Mobile IP Policy and Application-Based Routing for MR Multipath

Mobile IP has increasingly become important because the public safety and public transportation are likely to adopt multiple wireless technologies to support their mission-critical applications and new services. Before the introduction of the Mobile IP--Mobile Router Multipath Support feature, the Cisco implementation of Mobile IP supported only one tunnel between the mobile router (MR) and the home agent (HA). You must use only one tunnel and one wireless technology at a given time. This feature provides support for multiple paths, and thus multiple wireless technologies, between the mobile router and the home agent and allows user traffic to be load-balanced over all available interfaces.

Finding Feature Information

Your software release may not support all the features documented in this module. For the latest caveats and feature information, see Bug Search Tool and the release notes for your platform and software release. To find information about the features documented in this module, and to see a list of the releases in which each feature is supported, see the feature information table.

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

Prerequisites for Mobile IP Policy and Application-Based Routing for MR Multipath

- Both the HA and the MR must be configured for multipath support.

- The security association between the MR and the HA must be established in order for registrations to succeed.

Restrictions for Mobile IP Policy and Application-Based Routing for MR Multipath

Policy-based application routing has the following restrictions:

- When you change the mobile-map configuration or ACL template configuration while a registration is active, the existing dynamic mobile maps and ACLs get deleted and new ones are generated. This occurs when the user exits the "mobile-map" configuration submode.

- Priority-based multipath registration is enabled by default and is the only mode.

- Label-based application routing is disabled by default on both the MR and the HA. It can be enabled separately on the MR and HA.

- Application routing does not require multipath to be configured. It works in single-path mode too. Only one "match" clause is permited in each mobile-map entry.

- ACL templates on the HA can be configured with a destination address. If such an ACL is used to generate a dynamic ACL, that dynamic ACL ignores the configured destination address and uses the MR's mobile-network(s) instead.

Information About Mobile IP Policy and Application-Based Routing for MR Multipath

Mobile Router Multipath Support Feature Design

The Mobile Router Multipath Support feature extends the MR functionality to multiple interfaces. Before the introduction of this feature, the MR received agent advertisements or a collocated care-of address (CCoA) on multiple roaming interfaces. However, it would register through only one interface and set up the tunnel and routes based on that registration. During the routing or tunneling phase, packets arrived at the HA. The HA performed two encapsulations of the packets and tunneled them to the foreign agent or CCoA. The foreign agent or CCoA performed one de-encapsulation and sent the packets to the MR, which performed another de-encapsulation. The MR then sent the original packets to the IP devices on the mobile networks. See the figure below for an illustration of routing within a mobile network using a single tunnel.

