



# Cisco Mobile Networks

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## Feature History

Release	Modification
12.2(4)T	This feature was introduced.
12.2(4)T3	Support for this feature was introduced for the Cisco 7500 series.
12.2(13)T	Support for dynamic networks was introduced.

This feature module describes the Cisco Mobile Networks feature. It includes the following sections:

- [Feature Overview, page 1](#)
- [Supported Platforms, page 8](#)
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- [Prerequisites, page 9](#)
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- [Monitoring and Maintaining the Mobile Router, page 15](#)
- [Configuration Examples, page 16](#)
- [Command Reference, page 23](#)
- [Glossary, page 68](#)

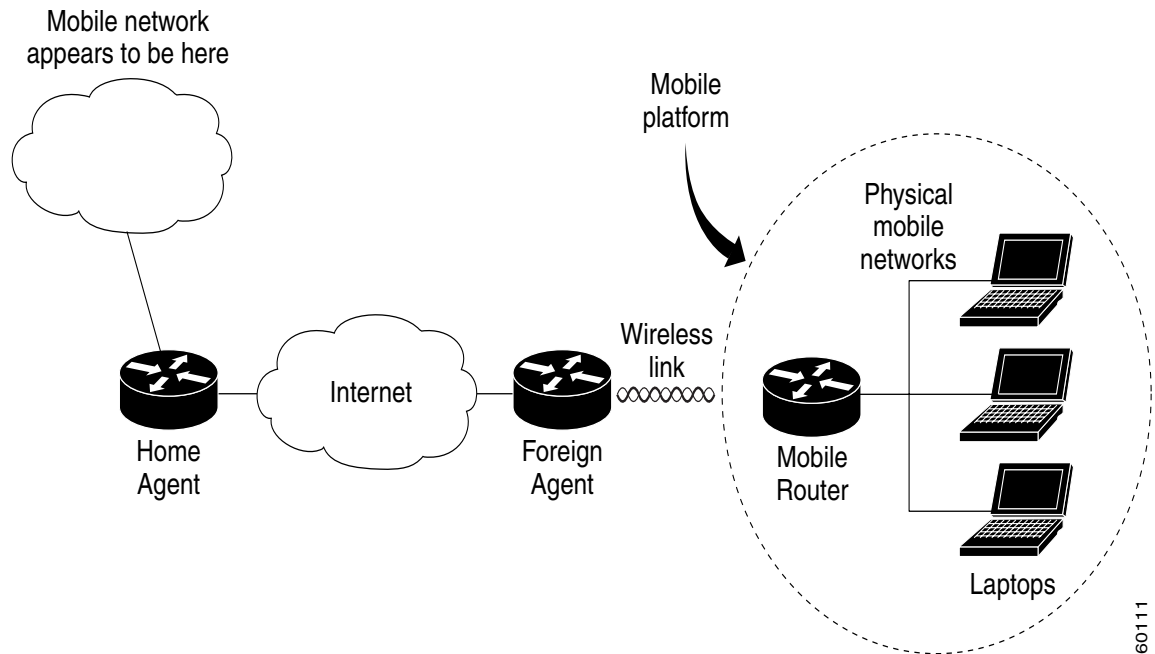
## Feature Overview

The Cisco Mobile Networks feature enables a mobile router and its subnets to be mobile and maintain all IP connectivity, transparent to the IP hosts connecting through this mobile router.

Mobile IP, as defined in standard RFC 3344, provides the architecture that enables the mobile router to connect back to its home network. Mobile IP allows a device to roam while appearing to a user to be at its home network. Such a device is called a mobile node. A mobile node is a node—for example, a personal digital assistant, a laptop computer, or a data-ready cellular phone—that can change its point of attachment from one network or subnet to another. This mobile node can travel from link to link and maintain ongoing communications while using the same IP address. There is no need for any changes to applications because the solution is at the network layer, which provides the transparent network mobility.

The Cisco Mobile Networks feature comprises three components—the mobile router (MR), home agent (HA), and foreign agent (FA). [Figure 1](#) shows the three components and their relationships within the mobile network.

**Figure 1 Cisco Mobile Network Components and Relationships**



The mobile router functions similarly to the mobile node with one key difference—the mobile router allows entire networks to roam. For example, an airplane with a mobile router can fly around the world while passengers stay connected to the Internet. This communication is accomplished by Mobile IP aware routers tunneling packets, which are destined to hosts on the mobile networks, to the location where the mobile router is visiting. The mobile router then forwards the packets to the destination device.

These destination devices can be mobile nodes running mobile IP client software or nodes without the software. The mobile router eliminates the need for a mobile IP client. In fact, the nodes on the mobile network are not aware of any IP mobility at all. The mobile router “hides” the IP roaming from the local IP nodes so that the local nodes appear to be directly attached to the home network. See the [“Mobile Router”](#) section later in this document for more details on how the mobile router operates.

A home agent is a router on the home network of the mobile router that provides the anchoring point for the mobile networks. The home agent maintains an association between the home IP address of the mobile router and its *care-of address*, which is the current location of the mobile router on a foreign or visited network. The home agent is responsible for keeping track of where the mobile router roams and tunneling packets to the current location of the mobile network. The home agent also injects the mobile networks into its forwarding table. See the [“Home Agent”](#) section later in this document for more details on how the home agent operates.

A foreign agent is a router on a foreign network that assists the mobile router in informing its home agent of its current care-of address. It functions as the point of attachment to the mobile router, delivering packets from the home agent to the mobile router. The foreign agent is a fixed router with a direct logical connection to the mobile router. The mobile router and foreign agent need not be connected directly by

a physical wireless link. For example, if the mobile router is roaming, the connection between the foreign agent and mobile router occurs on interfaces that are not on the same subnet. This feature does not add any new functionality to the foreign agent component.

Previously, this feature was a static network implementation that supported stub routers only. Cisco IOS Release 12.2(13)T introduces dynamic network support, which means that the mobile router dynamically registers its mobile networks to the home agent, which reduces the amount of configuration required at the home agent. For example, if a home agent supports 2000 mobile routers, the home agent does not need 2000 configurations but only a range of home IP addresses to use for the mobile routers.

This feature implements additional features in the Mobile IP MIB (RFC2006-MIB) to support Cisco Mobile Networks. Prior to this release, mobile node groups in the RFC2006-MIB were not supported.

Cisco IOS Release 12.2(4)T implements mobile node MIB groups from the RFC2006-MIB for the monitoring and management of Cisco Mobile Network activity. Data from managed objects is returned through the use of the **show** commands described in this document, or can be retrieved from a Network Management System using SNMP.

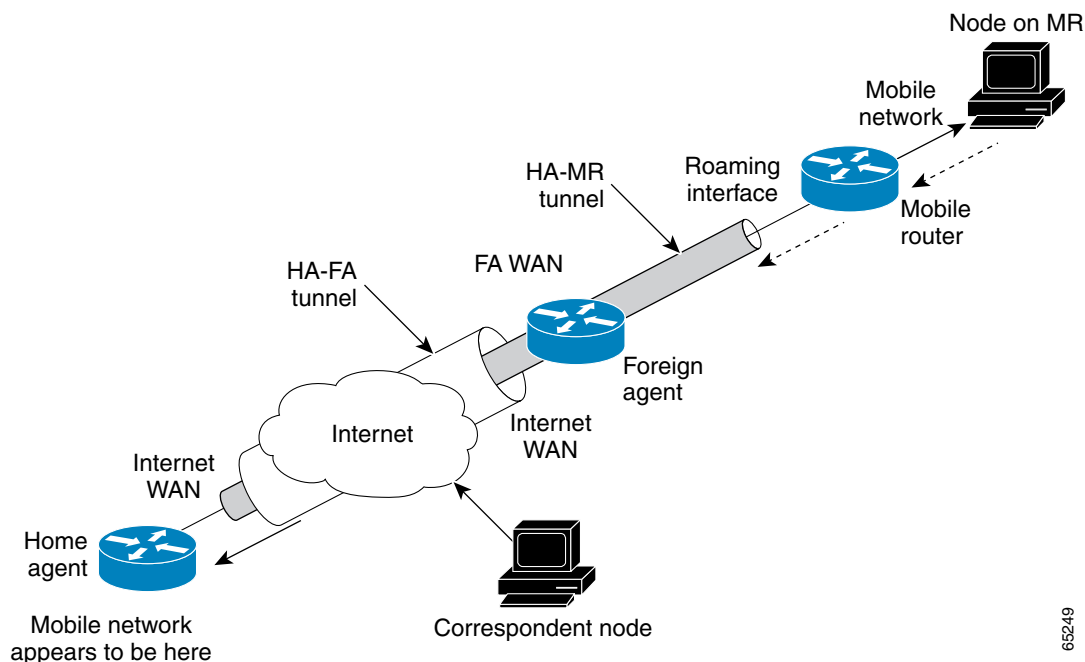
## Primary Components of Cisco Mobile Networks

The Cisco Mobile Networks feature introduces the mobile router and adds new functionality to the home agent component as described in the following sections:

- [Mobile Router](#)
- [Home Agent](#)

[Figure 2](#) shows how packets are routed within the mobile network. The following sections provide more detail on how this routing is accomplished.

**Figure 2** Routing Within the Cisco Mobile Network



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## Mobile Router

Deployed on a mobile platform (such as a car, plane, train, or emergency medical services vehicle), the mobile router functions as a roaming router that provides connectivity for its mobile network. A device connected to the mobile router need not be a mobile node because the mobile router is providing the roaming capabilities.

The mobile router process has three main phases described in the following sections:

- [Agent Discovery](#)
- [Registration](#)
- [Routing](#)

### Agent Discovery

During the agent discovery phase, home agents and foreign agents advertise their presence on their attached links by periodically multicasting or broadcasting messages called *agent advertisements*. Agent advertisements are ICMP Router Discovery Protocol (IRDP) messages that convey Mobile IP information. The advertisement contains the IRDP lifetime, which is the number of seconds the agent is considered valid. The advertisement also contains the care-of address, the point of attachment on the foreign network, as well as registration lifetime allowed and supported services such as generic routing encapsulation (GRE), and reverse tunnel.

Agent discovery occurs through periodic advertisements by agents or solicitations by the mobile router.

For periodic advertisements, the mobile router knows that the agent is up as long as it hears the advertisements from the agent. When the mobile router hears the agent advertisements, it keeps track of the agent in an agent table. When the IRDP lifetime expires, the agent is considered disconnected (for example, interface down, out of range, or agent down) and the mobile router removes the agent from its agent table.

Rather than wait for agent advertisements, a mobile router can send an agent solicitation. This solicitation forces any agents on the link to immediately send an agent advertisement.

The mobile router receives these advertisements on its interfaces that are configured for roaming and determines if it is connected to its home network or a foreign network. When the mobile router hears an agent advertisement and detects that it has moved outside of its home network, it begins registration, which is the second phase of the process.

### Registration

The mobile router is configured with its home address, the IP address or addresses of its home agents, and the mobility security association of its home agent. There is a shared key between the mobile router and the home agent for authentication, as discussed in the “[Security for Mobile Networks](#)” section later in this document. The mobile router uses this information along with the information that it learns from the foreign agent advertisements to form a registration request.

The mobile router prefers to register with a particular agent based on the received interface. If more than one interface receives agent advertisements, the one with the highest roaming priority value is preferred. In the case that multiple interfaces have the same priority, the highest bandwidth is preferred. If interfaces have the same bandwidth, the highest interface IP address is preferred.

After determining this preferred path, the mobile router informs the home agent of its current care-of address by sending a registration request. Because the mobile router is attached to a foreign network, the registration request is sent first to the foreign agent.

When the mobile router powers down or determines that it is reconnected to its home link, it deregisters by sending a deregistration request to the home agent.

A successful registration sets up the routing mechanism for transporting packets to and from the mobile networks as the mobile router roams, which is the third phase of the process.

## Routing

During the routing or tunneling phase, packets arrive at the home agent. The home agent performs two encapsulations of the packets and tunnels them to the foreign agent. The foreign agent performs one decapsulation and forwards the packets to the mobile router, which performs another decapsulation. The mobile router then forwards the original packets to the IP devices on the mobile networks.

By default, packets from devices on the mobile network arrive at the mobile router, which forwards them to the foreign agent, which routes them normally.

The mobile networks can be statically configured or dynamically registered on the home agent. As the mobile router moves from one foreign agent to another, the mobile router continuously reconfigures the default gateway definition to point to its new path. Although the mobile router can register through different foreign agents, the most recently contacted foreign agent provides the active connection.

A reverse tunnel is when the mobile router tunnels packets to the foreign agent and home agent. In this case, packets from devices arrive at the mobile router, which encapsulates them and then sends them to the foreign agent, which encapsulates the packets and forwards them to the home agent. The home agent decapsulates both encapsulations and routes the original packets.

## Home Agent

The home agent provides the anchoring point for the mobile networks. The home agent process has two main phases described in the following sections:

- [Registration](#)
- [Routing](#)

## Registration

After receiving the registration request originated from the mobile router, the home agent checks the validity of the registration request, which includes authentication of the mobile router. If the registration request is valid, the home agent sends a registration reply to the mobile router through the foreign agent.

The home agent also creates a *mobility binding table* that maps the home IP address of the mobile router to the current care-of address of the mobile router. An entry in this table is called a *mobility binding*. The main purpose of registration is to create, modify, or delete the mobility binding of a mobile router (or mobile node) at its home agent.

The home agent processes registration requests from the mobile router in the same way that it does with the mobile node. The only difference is that an additional tunnel is created to the mobile router. Thus, packets destined to the mobile networks are encapsulated twice, as discussed in the “[Routing](#)” section that follows. The home agent injects the mobile networks, which are statically defined or dynamically registered, into its forwarding table. This allows routing protocols configured on the home agent to redistribute these mobile routes.

