/0
ip address 10.10.10.1 255.255.255.252
ip verify unicast reverse-path
service-policy type control isg-control
ip subscriber routed
initiator unclassified ip-address
```

With this configuration, all IP packets that the router receives whose source IP address does not match an existing ISG IP session are punted to the Cisco 10000 Route Processor (RP) for uRPF processing. This could result in added interrupt-level CPU usage on the Cisco 10000 RP. To prevent IP spoofing issues, consider implementing input Access Control Lists (ACLs) specifying all legitimate IP networks as sources. The Cisco 10000 series router processes input ACLs in the PXF before doing ISG processing.

An access list applied to an ISG interface does not take effect for IP traffic belonging to an existing ISG session until after the ISG session is cleared and reintroduced. Therefore, when applying ACLs to filter traffic on ISG-enabled interfaces, always clear the ISG sessions after the ACL's application.

On the Cisco 10000 series router, existing sessions are terminated when a VRF instance is changed on the access interface.

### Cisco 7600 Router Restrictions

In Cisco IOS Release 12.2(33)SRC, the Cisco 7600 router does not support IP subscriber sessions on the following access interfaces:

- Gigabit EtherChannel (Port Channel)
- Switched virtual interfaces
- Generic routing encapsulation (GRE)
- PPP
- Layer 2 Tunnel Protocol (L2TP)

The shared port adapter interface processor (SIP2) network processor (NWP) does not support IP features configured on access, network, and multiservice interfaces for ISG subscriber traffic.

Subscriber redundancy and load balancing are not supported for IP subscribers.

Beginning in Cisco IOS Release 12.2(33)SRE, the Cisco 7600 router supports IP subscriber sessions only on the SIP400 and ES+ line cards and only on the following interfaces:

- Main interfaces and access-type subinterfaces on the SIP400 line card
- Main interfaces and all types of subinterfaces on the Ethernet Services Plus (ES+) line card
- Port-channel interfaces on the ES+ line card

The Cisco 7600 router enforces limits on the number of IP subscriber sessions per line card and router chassis. If the number of active sessions exceeds the following limits, an error message displays:

- Cisco 7600 chassis--32,000 subscriber sessions (supported in Cisco IOS Release 12.2(33)SRE1 and later releases)
- ES+ line card--4000 subscriber sessions per port group; 16,000 sessions per line card (supported in Cisco IOS Release 12.2(33)SRE and later releases)
- SIP400 line card--8000 subscriber sessions (supported in Cisco IOS Release 12.2(33)SRD4 and later releases)

## Information About ISG Access for IP Subscriber Sessions

- [Types of IP Subscriber Sessions, page 5](#)
- [Coexistence of Multicast and IP Sessions, page 6](#)
- [IP Subscriber Connectivity, page 6](#)
- [IP Subscriber Session Initiation, page 7](#)
- [IP Subscriber Addressing, page 8](#)
- [IP Subscriber Identity, page 10](#)
- [VPN Connectivity and Services for IP Subscribers, page 12](#)
- [IP Session Termination, page 16](#)
- [IP Session Recovery for DHCP-Initiated IP Sessions, page 16](#)
- [Default Services for IP Subscriber Sessions, page 16](#)

## Types of IP Subscriber Sessions

ISG supports the following types of IP subscriber sessions:

- [IP Sessions, page 5](#)
- [IP Interface Sessions, page 6](#)
- [IP Subnet Sessions, page 6](#)

### IP Sessions

An IP session includes all the traffic that is associated with a single subscriber IP address. If the IP address is not unique to the system, other distinguishing characteristics such as a VRF or MAC address form part of the identity of the session. ISG can be configured to create IP sessions upon receipt of DHCP packets, packets with unclassified IP or MAC addresses, or RADIUS packets. See the "IP Subscriber Session Initiation" section for more information.

IP sessions may be hosted for a connected subscriber device (one routing hop from the ISG) or one that is more than one hop from the gateway.

## IP Interface Sessions

An IP interface session includes all IP traffic received on a specific physical or virtual interface. IP interface sessions are provisioned through the CLI; that is, a session is created when the IP interface session commands are entered, and the session is continuous, even when the interface is shut down. By default, IP interface sessions come up in the state “unauthenticated” with full network access.

IP interface sessions might be used in situations in which a subscriber is represented by an interface (with the exception of PPP) and communicates using more than one IP address. For example, a subscriber using routed bridge encapsulation (RBE) access might have a dedicated ATM virtual circuit (VC) to home customer premises equipment (CPE) that is hosting a number of PCs.

## IP Subnet Sessions

An IP subnet session represents all the traffic that is associated with a single IP subnet. IP subnet sessions are used to apply uniform edge processing to packets associated with a particular IP subnet. When an IP subnet session is configured, ISG treats the subnet as a single subscriber, which means that ISG features and functionality are applied to the subnet traffic as an aggregate.

IP subnet sessions are supported for routed IP subscriber traffic.

IP subnet sessions are created the same way as IP sessions, except that when a subscriber is authorized or authenticated and the Framed-IP-Netmask attribute is present in the user or service profile, ISG converts the source-IP-based session into a subnet session with the subnet value in the Framed-IP-Netmask attribute.



### Note

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Where an ingress interface maps to a single subnet, the subnet might be accommodated with an IP interface session. However, if the ISG is more than one hop away from a subscriber, and there is the possibility that multiple subnets are accessible through the same interface, IP subnet sessions may be defined to distinguish the traffic and apply appropriate edge functionality to each subnet.

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## Coexistence of Multicast and IP Sessions

The ISG Session Multicast Coexistence feature introduces the ability to host all the subscribers and services (data and multicast) on the same VLAN by enabling multicast and IP sessions to coexist on the same subinterface for Cisco 7600 series routers. ISG IP sessions are supported on nonaccess-type subinterfaces. In the case of an existing session or even when no session exists, this support helps the multicast traffic to pass through the interfaces configured for the IP sessions in both upstream and downstream directions without creating a session.

## IP Subscriber Connectivity

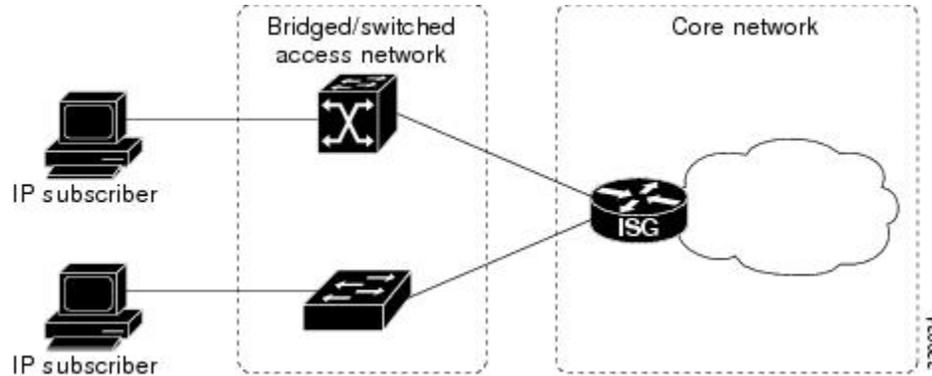
IP subscribers connect to ISG through either Layer 2 connected access networks or routed access networks. The following sections describe these types of IP subscriber connectivity:

- [Layer 2 Connected Access Networks, page 7](#)
- [Routed Access Networks, page 7](#)

## Layer 2 Connected Access Networks

Layer 2 connected subscribers are either directly attached to the physical interfaces of an ISG or connected to an ISG through a Layer 2 access network, such as a bridged or a switched network. Layer 3 forwarding is either absent or not used to direct subscriber traffic in the Layer 2 access network. IP addresses of the subscribers may or may not be on the same subnet as the Layer 2 connected physical interfaces. The figure below shows an example of a Layer 2 connected access network.

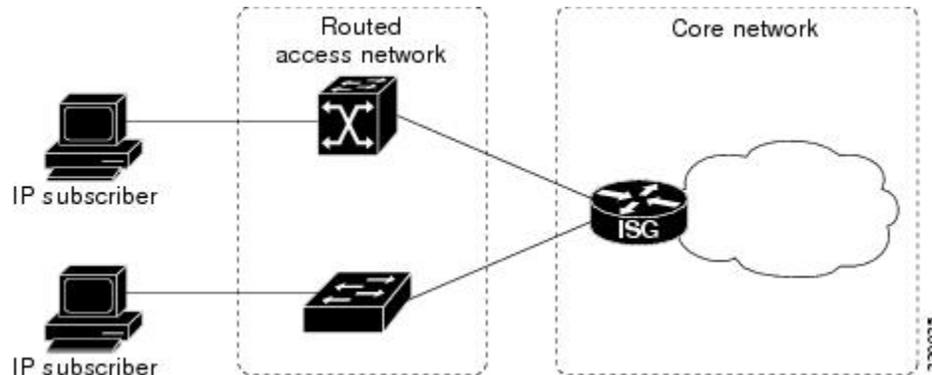
**Figure 1**



## Routed Access Networks

Routed subscriber traffic is routed through a Layer 3 access network with at least one transit router before reaching the ISG. IP addresses of the subscribers are at least routable in the Layer 3 access network. Layer 3 access networks contain a single routing domain and therefore do not support overlapping IP addresses. The figure below shows an example of a routed access network.

**Figure 2**



## IP Subscriber Session Initiation

ISG can be configured to allow one or more of the following events to signal the start of an IP session or IP subnet session on an interface:

- DHCP DISCOVER packet

If the following conditions are met, receipt of a DHCP DISCOVER packet will trigger the creation of an IP session:

- - The ISG serves as a DHCP relay or server for new IP address assignments.
  - Subscribers are configured for DHCP.
  - The DHCP DISCOVER packet is the first DHCP request received from the subscriber.
- Unclassified source IP address

For routed IP subscribers, a new IP session is triggered by the appearance of an IP packet with an unclassified source IP address (which means that an IP session does not yet exist for that IP address).

- Unclassified source MAC address

For Layer 2 connected IP subscribers, a new IP session is triggered by the appearance of an IP packet with an unclassified source MAC address (which means that an IP session does not yet exist for that MAC address).

- RADIUS Access-Request packet

For routed or Layer 2 connected access, a new IP session is triggered by the appearance of a RADIUS Access-Request packet when ISG is serving as a RADIUS proxy.

## IP Subscriber Addressing

The following sections provide information about how ISG handles IP addressing for IP subscribers:

- [Methods of ISG Subscriber IP Address Assignment, page 8](#)
- [Public and Private IP Addresses, page 9](#)
- [Overlapping IP Addresses, page 9](#)
- [ISG Subscriber IP Address Assignment Using DHCP, page 10](#)

### Methods of ISG Subscriber IP Address Assignment

IP subscribers either have IP addresses configured statically or obtain IP addresses dynamically through some network protocol that has the ability to assign IP addresses. For a subscriber to be routable within a given IP service domain, the subscriber must present a domain-specific IP address to the network. If a subscriber transfers between IP service domains (which include any private domain managed by the access provider), the IP address presented to the network must change to reflect the new domain.

The following sections describe the methods of IP address assignment that ISG supports for each type of Layer 3 session:

- [IP Interface Sessions, page 8](#)
- [IP Sessions, page 8](#)
- [IP Subnet Sessions, page 9](#)

#### IP Interface Sessions

For IP interface sessions, ISG is not involved in (or aware of) the assignment of subscriber IP addresses.

#### IP Sessions

For IP sessions, ISG supports the following methods of IP address assignment:

- Static IP addresses

If a subscriber's static IP address is configured correctly for the service domain, ISG does not have to be involved in the assignment of an IP address for the subscriber.

- DHCP

If DHCP is being used to assign IP addresses, and the IP address that is assigned by DHCP is correct for the service domain, ISG does not have to be involved in the assignment of an IP address for the subscriber.

If the IP address that is assigned by DHCP is not correct for the service domain, or if the domain changes because of a VRF transfer, ISG can be configured to influence the DHCP IP address assignment.

The following conditions must be met in order for ISG to influence DHCP IP address assignment:

- - The subscriber must be Layer 2 connected.
  - The ISG device must be in the path of DHCP requests by serving as a DHCP server or relay.
  - Subscribers must not have statically configured IP addresses.

For deployments that support it, DHCP is the recommended method of IP address assignment.

## IP Subnet Sessions

For IP subnet sessions, the IP subnet is specified in the user profile.

## Public and Private IP Addresses

No matter how an IP subscriber is assigned an IP address, the IP address falls in either the public or the private IP address category. If an IP subscriber is assigned with a private IP address and the subscriber has to reach the Internet, a Layer 3 gateway, such as ISG or a firewall, between the subscriber and the Internet must perform Network Address Translation (NAT) for the subscriber's private IP address.

When the access network is a Layer 2 connected network, a subscriber IP address can be either native or foreign to an access interface. A native subscriber IP address is one that belongs to the subnet provisioned on the access interface. A foreign subscriber IP address is one that does not belong to the subnet provisioned on the access interface. A foreign subscriber IP address could result when a retail ISP assigns an IP address to the IP subscriber from its own IP address allotment, which is different from the wholesale ISPs, or when an IP subscriber with a static IP address that is native in the home access network roams to a foreign access network. To support IP subscribers with foreign IP addresses, ISG must be able to respond to Address Resolution Protocol (ARP) requests that originate from foreign IP addresses with a MAC address of the ISG itself. Because the access network is Layer 2 connected, ISG maintains an adjacency to every subscriber.

When the access network is a routed network, a subscriber IP address must be routable in the access network; otherwise, subscriber traffic will never be able to reach ISG. ISG may not have an adjacency for each subscriber in this case, but rather an adjacency of the next hop toward a subscriber. The next hop is determined by the routing process on ISG.

## Overlapping IP Addresses

When an access network is deployed without VPN capability, the IP address space in the access network is shared among all IP subscribers. When the IP addresses are assigned dynamically, care must be taken to ensure that these addresses do not overlap. In cases where overlapping IP addresses are assigned to IP subscribers intentionally, the access network should use a Layer 2 separation mechanism to differentiate the IP address spaces. For example, the access network may put each IP address space in a different VLAN.

In cases in which the access network serves both local IP subscribers and roaming users, the static private IP address of a roaming subscriber may overlap the native private IP address of another subscriber. For

example, a public wireless hot spot that generally assigns dynamic IP addresses might want to provide access to occasional roaming users with statically configured IP addresses. To support this special overlapping condition, all IP subscribers must be in a Layer 2 connected access network in which overlapping MAC addresses do not exist. In this case, IP subscribers can be distinguished using MAC addresses.

