Service Provider WiFi: Support for Integrated Ethernet Over GRE

Generic Routing Encapsulation (GRE) is a tunneling protocol that encapsulates a wide variety of network layer protocols inside virtual point-to-point links over a Layer 3 IPv4 or Layer 3 IPv6 access network.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and 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 module.

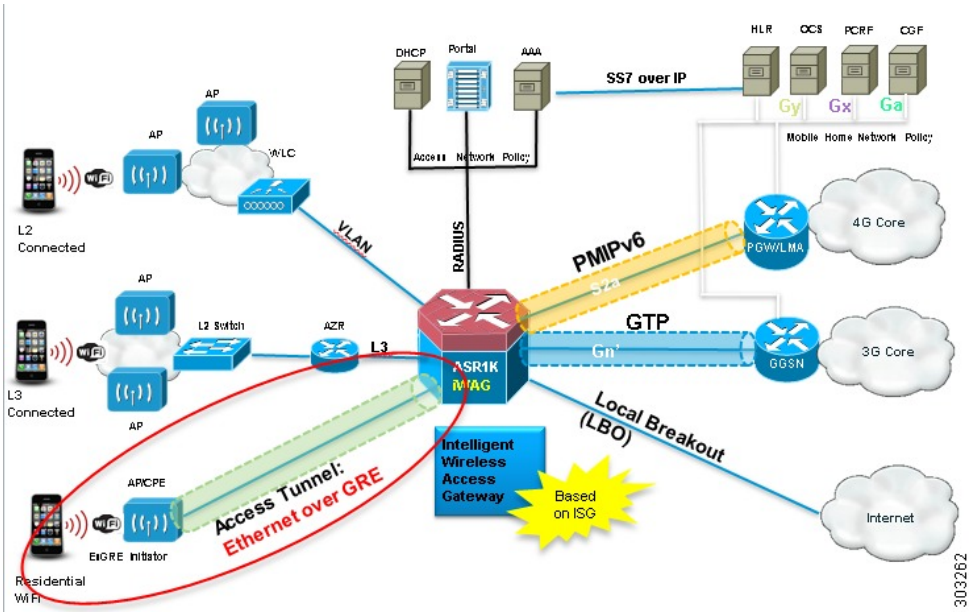
Use Cisco Feature Navigator to find information about platform support and Cisco software image support. To access Cisco Feature Navigator, go to www.cisco.com/go/cfn. An account on Cisco.com is not required.

Information About Ethernet Over GRE

Ethernet over GRE (EoGRE) is a new aggregation solution for aggregating WiFi traffic from hotspots. This solution enables customer premises equipment (CPE) devices to bridge the Ethernet traffic coming from an end host, and encapsulate the traffic in Ethernet packets over an IP GRE tunnel. When the IP GRE tunnels are terminated on a service provider broadband network gateway, the end host's traffic is terminated and subscriber sessions are initiated for the end host.

The following figure shows the structure of the Ethernet over GRE.

Figure 1: Ethernet Over GRE Structure



Restrictions for Configuring Ethernet Over GRE

The following features are not supported on the Cisco ASR 1000 Series Aggregation Services Routers:

- IPsec tunnel between the Cisco ASR 1000 Series Aggregation Services Routers and the CPE devices
- Native multicast coexistence for subscribers
- Per-CPE QoS
- IPv6 subscriber
- The Cisco Intelligent Services Gateway (ISG) RADIUS proxy initiator
- QinQ tag for the inner L2 frame
- High Availability is not supported if ISG is not configured.
- If the VLAN priority tag inside the EoGRE packet is set to a nonzero value, iWAG ignores the packet

Prerequisites for Configuring Ethernet Over GRE

Before you configure the Ethernet over GRE feature on the Cisco ASR 1000 Series Aggregation Services Routers, ensure that the following prerequisites are met:

- A physical interface or dot1Q interface should be configured.
- The ISG policy should not be applied to the physical interface.