## Routing

The home agent advertises reachability to the mobile networks on the mobile router, thereby attracting packets that are destined for them. When a device on the Internet, called a *correspondent node*, sends a packet to the node on the mobile network, the packet is routed to the home agent. The home agent creates tunnels in the following two areas:

- Between the home agent and foreign agent care-of address
- Between the home agent and mobile router

The home agent encapsulates the original packet from the correspondent node twice. The packet arrives at the foreign agent, which decapsulates the HA and FA care-of address tunnel header and forwards the packet to the mobile router, which performs another decapsulation (HA and MR tunnel header) to deliver the packet to the destination node on the mobile network. To the rest of the network, the destination node appears to be located at the home agent; however, it exists physically on the mobile network of the mobile router. See [Figure 2](#) for a graphical representation of how these packets are routed.

## Security for Mobile Networks

The home agent of the mobile router is configured with the home IP address of the mobile router and the mobile networks of the mobile router. The message digest algorithm 5 (MD5) hex key is a 128-bit key also defined here. MD5 is an algorithm that takes the registration message and a key to compute the smaller chunk of data called a *message digest*. The mobile router and home agent both have a copy of the key, called a *symmetric key*, and authenticate each other by comparing the results of the computation. If both keys yield the same result, nothing in the packet has changed during transit.

Mobile IP also supports the hash-based message authentication code (HMAC-MD5), which is the default authentication algorithm as of Cisco IOS Release 12.2(13)T.

Replay protection uses the identification field in the registration messages as a timestamp and sequence number. The home agent returns its time stamp to synchronize the mobile router for registration.

Cisco IOS software allows the mobility keys to be stored on an authentication, authorization, and accounting (AAA) server that can be accessed using TACACS+ or RADIUS protocols. Mobile IP in Cisco IOS software also contains registration filters, enabling companies to restrict who is allowed to register.

For more information on security in a Mobile IP environment, refer to the “Configuring Mobile IP” chapter of the *Cisco IOS IP Configuration Guide*, Release 12.2.

## Cisco Mobile Networks Redundancy

The Cisco Mobile Networks feature uses the Hot Standby Router Protocol (HSRP) to provide a full redundancy capability for the mobile router.

HSRP is a protocol developed by Cisco that provides network redundancy in a way that ensures that user traffic will immediately and transparently recover from failures. An HSRP group comprises two or more routers that share an IP address and a MAC (Layer 2) address and act as a single virtual router. For example, your Mobile IP topology can include one or more standby home agents that the rest of the topology views as a single virtual home agent.

You must define certain HSRP group attributes on the interfaces of the mobile routers so that Mobile IP can implement the redundancy. The mobile routers are aware of the HSRP states and assume the active or standby role as needed. For more information on mobile router redundancy, see the [“Enabling Mobile](#)

**Router Redundancy**” task later in this document. For more information on home agent redundancy, which is a Cisco proprietary feature that runs on top of HSRP, refer to the “Configuring Mobile IP” chapter of the *Cisco IOS IP Configuration Guide*, Release 12.2.

HSRP need not be configured on the foreign agent. Foreign agent redundancy is achieved by overlapping wireless coverage.

## Benefits

### Mobility Solution at the Network Layer

With the mobile router deployed in a moving vehicle, repeated reconfiguration of the various devices attached to that router as the vehicle travels is no longer necessary. Because the mobile router operates at the network layer and is independent of the physical layer, it operates transparently over cellular, satellite, and other wireless or fixed media.

### Always-On Connection to the Internet

This feature supports an always-on connection to the Internet, providing access to current and changing information. For example, aircraft pilots can access the latest weather updates while flying and EMS vehicles can be in communication with emergency room technicians while on the way to the hospital.

### Versatile

Any IP-enabled device can be connected to the mobile router LAN ports and achieve mobility. Applications that are not specifically designed for mobility can be accessed and deployed.

### Dynamic Mobile Networks

The dynamic network enables dynamic registration of mobile networks, which results in minimal configuration on the home agent making administration and set up easier. When configured for dynamic registration, the mobile router tells the home agent which networks are configured in each registration request. The home agent dynamically adds these networks to the forwarding table and there is no need to statically define the networks on the home agent.

### Preferred Path

By using the preferred path, a network designer can specify the primary link, based upon bandwidth or priority, to reduce costs or to use a specific carrier.

### Standards-Based Solution

Mobile IP complies with official protocol standards of the Internet.

### Mobile IP MIB Support

Support for mobile node MIB groups in the Mobile IP MIB allows the monitoring of Mobile Network activity using the Cisco IOS command line interface or SNMP. For further details, refer to the RFC2006-MIB.my file, available through Cisco.com at <ftp://ftp.cisco.com/pub/mibs/v2/>, and RFC 2006, *The Definitions of Managed Objects for IP Mobility Support using SMIPv2*.

## Related Features and Technologies

Mobile IP is documented in the *Cisco IOS IP Configuration Guide*. Mobile IP configuration commands are documented in the *Cisco IOS IP Command Reference, Volume 1 of 3: Addressing and Services*.

## Related Documents

- *Cisco IOS IP Command Reference, Volume 1 of 3: Addressing and Services*, Release 12.2
- *Cisco IOS IP Configuration Guide*, Release 12.2
- *Cisco Mobile Networks—Asymmetric Link Support*, Release 12.2(13)T

## Supported Platforms

- Cisco 2500 series
- Cisco 2600 series
- Cisco 3620 router
- Cisco 3640 router
- Cisco 3660 router
- Cisco 7200 series
- Cisco 7500 series (Cisco IOS Release 12.2(4)T2 and later releases)

### Determining Platform Support Through Cisco Feature Navigator

Cisco IOS software is packaged in feature sets that are supported on specific platforms. To get updated information regarding platform support for this feature, access Cisco Feature Navigator. Cisco Feature Navigator dynamically updates the list of supported platforms as new platform support is added for the feature.

Cisco Feature Navigator is a web-based tool that enables you to quickly determine which Cisco IOS software images support a specific set of features and which features are supported in a specific Cisco IOS image. You can search by feature or release. Under the release section, you can compare releases side by side to display both the features unique to each software release and the features in common.

To access Cisco Feature Navigator, you must have an account on Cisco.com. If you have forgotten or lost your account information, send a blank e-mail to [cco-locksmith@cisco.com](mailto:cco-locksmith@cisco.com). An automatic check will verify that your e-mail address is registered with Cisco.com. If the check is successful, account details with a new random password will be e-mailed to you. Qualified users can establish an account on Cisco.com by following the directions found at this URL:

<http://www.cisco.com/register>

Cisco Feature Navigator is updated regularly when major Cisco IOS software releases and technology releases occur. For the most current information, go to the Cisco Feature Navigator home page at the following URL:

<http://www.cisco.com/go/fn>

### Availability of Cisco IOS Software Images

Platform support for particular Cisco IOS software releases is dependent on the availability of the software images for those platforms. Software images for some platforms may be deferred, delayed, or changed without prior notice. For updated information about platform support and availability of software images for each Cisco IOS software release, refer to the online release notes or, if supported, Cisco Feature Navigator.

# Supported Standards, MIBs, and RFCs

## Standards

No new or modified standards are supported by this feature.

## MIBs

- RFC2006-MIB
- CISCO-MOBILE-IP-MIB

To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL:

<http://tools.cisco.com/ITDIT/MIBS/servlet/index>

If Cisco MIB Locator does not support the MIB information that you need, you can also obtain a list of supported MIBs and download MIBs from the Cisco MIBs page at the following URL:

<http://www.cisco.com/public/sw-center/netmgmt/cmtk/mibs.shtml>

To access Cisco MIB Locator, you must have an account on Cisco.com. If you have forgotten or lost your account information, send a blank e-mail to [cco-locksmith@cisco.com](mailto:cco-locksmith@cisco.com). An automatic check will verify that your e-mail address is registered with Cisco.com. If the check is successful, account details with a new random password will be e-mailed to you. Qualified users can establish an account on Cisco.com by following the directions found at this URL:

<http://www.cisco.com/register>

## RFCs

- RFC 2003, *IP Encapsulation within IP*
- RFC 2005, *Applicability Statement for IP Mobility Support*
- RFC 2006, *The Definitions of Managed Objects for IP Mobility Support*
- RFC 3024, *Reverse Tunneling for Mobile IP, revised*
- RFC 3344, *IP Mobility Support for IPv4*

## Prerequisites

To configure home agent functionality on your router, you need to determine IP addresses or subnets for which you want to allow roaming service. If you intend to support roaming on virtual networks, you need to identify the subnets for which you will allow this service and place these virtual networks appropriately on the home agent. It is possible to enable home agent functionality for a physical or virtual subnet. In the case of virtual subnets, you must define the virtual networks on the router using the **ip mobile virtual-network** global configuration command.

## Configuration Tasks

See the following sections for configuration tasks for the Cisco Mobile Networks feature. Each task in the list is identified as either required or optional.

- [Enabling Home Agent Services](#) (required)

- [Enabling Foreign Agent Services](#) (required)
- [Enabling Mobile Router Services](#) (required)
- [Enabling Mobile Router Redundancy](#) (optional)
- [Verifying Home Agent Configuration](#) (optional)
- [Verifying Foreign Agent Configuration](#) (optional)
- [Verifying Mobile Router Configuration](#) (optional)
- [Verifying Mobile Router Redundancy](#) (optional)

## Enabling Home Agent Services

You can configure a home agent with both dynamically registered and statically configured mobile networks. However, a statically configured mobile network will always take precedence over dynamic registrations of the same network.

To enable home agent services on the router, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# <b>router mobile</b>	Enables Mobile IP on the router.
Step 2	Router(config-router)# <b>exit</b>	Returns to global configuration mode.
Step 3	Router(config)# <b>ip mobile home-agent</b> [ <b>address ip-address</b> ] [ <b>broadcast</b> ] [ <b>care-of-access acl</b> ] [ <b>lifetime number</b> ] [ <b>replay seconds</b> ] [ <b>reverse-tunnel-off</b> ] [ <b>roam-access acl</b> ] [ <b>suppress-unreachable</b> ]	Enables home agent service.
Step 4	Router(config)# <b>ip mobile virtual-network</b> <i>net mask</i> [ <b>address address</b> ]	Defines a virtual network. Specifies that the home network is a virtual network, which means that the mobile router is not physically attached to the home agent. Adds the network to the home agent's forwarding table so that routing protocols can redistribute the subnet.  If not using virtual networks, go to step 8.
Step 5	Router(config-router)# <b>router protocol</b>	Configures a routing protocol.
Step 6	Router(config)# <b>redistribute mobile</b> [ <b>metric metric-value</b> ] [ <b>metric-type type-value</b> ]	Enables redistribution of a virtual network into routing protocols.
Step 7	Router(config-router)# <b>exit</b>	Returns to global configuration mode.
Step 8	Router(config)# <b>ip mobile host</b> <i>lower</i> [ <i>upper</i> ] [ <b>interface name</b>   <b>virtual-network net mask</b> ] [ <b>lifetime number</b> ]	Configures the mobile router as a mobile host. The IP address is in the home network.  The <b>interface name</b> option configures a physical connection from the home agent to the mobile router.

	Command	Purpose
Step 9	Router(config)# <b>ip mobile mobile-networks</b> <i>lower</i> [ <i>upper</i> ]	Configures mobile networks for the mobile host and enters mobile networks configuration mode. The <i>upper</i> range can be used only with dynamically registered networks and allows you to configure multiple mobile routers at once.  The range must match the range configured in the <b>ip mobile host</b> command.
Step 10	Router(mobile-networks)# <b>description</b> <i>string</i>	(Optional) Adds a description to a mobile router configuration.
Step 11	Router(mobile-networks)# <b>network</b> <i>net mask</i>	(Optional) Configures a network that is attached to the mobile router as a mobile network. Use this command to statically configure networks.
Step 12	Router(mobile-networks)# <b>register</b>	(Optional) Dynamically registers the mobile networks with the home agent. The home agent learns about the mobile networks through this registration process. When the mobile router registers its mobile networks on the home agent, the home agent looks up the mobile network configuration and verifies that the <b>register</b> command is configured before adding forwarding entries to the mobile networks.  If the <b>register</b> command is not configured, the home agent will reject an attempt by the mobile router to dynamically register its mobile networks.
Step 13	Router(mobile-networks)# <b>exit</b>	Exits mobile networks configuration mode.
Step 14	Router(config)# <b>ip mobile secure host</b> <i>address</i> { <b>inbound-spi</b> <i>spi-in</i> <b>outbound-spi</b> <i>spi-out</i>   <b>spi</b> <i>spi</i> } <b>key</b> <i>hex string</i>	Sets up mobile host security associations. This is the security association the mobile router uses when sending in a registration request. The SPI and key between the home agent and mobile router are known. The address is the home IP address of the mobile router.

## Enabling Foreign Agent Services

There are no changes to the foreign agent configuration with the introduction of dynamic network support.

To start a foreign agent providing default services, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# <b>router mobile</b>	Enables Mobile IP on the router.
Step 2	Router(config-router)# <b>exit</b>	Returns to global configuration mode.

	Command	Purpose
Step 3	Router(config)# <b>ip mobile foreign-agent care-of interface</b>	Enables foreign agent services when at least one care-of address is configured. This is the foreign network termination point of the tunnel between the foreign agent and home agent. The care-of address is the IP address of the interface. The interface, whether physical or loopback, need not be the same as the visited interface.
Step 4	Router(config)# <b>interface type number</b>	Configures an interface and enters interface configuration mode.
Step 5	Router(config-if)# <b>ip address ip-address mask</b>	Sets a primary IP address of the interface.
Step 6	Router(config-if)# <b>ip irdp</b>	Enables IRDP processing on an interface.
Step 7	Router(config-if)# <b>ip irdp maxadvertinterval seconds</b>	(Optional) Specifies maximum interval in seconds between advertisements.
Step 8	Router(config-if)# <b>ip irdp minadvertinterval seconds</b>	(Optional) Specifies minimum interval in seconds between advertisements.
Step 9	Router(config-if)# <b>ip irdp holdtime seconds</b>	(Optional) Length of time in seconds that advertisements are held valid. Default is three times the <b>maxadvertinterval</b> period.
Step 10	Router(config-if)# <b>ip mobile foreign-service</b>	Enables foreign agent service on an interface. This will also append Mobile IP information such as care-of address, lifetime, and service flags to the advertisement.