## ISG Subscriber IP Address Assignment Using DHCP

When ISG is in the path of DHCP requests (as either a DHCP server or a DHCP relay), ISG can influence the IP address pool and DHCP server that are used to assign subscriber IP addresses. To enable ISG to influence the IP addresses assigned to subscribers, associate a DHCP address pool class with an address domain. The DHCP address pool class must also be configured in a service policy map, service profile, or user profile that is associated with a subscriber. When a DHCP request is received from a subscriber, DHCP uses the address pool class that is associated with the subscriber to determine which DHCP address pool should be used to service the request. As a result, on a per-request basis, an IP address is provided by the local DHCP server or relayed to a remote DHCP server that is defined in the selected pool.

## IP Subscriber Identity

IP subscriber identity is closely related to IP session initiation because ISG must uniquely identify an IP subscriber at the moment that it creates the IP session. However, the need to identify an IP subscriber goes beyond the session initiation phase. The following sections describe how ISG uniquely identifies IP subscribers:

- [Routed IP Subscriber Identity, page 10](#)
- [MAC Address as Secondary Identity, page 11](#)
- [DHCP Lease Query Support, page 11](#)
- [Layer 2 Connected IP Subscriber Identity, page 11](#)
- [Interface IP Subscriber Identity, page 11](#)

## Routed IP Subscriber Identity

If the access network is a routed network, subscriber IP addresses can be used to uniquely identify IP subscribers because by definition subscriber IP addresses are at least routable in the access network.

When using a subscriber IP address as the identifier, ISG assumes that the subscriber IP address is unique. If the access network is deployed with Layer 3 load balancing, redundancy, or asymmetric routing, ISG also assumes that IP traffic from the same IP subscriber may arrive at different access interfaces. To support this type of deployment, ISG assumes a single IP address space for all the access interfaces connecting to the same access network.

If there is a requirement to support several IP address spaces over a single physical access network, the access network must use some Layer 2 encapsulation to create a separate logical access network for each IP address space. In this case, ISG can still have a single IP address space for all the logical access interfaces that connect to a logical access network.

When subscriber IP addresses are private IP addresses, the access network must be able to route such subscriber traffic. If the subscriber traffic is destined to the Internet, NAT must be performed.

For routed IP subscribers, the subscriber IP address serves as the key for an IP session. ISG associates IP traffic with an IP session as follows:

- In the upstream direction, the source IP address of an IP packet is used to identify the IP session. The source IP address is the subscriber IP address.

- In the downstream direction, the destination IP address of an IP packet is used to identify the IP session. The destination IP address is the subscriber IP address.

If the IP subscriber is a VPN user, the subscriber IP address must be routable in both the global routing table and the VPN routing table on the ISG.

In the case of an IP subnet subscriber, a subscriber IP address is defined as an IP prefix address instead of a /32 IP host address. This IP prefix covers a range of IP addresses used by end users but represents a single logical IP subscriber from the ISG point of view. In this deployment, all end users share the same connectivity and services provided by the ISG.

To normalize the classification of IP subscribers that have different network masks, ISG uses the network mask in conjunction with the subscriber IP address for routed IP subscribers.

## MAC Address as Secondary Identity

You must configure the **collect identifier mac-address** command at the start of a session. This instructs the ISG devices to store the MAC address as part of the session identifiers. For routed IP subscriber sessions, the MAC address is collected from the DHCP server using the DHCP Lease Query Protocol. For information about configuring the command, see the "Configuring ISG Control Policies" module.

## DHCP Lease Query Support

The DHCP Lease Query message is a DHCP message type transmitted from a DHCP relay agent to a DHCP server. A DHCP Lease Query-aware relay agent sends the location of an IP endpoint to the DHCP Lease Query message.

The DHCP Lease Query transaction is a DHCP transaction with special message types that enable clients to query DHCP servers regarding the owner and the lease expiration time of an IP address. For information about configuring DHCP server for Lease Query, see the "Configuring a DHCP Server IP Address" section.

## Layer 2 Connected IP Subscriber Identity

A Layer 2 connected access network is capable of providing IP connectivity to IP subscribers with foreign and overlapping IP addresses, in addition to IP subscribers with native IP addresses. Because subscriber IP addresses might not be unique in such an access network, ISG uses the subscriber MAC address to identify Layer 2 connected IP subscribers, regardless of what kind of IP address a subscriber has.

Traffic that comes from IP subscribers with private or overlapping IP addresses and that is destined to the Internet is subject to NAT.

For Layer 2 connected IP subscribers, both the subscriber MAC address (unique within a VLAN) and the IP address serve as the keys for the IP session, but they are used in different directions:

- In the upstream direction, the VLAN ID and source MAC address of an IP packet are used to identify the IP session.
- In the downstream direction, both the destination IP address and the VLAN ID of an IP packet are used to identify the IP subscriber context.

## Interface IP Subscriber Identity

When access interfaces are used to identify IP subscribers, each access interface corresponds to a single IP subscriber. As soon as the access interface becomes available, ISG creates an IP session using the interface as the key, and associates all IP traffic coming in and going out of this interface with the IP session.

To accurately associate IP traffic with an IP subscriber, ISG must be configured to use interfaces as the method of IP subscriber identification. ISG will then classify IP traffic as follows:

- When receiving IP traffic from the access network (upstream direction), ISG uses the input interface to identify the IP session.
- When receiving IP traffic from the core network (downstream direction), ISG uses the output interface to identify the IP session.

## VPN Connectivity and Services for IP Subscribers

- [Subscriber VPN Membership, page 12](#)
- [Multiservice Interface Model, page 12](#)
- [VPN Addressing, page 13](#)
- [VPN IP Subscriber Identity, page 13](#)
- [Service Model for VRF Transfers, page 13](#)
- [Benefits of Dynamic VPN Selection, page 14](#)
- [VRF-Aware Support for CoA Clients, page 14](#)

### Subscriber VPN Membership

Depending on deployment requirements, an IP subscriber may or may not have VPN service. If an IP subscriber does have VPN service, the subscriber may belong to only one VPN domain at any time. An IP subscriber is associated with a VPN domain in one of the following ways:

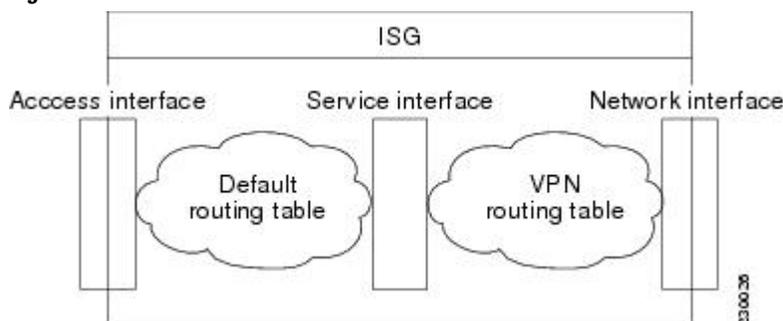
- **Static VPN assignment**--The VPN IP subscriber belongs to a static VPN domain. Whenever the IP subscriber connects to ISG, the IP subscriber is placed in the preassigned VPN domain.
- **Dynamic VPN selection**--The VPN IP subscriber can choose and switch among different VPN domains through dynamic service logon. Whenever a new VPN domain is selected, VPN services of the current VPN domain must be removed before VPN services of the new VPN domain can be applied to the IP subscriber.

Dynamic VPN selection can be initiated through automatic service logon, where the VRF is downloaded and applied to the subscriber session at session start, or through subscriber service selection at a web portal, in which case the subscriber is transferred to the VRF that corresponds to the selected service.

### Multiservice Interface Model

For a subscriber without a static VPN configuration, a multiservice interface must be configured on the ISG device to map the IP session to a VRF. The multiservice interface represents a boundary between a VPN routing domain and the default routing domain. In cases where an IP subscriber may be associated with several routing domains throughout the duration of a connection, multiservice interfaces serve as demarcation points for the IP subscriber to switch from one VPN domain to another. One multiservice interface must be configured for each VPN routing domain. The figure below illustrates the multiservice interface model.

**Figure 3**



## VPN Addressing

When a subscriber session is transferred from one VPN domain to another, it is effectively entering a new addressing domain that may or may not overlap the subscriber's previous domain. The subscriber's network-facing address must be altered accordingly so that packets can be correctly routed back from within the service domain.

A VRF transfer is necessary when a subscriber's identity and subscribed services cannot be determined without interaction with a web portal. A local routing context is required, at least initially, so that IP packets may be routed to and from the portal server. Following portal-based service selection, the subscriber would typically have to be transferred into the VRF associated with the selected service domain. Following a VRF transfer, the subscriber must also receive an address that is routable in this new domain.

If ISG is adjacent to the subscriber device and serves as a DHCP relay or server, DHCP can be used to assign domain-specific addresses to subscribers.

In order for VRF transfers to be supported, it is strongly recommended that DHCP be configured with short initial leases (this is because existing subscriber addresses can only be altered once the current lease has expired). Subscribers will not have access to the selected domain before the next DHCP renew request is received. Using short initial lease times minimizes the interval between a VRF change and a DHCP renewal. If long lease times are used, an out-of-band method of initiating IP address change should be implemented.

When DHCP can be used to assign a new address at the subscriber device, subnet-based VRF selection can be used to bring about the transfer. Subnet-based VRF selection (also known as *VRF autotclassify*) is a feature that selects the VRF at the ingress port on the basis of the source IP subnet address.

Service providers and organizations have allocated public IP address blocks that are not overlapping by nature. Therefore, when they are assigned public IP addresses, VPN IP subscribers have no overlapping IP addresses. When VPN IP subscribers of different VPN domains have private IP addresses assigned, they are likely to have overlapping addresses in the access network.

An access network is a single IP address space when there is no Layer 2 encapsulation separating VPN IP subscribers of different VPN domains. Therefore, ISG must be able to handle overlapping IP addresses when deploying VPN IP subscribers. IP connectivity for VPN IP subscribers with overlapping IP addresses is possible only when they are connected to ISG through a Layer 2 connected access network.

## VPN IP Subscriber Identity

ISG identifies VPN IP subscribers in the same way that it identifies non-VPN IP subscribers. Upstream IP traffic is defined as the subscriber IP traffic traveling from the access network to the VPN (overlaid on top of the service provider core network). Downstream IP traffic is defined as the subscriber IP traffic traveling from the VPN to the access network.

## Service Model for VRF Transfers

A *primary* service is a service that contains a network-forwarding policy (such as a VRF) in its service definition. Only one primary service at a time can be activated for a session. A *secondary* service is any service that does not contain a network-forwarding policy.

When a subscriber for whom a primary service has already been activated tries to select another primary service, ISG will deactivate all current services (including the current primary service) and activate the new primary service, and hence switch the VRF.

When a subscriber for whom a primary service has already been activated tries to select a secondary service, the action taken by ISG depends on whether the secondary service is part of a service group. A

*service group* is a grouping of services that may be simultaneously active for a given session. Typically, a service group includes one primary service and one or more secondary services. The table below describes the action that ISG will take when a subscriber selects a secondary service.

**Table 1** *ISG Activation Policy for Secondary Services*

Primary Service Characteristics	Secondary Service Characteristics	Resulting Behavior at ISG
Primary service with no service group attribute	Secondary service with service group	Do not bring up the secondary service.
	Secondary service with no service group	Bring up the secondary service.
Primary service with service group attribute	Secondary service with different service group	Do not bring up the secondary service.
	Secondary service with same service group	Bring up the secondary service.
	Secondary service with no service group	Bring up the secondary service.

## Benefits of Dynamic VPN Selection

The need for switching of a subscriber session between routing and forwarding domains (also called *network services*) occurs frequently in markets where so-called *equal access networking* must be supported. Equal access networking is often mandated by regulatory rules stating that an access provider should allow service providers equal access to a retail subscriber network. ISG dynamic VPN selection facilitates equal access networking by allowing subscribers to transfer between network services.

## VRF-Aware Support for CoA Clients

- ISG supports VRF-aware capabilities for CoA clients (RADIUS server), allowing one CoA client to accommodate subscribers in multiple VRFs. Subscriber sessions can be in a different VRF than where the CoA client is configured. To send a CoA message to ISG if the IP subscriber session is in a different VRF, the session identifier must use the vendor-specific attribute (VSA) format shown in the table below.

**Table 2** VRF ID VSA Description

Sub-AttrID	Attribute Type	Value	Example
250	account-info	S<subscriber-ip-address [:vrf-id=vrf-name ]> <ul style="list-style-type: none"> <li>• S--Code for subscriber IP</li> <li>• vrf-name --VRF where the Network access server (NAS) will look up the subscriber IP address.</li> </ul>	Cisco-Account-Info=S10.0.0.3:vrf-id=subscriber_VRF1

The following example shows the VRF configuration:

### RADIUS user profile