Information About Configuring Ethernet Over GRE

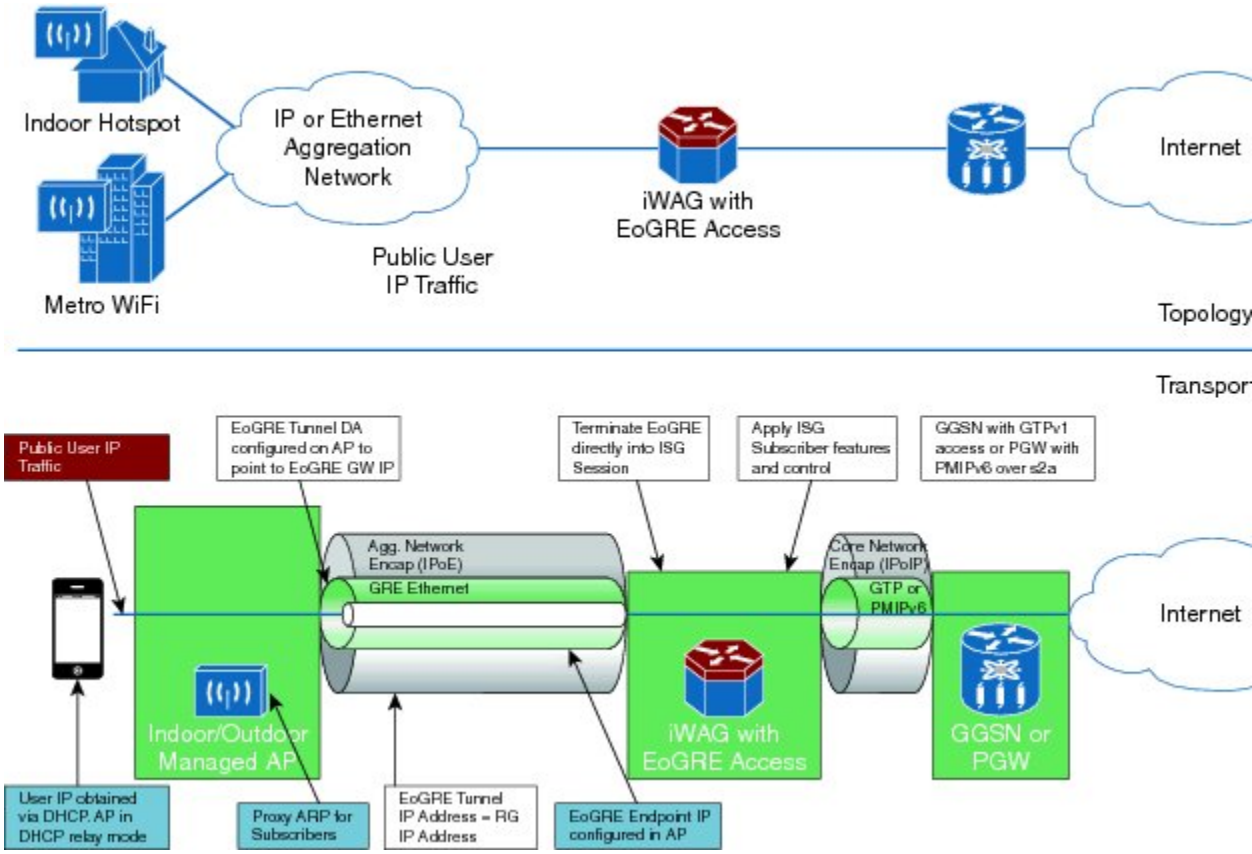
The Cisco ASR 1000 Series Aggregation Services Routers serve as a service provider broadband network gateway that:

- Terminates IPv4 or IPv6 GRE tunnels.
- Manages the subscriber session for end-host clients.

The EoGRE feature works with legacy residential gateways and CPE devices to terminate the Ethernet L2 traffic in the Cisco ASR 1000 Series Aggregation Services Routers. When configured as an intelligent Wireless Access Gateway (iWAG) with EoGRE access tunneling support, the Cisco ASR 1000 Series Aggregation Services Routers can extend mobility and the ISG services in support of these legacy devices.