## Enabling Mobile Router Services

To enable mobile router services, use the following commands beginning in global configuration mode:

	Command	Purpose
Step 1	Router(config)# <b>router mobile</b>	Enables Mobile IP on the router.
Step 2	Router(config-router)# <b>exit</b>	Returns to global configuration mode.
Step 3	Router(config)# <b>ip mobile router</b>	Enables the mobile router and enters mobile router configuration mode.
Step 4	Router(mobile-router)# <b>address address mask</b>	Sets the home IP address and network mask of the mobile router.
Step 5	Router(mobile-router)# <b>home-agent ip-address</b>	Specifies the home agent that the mobile router uses during registration.
Step 6	Router(mobile-router)# <b>mobile-network interface</b>	(Optional) Specifies the mobile router interface that is connected to the dynamic mobile network. There can be more than one mobile network configured on a mobile router. The mobile router's registrations will contain these mobile networks.

	Command	Purpose
Step 7	Router(mobile-router)# <b>register</b> { <b>extend expire seconds</b> <b>retry number interval seconds</b>   <b>lifetime seconds</b>   <b>retransmit initial milliseconds maximum milliseconds</b> <b>retry number</b> }	(Optional) Controls the registration parameters of the mobile router.
Step 8	Router(mobile-router)# <b>reverse-tunnel</b>	(Optional) Enables the reverse tunnel function.
Step 9	Router(mobile-router)# <b>exit</b>	Exits mobile router configuration mode.
Step 10	Router(config)# <b>ip mobile secure home-agent</b> <i>address</i> { <b>inbound-spi spi-in</b> <b>outbound-spi spi-out</b>   <b>spi spi</b> } <b>key hex string</b>	Sets up home agent security associations. The SPI and key between the mobile router and home agent are known. The address is the home IP address of the home agent.
Step 11	Router(config)# <b>interface</b> <i>type number</i>	Configures an interface and enters interface configuration mode.
Step 12	Router(config-if)# <b>ip address</b> <i>ip-address mask</i>	Sets a primary IP address of the interface.
Step 13	Router(config-if)# <b>ip mobile router-service</b> { <b>hold-down seconds</b>   <b>roam [priority value]</b>   <b>solicit [interval seconds]</b> [ <b>retransmit initial min maximum seconds</b> <b>retry number</b> ]}	Enables mobile router service, such as roaming, on an interface.

## Enabling Mobile Router Redundancy

To enable mobile router redundancy, use the following commands beginning in interface configuration mode:

	Command	Purpose
Step 1	Router(config-if)# <b>standby</b> [ <i>group-number</i> ] <b>ip</b> [ <i>ip-address</i> [ <b>secondary</b> ]]	Enables the HSRP.
Step 2	Router(config-if)# <b>standby priority</b> <i>priority</i>	Sets the Hot Standby priority used in choosing the active router.
Step 3	Router(config-if)# <b>standby preempt</b>	Configures the router to preempt, which means that when the local router has a Hot Standby priority higher than the current active router, the local router should attempt to assume control as the active router.
Step 4	Router(config-if)# <b>standby name</b> <i>group-name</i>	Configures the name of the standby group.
Step 5	Router(config-if)# <b>standby</b> [ <i>group-number</i> ] <b>track</b> <i>interface-type interface-number</i> [ <i>interface-priority</i> ]	Configures an interface so that the Hot Standby priority changes based on the availability of other interfaces. The <i>interface-priority</i> argument specifies the amount by which the Hot Standby priority for the router is decremented (or incremented) when the interface goes down (or comes back up). The default value is 10.
Step 6	Router(config-if)# <b>exit</b>	Exits interface configuration mode.

	Command	Purpose
Step 7	Router(config)# <b>ip mobile router</b>	Enables the mobile router.
Step 8	Router(mobile-router)# <b>redundancy group</b> <i>name</i>	Configures fault tolerance for the mobile router. The <i>name</i> argument must match the name specified in the <b>standby name</b> <i>group-name</i> command.

You need not configure HSRP on both the mobile router's roaming interface and the interface attached to the physical mobile networks. If one of the interfaces is configured with HSRP, and the **standby track** command is configured on the other interface, the redundancy mechanism will work. See the "[Cisco Mobile Network Redundancy Example](#)" section for a configuration example.

## Verifying Home Agent Configuration

To verify the home agent configuration, use the following commands in privileged EXEC mode, as needed:

Command	Purpose
Router# <b>show ip mobile mobile-networks</b> [ <i>address</i> ]	Displays a list of mobile networks associated with the mobile router.
Router# <b>show ip mobile host</b> [ <i>address</i> ]	Displays mobile node information.
Router# <b>show ip mobile secure host</b> [ <i>address</i> ]	Displays the mobility security associations for the mobile host.

## Verifying Foreign Agent Configuration

To verify the foreign agent configuration, use the following commands in privileged EXEC mode, as needed:

Command	Purpose
Router# <b>show ip mobile global</b>	Displays global information for mobile agents.
Router# <b>show ip mobile interface</b>	Displays advertisement information for interfaces that are providing foreign agent service or are home links for mobile nodes.

## Verifying Mobile Router Configuration

To verify the mobile router configuration, use the following commands in privileged EXEC mode as needed:

Command	Purpose
Router# <code>show ip mobile router</code>	Displays configuration information and monitoring statistics about the mobile router.
Router# <code>show ip mobile router traffic</code>	Displays the counters that the mobile router maintains.

## Verifying Mobile Router Redundancy

To verify that mobile router redundancy is configured correctly on the router, use the following commands in privileged EXEC mode, as needed:

Command	Purpose
Router# <code>show ip mobile router</code>	Displays configuration information and monitoring statistics about the mobile router.
Router# <code>show ip mobile router traffic</code>	Displays the counters that the mobile router maintains.
Router# <code>show standby</code>	Displays HSRP information.

## Troubleshooting Tips

- Adjust the agent advertisement interval value on the foreign agent using the `ip irdp maxadvertinterval seconds` interface configuration command. Begin by setting the timer to 10 seconds and adjust as needed.
- Before you can ping a subnet on the mobile router, the mobile router must be registered with the home agent and the mobile network (subnet) must be statically configured or dynamically registered on the home agent.
- Use extended pings for roaming interfaces. The pings from the mobile router need to have the home address of the mobile router as the source address in the extended ping. Standard pings will have the source address of the roaming interface as the source address, which is not routeable from the standpoint of the rest of the network unless the roaming interfaces are statically configured on the home agent.
- Redistribute mobile subnets on the home agent so that return traffic can be sent back to the mobile router. Most routing protocols require that default metrics be configured for redistribution.
- Establish a return route from the foreign agent to the home agent.
- Avoid placing any routers behind the mobile router because the mobile router functions as a stub router.
- A statically configured mobile network takes precedence over the same dynamically registered mobile network.
- A mobile network can be configured or registered by only one mobile router at a time.

## Monitoring and Maintaining the Mobile Router

To monitor and maintain the mobile router, use the following commands in privileged EXEC mode, as needed:

Command	Purpose
Router# <code>clear ip mobile router agent</code>	Deletes learned agents and the corresponding care-of address of the foreign agent from the mobile router agent table.
Router# <code>clear ip mobile router registration</code>	Deletes registration entries from the mobile router registration table.
Router# <code>clear ip mobile router traffic</code>	Clears the counters that the mobile router maintains.
Router# <code>show ip mobile router</code>	Displays configuration information and monitoring statistics about the mobile router.
Router# <code>show ip mobile router agent</code>	Displays information about the agents for the mobile router.
Router# <code>show ip mobile router interface</code>	Displays information about the interface that the mobile router is using for roaming.
Router# <code>show ip mobile router registration</code>	Displays the pending and accepted registrations of the mobile router.
Router# <code>show ip mobile router traffic</code>	Displays counters that the mobile router maintains.
Router# <code>debug ip mobile router [detail]</code>	Displays debug messages for the mobile router.

## Configuration Examples

This section provides the following configuration examples:

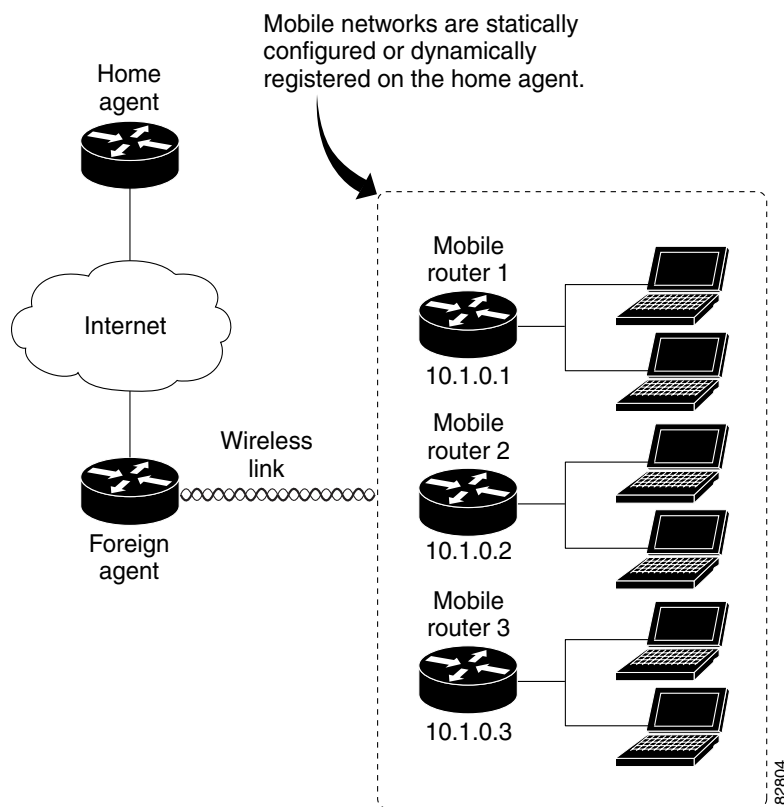
- [Home Agent Example](#)
- [Foreign Agent Example](#)
- [Mobile Router Example](#)
- [Cisco Mobile Network Redundancy Example](#)

In the following examples, a home agent provides service for three mobile routers. Each mobile router has a satellite link and wireless LAN link when roaming. Each is allocated a network that can be partitioned further.

The mobile networks on the mobile routers are both statically configured and dynamically registered on the home agent while the mobile routers roam via foreign agents.

See [Figure 3](#) for an example topology.

**Figure 3** Topology Showing Home Agent Supporting Three Mobile Routers



## Home Agent Example

In the following example, a home agent provides service for three mobile routers. Note that the home agent will advertise reachability to the virtual networks.

```
interface Loopback 0
 ip address 1.1.1.1 255.255.255.255
router mobile
!
! Virtual network advertised by HA is the home network of the MR
ip mobile virtual-network 10.1.0.0 255.255.0.0
ip mobile host 10.1.0.1 virtual-network 10.1.0.0 255.255.0.0
ip mobile host 10.1.0.2 virtual-network 10.1.0.0 255.255.0.0
ip mobile host 10.1.0.3 10.1.0.10 virtual-network 10.1.0.0 255.255.0.0 aaa load-sa
!
! Associated host address that informs HA that 10.1.0.1 is actually an MR
ip mobile mobile-networks 10.1.0.1
! Static config of MR's mobile networks
description jet
network 172.6.1.0 255.255.255.0
network 172.6.2.0 255.255.255.0
!
! Associated host address that informs HA that 10.1.0.2 is actually an MR
ip mobile mobile-networks 10.1.0.2
! One static mobile network; MR may also dynamically register mobile nets
description ship
network 172.7.1.0 255.255.255.0
```

```

register
!
! Range of hosts that are MRs
ip mobile mobile-networks 10.1.0.3 10.1.0.10
! All can dynamically register their mobile networks
register
!
ip mobile secure host 10.1.0.1 spi 101 key hex 12345678123456781234567812345678
ip mobile secure host 10.1.0.2 spi 102 key hex 23456781234567812345678123456781

```

## Foreign Agent Example

In the following example, the foreign agent is providing service on serial interface 0:

```

router mobile
ip mobile foreign-agent care-of serial0
!
interface serial0
ip irdp
ip irdp maxadvertinterval 4
ip irdp minadvertinterval 3
ip irdp holdtime 12
ip mobile foreign-service

```

## Mobile Router Example

In the following example, three mobile routers provide services for the mobile networks:

### Mobile Router 1

```

interface loopback0
! MR home address
ip address 10.1.0.1 255.255.255.255
!
interface serial 0
! MR roaming interface
ip address 172.21.58.253 255.255.255.252
ip mobile router-service roam
interface ethernet 0
! MR roaming interface
ip address 172.21.58.249 255.255.255.252
ip mobile router-service roam
interface ethernet 1
ip address 172.6.1.1 255.255.255.0
interface ethernet 2
ip address 172.6.2.1 255.255.255.0
!
!
router mobile
ip mobile router
address 10.1.0.1 255.255.0.0
home-agent 1.1.1.1
ip mobile secure home-agent 1.1.1.1 spi 101 key hex 12345678123456781234567812345678

```

**Mobile Router 2**

```

interface loopback0
! MR home address
ip address 10.1.0.2 255.255.255.255
!
interface serial 0
! MR roaming interface
ip address 172.21.58.245 255.255.255.252
ip mobile router-service roam
interface ethernet 0
! MR roaming interface
ip address 172.21.58.241 255.255.255.252
ip mobile router-service roam
interface ethernet 1
ip address 172.7.1.1 255.255.255.0
interface ethernet 2
ip address 172.7.2.1 255.255.255.0
!
!
router mobile
ip mobile router
address 10.1.0.2 255.255.0.0
home-agent 1.1.1.1
mobile-network ethernet 2
ip mobile secure home-agent 1.1.1.1 spi 102 key hex 23456781234567812345678123456781

```

**Mobile Router 3**

```

interface loopback0
! MR home address
ip address 10.1.0.3 255.255.255.255
!
interface serial 0
! MR roaming interface
ip address 172.21.58.237 255.255.255.252
ip mobile router-service roam
interface ethernet 0
! MR roaming interface
ip address 172.21.58.233 255.255.255.252
ip mobile router-service roam
interface ethernet 1
ip address 172.8.1.1 255.255.255.0
interface ethernet 2
ip address 172.8.2.1 255.255.255.0
!
!
router mobile
ip mobile router
address 10.1.0.3 255.255.0.0
home-agent 1.1.1.1
mobile-network ethernet 1
mobile-network ethernet 2
ip mobile secure home-agent 1.1.1.1 spi 103 key hex 45678234567812312345678123456781
!