```

simulator radius subscriber 401
authentication smith pap smith
vsa cisco 250 S10.0.0.3:vrf-id=subscriber_VRF1
vsa cisco generic 252 binary 015042484b

```

The lookup of the subscriber session is based on the method of providing the VRF. The order of precedence in determining which VRF to use to look up the subscriber IP address is as follows:

- 1 VRF present in CoA message as part of session-identifier
- 2 VRF present in client configuration.
- 3 VRF to which the CoA client belongs

The table below shows the expected behavior when the client sends the CoA message to the server.

**Table 3** Expected Behavior Using vrf-id Attribute

If vrf-id is present in...	Then the lookup of the subscriber IP address is done within this VRF	
CoA Message	CoA Client Configuration	
Yes	Yes	VRF in CoA message
Yes	No	VRF in CoA message
No	Yes	VRF in client configuration
No	No	VRF in the configuration of the interface facing the client
vrf-id=global	No	VRF in global routing table on server

## IP Session Termination

An IP session may be terminated in one of the following ways:

- DHCP Lease Expiry or DHCP Release from client

If DHCP is used to detect a new session, its departure may also be signaled by a DHCP event.

- Application stop

An application command that is used to terminate a session. The **application stop** command is typically used to terminate a session when a subscriber initiates an account logoff from a web portal. An application stop may also result from the actions of an administrator, such as action taken in response to rogue behavior from a subscriber.

- Idle timeout and session timeout

Idle timeouts and session timeouts can be used to detect or impose termination of an IP session.

- Control policy

A control policy containing the “service disconnect” action can be used to terminate a session.

## IP Session Recovery for DHCP-Initiated IP Sessions

When an IP session is terminated (for example, by account logoff or session timeout) or lost (for example, by router reload), the client may continue to hold an unexpired DHCP lease. When this happens, ISG performs a session restart to prevent the client’s IP connection from being stuck until the DHCP lease expires. A control policy can be configured to define the actions that ISG will take when the session restart event occurs. If a policy is not defined, a default policy will take effect. The default policy causes ISG to disconnect the session after 60 seconds following a session restart and is the equivalent of the following configuration:

```
policy-map type control GLOBAL
  class type control always event session-restart
    1 service disconnect delay 60
```

This default policy appears in the output for the **show subscriber policy rules** command as follows:

```
Rule: internal-rule-session-restart
Class-map: always event session-restart
  Action: 1 service disconnect delay 60
Executed: 0
```

## Default Services for IP Subscriber Sessions

Newly created IP sessions may require a default service to allow subsequent subscriber packets to be processed appropriately; for example, to permit or force TCP packets to a captive portal where menu-driven authentication and service selection can be performed. A default service policy map or service profile may be configured for IP sessions to redirect traffic, enable port-bundle host-key functionality for session identification, or enable transparent autologon. A default service would also likely include a network service, which allows subscribers to access a web portal for authentication and service selection.

# How to Configure ISG for IP Subscriber Sessions

- [Creating ISG Sessions for IP Subscribers](#), page 17
- [Managing ISG Subscriber IP Addresses Using DHCP](#), page 33
- [Configuring ISG Dynamic VPN Selection](#), page 40
- [What to Do Next](#), page 46

## Creating ISG Sessions for IP Subscribers

An ISG creates IP sessions for IP traffic on subscriber-side interfaces.

**Note**

For the Cisco 7600 router, ISG IP sessions can be configured on both access and nonaccess subinterfaces.

The following tasks enable IP sessions on an interface and indicate how sessions will be identified:

- [Creating IP Subscriber Sessions for Routed ISG Subscribers](#), page 17
- [Creating IP Subscriber Sessions for Layer 2 Connected ISG Subscribers](#), page 19
- [Creating ISG IP Interface Sessions](#), page 22
- [Creating an ISG Static Session](#), page 23
- [Creating ISG IP Subnet Sessions](#), page 26
- [Configuring IP Session Recovery for DHCP-Initiated IP Sessions](#), page 29
- [Verifying ISG IP Subscriber Sessions](#), page 30
- [Clearing ISG IP Subscriber Sessions](#), page 31
- [Troubleshooting Tips](#), page 32

## Creating IP Subscriber Sessions for Routed ISG Subscribers

Routed IP subscribers are subscribers that are routed through a Layer 3 access network with at least one transit router before reaching the ISG. Perform this task to configure ISG to create IP sessions for routed IP subscribers.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Do one of the following:
  - **interface** *type number*
  - or
  - **interface** *type number access*
4. **ip subscriber routed**
5. **initiator** { **dhcp** [**class-aware**] | **radius-proxy** | **unclassified ip-address** }
6. **end**

## DETAILED STEPS

Command or Action	Purpose
<p><b>Step 1</b> <code>enable</code></p> <p><b>Example:</b></p> <pre>Router&gt; enable</pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<p><b>Step 2</b> <code>configure terminal</code></p> <p><b>Example:</b></p> <pre>Router# configure terminal</pre>	<p>Enters global configuration mode.</p>
<p><b>Step 3</b> Do one of the following:</p> <ul style="list-style-type: none"> <li>• <code>interface type number</code></li> <li>• or</li> <li>• <code>interface type number access</code></li> </ul> <p><b>Example:</b></p> <pre>Router(config)# interface GigabitEthernet 1/0/0</pre> <p><b>Example:</b></p> <pre>Router(config)# interface GigabitEthernet 1/0/0.100 access</pre>	<p>Specifies an interface and enters interface configuration mode.</p> <ul style="list-style-type: none"> <li>• <code>access</code> --Specifies a subinterface.</li> </ul>
<p><b>Step 4</b> <code>ip subscriber routed</code></p> <p><b>Example:</b></p> <pre>Router(config-if)# ip subscriber routed</pre>	<p>Specifies the type of IP subscriber to be hosted on the interface, and enters ISG IP subscriber configuration mode.</p>

Command or Action	Purpose
<p><b>Step 5</b> <b>initiator</b> { <b>dhcp</b> [<b>class-aware</b>]   <b>radius-proxy</b>   <b>unclassified ip-address</b> }</p> <p><b>Example:</b></p> <pre>Router(config-subscriber)# initiator dhcp class-aware</pre>	<p>Configures ISG to create an IP subscriber session upon receipt of the specified packet type.</p> <ul style="list-style-type: none"> <li>• <b>dhcp</b> --ISG will initiate an IP session upon receipt of a DHCP DISCOVER packet. The <b>class-aware</b> keyword allows ISG to influence the IP address assigned by DHCP by providing DHCP with a class name.</li> <li>• <b>radius-proxy</b> --ISG will initiate an IP session upon receipt of a RADIUS Access-Request packet.</li> </ul> <p><b>Note</b> The RADIUS proxy feature is not supported on the Cisco 7600 router.</p> <ul style="list-style-type: none"> <li>• <b>unclassified ip-address</b> --ISG will initiate an IP session upon receipt of the first IP packet with an unclassified IP source address.</li> <li>• This command can be entered more than once to specify more than one method of IP session initiation.</li> </ul> <p><b>Note</b> If the ISG device serves as either a DHCP relay or DHCP server in the assignment of client IP addresses, ISG must be configured to initiate IP sessions upon receipt of DHCP DISCOVER packets. In other words, the <b>initiator dhcp</b> command must be configured instead of the <b>initiator unclassified ip</b> or <b>initiator unclassified mac</b> command.</p>
<p><b>Step 6</b> <b>end</b></p> <p><b>Example:</b></p> <pre>Router(config-subscriber)# end</pre>	<p>(Optional) Returns to privileged EXEC mode.</p>

## Creating IP Subscriber Sessions for Layer 2 Connected ISG Subscribers

Layer 2 connected subscribers are either directly attached to the physical interfaces of an ISG or connected to an ISG through a Layer 2 access network, such as a bridged network or a switched network. Perform this task to configure ISG to create IP sessions for Layer 2 connected IP subscribers.

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. Do one of the following:
  - **interface** *type number*
  - or
  - **interface** *type number access*
4. **ip subscriber l2-connected**
5. **initiator {dhcp [class-aware] | radius-proxy | unclassified mac-address}**
6. **arp ignore local**
7. **end**

**DETAILED STEPS**

Command or Action	Purpose
<b>Step 1 enable</b>  <b>Example:</b>  Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2 configure terminal</b>  <b>Example:</b>  Router# configure terminal	Enters global configuration mode.

Command or Action	Purpose
<p><b>Step 3</b> Do one of the following:</p> <ul style="list-style-type: none"> <li>• <b>interface</b> <i>type number</i></li> <li>• or</li> <li>• <b>interface</b> <i>type number access</i></li> </ul> <p><b>Example:</b></p> <pre>Router(config)# interface GigabitEthernet 1/0/0</pre> <p><b>Example:</b></p> <pre>Router(config)# interface GigabitEthernet 1/0/0.100 access</pre>	<p>Specifies an interface and enters interface configuration mode.</p> <ul style="list-style-type: none"> <li>• <b>access</b> --Specifies a subinterface.</li> </ul>
<p><b>Step 4</b> <b>ip subscriber l2-connected</b></p> <p><b>Example:</b></p> <pre>Router(config-if)# ip subscriber l2- connected</pre>	<p>Specifies the type of IP subscriber to be hosted on the interface, and enters ISG IP subscriber configuration mode.</p> <p><b>Note</b> It is recommended that you configure IP sessions for Layer 2 connected subscribers by using the <b>ip subscriber l2-connected</b> command. You can also use the <b>ip subscriber routed</b> command if subscriber IP addresses are routable in the access domain.</p>

Command or Action	Purpose
<p><b>Step 5</b> <b>initiator {dhcp [class-aware]   radius-proxy   unclassified mac-address}</b></p> <p><b>Example:</b></p> <pre>Router(config-subscriber)# initiator unclassified mac-address</pre>	<p>Configures ISG to create an IP subscriber session upon receipt of the specified packet type.</p> <ul style="list-style-type: none"> <li>• <b>dhcp</b> --ISG initiates an IP session upon receipt of a DHCP DISCOVER packet. The <b>class-aware</b> keyword is required when using the <b>dhcp</b> keyword.</li> <li>• <b>radius-proxy</b> --ISG initiates an IP session upon receipt of a RADIUS packet.</li> </ul> <p><b>Note</b> The RADIUS proxy feature is not supported on the Cisco 7600 router.</p> <ul style="list-style-type: none"> <li>• <b>unclassified mac-address</b> --ISG will initiate an IP session upon receipt of the first IP packet with an unclassified MAC source address.</li> <li>• This command can be entered more than once to specify more than one method of IP session initiation.</li> </ul> <p><b>Note</b> If the ISG device serves as either a DHCP relay or DHCP server in assigning client IP addresses, ISG must be configured to initiate IP sessions upon receipt of DHCP DISCOVER packets. In other words, the <b>initiator dhcp</b> command must be configured instead of the <b>initiator unclassified ip</b> or <b>initiator unclassified mac</b> command.</p>
<p><b>Step 6</b> <b>arp ignore local</b></p> <p><b>Example:</b></p> <pre>Router(config-subscriber)# arp ignore local</pre>	<p>(Optional) Prevents ISG from replying to incoming Address Resolution Protocol (ARP) requests for destinations on the same interface.</p>
<p><b>Step 7</b> <b>end</b></p> <p><b>Example:</b></p> <pre>Router(config-subscriber)# end</pre>	<p>(Optional) Returns to privileged EXEC mode.</p>

## Creating ISG IP Interface Sessions

An ISG IP interface session encompasses all IP packets that cross the specified interface or subinterface. Perform this task to create an ISG IP interface session.

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. **interface** *type number* [*. subinterface-number*]
4. **ip subscriber interface**
5. **end**

**DETAILED STEPS**

Command or Action	Purpose
<b>Step 1</b> <b>enable</b>  <b>Example:</b> <pre>Router&gt; enable</pre>	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b> <b>configure terminal</b>  <b>Example:</b> <pre>Router# configure terminal</pre>	Enters global configuration mode.
<b>Step 3</b> <b>interface</b> <i>type number</i> [ <i>. subinterface-number</i> ]  <b>Example:</b> <pre>Router(config)# interface ethernet 0/0.1</pre>	Specifies an interface or subinterface and enters interface configuration mode.
<b>Step 4</b> <b>ip subscriber interface</b>  <b>Example:</b> <pre>Router(config-if)# ip subscriber interface</pre>	Specifies the type of IP subscriber to be hosted on the interface.
<b>Step 5</b> <b>end</b>  <b>Example:</b> <pre>Router(config-if)# exit</pre>	(Optional) Returns to privileged EXEC mode.

**Creating an ISG Static Session**

The ISG Static Session Creation feature enables administrator-initiated static IP sessions. An ISG static session enables you to configure static IP sessions from the CLI. You can create static IP sessions by configuring a group of server addresses.

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. **ip subscriber list** *list-name*
4. Do one of the following:
  - **ip source** *ipaddress mac macaddress*
  - 
  - **ip source** *ipaddress mask subnetmask*
5. **exit**
6. Do one of the following:
  - **interface** *type number*
  - 
  - **interface** *type number access*
7. Do one of the following:
  - **ip subscriber l2-connected**
  - 
  - **ip subscriber routed**
8. **initiator static ip subscriber list list-name**
9. **end**

**DETAILED STEPS**

	<b>Command or Action</b>	<b>Purpose</b>
<b>Step 1</b>	<b>enable</b>  <b>Example:</b> Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b>	<b>configure terminal</b>  <b>Example:</b> Router# configure terminal	Enters global configuration mode.
<b>Step 3</b>	<b>ip subscriber list</b> <i>list-name</i>  <b>Example:</b> Router(config)# ip subscriber list mylist	Specifies the IP subscriber list name and enters server list configuration mode.

Command or Action	Purpose
<p><b>Step 4</b> Do one of the following:</p> <ul style="list-style-type: none"> <li>• <b>ip source</b> <i>ipaddress</i> <b>mac</b> <i>macaddress</i></li> <li>•</li> <li>• <b>ip source</b> <i>ipaddress</i> <b>mask</b> <i>subnetmask</i></li> </ul> <p><b>Example:</b></p> <pre>Router(config-server-list)# ip source 209.165.200.225 mac 0.7.f</pre> <p><b>Example:</b></p> <p><b>Example:</b></p> <pre>Router(config-server-list)# ip source 209.165.200.225 mask 255.255.255.224</pre>	<p>Specifies the static server IP address and MAC address (in the case of L2-connected) or subnet mask (in the case of routed).</p>
<p><b>Step 5</b> <b>exit</b></p> <p><b>Example:</b></p> <pre>Router(config-server-list)# exit</pre>	<p>Returns to global configuration mode.</p>
<p><b>Step 6</b> Do one of the following:</p> <ul style="list-style-type: none"> <li>• <b>interface</b> <i>type number</i></li> <li>•</li> <li>• <b>interface</b> <i>type number</i> <b>access</b></li> </ul> <p><b>Example:</b></p> <pre>Router(config)# interface GigabitEthernet 1/0/0</pre> <p><b>Example:</b></p> <p><b>Example:</b></p> <pre>Router(config)# interface GigabitEthernet 1/0/0.100 access</pre>	<p>Specifies an interface and enters interface configuration mode.</p> <ul style="list-style-type: none"> <li>• <b>access</b> --Specifies a subinterface.</li> </ul>

Command or Action	Purpose
<p><b>Step 7</b> Do one of the following:</p> <ul style="list-style-type: none"> <li>• <b>ip subscriber l2-connected</b></li> <li>•</li> <li>• <b>ip subscriber routed</b></li> </ul> <p><b>Example:</b></p> <pre>Router(config-if)# ip subscriber l2-connected</pre> <p><b>Example:</b></p> <p><b>Example:</b></p> <pre>Router(config-if)# ip subscriber routed</pre>	<p>Specifies the type of IP subscriber to be hosted on the interface and enters ISG IP subscriber configuration mode.</p> <p><b>Note</b> It is recommended that you configure IP sessions for Layer 2 connected subscribers by using the <b>ip subscriber l2-connected</b> command. However, you can also use the <b>ip subscriber routed</b> command if subscriber IP addresses are routable in the access domain.</p>
<p><b>Step 8</b> <b>initiator static ip subscriber list list-name</b></p> <p><b>Example:</b></p> <pre>Router(config-subscriber)# initiator static ip subscriber list mylist</pre>	<p>Creates an IP subscriber session with the packet type as static and attaches the session to the list.</p>
<p><b>Step 9</b> <b>end</b></p> <p><b>Example:</b></p> <pre>Router(config-subscriber)# end</pre>	<p>(Optional) Returns to privileged EXEC mode.</p>

## Creating ISG IP Subnet Sessions

An IP subnet session represents all the traffic that is associated with a single IP subnet. IP subnet sessions are used to apply uniform edge processing to packets associated with a particular IP subnet. When an IP subnet session is configured, ISG treats the subnet as a single subscriber, which means that ISG features and functionality are applied to the subnet traffic as an aggregate. Perform this task to configure an IP subnet session.

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. Do one of the following:
  - **interface** *type number*
  - or
  - **interface** *type number access*
4. **ip subscriber routed**
5. **initiator unclassified ip-address**
6. **end**
7. Add the Framed-IP-Netmask attribute to the service or user profile.

**DETAILED STEPS**

Command or Action	Purpose
<p><b>Step 1</b> <b>enable</b></p> <p><b>Example:</b></p> <pre>Router&gt; enable</pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<p><b>Step 2</b> <b>configure terminal</b></p> <p><b>Example:</b></p> <pre>Router# configure terminal</pre>	<p>Enters global configuration mode.</p>

Command or Action	Purpose
<p><b>Step 3</b> Do one of the following:</p> <ul style="list-style-type: none"> <li>• <b>interface</b> <i>type number</i></li> <li>• or</li> <li>• <b>interface</b> <i>type number access</i></li> </ul> <p><b>Example:</b></p> <pre>Router(config)# interface GigabitEthernet 1/0/0</pre> <p><b>Example:</b></p> <p><b>Example:</b></p> <pre>Router(config)# interface GigabitEthernet 1/0/0.100 access</pre>	<p>Specifies an interface and enters interface configuration mode.</p> <ul style="list-style-type: none"> <li>• <b>access</b> --Specifies a subinterface.</li> </ul>
<p><b>Step 4</b> <b>ip subscriber routed</b></p> <p><b>Example:</b></p> <pre>Router(config-if)# ip subscriber routed</pre>	<p>Specifies the type of IP subscriber to be hosted on the interface, and enters ISG IP subscriber configuration mode.</p>
<p><b>Step 5</b> <b>initiator unclassified ip-address</b></p> <p><b>Example:</b></p> <pre>Router(config-subscriber)# initiator unclassified ip-address</pre>	<p>Configures ISG to create an IP subscriber session upon receipt of an IP packet with an unclassified IP source address.</p>
<p><b>Step 6</b> <b>end</b></p> <p><b>Example:</b></p> <pre>Router(config-subscriber)# end</pre>	<p>(Optional) Returns to privileged EXEC mode.</p>
<p><b>Step 7</b> Add the Framed-IP-Netmask attribute to the service or user profile.</p>	<p>Enables an IP subnet session for the subscriber.</p> <ul style="list-style-type: none"> <li>• When a subscriber is authorized or authenticated and the Framed-IP-Netmask attribute is present in the user or service profile, ISG converts the source-IP-based session into a subnet session with the subnet value in the Framed-IP-Netmask attribute.</li> </ul>

## Configuring IP Session Recovery for DHCP-Initiated IP Sessions

Perform this task to configure ISG to perform specific actions upon recovery of an IP session after ISG has terminated the session or reloaded. This task applies to DHCP-initiated IP sessions only.

If a policy for session recovery is not configured, ISG will apply the following default policy:

```
policy-map type control GLOBAL
  class type control always event session-restart
    1 service disconnect delay 60
```

### SUMMARY STEPS

1. enable
2. configure terminal
3. policy-map type control *policy-map-name*
4. class type control {*control-class-name* | always} event session-restart
5. *action-number* authorize [aaa list *list-name*] [password *password*] [upon network-service-found {continue | stop}] identifier {authenticated-domain | authenticated-username | auto-detect | circuit-id [plus remote-id] | dnis | mac-address | nas-port | remote-id [plus circuit-id] | source-ip-address | tunnel-name | unauthenticated-domain | unauthenticated-username}
6. *action-number* service-policy type service [unapply] [aaa list *list-name*] {name *service-name* | identifier {authenticated-domain | authenticated-username | dnis | nas-port | tunnel-name | unauthenticated-domain | unauthenticated-username}}
7. *action-number* set-timer *name-of-timer* *minutes*
8. end

### DETAILED STEPS

Command or Action	Purpose
<b>Step 1</b> enable  <b>Example:</b> Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b> configure terminal  <b>Example:</b> Router# configure terminal	Enters global configuration mode.
<b>Step 3</b> policy-map type control <i>policy-map-name</i>  <b>Example:</b> Router(config)# policy-map type control MY-POLICY	Creates or modifies a control policy map, which is used to define a control policy, and enters control policy map configuration mode.

Command or Action	Purpose
<p><b>Step 4</b> <code>class type control {control-class-name   always} event session-restart</code></p> <p><b>Example:</b></p> <pre>Router(config-control-policymap)# class type control always event session-restart</pre>	<p>Specifies a control class that will be evaluated when the session-restart event occurs, and enters policy map class control configuration mode.</p> <ul style="list-style-type: none"> <li>A policy rule for which the control class is <b>always</b> will always be treated as the lowest priority rule within the control policy map.</li> </ul>
<p><b>Step 5</b> <code>action-number authorize [aaa list list-name] [password password] [upon network-service-found {continue   stop}] identifier {authenticated-domain   authenticated-username   auto-detect   circuit-id [plus remote-id]   dnis   mac-address   nas-port   remote-id [plus circuit-id]   source-ip-address   tunnel-name   unauthenticated-domain   unauthenticated-username}</code></p> <p><b>Example:</b></p> <pre>Router(config-control-policymap-class-control)# 1 authorize identifier source-ip-address</pre>	<p>(Optional) Initiates a request for authorization on the basis of the specified identifier.</p>
<p><b>Step 6</b> <code>action-number service-policy type service [unapply] [aaa list list-name] {name service-name   identifier {authenticated-domain   authenticated-username   dnis   nas-port   tunnel-name   unauthenticated-domain   unauthenticated-username}}</code></p> <p><b>Example:</b></p> <pre>Router(config-control-policymap-class-control)# 1 service-policy type service aaa list LISTA name REDIRECT</pre>	<p>(Optional) Activates an ISG service.</p> <ul style="list-style-type: none"> <li>Specifying an identifier instead of a service name will activate a service that has the same name as the specified identifier.</li> </ul>
<p><b>Step 7</b> <code>action-number set-timer name-of-timer minutes</code></p> <p><b>Example:</b></p> <pre>Router(config-control-policymap-class-control)# 1 set- timer TIMERA 5</pre>	<p>(Optional) Starts a named policy timer.</p> <ul style="list-style-type: none"> <li>Expiration of the timer generates the event timed-policy-expiry.</li> </ul>
<p><b>Step 8</b> <code>end</code></p> <p><b>Example:</b></p> <pre>Router(config-control-policymap-class-control)# end</pre>	<p>(Optional) Returns to privileged EXEC mode.</p>

## Verifying ISG IP Subscriber Sessions

Perform this task to verify IP subscriber session configuration and creation. The commands can be used in any order.

**SUMMARY STEPS**

1. **enable**
2. **show subscriber session** [**detailed**] [**identifier** *identifier* | **uid** *session-id*| **username** *name*]
3. **show ip subscriber** [**mac** *mac-address* | [**vrf** *vrf-name*] [[**dangling** *seconds*] [**detail**] | **interface** *interface-name* [**detail** | **statistics**] | **ip** *ip-address* | **static list** *listname* | **statistics** {**arp** | **dangling**}]]
4. **show platform isg session-count** {**all** | *slot*}
5. **exit**

**DETAILED STEPS**

Command or Action	Purpose
<p><b>Step 1</b> <b>enable</b></p> <p><b>Example:</b></p> <pre>Router&gt; enable</pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<p><b>Step 2</b> <b>show subscriber session</b> [<b>detailed</b>] [<b>identifier</b> <i>identifier</i>   <b>uid</b> <i>session-id</i>  <b>username</b> <i>name</i>]</p> <p><b>Example:</b></p> <pre>Router# show subscriber session detailed</pre>	<p>Displays information about ISG policies and features for subscriber sessions.</p>
<p><b>Step 3</b> <b>show ip subscriber</b> [<b>mac</b> <i>mac-address</i>   [<b>vrf</b> <i>vrf-name</i>] [[<b>dangling</b> <i>seconds</i>] [<b>detail</b>]   <b>interface</b> <i>interface-name</i> [<b>detail</b>   <b>statistics</b>]   <b>ip</b> <i>ip-address</i>   <b>static list</b> <i>listname</i>   <b>statistics</b> {<b>arp</b>   <b>dangling</b>}]]</p> <p><b>Example:</b></p> <pre>Router# show ip subscriber ip 10.10.10.10</pre>	<p>Displays information about ISG IP subscriber sessions.</p>
<p><b>Step 4</b> <b>show platform isg session-count</b> {<b>all</b>   <i>slot</i>}</p> <p><b>Example:</b></p> <pre>Router# show platform isg session-count all</pre>	<p>Displays the number of active ISG subscriber sessions by line card.</p>
<p><b>Step 5</b> <b>exit</b></p> <p><b>Example:</b></p> <pre>Router# exit</pre>	<p>(Optional) Exits privileged EXEC mode.</p>

**Clearing ISG IP Subscriber Sessions**

Perform this task to clear IP subscriber sessions.

### SUMMARY STEPS

1. **enable**
2. **show ip subscriber** [**mac** *mac-address* | [**vrf** *vrf-name*] [[**dangling** *seconds*] [**detail**] | **interface** *interface-name* [**detail** | **statistics**] | **ip** *ip-address* | **static list** *listname* | **statistics** {**arp** | **dangling**}] ]
3. **clear ip subscriber** [**interface** *interface-name* | **mac** *mac-address* | **slot** *slot-number* **no-hardware** | [**vrf** *vrf-name*] [**dangling** *seconds* | **ip** *ip-address* | **statistics**] ]
4. **exit**

### DETAILED STEPS

Command or Action	Purpose
<p><b>Step 1</b> <b>enable</b></p> <p><b>Example:</b></p> <pre>Router&gt; enable</pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<p><b>Step 2</b> <b>show ip subscriber</b> [<b>mac</b> <i>mac-address</i>   [<b>vrf</b> <i>vrf-name</i>] [[<b>dangling</b> <i>seconds</i>] [<b>detail</b>]   <b>interface</b> <i>interface-name</i> [<b>detail</b>   <b>statistics</b>]   <b>ip</b> <i>ip-address</i>   <b>static list</b> <i>listname</i>   <b>statistics</b> {<b>arp</b>   <b>dangling</b>}] ]</p> <p><b>Example:</b></p> <pre>Router# show ip subscriber ip 10.10.10.10</pre>	<p>(Optional) Displays information about ISG subscriber IP sessions.</p>
<p><b>Step 3</b> <b>clear ip subscriber</b> [<b>interface</b> <i>interface-name</i>   <b>mac</b> <i>mac-address</i>   <b>slot</b> <i>slot-number</i> <b>no-hardware</b>   [<b>vrf</b> <i>vrf-name</i>] [<b>dangling</b> <i>seconds</i>   <b>ip</b> <i>ip-address</i>   <b>statistics</b>] ]</p> <p><b>Example:</b></p> <pre>Router# clear ip subscriber ip 10.10.10.10</pre>	<p>Clears ISG IP subscriber sessions.</p>
<p><b>Step 4</b> <b>exit</b></p> <p><b>Example:</b></p> <pre>Router# exit</pre>	<p>Exits privileged EXEC mode.</p>

### Troubleshooting Tips

Use the following commands to troubleshoot ISG IP subscriber sessions:

- **debug ip subscriber**
- **debug condition**

# Managing ISG Subscriber IP Addresses Using DHCP

The tasks in this section assume that you have configured DHCP support in your network.

- [Configuring an ISG Interface for Dynamic DHCP Class Association, page 33](#)
- [Configuring DHCP Server User Authentication, page 35](#)
- [Configuring a DHCP Class in a Service Policy Map, page 37](#)
- [Configuring a DHCP Class in a Service Profile or User Profile, page 39](#)
- [Configuring a DHCP Server IP Address, page 39](#)

## Configuring an ISG Interface for Dynamic DHCP Class Association

Perform this task to enable ISG to influence the assignment of IP addresses to subscribers on the interface by providing the local DHCP component with a class name. The class name refers to a class configured using their `dhcp pool` command and can reference a pool of addresses or a relay destination.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. Do one of the following:
  - **interface** *type number*
  - or
  - **interface** *type number access*
4. **ip address** *ip-address mask* [**secondary**]
5. **ip subscriber** {**l2-connected** | **routed**}
6. **initiator dhcp class-aware**
7. **end**

### DETAILED STEPS

Command or Action	Purpose
<b>Step 1 enable</b>  <b>Example:</b> Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2 configure terminal</b>  <b>Example:</b> Router# configure terminal	Enters global configuration mode.

Command or Action	Purpose
<p><b>Step 3</b> Do one of the following:</p> <ul style="list-style-type: none"> <li>• <b>interface</b> <i>type number</i></li> <li>• or</li> <li>• <b>interface</b> <i>type number access</i></li> </ul> <p><b>Example:</b></p> <pre>Router(config)# interface GigabitEthernet 1/0/0</pre> <p><b>Example:</b></p> <pre>Router(config)# interface GigabitEthernet 1/0/0.100 access</pre>	<p>Specifies an interface for configuration, and enters interface configuration mode.</p> <ul style="list-style-type: none"> <li>• <b>access</b> --Specifies a subinterface.</li> </ul>
<p><b>Step 4</b> <b>ip address</b> <i>ip-address mask</i> [<b>secondary</b>]</p> <p><b>Example:</b></p> <pre>Router(config-if)# ip address 209.165.200.225 255.255.0.0</pre>	<p>Sets a primary or secondary IP address for an interface.</p>
<p><b>Step 5</b> <b>ip subscriber</b> {<b>l2-connected</b>   <b>routed</b>}</p> <p><b>Example:</b></p> <pre>Router(config-if)# ip subscriber l2-connected</pre>	<p>Enables ISG IP subscriber configuration mode.</p>
<p><b>Step 6</b> <b>initiator dhcp class-aware</b></p> <p><b>Example:</b></p> <pre>Router(config-subscriber) initiator dhcp class-aware</pre>	<p>Configures ISG to create IP sessions upon receipt of DHCP DISCOVER packets.</p> <ul style="list-style-type: none"> <li>• <b>class-aware</b> --Allows ISG to influence the IP address assigned by DHCP by providing DHCP with a class name.</li> </ul>
<p><b>Step 7</b> <b>end</b></p> <p><b>Example:</b></p> <pre>Router(config-subscriber)# end</pre>	<p>(Optional) Returns to privileged EXEC mode.</p>

## Configuring DHCP Server User Authentication

Perform this task to authenticate the DHCP clients on the server.

You need to use the ISG framework to enable DHCP server user authentication.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **aaa new-model**
4. **aaa authentication login *list-name* local**
5. **ip dhcp pool *pool-name***
6. **network *network-number* *mask***
7. **exit**
8. **interface *type* *number***
9. **ip subscriber l2-connected**
10. **initiator dhcp class-aware**
11. **end**

### DETAILED STEPS

	Command or Action	Purpose
Step 1	<b>enable</b>  <b>Example:</b> Router> enable	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
Step 2	<b>configure terminal</b>  <b>Example:</b> Router# configure terminal	Enters global configuration mode.
Step 3	<b>aaa new-model</b>  <b>Example:</b> Router(config)# aaa new model	Enables authentication, authorization, and accounting (AAA).
Step 4	<b>aaa authentication login <i>list-name</i> local</b>  <b>Example:</b> Router(config)# aaa authentication login mylist local	Sets the AAA authentication at login.

Command or Action	Purpose
<p><b>Step 5</b> <code>ip dhcp pool <i>pool-name</i></code></p> <p><b>Example:</b></p> <pre>Router(config)# ip dhcp pool testpool</pre>	Creates a name for the DHCP server address pool and enters DHCP pool configuration mode.
<p><b>Step 6</b> <code>network <i>network-number mask</i></code></p> <p><b>Example:</b></p> <pre>Router(dhcp-config)# network 172.16.0.0 255.240.0.0</pre>	Configures the network number and mask for a DHCP address pool primary or secondary subnet on a Cisco IOS DHCP server.
<p><b>Step 7</b> <code>exit</code></p> <p><b>Example:</b></p> <pre>Router(dhcp-config)# exit</pre>	Returns to global configuration mode.
<p><b>Step 8</b> <code>interface <i>type number</i></code></p> <p><b>Example:</b></p> <pre>Router(config)# interface Ethernet 0/0</pre>	Enters interface configuration mode.
<p><b>Step 9</b> <code>ip subscriber l2-connected</code></p> <p><b>Example:</b></p> <pre>Router(config-if)# ip subscriber l2-connected</pre>	Configures a Layer 2 connected IP session on the interface and enters IP subscriber configuration mode.
<p><b>Step 10</b> <code>initiator dhcp class-aware</code></p> <p><b>Example:</b></p> <pre>Router(config-subscriber)# initiator dhcp class-aware</pre>	Initiates a class for DHCP for an IP session initiated by DHCP.
<p><b>Step 11</b> <code>end</code></p> <p><b>Example:</b></p> <pre>Router(config-subscriber)# end</pre>	Returns to privileged EXEC mode.

- [Troubleshooting Tips, page 36](#)

## Troubleshooting Tips

You can determine the DHCP authentication by using the **debug ip dhcp server events**, **debug ip dhcp server packet**, and **debug subscriber policy dpm event** commands. The following is sample output from the **debug subscriber policy dpm event** command:

```
*Apr 20 20:20:03.510: SG-DPM: DHCP Discover notification from client, mac_address = 001a.7014.c03e
*Apr 20 20:20:03.510: SG-DPM: getting the context for mac_address = 001a.7014.c03e
*Apr 20 20:20:03.510: SG-DPM: Could not find a dhcp_context for 001a.7014.c03e:
*Apr 20 20:20:03.510: SG-DPM: Sending an ID manager request with key as 001a.7014.c03e
*Apr 20 20:20:03.510: SG-DPM: Received reply from Id manager
*Apr 20 20:20:03.510: SG-DPM: Session Initiation notification on Active
*Apr 20 20:20:03.510: SG-DPM: Allocated SHDB Handle (0xB6000252) for Mac address 001a.7014.c03e
*Apr 20 20:20:03.510: SG-DPM: Client is able to perform DHCP Authentication.Setting the SSS_INFOTYPE_DHCP_AUTH_KEY
*Apr 20 20:20:03.510: SG-DPM: Sending Session start to PM, mac_address = 001a.7014.c03e
*Apr 20 20:20:03.514: SG-DPM: Request for Classname from client, mac_address = 001a.7014.c03e
*Apr 20 20:20:03.514: SG-DPM: getting the context for mac_address = 001a.7014.c03e
*Apr 20 20:20:03.514: SG-DPM: Sending an ID manager request with key as 001a.7014.c03e
*Apr 20 20:20:03.514: SG-DPM: Received reply from Id manager
*Apr 20 20:20:03.514: SG-DPM: No session found in ID manager
*Apr 20 20:20:03.514: SG-DPM: Processing sg_dpm_get_more_keys from SSS hdl 56000E52
*Apr 20 20:20:03.514: SG-DPM: DPM is providing Auth-User
```

You can also use the **show subscriber session detailed** and **show ip dhcp binding** commands to display subscriber information and DHCP pool information. The following is sample output from the **show ip dhcp binding** command:

```
Router# show ip dhcp binding
Bindings from all pools not associated with VRF:
IP address      Client-ID/      Lease expiration      Type
                Hardware address/
                User name
10.0.0.1        0100.1a70.1530.38      Nov 18 2008 03:43 PM      Automatic
```

## Configuring a DHCP Class in a Service Policy Map

Perform this task to assign a DHCP class to a service policy map. Subscribers for which this service policy map is activated will be assigned IP addresses from the DHCP pool or the remote server that is associated with the class.

A DHCP pool must be configured. Classes configured within the DHCP pool must match the DHCP classes configured in the service policy map.

### SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **policy-map type service *policy-name***
4. **classname *class-name***
5. **end**
6. **show policy-map type service**

## DETAILED STEPS

Command or Action	Purpose
<b>Step 1</b> <code>enable</code>  <b>Example:</b> <pre>Router&gt; enable</pre>	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>Enter your password if prompted.</li> </ul>
<b>Step 2</b> <code>configure terminal</code>  <b>Example:</b> <pre>Router# configure terminal</pre>	Enters global configuration mode.
<b>Step 3</b> <code>policy-map type service <i>policy-name</i></code>  <b>Example:</b> <pre>Router(config)# policy-map type service service1</pre>	Creates a service policy map or specifies an existing service policy map for configuration, and enters service policy-map configuration mode.
<b>Step 4</b> <code>classname <i>class-name</i></code>  <b>Example:</b> <pre>Router(config-service-policymap)# classname class1</pre>	Associates a DHCP pool with a service policy map.
<b>Step 5</b> <code>end</code>  <b>Example:</b> <pre>Router(config-service-policymap)# end</pre>	(Optional) Returns to privileged EXEC mode.
<b>Step 6</b> <code>show policy-map type service</code>  <b>Example:</b> <pre>Router# show policy-map type service</pre>	(Optional) Displays the contents of all service policy maps. <ul style="list-style-type: none"> <li>Use this command to verify that the DHCP class is associated with the service policy map.</li> </ul>

- [What to Do Next, page 38](#)

## What to Do Next

Once you have configured the DHCP address pool class in a service policy map, you may want to configure a method of activating the service policy map; for example, control policies can be used to activate services. For more information about methods of service activation, see the module "Configuring ISG Subscriber Services".

## Configuring a DHCP Class in a Service Profile or User Profile

Perform this task to add the vendor-specific attribute (VSA) for a DHCP class to a user profile or service profile. Subscribers for whom the user or service profile is activated will be assigned IP addresses from the DHCP pool or the remote server that is associated with the class.

- [Prerequisites, page 39](#)
- [What to Do Next, page 39](#)

### Prerequisites

A DHCP address pool must be configured. Classes configured within the DHCP address pool must match the DHCP address pool classes configured in the service or user profile.

### SUMMARY STEPS

1. Add the DHCP Class attribute to the user or service profile.

### DETAILED STEPS

Command or Action	Purpose
<p><b>Step 1</b> Add the DHCP Class attribute to the user or service profile.</p> <p><b>Example:</b></p> <pre>26,9,1 = "subscriber:classname=class-name"</pre>	<p>Associates a DHCP address pool with a service or specific subscriber.</p>

### What to Do Next

You may want to configure a method of activating the service policy map or service profile; for example, control policies can be used to activate services. For more information about methods of service activation, see the module "Configuring ISG Subscriber Services."

## Configuring a DHCP Server IP Address

Perform this task to specify which DHCP servers to use on your network, or to configure the IP address of one or more DHCP servers available on the network, and to specify the DHCP Lease Query for routed IP sessions.



**Note**

The DHCP server IP address needs to be configured for routed IP sessions, if the DHCP Lease Query is performed.

- The DHCP server must support the DHCP lease protocol.
- The IP address of the phone must be assigned by DHCP address assignments.
- The traffic must be classified as Layer 3.

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. **ip dhcp-server** {*ip-address* | **query lease** {*retries max-retransmissions* | **timeout** *timeout-query-seconds*}}
4. **end**

**DETAILED STEPS**

Command or Action	Purpose
<b>Step 1 enable</b>  <b>Example:</b> <pre>Router&gt; enable</pre>	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2 configure terminal</b>  <b>Example:</b> <pre>Router# configure terminal</pre>	Enters global configuration mode.
<b>Step 3 ip dhcp-server</b> { <i>ip-address</i>   <b>query lease</b> { <i>retries max-retransmissions</i>   <b>timeout</b> <i>timeout-query-seconds</i> }}  <b>Example:</b> <pre>Router(config)# ip dhcp-server query lease retries 3</pre>	Configures the IP address of one or more DHCP servers available on the network, and specifies the DHCP Lease Query for routed IP sessions.
<b>Step 4 end</b>  <b>Example:</b> <pre>Router(config)# end</pre>	Exits global configuration mode.

**Configuring ISG Dynamic VPN Selection**

- [Configuring a Multiservice Interface, page 40](#)
- [Specifying a VRF in a Service Policy Map, page 42](#)
- [Verifying VRF Transfer for IP Sessions, page 43](#)
- [Troubleshooting VRF Transfer for IP Sessions, page 45](#)

**Configuring a Multiservice Interface**

Perform the steps in this procedure to configure a multiservice interface.

**SUMMARY STEPS**

1. **enable**
2. **configure terminal**
3. **interface multiservice** *interface-number*
4. **ip vrf forwarding** *vrf-name*
5. **ip address** *ip-address mask*
6. **end**

**DETAILED STEPS**

Command or Action	Purpose
<p><b>Step 1</b> <b>enable</b></p> <p><b>Example:</b></p> <pre>Router&gt; enable</pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<p><b>Step 2</b> <b>configure terminal</b></p> <p><b>Example:</b></p> <pre>Router# configure terminal</pre>	<p>Enters global configuration mode.</p>
<p><b>Step 3</b> <b>interface multiservice</b> <i>interface-number</i></p> <p><b>Example:</b></p> <pre>Router(config)# interface multiservice 1</pre>	<p>Creates a multiservice interface, which enables dynamic VPN selection, and enters interface configuration mode.</p>
<p><b>Step 4</b> <b>ip vrf forwarding</b> <i>vrf-name</i></p> <p><b>Example:</b></p> <pre>Router(config-if)# ip vrf forwarding vrf1</pre>	<p>Associates a VPN VRF with an interface or subinterface.</p>
<p><b>Step 5</b> <b>ip address</b> <i>ip-address mask</i></p> <p><b>Example:</b></p> <pre>Router(config-if)# ip address 172.16.0.0 255.255.255.0</pre>	<p>Sets the primary IP address for an interface.</p> <ul style="list-style-type: none"> <li>• Specify the IP address of the VPN.</li> </ul>

Command or Action	Purpose
<b>Step 6</b> <code>end</code>  <b>Example:</b>  <code>Router(config-if)# end</code>	(Optional) Returns to privileged EXEC mode.

## Specifying a VRF in a Service Policy Map

VRF transfer occurs when a new primary service is activated for a session, causing the session to transfer from one VRF to another. Services can be configured in service profiles on an external authentication, authorization, and accounting (AAA) server or they can be configured on the ISG device in service policy maps. Perform this task to configure a VRF in a service policy map on the ISG device.

### SUMMARY STEPS

1. `enable`
2. `configure terminal`
3. `policy-map type service policy-map-name`
4. `ip vrf forwarding name-of-vrf`
5. `sg-service-type primary`
6. `sg-service-group service-group-name`
7. `end`

### DETAILED STEPS

Command or Action	Purpose
<b>Step 1</b> <code>enable</code>  <b>Example:</b>  <code>Router&gt; enable</code>	Enables privileged EXEC mode. <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<b>Step 2</b> <code>configure terminal</code>  <b>Example:</b>  <code>Router# configure terminal</code>	Enters global configuration mode.
<b>Step 3</b> <code>policy-map type service <i>policy-map-name</i></code>  <b>Example:</b>  <code>Router(config)# policy-map type service servicel</code>	Creates or modifies a service policy map, which is used to define an ISG service, and enters service policy-map configuration mode.

Command or Action	Purpose
<b>Step 4</b> <code>ip vrf forwarding <i>name-of-vrf</i></code>  <b>Example:</b>  <pre>Router(config-service-policy)# ip vrf forwarding vrf1</pre>	Associates the service with a VRF.
<b>Step 5</b> <code>sg-service-type primary</code>  <b>Example:</b>  <pre>Router(config-service-policy)# sg-service-type primary</pre>	Defines the service as a primary service. <ul style="list-style-type: none"> <li>A primary service is a service that contains a network-forwarding policy. A primary service must be defined as a primary service by using the <b>sg-service-type primary</b> command. Any service that is not a primary service is defined as a secondary service by default.</li> </ul>
<b>Step 6</b> <code>sg-service-group <i>service-group-name</i></code>  <b>Example:</b>  <pre>Router(config-service-policy)# sg-service-group group1</pre>	(Optional) Associates an ISG service with a service group. <ul style="list-style-type: none"> <li>A service group is a grouping of services that may be active simultaneously for a given session. Typically, a service group includes one primary service and one or more secondary services.</li> </ul>
<b>Step 7</b> <code>end</code>  <b>Example:</b>  <pre>Router(config-service-policy)# end</pre>	(Optional) Returns to privileged EXEC mode.

## Verifying VRF Transfer for IP Sessions

Perform the steps in the following task as needed to verify VRF transfer for IP sessions.

### SUMMARY STEPS

- enable**
- show subscriber session uid *session-identifier* detail**
- show ip subscriber [dangling *seconds* | detail | ip *ip-address* | mac *mac-address* | vrf *vrf-name* [dangling *seconds* | detail | ip *ip-address*]]**
- show idmgr {memory [detailed [component [*substring*]]] | service key session-handle *session-handle-string* service-key *key-value* | session key {aaa-unique-id *aaa-unique-id-string* | domainip-vrf *ip-address* *ip-address* vrf-id *vrf-id* | nativeip-vrf *ip-address* *ip-address* vrf-id *vrf-id* | portbundle ip *ip-address* bundle *bundle-number* | session-guid *session-guid* | session-handle *session-handle-string* | session-id *session-id-string*} | statistics}**
- show ip route [vrf *vrf-name*]**
- show ip dhcp binding [ip-address]**
- exit**

## DETAILED STEPS

Command or Action	Purpose
<p><b>Step 1</b> <code>enable</code></p> <p><b>Example:</b></p> <pre>Router&gt; enable</pre>	<p>Enables privileged EXEC mode.</p> <ul style="list-style-type: none"> <li>• Enter your password if prompted.</li> </ul>
<p><b>Step 2</b> <code>show subscriber session uid <i>session-identifier</i> detail</code></p> <p><b>Example:</b></p> <pre>Router# show subscriber session uid 4 detail</pre>	<p>Displays information about ISG subscriber sessions with a specific session identifier.</p>
<p><b>Step 3</b> <code>show ip subscriber [<b>dangling</b> <i>seconds</i>   <b>detail</b>   <b>ip</b> <i>ip-address</i>   <b>mac</b> <i>mac-address</i>   <b>vrf</b> <i>vrf-name</i> [<b>dangling</b> <i>seconds</i>   <b>detail</b>   <b>ip</b> <i>ip-address</i>]]</code></p> <p><b>Example:</b></p> <pre>Router# show ip subscriber vrf vrf1</pre>	<p>Displays information about ISG IP subscriber sessions.</p>
<p><b>Step 4</b> <code>show idmgr {<b>memory</b> [<b>detailed</b> [<b>component</b> [<i>substring</i>]]]   <b>service key session-handle</b> <i>session-handle-string</i> <b>service-key</b> <i>key-value</i>   <b>session key</b> {<b>aaa-unique-id</b> <i>aaa-unique-id-string</i>   <b>domainip-vrf ip-address</b> <i>ip-address</i> <b>vrf-id</b> <i>vrf-id</i>} <b>nativeip-vrf ip-address</b> <i>ip-address</i> <b>vrf-id</b> <i>vrf-id</i>   <b>portbundle ip</b> <i>ip-address</i> <b>bundle</b> <i>bundle-number</i>   <b>session-guid</b> <i>session-guid</i>   <b>session-handle</b> <i>session-handle-string</i>   <b>session-id</b> <i>session-id-string</i>}   <b>statistics</b>}</code></p> <p><b>Example:</b></p> <pre>Router# show idmgr session key nativeip-vrf ip-address 209.165.200.225</pre>	<p>Displays information related to ISG session and service identity.</p>
<p><b>Step 5</b> <code>show ip route [<b>vrf</b> <i>vrf-name</i>]</code></p> <p><b>Example:</b></p> <pre>Router# show ip route</pre>	<p>Displays the current state of the routing table.</p>
<p><b>Step 6</b> <code>show ip dhcp binding [<i>ip-address</i>]</code></p> <p><b>Example:</b></p> <pre>Router# show ip dhcp binding</pre>	<p>Displays address bindings on the Cisco IOS DHCP server.</p>

Command or Action	Purpose
<b>Step 7</b> exit  <b>Example:</b> Router# exit	Exits privileged EXEC mode.

## Troubleshooting VRF Transfer for IP Sessions

The commands in this procedure can be used to troubleshoot VRF transfer for IP sessions. These commands can be entered in any order.

### SUMMARY STEPS

1. debug subscriber {event | error | packet| policy | service}
2. debug ip subscriber {event | error | packet | fsm | all}
3. debug subscriber policy dpm {error | event}
4. debug ip dhcp server {events | packets | linkage | class}

### DETAILED STEPS

Command or Action	Purpose
<b>Step 1</b> debug subscriber {event   error   packet  policy   service}  <b>Example:</b> Router# debug subscriber service	Displays debugging messages pertaining to subscriber policies, policy server events, and changes to service.
<b>Step 2</b> debug ip subscriber {event   error   packet   fsm   all}  <b>Example:</b> Router# debug ip subscriber error	Displays debugging messages pertaining to an IP session created on the service gateway.
<b>Step 3</b> debug subscriber policy dpm {error   event}  <b>Example:</b> Router# debug subscriber policy dpm event	Displays diagnostic information about policy execution that is related to DHCP events.
<b>Step 4</b> debug ip dhcp server {events   packets   linkage   class}  <b>Example:</b> Router# debug dhcp ip dhcp server events	Enables Cisco IOS DHCP server debugging.

## What to Do Next

After you have configured the ISG to bring up Layer 3 sessions, you may want to configure policies for subscriber identification and authorization, such as the Port-Bundle Host Key feature, redirection of unauthenticated subscriber traffic, or automatic subscriber logon. Instructions on how to configure these policies can be found in the following modules:

- [Configuring ISG Port-Bundle Host Key](#)
- [Redirecting Subscriber Traffic Using ISG Layer 4 Redirect](#)
- [Configuring ISG Policies for Automatic Subscriber Logon](#)

## Configuration Examples for ISG Access for IP Subscriber Sessions

- [Example ISG IP Interface Subscriber, page 46](#)
- [Example ISG Routed IP Subscriber, page 46](#)
- [Example ISG Layer 2 Connected IP Subscriber, page 47](#)
- [Example ISG Static Session Creation, page 47](#)
- [Example DHCP-Initiated Session Recovery, page 47](#)
- [Example ISG Interface with DHCP Class-Aware Capability, page 47](#)
- [Example DHCP Address Pool Classes and Relay Actions for ISG, page 48](#)
- [Example Dynamic VPN Selection, page 49](#)

### Example ISG IP Interface Subscriber

The following example shows how to configure an IP interface session on GigabitEthernet interface 0/0/1.401:

```
interface GigabitEthernet 0/0/1.401
 ip subscriber interface
```

### Example ISG Routed IP Subscriber

The following example shows how to configure ISG to create IP sessions for subscribers who connect to ISG on GigabitEthernet interface 0/0/1.401 through a routed access network. ISG will create IP sessions upon receipt of DHCP DISCOVER packets, incoming valid IP packets, and RADIUS Access-Request packets.

```
interface GigabitEthernet0/0/1.401
 ip subscriber routed
 initiator dhcp class-aware
 initiator unclassified ip-address
 initiator radius-proxy
```

## Example ISG Layer 2 Connected IP Subscriber

The following example shows how to configure ISG to create IP sessions for subscribers who connect to ISG on GigabitEthernet interface 0/0/1.401 through a Layer 2 connected access network. ISG will create IP sessions upon receipt of any frame with a valid source MAC address.

```
interface GigabitEthernet0/0/1.401
 ip subscriber l2-connected
 initiator unclassified mac-address
```

## Example ISG Static Session Creation

The following example shows how to create an ISG static session for server 209.165.200.225 for subscribers who connect to ISG on GigabitEthernet interface 0/4 through a Layer 2 connected access network. ISG will create a static session upon receipt of valid source IP address.

```
ip subscriber list mylist
 ip source 209.165.200.225 mac 0.7.f
interface GigabitEthernet 2/0/0
 ip subscriber l2-connected
 initiator static ip subscriber list mylist
```

## Example DHCP-Initiated Session Recovery

The following example shows how to configure an ISG policy that applies a service called “FIRST-SERVICE” upon session restart for subscribers belonging to the VRF “FIRST”:

```
class-map type control TEST
 match vrf FIRST
policy-map type control GLOBAL
 class type control TEST event session-restart
 1 service-policy type service name FIRST-SERVICE
```

## Example ISG Interface with DHCP Class-Aware Capability

In the following example, GigabitEthernet interface 1/0/0.400 is configured with DHCP class-aware functionality, which enables ISG to influence DHCP IP address assignment. If the service “SERVICE\_DHCP” is activated, the DHCP pool “DHCP\_POOL2” is used for address assignment. Otherwise, the default pool “DHCP\_POOL1” is used.