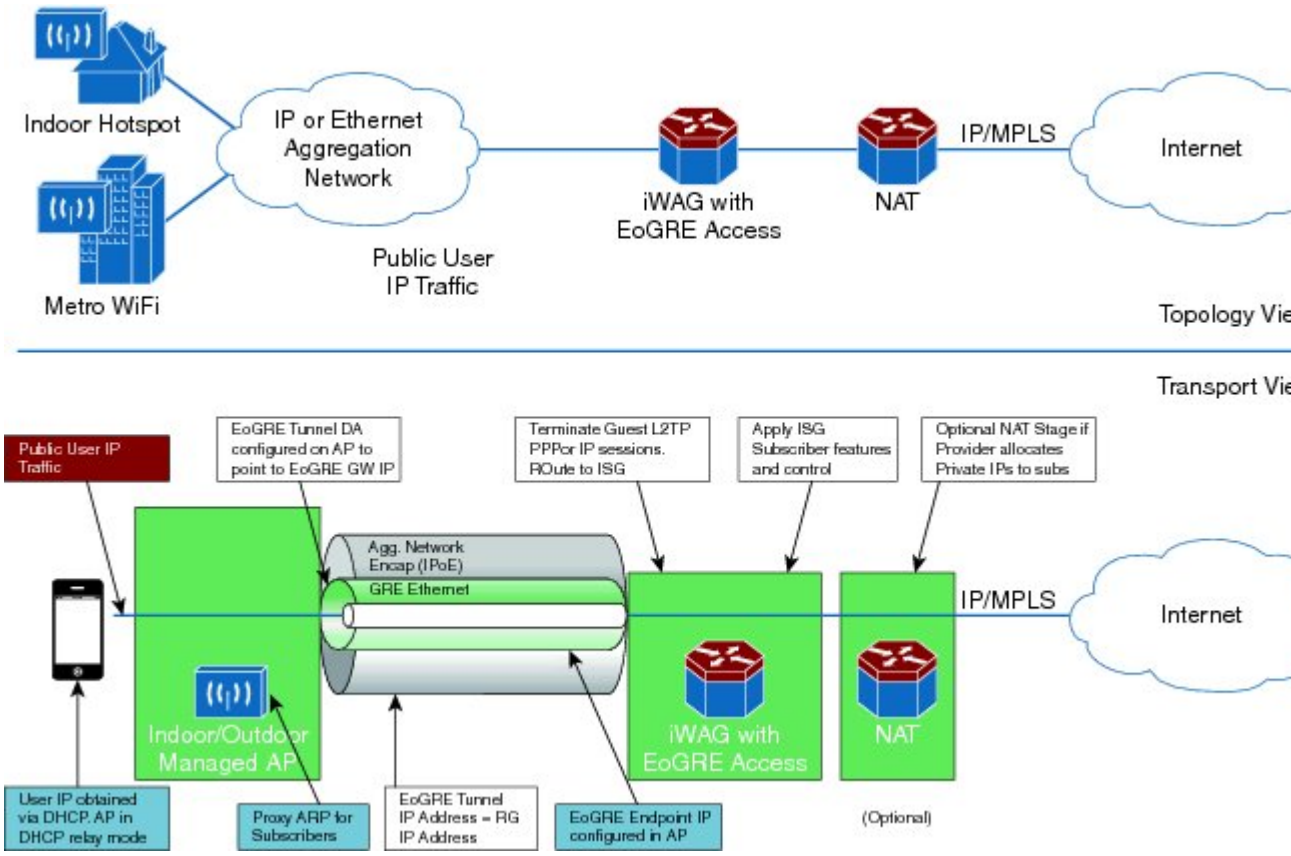
The following figure shows the structure of the EoGRE feature with PMIP/GTP integrated for mobility service.

Figure 2: Structure of the EoGRE Feature with PMIP/GTP Integrated for Mobility Service



The following figure shows the structure of the EoGRE feature for simple IP service.