```

## Cisco Mobile Network Redundancy Example

There can be three levels of redundancy for the Cisco Mobile Network: home agent redundancy, foreign agent redundancy, and mobile router redundancy.

In the home agent example, two home agents provide redundancy for the home agent component. If one home agent fails, the standby home agent immediately becomes active so that no packets are lost. HSRP is configured on the home agents, along with HSRP attributes such as the HSRP group name. Thus, the rest of the topology treats the home agents as a single virtual home agent and any fail-over is transparent.

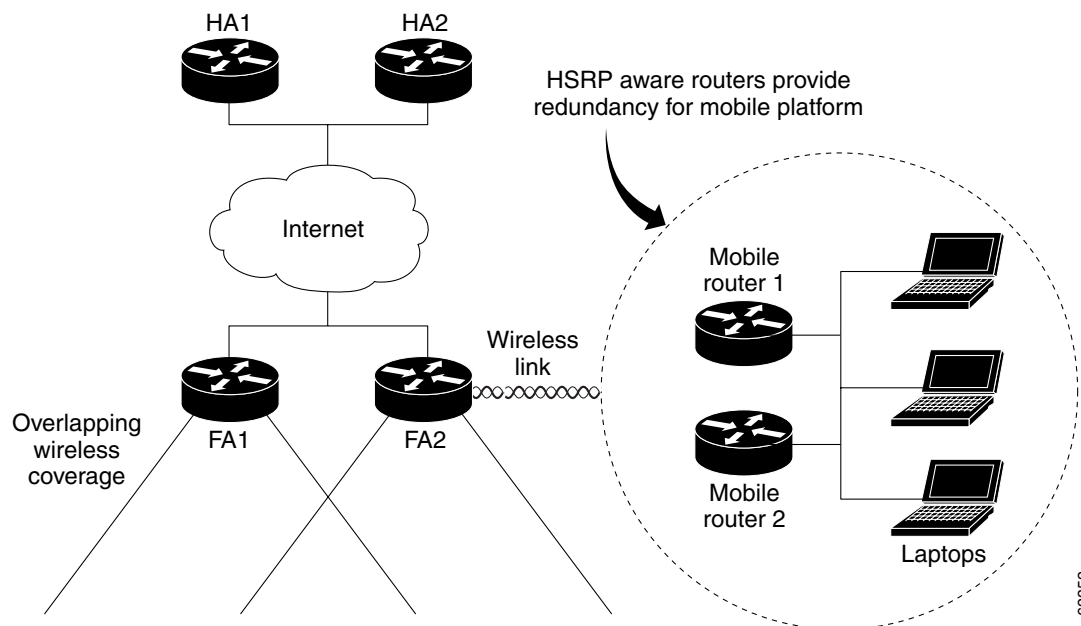
The mobile networks also are defined on the home agent so that the home agent knows to inject these networks into the routing table when the mobile router is registered.

In the foreign agent example, two routers provide foreign agent services. No specific redundancy feature needs to be configured on foreign agents; overlapping wireless coverage provides the redundancy.

The mobile routers use HSRP to provide redundancy, and their group name is associated to the HSRP group name. The mobile routers are aware of the HSRP states. When HSRP is in the active state, the mobile router is active. If HSRP is in the nonactive state, the mobile router is passive. When an active mobile router fails, the standby mobile router becomes active and sends out solicitations out its roaming interfaces to learn about foreign agents and register.

See [Figure 4](#) for an example topology of a redundant network where two mobile routers are connected to each other on a LAN with HSRP enabled.

**Figure 4** Topology Showing Cisco Mobile Networks Redundancy



#### Home Agent 1 (HA1) Configuration

```
interface Ethernet1/1
 ip address 100.100.100.3 255.255.255.0
 ip irdp
 ip irdp maxadvertinterval 10
 ip irdp minadvertinterval 7
 ip irdp holdtime 30
 duplex half
 standby ip 100.100.100.1
 standby priority 100
 standby preempt delay sync 60
 !HSRP group name
 standby name HA_HSRP2
 !
```

```

router mobile
!
router rip
  version 2
  redistribute mobile
  network 100.0.0.0
  default-metric 1
!
ip classless
ip mobile home-agent
! Maps to HSRP group name
ip mobile home-agent redundancy HA_HSRP2 virtual-network address 100.100.100.1
ip mobile virtual-network 70.70.70.0 255.255.255.0
ip mobile host 70.70.70.70 virtual-network 70.70.70.0 255.255.255.0
ip mobile mobile-networks 70.70.70.70
  description san jose jet
! Mobile Networks
  network 20.20.20.0 255.255.255.0
  network 10.10.10.0 255.255.255.0
ip mobile secure host 70.70.70.70 spi 100 key hex 12345678123456781234567812345678
ip mobile secure home-agent 100.100.100.2 spi 300 key hex 12345678123496781234567812345678

```

### Home Agent 2 (HA2) Configuration

```

interface Ethernet1/1
  ip address 100.100.100.2 255.255.255.0
  ip irdp
  ip irdp maxadvertinterval 10
  ip irdp minadvertinterval 7
  ip irdp holdtime 30
  standby ip 100.100.100.1
  standby priority 95
  standby preempt delay sync 60
! HSRP group name
  standby name HA_HSRP2
!
router mobile
!
router rip
  version 2
  redistribute mobile
  network 100.0.0.0
  default-metric 1
!
ip classless
ip mobile home-agent
!Maps to HSRP group name
ip mobile home-agent redundancy HA_HSRP2 virtual-network address 100.100.100.1
ip mobile virtual-network 70.70.70.0 255.255.255.0
ip mobile host 70.70.70.70 virtual-network 70.70.70.0 255.255.255.0
ip mobile mobile-networks 70.70.70.70
  description san jose jet
!Mobile Networks
  network 20.20.20.0 255.255.255.0
  network 10.10.10.0 255.255.255.0
ip mobile secure host 70.70.70.70 spi 100 key hex 12345678123456781234567812345678
ip mobile secure home-agent 100.100.100.1 spi 300 key hex 12345978123456781234567812345678

```

### Foreign Agent 1 (FA1) Configuration

```

interface Ethernet0
  ip address 171.69.68.2 255.255.255.0
  media-type 10BaseT
!

```

```

interface Ethernet1
 ip address 80.80.80.1 255.255.255.0
 ip irdp
 ip irdp maxadvertinterval 10
 ip irdp minadvertinterval 7
 ip irdp holdtime 30
 ip mobile foreign-service
 media-type 10BaseT
!
router mobile
!
router rip
 version 2
 network 80.0.0.0
 network 100.0.0.0
!
ip classless
no ip http server
ip mobile foreign-agent care-of Ethernet1

```

### Foreign Agent 2 (FA2) Configuration

```

interface Ethernet1
 ip address 171.69.68.1 255.255.255.0
 media-type 10BaseT
!
interface Ethernet2
 ip address 80.80.80.2 255.255.255.0
 ip irdp
 ip irdp maxadvertinterval 10
 ip irdp minadvertinterval 7
 ip irdp holdtime 30
 ip mobile foreign-service
 media-type 10BaseT
!
router mobile
!
router rip
 version 2
 network 80.0.0.0
 network 100.0.0.0
!
ip classless
no ip http server
ip mobile foreign-agent care-of Ethernet2

```

### Mobile Router 1 Configuration

```

interface Ethernet5/2
! MR roaming interface
 ip address 70.70.70.4 255.255.255.0
 ip mobile router-service roam
! Configure redundancy for mobile router using HSRP
 standby ip 70.70.70.70
 standby priority 105
 standby preempt
 standby name MR_HSRP2
 standby track Ethernet5/4
!
interface Ethernet5/4
! Interface to Mobile Network
 ip address 20.20.20.2 255.255.255.0
!
router mobile

```

```

!
router rip
  version 2
  passive-interface Ethernet5/2
  network 20.0.0.0
  network 70.0.0.0
!
ip classless
no ip http server
ip mobile secure home-agent 100.100.100.100 spi 100 key hex
12345678123456781234567812345678
ip mobile router
! Maps to HSRP group name
  redundancy group MR_HSRP2
! Using roaming interface hot address as MR address
  address 70.70.70.70 255.255.255.0
  home-agent 100.100.100.1

```

### Mobile Router 2 Configuration

```

interface Ethernet1/2
! MR roaming interface
  ip address 70.70.70.3 255.255.255.0
  ip mobile router-service roam
! Configure redundancy for mobile router using HSRP
  standby ip 70.70.70.70
  standby priority 100
  standby preempt
  standby name MR_HSRP2
  standby track Ethernet1/4
!
interface Ethernet1/4
! Interface to Mobile Network
  ip address 20.20.20.1 255.255.255.0
!
router mobile
!
router rip
  version 2
  passive-interface Ethernet1/2
  network 20.0.0.0
  network 70.0.0.0
!
ip classless
no ip http server
ip mobile secure home-agent 100.100.100.100 spi 100 key hex
12345678123456781234567812345678
ip mobile router
! Maps to HSRP group name
  redundancy group MR_HSRP2
! Using roaming interface hot address as MR address
  address 70.70.70.70 255.255.255.0
  home-agent 100.100.100.1

```

## Command Reference

This section documents new and modified commands. All other commands used with this feature are documented in the Cisco IOS Release 12.2 command reference publications.

- [address \(mobile router\)](#)

- **clear ip mobile router agent**
- **clear ip mobile router registration**
- **clear ip mobile router traffic**
- **debug ip mobile**
- **debug ip mobile router**
- **description (mobile networks)**
- **home-agent**
- **ip mobile mobile-networks**
- **ip mobile router**
- **ip mobile router-service**
- **mobile-network**
- **network (mobile networks)**
- **redundancy group**
- **register (mobile networks)**
- **register (mobile router)**
- **reverse-tunnel**
- **show ip mobile binding**
- **show ip mobile host**
- **show ip mobile mobile-networks**
- **show ip mobile router**
- **show ip mobile router agent**
- **show ip mobile router interface**
- **show ip mobile router registration**
- **show ip mobile router traffic**

# address (mobile router)

To set the home IP address of the mobile router, use the **address** command in mobile router configuration mode. To remove the address, use the **no** form of this command.

**address** *address mask*

**no address** *address mask*

Syntax	Description
<i>address</i>	Home IP address.
<i>mask</i>	Mask for the associated subnet.

**Defaults** No default behavior or values.

**Command Modes** Mobile router configuration

Command History	Release	Modification
	12.2(4)T	This command was introduced.

**Usage Guidelines** The **address** command configures the home IP address and subnet mask of the mobile router. The address and subnet mask identify the home network of the mobile router and are used to discover when the mobile router is at home.

**Examples** The following example sets the home IP address and subnet mask of the mobile router:

```
ip mobile router
address 10.1.0.1 255.255.0.0
```

Related Commands	Command	Description
	<a href="#">show ip mobile router</a>	Displays configuration information and monitoring information about the mobile router.

# clear ip mobile router agent

To delete learned agents and the corresponding care-of address of the foreign agent from the mobile router agent table, use the **clear ip mobile router agent** command in privileged EXEC mode.

**clear ip mobile router agent** [*ip-address*]

<b>Syntax Description</b>	<i>ip-address</i>	(Optional) IP address of an agent. If not specified, all agents are deleted from the agent table.
---------------------------	-------------------	---

<b>Defaults</b>	No default behavior or values.
-----------------	--------------------------------

<b>Command Modes</b>	Privileged EXEC
----------------------	-----------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	12.2(4)T	This command was introduced.

**Usage Guidelines**

The mobile router maintains an agent table listing active agents and the corresponding care-of address of the foreign agent. The mobile router uses this agent table to decide which foreign agent to register with. The mobile router updates the table when it receives advertisements. If an advertisement expires, its entry is automatically deleted from the table.

The **clear ip mobile router agent** *ip-address* option allows you to remove a specific agent. If no address is specified, all agents are cleared.

**Examples**

The following example removes all agents from the mobile router agent table:

```
Router# clear ip mobile router agent
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<a href="#">show ip mobile router agent</a>	Displays information about the agents for the mobile router.

# clear ip mobile router registration

To delete registration entries from the mobile router registration table, use the **clear ip mobile router registration** command in privileged EXEC mode.

**clear ip mobile router registration** [*ip-address*]

<b>Syntax Description</b>	<i>ip-address</i>	(Optional) IP address of a specific agent. If not specified, all registration entries are deleted.
---------------------------	-------------------	--

**Defaults** No default behavior or values.

**Command Modes** Privileged EXEC

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	12.2(4)T	This command was introduced.

**Usage Guidelines** The mobile router maintains a registration table listing registration entries that are used for retransmissions. For example, a registration request is sent when no reply is received or the lifetime is about to expire.

A registration request can be removed from the table to prevent further registration requests from being sent to the agent. The **clear ip mobile router registration** *ip-address* option allows you to remove a registration to a specific agent.

Clearing an active registration will cause the mobile router to attempt to deregister.

**Examples** The following example removes all registration entries from the mobile router registration table:

```
Router# clear ip mobile router registration
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<a href="#">show ip mobile router registration</a>	Displays the pending and accepted registrations of the mobile router.

# clear ip mobile router traffic

To clear the counters that the mobile router maintains, use the **clear ip mobile router traffic** command in privileged EXEC mode.

**clear ip mobile router traffic**

**Syntax Description** This command has no arguments or keywords.

**Defaults** No default behavior or values.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.2(4)T	This command was introduced.

**Usage Guidelines** Mobile router counters are accumulated during operation. They are useful for debugging and monitoring.