Figure 1: Routing Within the Mobile Network Using a Single Tunnel
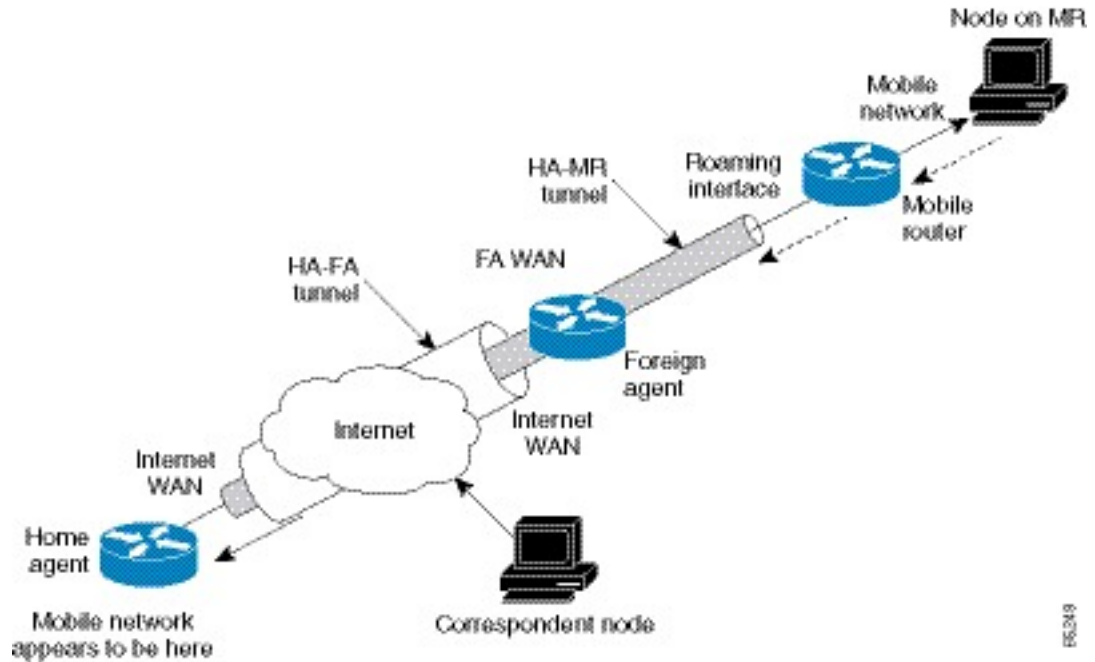
With the introduction of the Mobile Router Multipath support feature, the MR can register to the HA through all of its available roaming interfaces. Each registration is independent of the other registrations that occur on the other roaming interfaces. Once registered through more than one roaming interface, the MR has multiple routes to the HA. If a reverse tunnel is configured, the MR will have multiple paths--each tunnel going out its respective interface. Because the MR is registering independently on each of its roaming interfaces, it can use a foreign agent to register on one interface or a CCoA to register with another interface.

See the figure below for an illustration of the mobile router registering through multiple interfaces.

Figure 2: Mobile Router Registering Through Multiple Interfaces to the Home Agent
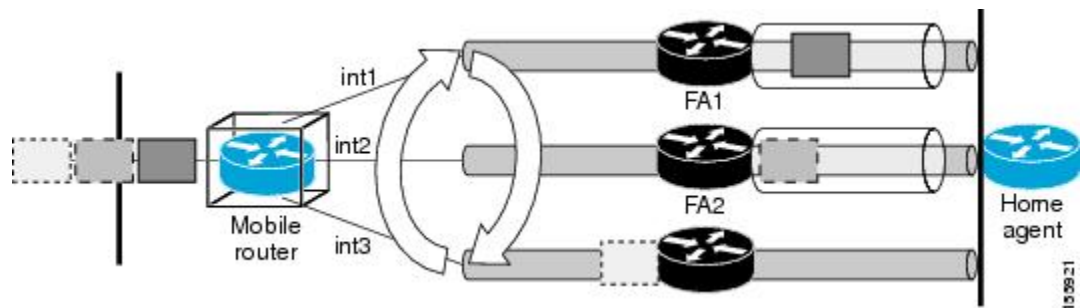
Upon successful registration, the HA maintains multiple care-of addresses, mobility bindings, tunnels, and routes to the same MR. Multiple bindings are not the same as simultaneous bindings. With multiple bindings, the traffic is not replicated on all tunnels but rather load-balanced across them, which means that the packets are sent through only one path.

Mobile Router Multipath Load-Balancing Behavior

When there are multiple paths between the MR and the HA, the traffic from the mobile networks that goes toward the HA is generally load-balanced. Per-destination load balancing is the default behavior. But you can also make use of an advanced behavior, policy-based application routing. Policy-based application routing allows you to identify a particular type of traffic from the mobile networks and then select the tunnel for routing this traffic.

Policy-based application routing allows you to control the roaming interface that is used by an application to route its traffic to the other end of a Mobile IP tunnel. This provides flexibility to control how the applications are routed over different mobile wireless networks based on a defined policy. The applications are policy-routed based on the roaming interface type. See the Routing Based on Policies and Selecting Roaming Interfaces, on page 7 for more information on policy-based application routing.