Figure 3: Structure of the EoGRE Feature for Simple IP Service



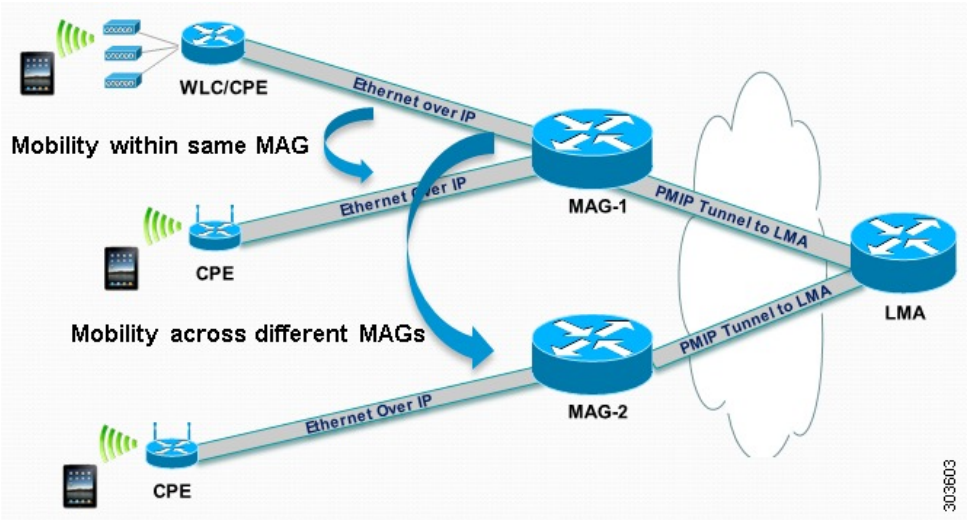
The EoGRE feature supports the following deployments:

- EoGRE Deployment with PMIPv6 Integrated for Mobility Service
- EoGRE Deployment with GTP Integrated for Mobility Service
- EoGRE Deployment with ISG Integrated for Simple IP Service

EoGRE Deployment with PMIPv6 Integrated for Mobility Service

Proxy Mobile IPv6 (PMIPv6) provides mobility service to the mobile nodes that are connected to the Mobile Access Gateway (MAG) via an EoGRE tunnel. The following figure shows the structure of the EoGRE deployment with PMIPv6 integrated for mobility service.

Figure 4: Structure of the EoGRE Deployment with PMIPv6 Integrated for Mobility Service



Mobile nodes access the mobile internet service over Wi-Fi access points. The access points are either autonomous access points or are connected to the Cisco Wireless LAN Controller (WLC). These access points and WLCs are used as residential gateways or CPE devices. CPEs are preconfigured with a point-to-multipoint GRE IP tunnel to the Cisco ASR 1000 Series Aggregation Services Routers as the MAG. The tunnel from the CPE device can be configured with a static GRE key. The CPEs are provisioned to forward the Ethernet traffic from both public and private customers to the GRE tunnel, and to add a VLAN tag on the Ethernet frame before forwarding the traffic.

As with regular PMIPv6 deployments, the Cisco ASR 1000 Series Aggregation Services Routers can create IP sessions on EoGRE access tunnels similar to the regular IP sessions on the physical Ethernet interfaces, and allocate IP addresses for mobile nodes, either locally or in the proxy mode. Mobility service is provided to the mobile nodes and the tunneled Ethernet traffic is forwarded via IP tunnels to the Local Mobility Anchor (LMA).