**Examples**

The following example shows how the mobile router counters can be used for debugging:

```
Router# show ip mobile router traffic

Mobile Router Counters:

Agent Discovery:
  Solicitations sent 90, advertisements received 17
  Agent reboots detected 0
Registrations:
  Register 70, Deregister 0 requests sent
  Register 70, Deregister 0 replies received
  Requests accepted 68, denied 1 by HA 1 /FA 0
  Denied due to mismatched ID 1
  .
  .
  .
Router# clear ip mobile router traffic
Router# show ip mobile router traffic

Mobile Router Counters:

Agent Discovery:
  Solicitations sent 0, advertisements received 0
  Agent reboots detected 0
Registrations:
  Register 0, Deregister 0 requests sent
  Register 0, Deregister 0 replies received
  Requests accepted 0, denied 0 by HA 0 /FA 0
  Denied due to mismatched ID 0
  .
  .
  .
```

**Related Commands**

Command	Description
<a href="#">show ip mobile router traffic</a>	Displays the counters that the mobile router maintains.

# debug ip mobile

To display IP mobility activities, use the **debug ip mobile** command.

**debug ip mobile** [**advertise** | **host** [*access-list-number*] | **local-area** | **standby**]

Syntax Description		
	<b>advertise</b>	(Optional) Advertisement information.
	<b>host</b>	(Optional) Mobile node host.
	<i>access-list-number</i>	(Optional) Number of an IP access list.
	<b>local-area</b>	(Optional) Local area.
	<b>standby</b>	(Optional) Redundancy activities

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.0(1)T	This command was introduced.
	12.0(2)T	The <b>standby</b> keyword was added.
	12.2(13)T	This command was enhanced to display information about the mobile networks attached to the mobile router.

**Usage Guidelines** Use the **debug ip mobile standby** command to troubleshoot redundancy problems.

**Examples** The following is sample output from the **debug ip mobile standby** command. In this example, the active home agent receives a registration request from MN 20.0.0.2 and sends a binding update to peer home agent 1.0.0.2:

```
Router# debug ip mobile standby

MobileIP:MN 20.0.0.2 - sent BindUpd to HA 1.0.0.2 HAA 20.0.0.1
MobileIP:HA standby maint started - cnt 1
MobileIP:MN 20.0.0.2 - sent BindUpd id 3780410816 cnt 0 elapsed 0
adjust -0 to HA 1.0.0.2 in grp 1.0.0.10 HAA 20.0.0.1
```

In this example, the standby home agent receives a binding update for mobile node 20.0.0.2 sent by the active home agent:

```
MobileIP:MN 20.0.0.2 - HA rcv BindUpd from 1.0.0.3 HAA 20.0.0.1
```

The following is sample output from the **debug ip mobile host** command. In the following example, a mobile network is dynamically registered on the home agent:

```
Router# debug ip mobile host

MobileIP: HA 126 received registration for MN 100.0.0.1 on Ethernet3/2 using COA 30.0.0.2
HA 1\
00.0.0.3 lifetime 120 options sbdmgvt
```

```
MobileIP: MN 100.0.0.1 - authenticating MN 100.0.0.1 using SPI 100
MobileIP: MN 100.0.0.1 - authenticated MN 100.0.0.1 using SPI 100
MobileIP: Mobility binding for MN 100.0.0.1 created
MobileIP: Roam timer started for MN 100.0.0.1, lifetime 120
MobileIP: MN 100.0.0.1 is now roaming
MobileIP: Gratuitous ARPs sent for MN 100.0.0.1 MAC 00d0.ff79.5c55
00:05:41:
MobileIP: Insert host route for 100.0.0.1/255.255.255.255 via gateway 30.0.0.2 on Tunnel0
MobileIP: Add mobnet for MR 100.0.0.1 20.0.0.0/255.0.0.0
00:05:41:
MobileIP: Insert host route for 20.0.0.0/255.0.0.0 via gateway 100.0.0.1 on Tunnel1
00:05:41:
MobileIP: HA accepts registration from MN 100.0.0.1
MobileIP: MN 100.0.0.1 - MH auth ext added (SPI 100) to MN 100.0.0.1
MobileIP: MN 100.0.0.1 - HA sent reply to 30.0.0.2
```

# debug ip mobile router

To display debug messages for the mobile router, use the **debug ip mobile router** command in privileged EXEC mode. To disable debugging output, use the **no** form of this command.

**debug ip mobile router [detail]**

**no debug ip mobile router [detail]**

<b>Syntax Description</b>	<b>detail</b> (Optional) Displays detailed mobile router debug messages.
---------------------------	--

<b>Defaults</b>	No default behavior or values.
-----------------	--------------------------------

<b>Command Modes</b>	Privileged EXEC
----------------------	-----------------

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	12.2(4)T	This command was introduced.
12.2(13)T	This command was enhanced to display information about the addition and deletion of mobile networks.	

<b>Usage Guidelines</b>	<p>The mobile router operations can be debugged. The following conditions trigger debugging messages:</p> <ul style="list-style-type: none"> <li>• Agent discovery</li> <li>• Registration</li> <li>• Mobile router state change</li> <li>• Routes and tunnels created or deleted</li> <li>• Roaming information</li> </ul>
-------------------------	---

Debugging messages are prefixed with MobRtr and detail messages are prefixed with MobRtrX.

<b>Examples</b>	The following example provides output from the <b>debug ip mobile router</b> command:
-----------------	---

```
Router# debug ip mobile router

MobileRouter: New FA 27.0.0.12 coa 27.0.0.12 int Ethernet0/1 MAC 0050.50c1.c855
2w2d: MobileRouter: Register reason: isolated
2w2d: MobileRouter: Snd reg request agent 27.0.0.12 coa 27.0.0.12 home 9.0.0.1 ha 29.0.0.4
lifetime 36000 int Ethernet0/1 flag sbdmgtv cnt 0 id B496B69C.55E77974
2w2d: MobileRouter: Status Isolated -> Pending
```

The following example provides output from the **debug ip mobile router detail** command.

```
Router# debug ip mobile router detail

1d09h: MobRtr: New agent 20.0.0.2 coa 30.0.0.2 int Ethernet3/1 MAC 00b0.8e35.a055
```

```
1d09h: MobRtr: Register reason: left home
1d09h: MobRtrX: Extsize 18 add 1 delete 0
1d09h: MobRtrX: Add network 20.0.0.0/8
MobileIP: MH auth ext added (SPI 100) to HA 100.0.0.3
1d09h: MobRtr: Register to fa 20.0.0.2 coa 30.0.0.2 home 100.0.0.1 ha 100.0.0.3 life 120
int Ethernet3/1 flag sbdmgt cnt 0 id BE804340.447F50A4
1d09h: MobRtr: Status Isolated -> Pending
1d09h: MobRtr: MN rcv accept (0) reply on Ethernet3/1 from 20.0.0.2 lifetime 120
MobileIP: MN 100.0.0.3 - authenticating HA 100.0.0.3 using SPI 100
MobileIP: MN 100.0.0.3 - authenticated HA 100.0.0.3 using SPI 100
1d09h: MobRtr: Status Pending -> Registered
1d09h: MobRtr: Add default gateway 20.0.0.2 (Ethernet3/1)
1d09h: MobRtr: Add default route via 20.0.0.2 (Ethernet3/1)
```

**Related Commands**

Command	Description
<b>debug ip mobile advertise</b>	Displays Mobile IP advertisement information.
<b>debug ip mobile host</b>	Displays IP mobility events.

# description (mobile networks)

To add a description to a mobile router configuration, use the **description** command in mobile networks configuration mode. To remove the description, use the **no** form of this command.

**description** *string*

**no description**

<b>Syntax Description</b>	<i>string</i>	Comment or description about the mobile router or its networks.
---------------------------	---------------	---

<b>Defaults</b>	No default behavior or values.	
-----------------	--------------------------------	--

<b>Command Modes</b>	Mobile networks configuration	
----------------------	-------------------------------	--

<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	12.2(4)T	This command was introduced.

<b>Usage Guidelines</b>	The <b>description</b> command is meant solely as a comment to be put in the configuration to help you remember information about the configured mobile router or its mobile networks.	
-------------------------	--	--

<b>Examples</b>	The following example shows how to add a description for the mobile router:	
-----------------	---	--

```
ip mobile mobile-networks 10.1.0.2
description san jose jet
network 172.6.1.0 255.255.255.0
network 172.6.2.0 255.255.255.0
```

<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<a href="#">show ip mobile mobile-networks</a>	Displays a list of mobile networks associated with the mobile router.

# home-agent

To specify the home agent that the mobile router uses during registration, use the **home-agent** command in mobile router configuration mode. To disable the home agent, use the **no** form of this command.

**home-agent** *ip-address* [**priority level**]

**no home-agent** *ip-address* [**priority level**]

Syntax Description		
	<i>ip-address</i>	Home IP address.
	<b>priority level</b>	(Optional) Priority level that prioritizes which home agent address is the best to use during registration. The range is from 0 to 255, where 0 denotes the lowest priority and 255 denotes the highest priority. The default is 100.

**Defaults** The default priority level is 100.

**Command Modes** Mobile router configuration

Command History	Release	Modification
	12.2(4)T	This command was introduced.

**Usage Guidelines** The **home-agent** command specifies which home agent the mobile router uses for registration and to detect when it is home. The priority level determines which home agent address to register with. The mobile router registers with the home agent with the highest priority level. If the registration is rejected, it tries the next highest priority agent.

The home agent address list is used to detect when the mobile router is home. The mobile router knows that it is at home when the source of the agent advertisements is an IP source address that exists on the home agent address list.

**Examples** The following example shows that the mobile router will use the home agent address 1.1.1.1 during registration and will detect when it is at home after receiving agent advertisements from either address 1.1.1.1 or 2.2.2.2:

```
router mobile
ip mobile router
  address 10.1.0.1 255.255.0.0
  home-agent 1.1.1.1 priority 101
  home-agent 2.2.2.2 priority 100
```

Related Commands	Command	Description
	<a href="#">show ip mobile router</a>	Displays configuration information and monitoring statistics about the mobile router.

# ip mobile mobile-networks

To associate one or more networks with a mobile router configured as a mobile host and enter mobile networks configuration mode, use the **ip mobile mobile-networks** command in global configuration mode. To disassociate the networks from the mobile router, use the **no** form of this command.

**ip mobile mobile-networks** *lower* [*upper*]

**no ip mobile mobile-networks** *lower* [*upper*]

## Syntax Description

<i>lower</i> [ <i>upper</i> ]	Range of mobile host or mobile node group IP addresses. The upper end of the range is optional but can only be used for dynamic registration of mobile networks. Static mobile network configurations are not permitted for a range of hosts.
-------------------------------	---

## Defaults

No default behavior or values.

## Command Modes

Global configuration

## Command History

Release	Modification
12.2(4)T	This command was introduced.
12.2(13)T	The <i>upper</i> argument was added to allow a range of mobile host or mobile node group addresses.

## Usage Guidelines

The home agent supports mobile routers configured with the mobile networks that are roaming with the mobile routers.

The *lower* [*upper*] arguments associate the mobile networks with the IP address of the mobile router, which was configured using the **ip mobile host** command. You can use the *upper* range only with dynamic mobile network registration. Static mobile network configurations are not permitted for a range of hosts.

You can configure the home agent to dynamically learn of the mobile networks during registration as shown in the following example:

```
ip mobile host 10.0.0.1 10.0.0.10 virtual-networks 10.0.0.0 255.0.0.0
ip mobile mobile-networks 10.0.0.1 10.0.0.10
!dynamic registration
register
```

You can configure the home agent to learn of the mobile networks through static configuration as shown in the following example:

```
ip mobile host 10.0.0.1 virtual-networks 10.0.0.0 255.0.0.0
ip mobile host 10.0.0.2 virtual-networks 10.0.0.0 255.0.0.0
!
ip mobile mobile-networks 10.0.0.1
!static configuration
```

```

network 172.16.1.0 255.255.255.0

ip mobile mobile-networks 10.0.0.2
!static configuration
network 172.16.2.0 255.255.255.0

```

You cannot configure the range as shown in the following static configuration:

```

!static configuration not permitted for range of hosts
ip mobile mobile-networks 10.0.0.1 10.0.0.10
network 172.16.2.0

```

The mobile router configuration is only allowed for one mobile router or an entire range of mobile routers in the mobile host group, exclusively. You cannot configure a partial range of mobile routers as shown in the following example:

```

ip mobile host 10.0.0.1 10.0.0.10 virtual-network 10.0.0.0 255.0.0.0
!Partial range shown below is prohibited
ip mobile mobile-networks 10.0.0.1 10.0.0.3
register

```

You cannot combine full ranges and partial ranges of IP addresses in a configuration as shown in the following example:

```

ip mobile host 10.0.0.1 10.0.0.10 virtual-network 10.0.0.0 255.0.0.0
ip mobile mobile-networks 10.0.0.1 10.0.0.10
register
ip mobile mobile-networks 10.0.0.2
network 172.16.2.0 255.255.255.0

```

## Examples

The following example configures the mobile host, which is a mobile router at 10.1.1.10, and associates it with the mobile networks that it is supporting:

```

ip mobile host 10.1.1.10 virtual-network 10.0.0.0 255.0.0.0
ip mobile mobile-networks 10.1.1.10
network 172.6.2.0 255.255.255.0
ip mobile secure host 10.1.1.10 spi 100 key hex 12345678123456781234567812345678

```

The following example shows the mobile router configured for both static and dynamic mobile networks.

```

ip mobile host 10.1.1.10 virtual-network 10.0.0.0 255.0.0.0
ip mobile mobile-networks 10.1.1.10
network 172.16.1.0 255.255.255.0
register

```

## Related Commands

Command	Description
<b>ip mobile host</b>	Associates a mobile router with mobile networks.
<b>register (mobile networks)</b>	Dynamically registers the mobile networks with the home agent.
<b>show ip mobile mobile-networks</b>	Displays a list of mobile networks associated with the mobile router.

# ip mobile router

To enable the mobile router and enter mobile router configuration mode, use the **ip mobile router** command in global configuration mode. To disable the mobile router, use the **no** form of this command.