```
interface GigabitEthernet1/0/0.400
 encapsulation dot1Q 400
 ip address 10.1.15.1 255.255.255.0 secondary
 ip address 10.1.10.1 255.255.255.0
 no snmp trap link-status
 service-policy type control RULE_406a
 ip subscriber l2-connected
 initiator dhcp class-aware
!
ip dhcp excluded-address 10.1.10.1
!
ip dhcp pool DHCP_POOL1
 network 10.1.10.0 255.255.255.0
 default-router 10.1.10.1
 lease 0 0 30
 class default
!
ip dhcp class default
!
```

```

ip dhcp pool DHCP_POOL2
  network 10.1.15.0 255.255.255.0
  default-router 10.1.15.1
  lease 0 0 30
  class DHCP_CLASS2
!
ip dhcp class DHCP_CLASS2
!
policy-map type service SERVICE_DHCP
  classname DHCP_CLASS2
!

```

## Example DHCP Address Pool Classes and Relay Actions for ISG

This section contains examples of DHCP address pool configuration and relay actions for ISG.

### DHCP Server Coresident with ISG Configuration

In the following configuration example, the ISPs are ISP1 and ISP2 companies. The ISP1 company has its addresses assigned from an address pool that is dynamically allocated using on-demand address pools (ODAP). The ISP2 company has its customer addresses assigned from the address pool 10.100.0.0/16. Customers not associated with any ISP will have an address allocated from the address pool 10.1.0.0/16, and the lease time is set to 10 minutes.

```

!Address pool for ISP1 customers
ip dhcp pool isp1-pool
  origin dhcp
  class isp1
!
!Address pool for ISP2 customers
!
ip dhcp pool isp2-pool
  network 10.100.0.0 255.255.0.0
  class isp2
!
!Address pool for customers without an ISP
!
ip dhcp pool temp
  network 10.1.0.0 255.255.0.0
  lease 0 0 10
  class default

```

### DHCP Relay Agent Coresident with ISG Configuration

In the following configuration example, there are two ISPs, “poolA” and “poolB”. The “poolA” ISP and its customers are allowed to have addresses in the ranges 10.1.0.0/16 and 10.3.0.0/16, and are relayed to the DHCP server at 10.55.10.1. The “poolB” ISP and its customers are allowed to have addresses in the range 10.2.0.0/16 and 10.4.0.0/16, and are relayed to the DHCP server at 10.10.2.1.

```

!Address ranges:
interface gigabitethernet1/0/0
  ip address 10.1.0.0 255.255.0.0
  ip address 10.2.0.0 255.255.0.0 secondary
interface gigabitethernet2/0/0
  ip address 10.3.0.0 255.255.0.0
  ip address 10.4.0.0 255.255.0.0
!Address pools for poolA1 and poolB2:
ip dhcp pool poolA1
  relay source 10.1.0.0 255.255.0.0
  class poolA1
  relay target 10.55.10.1
!Address pool for poolA2:
ip dhcp pool poolA2
  relay source 10.3.0.0 255.255.0.0
  class poolA2

```

```

    relay target 10.55.10.1
!Address pools for poolB1 and poolB2:
ip dhcp pool poolB1
    relay source 10.2.0.0 255.255.0.0
    class poolB1
    relay target 10.10.2.1
ip dhcp pool poolB2
    relay source 10.4.0.0 255.255.0.0
    class poolB2
    relay target 10.10.2.1

```

Configuration of secure ARP for the relay will use the same configuration command as secure ARP already uses on a DHCP server by using the **update arp** command in address-pool configuration mode. If the system is allocating an address from this address pool, it will add secure ARP. If the system is relaying a packet using this address pool, it will also add secure ARP.

## Example Dynamic VPN Selection

The following example shows a configuration in which subscribers are initially assigned an IP address from the DHCP global pool “DHCP\_POOL1”. After a subscriber accesses the web portal and selects the service “CorporateVPN”, ISG performs a VRF transfer and the subscriber is assigned a new IP address from the DHCP pool “VPN\_POOL1.” In this case, a single multiservice interface is required.

```

!
ip vrf VPN_406_1001
rd 406:1001
route-target export 406:1001
route-target import 406:1001
!
interface GigabitEthernet 1/0/0.400
encapsulation dot1Q 400
ip address 10.1.10.1 255.255.255.0
no snmp trap link-status
service-policy type control RULE_406a
ip subscriber l2-connected
initiator dhcp class-aware
!
ip dhcp relay information trust-all
ip dhcp use vrf connected
!
!!!! Default Global DHCP Pool
!
ip dhcp excluded-address 10.1.10.1
!
ip dhcp pool DHCP_POOL1
network 10.1.10.0 255.255.255.0
default-router 10.1.10.1
lease 0 0 30
class default
!
ip dhcp class default
!
!
!!! DHCP Pool for CorporateVPN
!
ip dhcp excluded-address 10.1.11.1
!
ip dhcp pool VPN_POOL1
vrf VPN_406_1001
network 10.1.11.0 255.255.255.0
default-router 10.1.11.1
lease 0 0 30
class DHCP_CLASS_VPN_406_1001
!
interface multiservice 1
ip vrf forwarding VPN_406_1001
ip address 10.1.11.1 255.255.255.0
no keepalive

```

# Additional References

## Related Documents

Related Topic	Document Title
Cisco IOS commands	<a href="#">Cisco IOS Master Commands List, All Releases</a>
ISG commands	<a href="#">Cisco IOS Intelligent Services Gateway Command Reference</a>
DHCP configuration	The "DHCP" module of the <i>Cisco IOSIP Addressing Configuration Guide</i>
Configuring ISG control policies	"Configuring ISG Control Policies" module in this guide

## Standards

Standard	Title
None	--

## MIBs

MIB	MIBs Link
None	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: <a href="http://www.cisco.com/go/mibs">http://www.cisco.com/go/mibs</a>

## RFCs

RFC	Title
None	--

### Technical Assistance

Description	Link
<p>The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies.</p> <p>To receive security and technical information about your products, you can subscribe to various services, such as the Product Alert Tool (accessed from Field Notices), the Cisco Technical Services Newsletter, and Really Simple Syndication (RSS) Feeds.</p> <p>Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.</p>	<p><a href="http://www.cisco.com/cisco/web/support/index.html">http://www.cisco.com/cisco/web/support/index.html</a></p>

## Feature Information for ISG Access for IP Subscriber Sessions

The following table provides release information about the feature or features described in this module. This table lists only the software release that introduced support for a given feature in a given software release train. Unless noted otherwise, subsequent releases of that software release train also support that feature.

Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to [www.cisco.com/go/cfn](http://www.cisco.com/go/cfn). An account on Cisco.com is not required.

**Table 4** Feature Information for ISG Access for IP Subscriber Sessions

Feature Name	Releases	Feature Information
DHCP Server User Authentication	12.2(33)SRE 15.0(1)S	<p>The DHCP Server User Authentication feature is used to authenticate the DHCP clients.</p> <p>In Cisco IOS Release 12.2(33)SRE, support was added for the Cisco 7600 router.</p>

Feature Name	Releases	Feature Information
IP Session Recovery for DHCP-Initiated IP Sessions	12.2(31)SB 12.2(33)SRC2	<p>ISG provides a default policy and the ability to configure a policy that determines the actions ISG will take upon session restart following the recovery of a DHCP-initiated IP session.</p> <p>In Cisco IOS Release 12.2(33)SRC, support was added for the Cisco 7600 router.</p> <p>The following commands were introduced or modified by this feature: <b>class type control</b>, <b>match vrf</b>.</p>
IP Subscriber Session CLI Updates	12.2(31)SB2 12.2(33)SRC	<p>Some of the commands that are used to configure ISG IP subscriber sessions were modified or replaced.</p> <p>In Cisco IOS Release 12.2(33)SRC, support was added for the Cisco 7600 router.</p> <p>The following commands were introduced or modified by this feature: <b>clear ip subscriber</b>, <b>debug ip subscriber</b>, <b>identifier interface</b>, <b>identifier ip src-addr</b>, <b>initiator</b>, <b>interface multiservice</b>, <b>ip subscriber interface</b>, <b>ip subscriber</b>, <b>show ip subscriber</b>.</p>
ISG: Instrumentation: DHCP Lease Query Support	12.2(33)SRE 12.2(33)XNE	<p>The DHCP Lease Query transaction is a DHCP transaction with special message types that enable, among other things, clients to query DHCP servers regarding the owner and the lease expiration time of an IP address.</p> <p>In Cisco IOS Release 12.2(33)XNE, support was added for the Cisco 10000 series routers.</p>

Feature Name	Releases	Feature Information
ISG: Session: Creation: Interface IP Session: L2	12.2(28)SB 12.2(33)SRC 12.2SRE	<p>ISG IP interface sessions include all IP traffic received on a specific physical or virtual interface. IP interface sessions are provisioned through the CLI; that is, a session is created when the IP interface session commands are entered.</p> <p>In Cisco IOS Release 12.2(33)SRC, support was added for the Cisco 7600 router.</p>
ISG: Session: Creation: Interface IP Session: L3	12.2(28)SB 12.2(33)SRC 12.2SRE	<p>ISG IP interface sessions include all IP traffic received on a specific physical or virtual interface. IP interface sessions are provisioned through the CLI; that is, a session is created when the IP interface session commands are entered.</p> <p>In Cisco IOS Release 12.2(33)SRC, support was added for the Cisco 7600 router.</p> <p>The following sections provide information about this feature:</p>
ISG: Session: Creation: IP Session: Protocol Event (DHCP)	12.2(28)SB 12.2(33)SRC	<p>Most ISG sessions are created upon detection of a data flow that cannot be affiliated with an already active session. An ISG can be configured to create an IP session upon receipt of the first DHCP DISCOVER packet received from a subscriber.</p> <p>In Cisco IOS Release 12.2(33)SRC, support was added for the Cisco 7600 router.</p>

Feature Name	Releases	Feature Information
ISG: Session: Creation: IP Session: Subnet and Source IP: L2	12.2(28)SB 12.2(33)SRC	<p>The ISG session is the primary component used for associating services and policies across specific data flows. An IP subnet session is an ISG session that includes any IP traffic from a single IP subnet. A source-IP-based session includes traffic from a single source IP address.</p> <p>In Cisco IOS Release 12.2(33)SRC, support was added for the Cisco 7600 router.</p>
ISG: Session: Creation: IP Session: Subnet and Source IP: L3	12.2(28)SB 12.2(33)SRC	<p>The ISG session is the primary component used for associating services and policies across specific data flows. An IP subnet session is an ISG session that includes any IP traffic from a single IP subnet. A source-IP-based session includes traffic from a single source IP address.</p> <p>In Cisco IOS Release 12.2(33)SRC, support was added for the Cisco 7600 router.</p>
ISG: Session: Multicast: Coexistence	12.2(33)SRE	<p>The ISG Session Multicast Coexistence feature introduces the ability to host all the subscribers and services (data and multicast) on the same VLAN by enabling multicast and IP sessions to coexist on the same subinterface for Cisco 7600 series routers.</p> <p>In Cisco IOS Release 12.2(33)SRE, support was added for the Cisco 7600 router.</p>

Feature Name	Releases	Feature Information
ISG: Session: VRF Transfer:	12.2(28)SB 12.2(33)SRC	<p>The ISG session is the primary component used for associating services and policies with specific data flows. ISG sessions are associated with virtual routing and forwarding instances when routing is required for the network service. ISG VRF transfer provides a means to dynamically switch an active session between virtual routing domains.</p> <p>In Cisco IOS Release 12.2(33)SRC, support was added for the Cisco 7600 router.</p>
ISG: Static Session Creation	12.2(33)SRE 12.2(33)XNE	<p>The ISG Static Session Creation feature enables administrator-initiated static IP sessions.</p> <p>In Cisco IOS Release 12.2(33)SRE, support was added for the Cisco 7600 router.</p> <p>In Cisco IOS Release 12.2(33)XNE, support was added for the Cisco 10000 series routers.</p> <p>The following commands were introduced or modified by this feature: <b>initiator static subscriber list,ip source,ip subscriber list,show ip subscriber static list.</b></p>
VRF-Aware Support for CoA Clients	12.2(31)SB12	<p>Allows one CoA client to support ISG subscribers in different VRFs.</p>

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