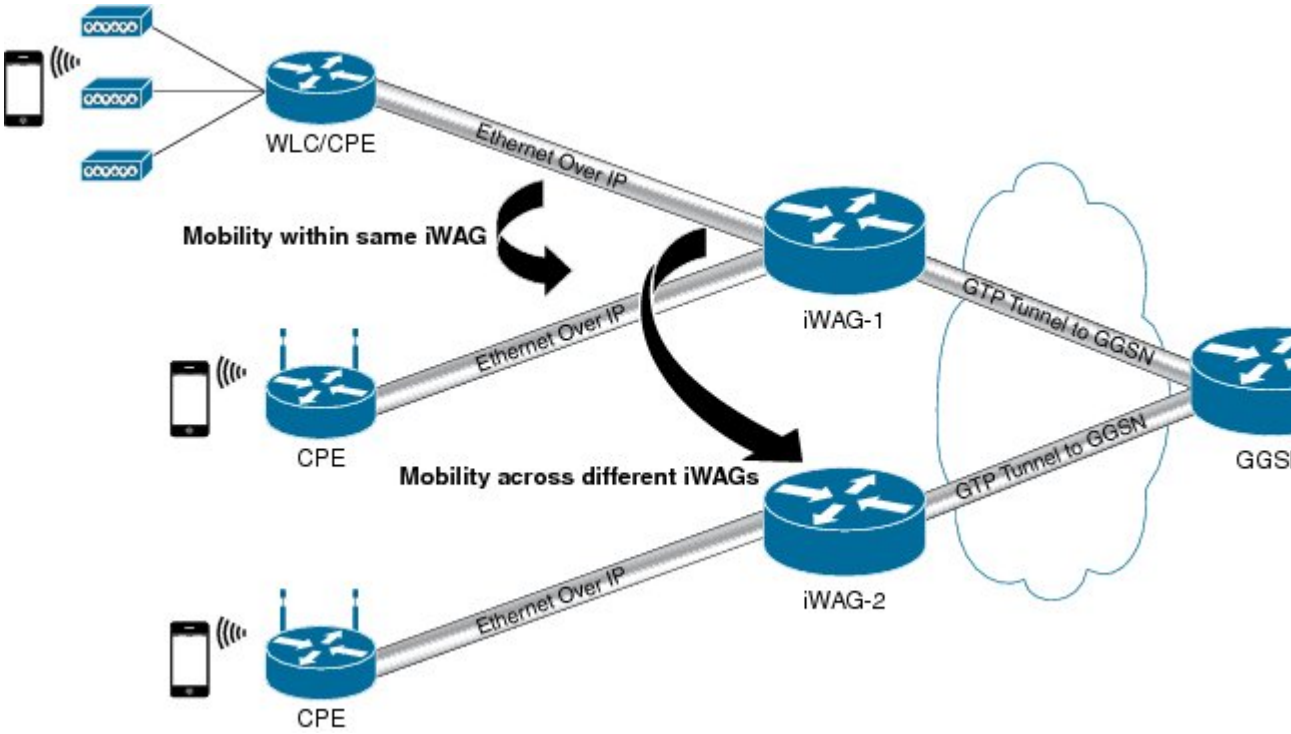
Note When you ping a mobile node from the MAG with a packet size that is larger than that of the path maximum transmission unit (PMTU) that is configured with the DF bit set, the packet will be dropped. However, you will not get the return type as M.M.M (could not fragment). This is reflected in the log messages or error messages.

For more information about PMIPv6 and the ISG configurations for the iWAG, see the *Intelligent Wireless Gateway Configuration Guide*.

EoGRE Deployment with GTP Integrated for Mobility Service

GPRS Tunneling Protocol (GTP) provides mobility service to the mobile nodes that are connected to the iWAG via an EoGRE tunnel, as shown in the following figure.

Figure 5: Structure of the EoGRE Deployment with GTP Integrated for Mobility Service

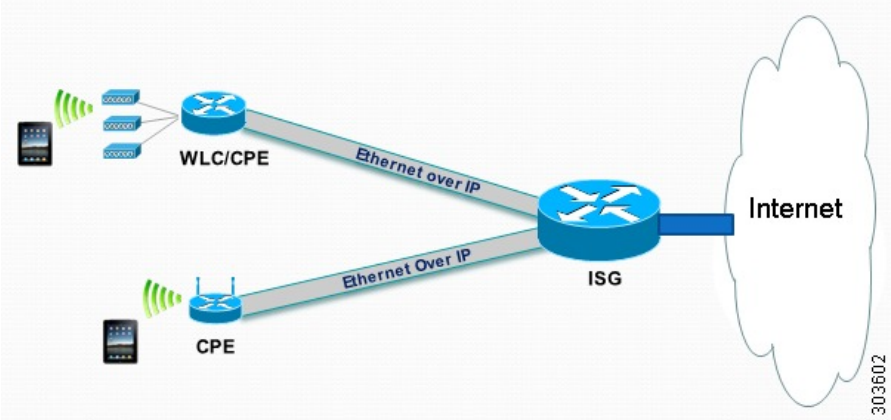


For more information about the GTP and ISG configurations for the iWAG, see the *Intelligent Wireless Gateway Configuration Guide*.

EoGRE Deployment with ISG Integrated for Simple IP Service

The ISG provides simple IP service to mobile nodes that are connected to ISG via the EoGRE tunnel, as shown in the following figure. The Cisco ASR 1000 Series Aggregation Services Routers use the ISG framework to allocate IP sessions for authenticated subscribers. Simple IP subscribers are provided ISG services, including Internet access, but are not provided access to mobility services via GTP or PMIPv6.