**ip mobile router**

**no ip mobile router**

---

**Syntax Description** This command has no arguments or keywords.

---

**Defaults** Disabled

---

**Command Modes** Global configuration

---

Command History	Release	Modification
	12.2(4)T	This command was introduced.

---



---

**Usage Guidelines** The mobile router is a router that operates as a mobile node. The mobile router can roam from its home network and still provide connectivity for devices on its networks. The mobile networks are locally attached to the router.

---

**Examples** The following example enables the mobile router:

```
ip mobile router
```

---

Related Commands	Command	Description
	<a href="#">show ip mobile router</a>	Displays configuration information and monitoring statistics about the mobile router.

---

## ip mobile router-service

To enable mobile router service on an interface, use the **ip mobile router-service** command in interface configuration mode. To disable this service, use the **no** form of this command.

**ip mobile router-service** { **hold-down** *seconds* | **roam** [**priority** *value*] | **solicit** [**interval** *seconds*] [**retransmit** **initial** *minimum-seconds* **maximum** *seconds* **retry** *number*]}

**no ip mobile router-service** { **hold-down** *seconds* | **roam** [**priority** *value*] | **solicit** [**interval** *seconds*] [**retransmit** **initial** *minimum-seconds* **maximum** *seconds* **retry** *number*]}

Syntax	Description
<b>hold-down</b> <i>seconds</i>	Time (in seconds) to wait before the mobile router registers to agents heard on an interface. The range is from 0 to 3600. There is no default value.
<b>roam</b>	Enables the mobile router to specify on which configured interface it will discover foreign agents.
<b>priority</b> <i>value</i>	(Optional) Priority value that is compared among multiple configured interfaces to select the interface on which to send the registration request. When multiple interfaces have highest priority, the highest bandwidth is the preferred choice. When multiple interfaces have the same bandwidth, the interface with the highest IP address is preferred. The range is from 0 to 255; the default is 100. Higher values equate to a higher priority.
<b>solicit</b>	Instructs the mobile router to send agent solicitation messages periodically.
<b>interval</b> <i>seconds</i>	(Optional) Interval (in seconds) to wait before the mobile router sends the next agent solicitation message after an advertisement is received on an interface. The range is from 1 to 65535; the default is 600 (10 minutes).
<b>retransmit</b> <b>initial</b>	(Optional) Wait period before a registration request is retransmitted when no reply is received. The range is from 10 to 10000 (10 seconds); the default is 1000 milliseconds (1 second).
<i>minimum-seconds</i>	(Optional) Minimum wait period (in seconds) before a registration request is retransmitted when no reply is received.
<b>maximum</b> <i>seconds</i>	(Optional) Maximum wait period (in seconds) before a registration request is retransmitted when no reply is received. Each successive retransmission timeout period is twice the previous period, as long as that is less than the <b>maximum</b> value.
<b>retry</b> <i>number</i>	(Optional) Number of times to retry sending the retransmission request. Retransmission stops after the maximum number of retries are attempted. The range is from 0 to 10; the default is 3. A value of 0 means no retransmission.

**Defaults** Mobile router service is disabled.

**Command Modes** Interface configuration

**Command History**

Release	Modification
12.2(4)T	This command was introduced.

**Usage Guidelines**

The mobile router discovers home agents (HAs) and foreign agents (FAs) by receiving agent advertisements.

When a wireless link connected to an interface is lossy, the mobile router must not register with the FA even when heard on a preferred interface. The **ip mobile router-service hold-down seconds** command allows communications to continue with mobile networks while the mobile router gauges the quality of the link to the new FA.

The **ip mobile router-service solicit** command instructs the mobile router to send agent solicitation messages periodically. Some networks send out agent advertisements only periodically or when solicited. For networks on which agents do not advertise periodically, this function must be enabled to detect agents. The mobile router always sends solicitation messages when roaming interfaces come up.

**Note**

The mobile router will reset the solicit timer if it receives an advertisement from the FA or HA. For example, if the solicit timer is set to 5 seconds and an FA is advertising every 3 seconds, the mobile router will *not* solicit because the FA advertisement resets the timer on the interface.

If a mobile router interface is configured for solicitations, you should set both **ip irdp maxadvertinterval seconds** and **ip irdp holdtime seconds** to 0 seconds on the FA. These settings ensure that the FA will not send out any ICMP Router Discovery Protocol (IRDP) advertisements unless solicited. If a FA or HA is sending IRDP advertisements periodically, then a solicitation will trigger the agent to send an advertisement immediately instead of at the next-time interval.

Use the **show ip mobile router agent** command to display agents learned from advertisements. Use the **show ip mobile router interface** command to display the configuration of the interfaces used for roaming.

**Examples**

The following example configures roaming interfaces, solicitation services, and hold-down timers on serial interface 0 and roaming interfaces and hold-down timers on Ethernet interface 0 of the mobile router:

```
interface serial0
 ip mobile router-service roam
 ! Serial interface 0 solicits every 5 seconds.
 ip mobile router-service solicit interval 5
 ip mobile router-service hold-down 20
interface ethernet0
 ip mobile router-service roam priority 101
 ip mobile router-service hold-down 20
```

In this example, the mobile router has two interfaces. The serial interface is connected to a serial interface of a FA and the Ethernet interface is connected to an Ethernet interface of a FA. If the mobile router does not receive any agent advertisements on the Ethernet interface, it will use the serial interface to solicit FAs.

If the Ethernet interface hears a new FA advertisement after the mobile router has already registered using the serial interface, it will wait the duration of the hold-down timer (20 seconds) before registering with the FA on the Ethernet interface.

The **ip mobile router-service hold-down *seconds*** command allows communications to continue with mobile networks while the mobile router gauges the quality of the link to the new FA. The Ethernet interface is configured with a higher priority so the mobile router prefers to register with this interface. Once it receives an agent advertisement on the Ethernet interface, it will use the Ethernet interface to register to its HA.

**Related Commands**

<b>Command</b>	<b>Description</b>
ip irdp	Enables IRDP processing on an interface.
<b>show ip mobile router agent</b>	Displays information about the agents for the mobile router.
<b>show ip mobile router interface</b>	Displays information about the interface that the mobile router is using for roaming.

# mobile-network

To specify the mobile router interface that is connected to the dynamic mobile network, use the **mobile-network** command in mobile router configuration mode. To disassociate the networks from the mobile router, use the **no** form of this command.

**mobile-network** *interface*

**no mobile-network** *interface*

<b>Syntax Description</b>	<i>interface</i>	Mobile router interface that is connected to the dynamic network.
<b>Defaults</b>	No default behavior or values.	
<b>Command Modes</b>	Mobile router configuration	
<b>Command History</b>	<b>Release</b>	<b>Modification</b>
	12.2(13)T	This command was introduced.
<b>Usage Guidelines</b>	The IP address and mask of the interface are added to the registration request to notify the home agent of the mobile networks. Once the home agent acknowledges the mobile network, the mobile router will no longer add the mobile network information in subsequent requests.	
<b>Examples</b>	<p>The following example shows how to enable mobile router services. In this example, the mobile router located at 100.0.0.3 is dynamically registering the primary interface address on interface Ethernet3/2:</p> <pre>router mobile ip mobile router address 100.0.0.3 255.0.0.0 home-agent 100.0.0.1 !specifies the Mobile Router interface connected to the mobile network mobile-network Ethernet3/2 register lifetime 120</pre>	
<b>Related Commands</b>	<b>Command</b>	<b>Description</b>
	<a href="#">register (mobile networks)</a>	Dynamically registers the mobile networks with the home agent.

# network (mobile networks)

To specify a list of mobile networks for a mobile router, use the **network** command in mobile networks configuration mode. To remove an entry, use the **no** form of this command.

**network** *net mask*

**no network** *net mask*

## Syntax Description

<i>net</i>	IP address of the directly connected networks.
<i>mask</i>	Network mask.

## Defaults

No networks are specified.

## Command Modes

Mobile networks configuration

## Command History

Release	Modification
12.2(4)T	This command was introduced.

## Usage Guidelines

When the mobile router is registered, the home agent injects the mobile networks into its forwarding table.

## Examples

The following configuration example shows how to associate the mobile router address, 10.1.1.10, with the mobile networks:

### Mobile Router Configuration:

```
ip mobile router
  address 10.1.1.10 255.255.255.0
  home-agent 171.68.69.1
ip mobile secure home-agent 171.68.69.1 spi 100 key hex 12345678123456781234567812345678
```

### Home Agent Configuration:

```
! mobile host is mobile router address
ip mobile host 10.1.1.10 virtual-network 10.0.0.0 255.0.0.0
! associates mobile router address with mobile networks
ip mobile mobile-networks 10.1.1.10
  description jet
  network 172.6.1.0 255.255.255.0
ip mobile secure host 10.1.1.10 spi 100 key hex 12345678123456781234567812345678
```

Related Commands	Command	Description
	<a href="#">show ip mobile mobile-networks</a>	Displays a list of mobile networks associated with the mobile router.

# redundancy group

To configure fault tolerance for the mobile router, use the **redundancy group** command in mobile router configuration mode. To disable this functionality, use the **no** form of this command.

**redundancy group** *name*

**no redundancy group** *name*

Syntax Description	<i>name</i>	Name of the mobile router group.
--------------------	-------------	----------------------------------

Defaults	No default behavior or values.
----------	--------------------------------

Command Modes	Mobile router configuration
---------------	-----------------------------

Command History	Release	Modification
	12.2(4)T	This command was introduced.

Usage Guidelines	The <b>redundancy group</b> command provides fault tolerance by selecting one mobile router in the redundancy group <i>name</i> argument to provide connectivity for the mobile networks. This mobile router is in the active state. The other mobile routers are passive and wait until the active mobile router fails before a new active mobile router is selected. Only the active mobile router registers and sets up proper routing for the mobile networks. The redundancy state is either active or passive.
------------------	--

Examples	The following example selects the mobile router in the sanjose group, to provide fault tolerance:
----------	---

```
ip mobile router
 redundancy group sanjose
 address 10.1.1.10 255.255.255.0
 home-agent 10.1.1.20
 register lifetime 600
```

Related Commands	Command	Description
	<b>standby name</b>	Configures the name of the standby group, which is associated with the mobile router.

# register (mobile networks)

To dynamically register the mobile networks with the home agent, use the **register** command in mobile networks configuration mode. To disable the registration, use the **no** form of this command.

**register**

**no register**

**Syntax Description** This command has no arguments or keywords.

**Defaults** No default behavior or values.

**Command Modes** Mobile networks configuration

## Command History

Release	Modification
12.2(13)T	This command was introduced.

## Usage Guidelines

When the mobile router registers its mobile networks on the home agent, the home agent looks up the mobile network configuration and verifies that the **register** command is configured before adding forwarding entries into the home agent forwarding table for the mobile router. If the mobile router is not configured properly, the home agent will reject the request with error code 129.

It is possible to have both statically configured mobile networks and dynamically registered mobile networks. However, static mobile network configurations take precedence over dynamic mobile network registrations. For example, if a mobile router tries to dynamically add (or delete) a mobile network and that network is already statically configured for that mobile router or any other mobile router, then the dynamic mobile network is ignored and an error message is generated.

Similarly, if a mobile router has dynamically added a mobile network, an attempt by another mobile router to dynamically add or delete the same mobile network is ignored and an error message is generated.

## Examples

In the following example, the mobile router is configured to dynamically register its mobile networks with the home agent:

```
router mobile
 ip mobile home-agent
 ip mobile host 10.20.30.4 interface Ethernet 1
 !Associated host address that informs HA that 10.20.30.4 is actually an MR
 ip mobile mobile-networks 10.20.30.4
 register
 ip mobile secure host 10.20.30.4 spi 100 key hex 12345678123456781234567812345678
```

**Related Commands**

Command	Description
<b>ip mobile host</b>	Configures the mobile host or mobile node group.
<b>mobile-network</b>	Specifies the mobile router interface that is connected to the dynamic mobile network.

## register (mobile router)

To control the registration parameters of the mobile router, use the **register** command in mobile router configuration mode. To return the registration parameters to their default settings, use the **no** form of this command.

**register** { **extend expire** *seconds* **retry number** **interval** *seconds* | **lifetime** *seconds* | **retransmit initial** *milliseconds* **maximum** *milliseconds* **retry number** }

**no register** { **extend expire** *seconds* **retry number** **interval** *seconds* | **lifetime** *seconds* | **retransmit initial** *milliseconds* **maximum** *milliseconds* **retry number** }

### Syntax Description

<b>extend</b>	Re-registers before the lifetime expires.
<b>expire</b> <i>seconds</i>	Time (in seconds) in which to send a registration request before expiration. The range is from 1 to 3600; the default is 120.
<b>retry number</b>	Number of times the mobile router retries sending a registration request if no reply is received. The range is from 0 to 10; the default is 3. A value of 0 means no retry. The mobile router stops sending registration requests after the maximum number of retries is attempted.
<b>interval</b> <i>seconds</i>	Time (in seconds) that the mobile router waits before sending another registration request if no reply is received. The range is from 1 to 3600; the default is 10.
<b>lifetime</b> <i>seconds</i>	Requested lifetime (in seconds) of each registration. The smallest value between the configured lifetime and the foreign agent advertised registration lifetime is used. The range is from 3 to 65534; default is 65534 (infinity). This default ensures that the advertised lifetime is used, excluding infinity.
<b>retransmit initial</b> <i>milliseconds</i>	Wait period (in milliseconds) before sending a retransmission the first time no reply is received from the foreign agent. The range is from 10 to 10000 milliseconds (10 seconds); the default is 1000 milliseconds (1 second).
<b>maximum</b> <i>milliseconds</i> <b>retry number</b>	Maximum wait period (in milliseconds) before retransmission of a registration request. The range is 10 to 10000 milliseconds (10 seconds); the default is 5000 milliseconds (5 seconds). Each successive retransmission timeout period is twice the previous period, as long as it is less than the maximum value. Retransmission stops after the maximum number of retries.

### Defaults

**expire** *seconds*: 120 seconds  
**retry number**: Three retries  
**interval** *seconds*: 10 seconds  
**lifetime** *seconds*: 65534 seconds  
**retransmit initial** *milliseconds*: 1000 milliseconds (1 second)  
**maximum** *milliseconds*: 5000 milliseconds (5 seconds)

### Command Modes

Mobile router configuration

**Command History**

Release	Modification
12.2(4)T	This command was introduced.

**Usage Guidelines**

The **register lifetime** *seconds* command configures the lifetime that the mobile router requests in a registration request. The home agent also has lifetimes that are set. If the registration request from a mobile router has a greater lifetime than the registration reply from the home agent, the lifetime set on the home agent will be used for the registration. If the registration request lifetime from the mobile router is less than the registration reply from the home agent, the lifetime set on the mobile router will be used. Thus, the smaller lifetime between the home agent and mobile router is used for registration.

**Examples**

The following example specifies a registration lifetime of 600 seconds:

```
ip mobile router
address 10.1.1.10 255.255.255.0
home-agent 10.1.1.20
register lifetime 600
```

**Related Commands**

Command	Description
<a href="#">show ip mobile router</a>	Displays configuration information and monitoring statistics about the mobile router.
<a href="#">show ip mobile router registration</a>	Displays the pending and accepted registrations of the mobile router.

# reverse-tunnel

To enable the reverse tunnel function on the mobile router, use the **reverse-tunnel** command in mobile router configuration mode. To disable the reverse tunnel function, use the **no** form of this command.

**reverse-tunnel**

**no reverse-tunnel**

**Syntax Description** This command has no arguments or keywords.

**Defaults** No default behavior or values.

**Command Modes** Mobile router configuration

## Command History

Release	Modification
12.2(4)T	This command was introduced.

## Usage Guidelines

The mobile router supports the reverse tunnel function. The home agent supports reverse tunnel by default. The foreign agent supports reverse tunnel if configured.

## Examples

The following example configures reverse tunneling on the mobile router:

```
ip mobile router
address 10.1.1.2 255.0.0.0
home-agent 10.1.1.1
register extend expire 10 retry 2 interval 2
reverse-tunnel
```

## Related Commands

Command	Description
<a href="#">show ip mobile router</a>	Displays configuration information and monitoring statistics about the mobile router.
<a href="#">show ip mobile router registration</a>	Displays the pending and accepted registrations of the mobile router.
<a href="#">show ip mobile tunnel</a>	Displays active tunnels.

# show ip mobile binding

To display the mobility binding table, use the **show ip mobile binding** command in privileged EXEC mode.

**show ip mobile binding** [**home-agent** *address* | **summary**]

Syntax Description	
<b>home-agent</b> <i>address</i>	(Optional) IP address of mobile node.
<b>summary</b>	(Optional) Total number of bindings in the table.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.0(1)T	This command was introduced.
	12.0(2)T	The <b>home-agent</b> keyword and <i>address</i> argument were added.
	12.1(2)T	The <b>summary</b> keyword was added.
	12.2(4)T	This command was expanded to include information about the mobile router tunnel interface.
	12.2(13)T	This command was expanded to include information about the mobile networks registered on the home agent.

**Usage Guidelines** The home agent updates the mobility binding table in response to registration events from mobile nodes. If the *address* argument is specified, bindings are shown for only that mobile node.

The home agent also creates an additional tunnel interface directly to the mobile routers to provide connectivity for mobile networks.

All bindings are displayed if

**Examples** The following is sample output from the **show ip mobile binding** command:

```
Router# show ip mobile binding

Mobility Binding List:
Total 1
20.0.4.1:
  Care-of Addr 45.0.0.5, Src Addr 45.0.0.5
  Lifetime granted 00:02:00 (120), remaining 00:01:56
  Flags sbDmgvT, Identification B7A262C5.DE43E6F4
  Tunnel0 src 46.0.0.3 dest 45.0.0.5 reverse-allowed
  MR Tunnel1 src 46.0.0.3 dest 20.0.4.1 reverse-allowed
  Routing Options - (D)Direct-to-MN (T)Reverse-tunnel
  Mobile Networks: 54.0.0.0/255.255.255.0(S)
                   44.0.0.0/255.255.255.0 (D)
                   46.0.0.0/255.0.0.0(D)
```

```
12.0.0.0/255.255.255.0 (D)
```

Table 1 describes the significant fields shown in the display.

**Table 1** show ip mobile binding Field Descriptions

Field	Description
Total	Total number of mobility bindings.
20.0.4.1	Home IP address of the mobile node.
Care-of Addr	Care-of address of the mobile node.
Src Addr	IP source address of the registration request as received by the home agent. Will be either the collocated care-of address of a mobile node or an address of the foreign agent.
Lifetime granted	The lifetime granted to the mobile node for this registration. The number of seconds is in parentheses.
Lifetime remaining	The time remaining until the registration is expired. It has the same initial value as lifetime granted, and is counted down by the home agent.
Flags	Registration flags sent by the mobile node. Uppercase characters denote the bit set.
Identification	Identification used in that binding by the mobile node. This field has two purposes: unique identifier for each request, and replay protection.
Tunnel	The tunnel used by the mobile node is characterized by the source and destination addresses, and reverse-allowed or reverse-off for reverse tunnel. The default is IPIP encapsulation; otherwise GRE will be displayed in the Routing Options field.
MR Tunnel	Tunnel interface to the mobile router.
src/dest	Tunnel source and destination IP addresses.
Routing Options	Routing options list all home agent-accepted services. Options are B (broadcast), D (direct-to-mobile node), G (GRE), and T (reverse-tunnel).
Mobile Networks	Mobile networks configured or registered on the home agent. D denotes dynamic (registered) mobile networks and S denotes static (configured) mobile networks.

# show ip mobile host

To display mobile node or mobile network information, use the **show ip mobile host** command in privileged EXEC mode.

**show ip mobile host** [*address* | **interface** *interface* | **network** *address* | **group** | **summary**]

Syntax Description		
<i>address</i>	(Optional) IP address of specific mobile node. If not specified, information for all mobile nodes is displayed.	
<b>interface</b> <i>interface</i>	(Optional) All mobile nodes whose home network is on this interface.	
<b>network</b> <i>address</i>	(Optional) All mobile nodes residing on this network or virtual network.	
<b>group</b>	(Optional) All mobile node groups configured using the <b>ip mobile host</b> command.	
<b>summary</b>	(Optional) All values in the table.	

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.0(1)T	This command was introduced.
	12.2(4)T	This command was expanded to include information about mobile networks.

**Usage Guidelines** The mobile host can be a mobile node or mobile router.

**Examples** The following is sample output from the **show ip mobile host** command:

```
Router# show ip mobile host

20.0.0.1:
  Allowed lifetime 10:00:00 (36000/default)
  Roaming status -Unregistered-, Home link on virtual network 20.0.0.0/8
  Accepted 0, Last time -never-
  Overall service time -never-
  Denied 0, Last time -never-
  Last code '-never- (0)'
```

Table 2 describes the significant fields shown in the display.

**Table 2** *show ip mobile host Field Descriptions*

Field	Description
20.0.0.1	Home IP address of the mobile node.
Allowed lifetime	Allowed lifetime of the mobile node. By default, it is set to the global lifetime ( <b>ip mobile home-agent lifetime</b> command). Setting this lifetime will override global value.
Roaming status	When the mobile node is registered, the roaming status is Registered; otherwise, it is Unregistered . Use the <b>show ip mobile binding</b> command for more information when the user is registered.
Home link	Interface or virtual network.
Accepted	Total number of service requests for the mobile node accepted by the home agent.
Last time	The time at which the most recent registration request was accepted by the home agent for this mobile node.
Overall service time	Overall service time that has accumulated for the mobile node since the home agent last rebooted or counters cleared.
Denied	Total number of service requests for the mobile node denied by the home agent (sum of all registrations denied with Code 128 through Code 159).
Last time	The time at which the most recent registration request was denied by the home agent for this mobile node.
Last code	The code indicating the reason why the most recent Registration Request for this mobile node was rejected by the home agent.
Total violations	Total number of security violations.
Tunnel to MN	Number of packets and bytes tunneled to a mobile node.
Reverse tunnel from MN	Number of packets and bytes reverse tunneled from a mobile node.
Mobile networks supported	If the mobile router is configured as a mobile host, this field is displayed.

**Related Commands**

Command	Description
<b>show ip mobile binding</b>	Displays the mobility binding table.
<b>show ip mobile mobile-networks</b>	Displays a list of mobile networks associated with the mobile router.

# show ip mobile mobile-networks

To display a list of mobile networks associated with the mobile router, use the **show ip mobile mobile-networks** command in EXEC mode.

```
show ip mobile mobile-networks [address]
```

## Syntax Description

<i>address</i>	(Optional) Address of a specific mobile router. If not specified, information for all mobile networks is displayed.
----------------	---

## Defaults

No default behavior or values.

## Command Modes

EXEC

## Command History

Release	Modification
12.2(4)T	This command was introduced.
12.2(13)T	This command was enhanced to display information about the dynamically registered mobile networks.

## Usage Guidelines

The home agent maintains a list of static and dynamic mobile networks associated with mobile routers.

## Examples

The following is sample output from the **show ip mobile mobile-networks** command:

```
Router# show ip mobile mobile-networks
Mobile Networks:
MR 20.0.4.1:
Dynamic registration
  Configured:54.0.0.0/255.255.255.0
  Registered:44.0.0.0/255.255.255.0
              46.0.0.0/255.0.0.0
              12.0.0.0/255.255.255.0
```

[Table 3](#) shows the significant fields in the display.

**Table 3** *show ip mobile mobile-networks Field Descriptions*

Field	Description
MR IP address	IP address of the mobile router
Dynamic Registration	Configured for dynamic registration of mobile networks.
Configured	Mobile networks statically configured on the home agent.
Registered	Mobile networks dynamically registered on the home agent.

■ show ip mobile mobile-networks

Related Commands	Command	Description
	<a href="#">ip mobile mobile-networks</a>	Associates one or more networks with a mobile router configured as a mobile host and enters mobile networks configuration mode.

# show ip mobile router

To display configuration information and monitoring statistics about the mobile router, use the **show ip mobile router** command in privileged EXEC mode.

## show ip mobile router

**Syntax Description** This command has no arguments or keywords.

**Defaults** No default behavior or values.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.2(4)T	This command was introduced.
	12.2(13)T	This command was enhanced to display information about the mobile network interfaces.

**Usage Guidelines** The display includes the mobile router configuration information such as the home address and network mask, home agent, and registration settings, and operational information such as status, tunnel interface, active foreign agent, and care-of address.

**Examples** The following is sample output from the **show ip mobile router** command:

```
Router# show ip mobile router

Mobile Router
  Enabled 05/30/02 11:16:03
  Last redundancy state transition 05/30/02 11:15:01

Configuration:
  Home Address 20.0.4.1 Mask 255.255.255.0
  Home Agent 46.0.0.3 Priority 100 (best)
  Registration lifetime 120 sec
  Retransmit Init 1000, Max 5000 msec, Limit 3
  Extend Expire 120, Retry 3, Interval 10
  Redundancy group AlwaysUp (active)
  Mobile Networks:Ethernet5 (200.0.0.0/255.255.255.248)
    Ethernet2 (46.0.0.0/255.0.0.0)
    Ethernet3 (44.0.0.0/255.255.255.0)

Monitor:
  Status -Registered-
  Active foreign agent 11.0.0.2, Care-of 11.0.0.2
  On interface Serial0
  Tunnel0
```

Table 4 describes the significant fields shown in the display.

**Table 4** show ip mobile router Field Descriptions

Field	Description
Enabled	Date and time when the mobile router was enabled.
Last redundancy state transition	Date and time when the mobile router redundancy state changed.
Home Address/Mask	Home IP address of the mobile router, including the network mask.
Home Agent	Home agent providing connectivity to the networks of the mobile router. The mobile router registers only to the home agent with the highest priority when multiple addresses are configured. These addresses are on the same home agent.
Registration lifetime	Requested lifetime is the minimum of this value and advertised registration lifetime in the registration sent by the mobile router.
Retransmit Init/Max/Limit	Registration retransmission settings. When requests are not responded to, the mobile router will resend. Displays the initial and maximum transmission timers and the limit on the number of retries allowed.
Extend Expire/Retry/Interval	Extend registration lifetime. After the mobile router has registered, reregister before lifetime expires. Retry is the number of times between intervals.
Redundancy group	Name of redundancy group used to provide network availability. mobile router is either “active” or “passive.” If redundancy is enabled or disabled, this information is displayed or absent, respectively. Active means the mobile router is functioning fully, and passive means the mobile router is idle.
Mobile Networks	Mobile networks associated to the mobile router.
Reverse tunnel required	If reverse tunnel is enabled or disabled, this information is displayed or absent, respectively.
Status	Indication of the state of the mobile router: <ul style="list-style-type: none"> <li>• Home—connected to home network</li> <li>• Registered—registered on foreign network</li> <li>• Pending—sent registration and waiting for reply</li> <li>• Isolated—mobile router has heard an agent advertisement but is isolated from the network</li> <li>• Unknown—cannot determine status</li> </ul>
Active Foreign Agent/Care-of	Foreign agent and care-of address used by the registered mobile router.
On interface	Mobile router registered on this interface.
Tunnel	Tunnel between mobile router and home agent.

#### Related Commands

Command	Description
<a href="#">ip mobile router</a>	Enables the mobile router and enters mobile router configuration mode

# show ip mobile router agent

To display information about the agents for the mobile router, use the **show ip mobile router agent** command in privileged EXEC mode.

## show ip mobile router agent

**Syntax Description** This command has no arguments or keywords.

**Defaults** No default behavior or values.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.2(4)T	This command was introduced.

**Usage Guidelines** The mobile router learns about home agents and foreign agents from agent advertisements. Registrations are sent to the foreign agent to notify the mobile router's home agent of its locality. The mobile router deregisters when it hears an advertisement from its home agent.