Figure 6: Structure of the EoGRE Deployment with ISG Integrated for Simple IP Service



Supported Features

The following features are supported as part of the EoGRE feature on the Cisco ASR 1000 Series Aggregation Services Routers:

- Ethernet over GRE traffic termination on the routers
- Frames can have up to one dot1Q VLAN tag
- L2-connected IPv4 mobile nodes
- GRE tunnel for IPv4 or IPv6
- ISG and PMIPv6 or GTP integrated with the EoGRE tunnel
- ISG initiator-unclassified MAC, DHCP, DNAv4
- Subscriber roaming

How to Configure the EoGRE Feature

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *interface-name*
4. **ip unnumbered loopback** *interface-name* or **ip address** *ip-address*
5. **tunnel source** *interface-type interface-number*
6. (For simple IP mode) **mac-address** *H.H.H*
7. **tunnel mode ethernet gre ipv4** or **tunnel mode ethernet gre ipv6**
8. (Optional) **tunnel vlan** *vlan-id*
9. end

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables the privileged EXEC mode. Enter your password, if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters the global configuration mode.
Step 3	**interface** *interface-name* **Example:** `Router(config)# interface Tunnel 0`	Specifies the logical interface for the EoGRE tunnel.

	Command or Action	Purpose

Step 4	**ip unnumbered loopback** *interface-name* or **ip address** *ip-address*
	Example:
	`Router(config-if)# ip unnumbered loopback 0`
	or
	`Router(config-if)# ip address 20.1.1.2 255.255.255.0`
		For PMIPv6 and GTP scenarios, an unnumbered address or a specified IP address can be configured on the tunnel interface.
		For a simple IP scenario, only a specified IP address can be configured on the tunnel interface. This IP address can be used as a default gateway IP address.

Step 5	**tunnel source** *interface-type interface-number* **Example:** `Router(config-if)# tunnel source Loopback 0`	Sets the source interface for the EoGRE tunnel interface.
Step 6	(For simple IP mode) **mac-address** *H.H.H* **Example:** `Router(config-if)# mac-address 0000.5e00.5213`	Sets the source MAC address for the EoGRE tunnel interface. The MAC address is mandatory for simple IP deployment. For PMIPv6/GTP, the default MAC address associated with EoGRE Tunnel is 0000.5e00.5213.

Step 7	**tunnel mode ethernet gre ipv4** or **tunnel mode ethernet gre ipv6**
	Example:
	`Router(config-if)# tunnel mode ethernet gre ipv4`
	or
	`Router(config-if)# tunnel mode ethernet gre ipv6`
		Sets the EoGRE encapsulation mode for the tunnel interface for IPv4.
		or
		Sets the EoGRE encapsulation mode for the tunnel interface for IPv6.

Step 8	(Optional) **tunnel vlan** *vlan-id* **Example:** `Router(config-if)# tunnel vlan 1000`	(Optional) Sets the VLAN ID of the EoGRE tunnel.
Step 9	end **Example:** `Router(config-if)# end`	Ends the current configuration session.