**Examples** The following is sample output from the **show ip mobile router agent** command:

```
Router# show ip mobile router agent

Mobile Router Agents:

Foreign Agent 44.0.0.1:
  Care-of address 41.0.0.1
  Interface Ethernet2/2, MAC 0002.4a19.b83a
  Agent advertisement seq 53271, Flags rbhFmGvt, Lifetime 36000
  IRDP advertisement lifetime 60, Remaining 48
  Last received 01/15/01 09:51:26
  First heard 01/12/01 13:26:50
```

[Table 5](#) describes the significant fields shown in the display.

**Table 5** *show ip mobile router agent Field Descriptions*

Field	Description
Foreign Agent or Home Agent	IP address of the home agent or foreign agent.
Care-of address	Attachment point in the foreign network.
Interface	Interface on which the agent was learned.
MAC	MAC address of the learned agent.

**Table 5** *show ip mobile router agent Field Descriptions (continued)*

Field	Description
Agent advertisement seq/Flags/Lifetime	Agent advertisement sequence number, flags, and lifetime. The sequence number can be used to detect reboot by the agent. The flags are services provided by the agent. The lifetime is the limit advertised by the agent.
IRDP advertisement lifetime/ Remaining	The IRDP advertisement lifetime is the interval in which this foreign agent will provide service. When lifetime expires, the foreign agent is disconnected from the mobile router. The remaining field shows the time before expiration .
Last received	Date and time when advertisement was received.
First heard	Date and time when the agent was first heard. This is useful information in determining which agent to use when multiple learned agents are heard by the mobile router.

**Related Commands**

Command	Description
<b>clear ip mobile router agent</b>	Deletes learned agents and the corresponding care-of address of the foreign agent from the mobile router agent table.

# show ip mobile router interface

To display information about the interface that the mobile router is using for roaming, use the **show ip mobile router interface** command in privileged EXEC mode.

**show ip mobile router interface**

**Syntax Description** This command has no arguments or keywords.

**Defaults** No default behavior or values.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.2(4)T	This command was introduced.

**Usage Guidelines** The mobile router uses the interfaces for roaming, discovering foreign agents, and registering its location on the foreign network.

**Examples** The following example is sample output from the **show ip mobile router interface** command:

```
Router# show ip mobile router interface

Mobile Router Interfaces:

Listed in order of preference.

Ethernet2/2:
  Priority 101, Bandwidth 10000, Address 46.0.0.5
  Periodic solicitation disabled, Interval 600 sec
  Retransmit Init 1000, Max 5000 msec, Limit 3
  Current 5000, Remaining 0 msec, Count 6
  Hold down 70 sec
  Routing disallowed
```

[Table 6](#) describes the significant fields shown in the display.

**Table 6** *show ip mobile router interface Field Descriptions*

Field	Description
Priority	Displays the priority for this interface. Default is 100. The interface with the highest priority on the mobile router is used to send registrations.
Bandwidth	Interface bandwidth. When multiple interfaces have the highest priority, the highest bandwidth is the preferred choice.

**Table 6** *show ip mobile router interface Field Descriptions (continued)*

<b>Field</b>	<b>Description</b>
Address	If priority and bandwidth are the same among roaming interfaces, the highest address is preferred by the mobile router.
Periodic solicitation	Send solicitations periodically (enabled) or wait for periodic advertisements (disabled).
Interval	Period of time (in seconds) to wait before sending a solicitation after the advertisement is heard.
Retransmit Init/Max/Limit	Solicitation retransmission settings. Displays the initial and maximum transmission timers (in milliseconds) and the limit on the number of retries allowed.
Current/Remaining	Current retransmission interval and remaining time before it expires.
Count	Retransmission count.
Hold down	Period of time (in seconds) to wait before registering through a learned agent.
Routing	Routing is disallowed when the mobile router is roaming and allowed only when the mobile router is connected to its home network.

**Related Commands**

<b>Command</b>	<b>Description</b>
<a href="#">ip mobile router-service</a>	Enables mobile router service on an interface.

# show ip mobile router registration

To display the pending and accepted registrations of the mobile router, use the **show ip mobile router registration** command in privileged EXEC mode.

## show ip mobile router registration

**Syntax Description** This command has no arguments or keywords.

**Defaults** No default behavior or values.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.2(4)T	This command was introduced.
	12.2(13)T	This command was enhanced to display new extensions in the registration request.

**Examples** The following is sample output from the **show ip mobile router registration** command:

```
Router# show ip mobile router registration

Mobile Router Registrations:

Foreign Agent 44.0.0.1:
  Registration accepted 01/15/01 10:04:01, On Ethernet2/2
  Care-of addr 41.0.0.1, HA addr 49.0.0.3, Home addr 49.0.0.5
  Lifetime requested 01:00:00 (3600), Granted 00:30:00 (1800)
  Remaining 00:20:13
  Flags sbdmgt, Identification BE0D49E5.5E1C56E4
  Register next time 00:18:13
  Extensions
    Mobile Network Add 44.0.0.0/8
    MN-HA Authentication SPI 100
```

Table 7 describes the significant fields shown in the display.

**Table 7** show ip mobile router registraton Field Descriptions

Field	Description
Registration accepted	Date and time when registration was accepted.
On	Which interface registration occurred.
Care-of addr	Attachment point in the foreign network.
HA addr	IP address of the home agent.

**Table 7** *show ip mobile router registraton Field Descriptions (continued)*

<b>Field</b>	<b>Description</b>
Home addr	Home IP address.
Lifetime requested	Requested lifetime of registration.
Granted	Registration lifetime granted by the home agent.
Remaining	Remaining time before registration expires.
Flags	Flags in the registration reply.
Identification	Identification in the registration reply.
Register next time	Remaining time before the mobile router sends the next registration request.
Extensions	New extensions displayed in the registration request.
Mobile Network Add	Action requested in the last registration from mobile router. Message is “Add” or “Delete”.
MN-HA Authentication	Mobile Node and home agent Authentication.

**Related Commands**

<b>Command</b>	<b>Description</b>
<a href="#">register (mobile networks)</a>	Controls the registration parameters of the mobile router.

# show ip mobile router traffic

To display the counters that the mobile router maintains, use the **show ip mobile router traffic** command in privileged EXEC mode.

**show ip mobile router traffic [since bootup]**

Syntax Description	since bootup	(Optional) Displays counters since the mobile router process started, regardless of how many times the counters were cleared.
--------------------	--------------	---

**Defaults** Displays counters since the counters were last cleared.

**Command Modes** Privileged EXEC

Command History	Release	Modification
	12.2(4)T	This command was introduced.

**Usage Guidelines** The mobile router maintains counters for agent discovery, registration, movement, and services.

**Examples** The following is sample output from the **show ip mobile router traffic** command:

```
Router# show ip mobile router traffic

Mobile Router Counters:

Agent Discovery:
  Solicitations sent 90, advertisements received 17
  Agent reboots detected 0
Registrations:
  Register 70, Deregister 0 requests sent
  Register 70, Deregister 0 replies received
  Requests accepted 68, denied 1 by HA 1 /FA 0
  Denied due to mismatched ID 1
  Authentication failed for HA 0/FA 0
  Invalid extensions 0, ignored 0
  Invalid home address 0, ID 0
  Unknown HA 0/FA 0
  Gratuitous ARPs sent 0
Movement:
  Came up on HA 0, on FA 1
  Moved HA to FA 0, FA to FA 0, FA to HA 0
  Better interface detected 0 source 46.0.0.5 dest 49.0.0.3
Tunnel Traffic:
  Packets received 188105, sent 0
  Bytes received 142691351, sent 0
Services:
  Redundancy state active 2, passive 1
```

Table 8 describes the significant fields shown in the display.

**Table 8** *show ip mobile router traffic Field Descriptions*

Field	Description
Agent Discovery	Counters categorized for discovering agents.
Solicitations sent	Total number of solicitations sent by the mobile router.
Advertisements received	Total number of advertisements received by the mobile router.
Agent reboots detected	Total number of agent reboots detected by the mobile router through the sequence number of the advertisement.
Registrations	Counters categorized for registration.
Register / Deregister requests sent	Total number of registration and deregistration requests sent by the mobile router.
Register / Deregister replies received	Total number of registration and deregistration replies received by the mobile router.
Requests accepted	Total number of registration requests that were accepted by the home agent from the mobile router.
denied by HA/FA	Total number of registration requests that were denied by the home agent from the mobile router (sum of Code 128 through Code 191) and visited foreign agent (sum of Codes 64 through Code 127).
Denied due to mismatched ID	Total number of registration requests denied by the home agent due to identification mismatch. This means that the mobile router needs to synchronize its clock with the home agent in its request. A mobile router will adjust its time in the identification field to match the home agent's time for subsequent requests.
Authentication failed for HA/FA	Total number of authentication failures.
Invalid extensions	Total number of registration replies dropped by the mobile router due to both poorly formed extensions and unrecognized extensions with an extension number in the range from 0 to 127.
Invalid ignored	Total number of registration replies that contained one or more unrecognized extensions in the range from 128 to 255 that were ignored by the mobile router.
Invalid home address	Total number of replies with an invalid home address.
Invalid ID	Total number of replies with invalid Identification fields.
Unknown HA/FA	Total number of replies with unknown home agents or foreign agents.
Gratuitous ARPs sent	Total number of Gratuitous ARPs sent by the mobile router in order to clear out any stale ARP entries in the ARP caches of nodes on the home network.
Movement	Counters categorized for movement.
Came up on HA/on FA	Number of times the mobile router came up on its home network or some foreign network.

**Table 8** *show ip mobile router traffic Field Descriptions (continued)*

Field	Description
Moved HA to FA / FA to FA / FA to HA	Number of times that the mobile router moved between its home network and the foreign network, and among foreign networks.
Better interface detected	Number of times a better interface was detected.
Tunnel Traffic	Counters categorized for tunnel traffic while the mobile router is roaming.
Packets received / sent	Number of packets received and sent by the mobile router.
Bytes received / sent	Number of bytes received and sent by the mobile router.
Services:	Mobile router services.
Redundancy state active 2, passive num 1	Number of times the mobile router changes between active and passive states, which occurs when a redundancy state change is detected.

**Related Commands**

Command	Description
<b>clear ip mobile router traffic</b>	Clears the counters that the mobile router maintains.

# Glossary

**agent advertisement**—An advertisement message constructed by an attachment of a special extension to a ICMP Router Discovery Protocol (IRDP).

**agent discovery**—The method by which a mobile node or mobile router determines whether it is currently connected to its home network or a foreign network and detects whether it has moved and the way it has moved. It is the mechanism by which mobile nodes or mobile routers query and discover mobility agents. Agent discovery is an extension to ICMP Router Discovery Protocol (IRDP) (RFC 1256), which includes a mechanism to advertise mobility services to potential users.

**agent solicitation**—A request for an agent advertisement sent by the mobile node or mobile router.

**care-of address**—The termination point of the tunnel to a mobile node or mobile router. This can be a collocated care-of address, by which the mobile node or mobile router acquires a local address and detunnels its own packets, or a foreign agent care-of address, by which a foreign agent detunnels packets and forwards them to the mobile node or mobile router.

**correspondent node**—A peer with which a mobile node is communicating. A correspondent node may be either stationary or mobile.

**foreign agent**—A router on the visited network of a foreign network that provides routing services to the mobile node while registered. The foreign agent detunnels and delivers packets to the mobile node or mobile router that were tunneled by the home agent of the mobile node. For packets sent by a mobile node, the foreign agent may serve as a default router for registered mobile nodes.

**foreign network**—Any network other than the home network of the mobile node.

**home address**—An IP address that is assigned for an extended time to a mobile node. It remains unchanged regardless of where the node is attached to the Internet.

**home agent**—A router on a home network of the mobile node or that tunnels packets to the mobile node or mobile router while they are away from home. It keeps current location information for registered mobile nodes called a *mobility binding*.

**home network**—The network, possibly virtual, whose network prefix equals the network prefix of the home address of a mobile node.

**link**—A facility or medium over which nodes communicate at the link layer. A link underlies the network layer.

**link-layer address**—The address used to identify an endpoint of some communication over a physical link. Typically, the link-layer address is a MAC address of an interface.

**mobility agent**—A home agent or a foreign agent.

**mobility binding**—The association of a home address with a care-of address and the remaining lifetime.

**mobile network**—A network that moves with the mobile router. A mobile network is a collection of hosts and routes that are fixed with respect to each other but are mobile, as a unit, with respect to the rest of the Internet.

**mobile node**—A host or router that changes its point of attachment from one network or subnet to another. A mobile node may change its location without changing its IP address; it may continue to communicate with other Internet nodes at any location using its home IP address, assuming that link-layer connectivity to a point of attachment is available.

**mobile router**—A mobile node that is a router. It provides for the mobility of one or more entire networks moving together, perhaps on an airplane, a ship, a train, an automobile, a bicycle, or a kayak. The nodes connected to a network served by the mobile router may themselves be fixed nodes or mobile nodes or routers.

**mobility security association**—A collection of security contexts between a pair of nodes that may be applied to Mobile IP protocol messages exchanged between them. Each context indicates an authentication algorithm and mode, a secret (a shared key or appropriate public/private key pair), and a style of replay protection in use.

**MTU**—maximum transmission unit. Maximum packet size, in bytes, that a particular interface can handle.

**node**—A host or router.

**registration**—The process by which the mobile node is associated with a care-of address on the home agent while it is away from home. Registration may happen directly from the mobile node to the home agent or through a foreign agent.

**roaming interface**—An interface used by the mobile router to detect foreign agents and home agents while roaming. Registration and traffic occur on the interface.

**SPI**—security parameter index. The index identifying a security context between a pair of nodes. On the home agent, the SPI identifies which shared secret to use to compute the md5 hash value.

**tunnel**—The path followed by a packet while it is encapsulated from the home agent to the mobile node. The model is that, while it is encapsulated, a packet is routed to a knowledgeable decapsulating agent, which decapsulates the datagram and then correctly delivers it to its ultimate destination.

**virtual network**—A network with no physical instantiation beyond a router (with a physical network interface on another network). The router (a home agent, for example) generally advertises reachability to the virtual network using conventional routing protocols.

**visited network**—A network other than the home network of a mobile node, to which the mobile node is currently connected.

**visitor list**—The list of mobile nodes visiting a foreign agent.