Example: Configuring the EoGRE Feature

```
aaa new-model
!
aaa group server radius AAA_SERVER_CAR
server-private 5.3.1.76 auth-port 2145 acct-port 2146 key cisco
```

```
!
aaa authentication login default none
aaa authentication login ISG_PROXY_LIST group AAA_SERVER_CAR
aaa authorization network ISG_PROXY_LIST group AAA_SERVER_CAR
aaa authorization subscriber-service default local group AAA_SERVER_CAR
aaa accounting network PROXY_TO_CAR
action-type start-stop
group AAA_SERVER_CAR
!
aaa accounting network ISG_PROXY_LIST start-stop group AAA_SERVER_CAR
!
aaa server radius dynamic-author
client 5.3.1.76 server-key cisco
auth-type any
ignore server-key
!
!
ip dhcp excluded-address 172.16.254.254
!
ip dhcp pool ISG_SIMPLE_IP
 network 172.16.0.0 255.255.0.0
 default-router 172.16.254.254
 domain-name cisco.com
!
policy-map type control EOGRE_L2_ISG
 class type control always event session-start
  2 authorize aaa list ISG_PROXY_LIST password cisco identifier mac-address
  4 set-timer IP_UNAUTH_TIMER 5
 !
 class type control always event service-start
  1 service-policy type service identifier service-name
  2 collect identifier nas-port
 !
!
interface Loopback0
 ip address 9.9.9.9 255.255.255.255
interface GigabitEthernet1/0/0
ip address 192.168.0.9 255.255.255.0
negotiation auto
!
interface GigabitEthernet1/0/0.778
description "to ASR5K GGSN"
encapsulation dot1Q 778
ip address 172.16.199.9 255.255.255.0
!
interface Tunnel10
 description "EoGRE Tunnel for Simple IP subscribers"
 mac-address 0000.5e00.5213
 ip address 172.16.254.254 255.255.0.0
 no ip redirects
 tunnel source 172.16.199.9
 tunnel mode ethernet gre ipv4
 service-policy type control EOGRE_L2_ISG
 ip subscriber l2-connected
  initiator unclassified mac-address
  initiator dhcp
interface Tunnel100
description "IPv4 EoGRE Tunnel for PMIP/GTP subscribers"
 ip unnumbered Loopback0
 tunnel source GigabitEthernet1/0/0
 tunnel mode ethernet gre ipv4
 tunnel vlan 100
 service-policy type control EOGRE_L2_ISG
 ip subscriber l2-connected
```

```
  initiator unclassified mac-address
  initiator dhcp
!
interface Tunnel200
description "IPv6 EoGRE Tunnel for PMIP/GTP subscribers"
 ip unnumbered Loopback0
 tunnel source 2001:161::9
 tunnel mode ethernet gre ipv6
 tunnel vlan 200
service-policy type control EOGRE_L2_ISG
 ip subscriber l2-connected
  initiator unclassified mac-address
  initiator dhcp
!
mcsa
 enable sessionmgr
!
ipv6 mobile pmipv6-domain D1
 replay-protection timestamp window 255
lma LMA_5K
  ipv4-address 192.168.199.1
!
ipv6 mobile pmipv6-mag M1 domain D1
sessionmgr
 role 3GPP
 address ipv4 9.9.9.9
interface Tunnel100
 interface Tunnel200
 lma LMA_5K D1
  ipv4-address 192.168.199.1
  encap gre-ipv4
!
ntp master
!
gtp
 information-element rat-type wlan
 interface local GigabitEthernet1/0/0.778
 apn 1
  apn-name gtp.com
  ip address ggsn 172.16.199.1
  fixed link-layer address 00ab.00cd.00ef
  default-gw 20.100.254.254 prefix-len 16
  dns-server 20.100.254.254
  dhcp-server 20.100.254.254
!
end
```

You can use the following commands to check and show subscriber session information:

```
show ip dhcp sip statistics
show subscriber statistics
show subscriber session
show ipv6 mobile pmipv6 mag binding
show gtp pdp-context all
show interface tunnel-name
```

Additional References

Related Documents

Related Topic	Document Title
Cisco IOS commands	*Cisco IOS Master Commands List, All Releases*
iWAG commands	Cisco IOS Intelligent Wireless Access Gateway Command Reference

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature.	To locate and download MIBs for selected platforms, Cisco software releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

Technical Assistance

Description	Link
The Cisco Support website provides extensive online resources, including documentation and tools for troubleshooting and resolving technical issues with Cisco products and technologies. 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. Access to most tools on the Cisco Support website requires a Cisco.com user ID and password.	http://www.cisco.com/cisco/web/support/index.html

Feature Information for Configuring Ethernet Over GRE

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. An account on Cisco.com is not required.

Table 1: Feature Information for Configuring the Ethernet Over GRE Feature

Feature Name	Releases	Feature Information
Service Provider WiFi: Integrated Ethernet Over GRE	3.9.1S	This feature enables the Ethernet over Generic Routing Encapsulation (EoGRE) tunnel to be used as a service provider WiFi access interface from CPE devices. A Cisco ASR 1000 Series Aggregation Services Router is used as an L2 aggregator to terminate L2 traffic at the GRE tunnel interface and provide L3 services. In Cisco IOS XE Release 3.9.1S, this feature is implemented on the Cisco ASR 1000 Series Aggregation Services Routers. The following sections provide information about this feature: • Information About Configuring Ethernet Over GRE, on page 2 • How to Configure the EoGRE Feature, on page 7