Setting Priority Levels and MR Registration

You can configure policy-based application routing and the MR roaming interfaces. You should set the priority levels when you enable the roaming interface. The MR registers on multiple roaming interfaces based on the roaming interface configuration. The MR registers only through the highest priority interface. If there is more than one interface with the same highest priority, then both interfaces are used by the MR during registration. If all highest priority interfaces are unavailable, then the MR switches to the next available highest priority interface. The interfaces have link-type labels configured on them. See Registering the MR Based on the Roaming Priority Example, on page 17 for an example.

A label is used to describe a link-type associated with a roaming interface. The label indicates the path such as, link type, actual bandwidth, or stability. You need to manually configure the label on a roaming interface using the **ip mobile router-service link-type**command.

Benefits of Mobile Router Multipath Support

Because multiple access technologies can be deployed in mobile networks, the Mobile Router Multipath support feature offers the ability to leverage all available links when Mobile IP is used. This multiple path support offers good investment protection for existing legacy wireless connections or any newly purchased or deployed wireless technologies.

How to Configure Mobile Router Multipath Support

The Mobile Router Multipath support feature is enabled by default on the MR but is disabled by default on the HA. For this feature to work, both the HA and the MR must be configured for multipath support. Because this feature is enabled by default on the MR, the MR will try for multiple registrations. However, if the MR determines that the HA is not configured for multipath support by receiving registration replies without multiple path support, the MR will switch to single-path mode. This feature is disabled by default on the HA so that during deployments, upgrading the software does not surprise the deployment engineer with multiple registrations.

After configuring the MR, you can configure the policy-based application routing and the MR roaming interfaces. You then need to enable the roaming interfaces and define the traffic policies. This allows you to identify a particular type of traffic from the mobile networks and then select the tunnel for routing the traffic. This provides flexibility to control how the applications are routed over different mobile wireless networks based on a policy.

This section contains the following tasks:

Configuring the Mobile Router for Multipath Support

This task shows how to configure the mobile router for multipath support.

Before you begin

The security association between the MR and the HA should be established in order for registrations to succeed.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip address** *ip-address mask*
5. **exit**
6. **router mobile**
7. **exit**
8. **ip mobile router**
9. **address** *address mask*
10. **home-agent** *ip-address*
11. **mobile-network** *interface-type interface number*
12. **multi-path** [**metric** {**bandwidth** | **hopcount**}]
13. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface loopback0`	Configures an interface and enters interface configuration mode.
Step 4	**ip address** *ip-address mask* **Example:**	Sets a primary IP address of the interface. • This is the home address of the mobile router.

	Command or Action	Purpose
	`Router(config-if)# ip address 209.165.200.225 255.255.255.224`	
Step 5	**exit** **Example:** `Router(config-if)# exit`	Returns to global configuration mode.
Step 6	**router mobile** **Example:** `Router(config)# router mobile`	Enables Mobile IP on the router and enters router configuration mode.
Step 7	**exit** **Example:** `Router(config-router)# exit`	Returns to global configuration mode.
Step 8	**ip mobile router** **Example:** `Router(config)# ip mobile router`	Enables the mobile router and enters mobile router configuration mode.
Step 9	**address** *address mask* **Example:** `Router(mobile-router)# address 209.165.200.225 255.255.255.224`	Sets the home IP address and network mask of the mobile router.
Step 10	**home-agent** *ip-address* **Example:** `Router(mobile-router)# home-agent 192.0.2.19`	Specifies the home agent that the mobile router uses during registration.
Step 11	**mobile-network** *interface-type interface number* **Example:** `Router(mobile-router)# mobile-network Ethernet3/0`	Specifies the mobile router interface that is connected to the mobile network.
Step 12	**multi-path** [**metric** {**bandwidth** | **hopcount**}] **Example:** `Router(mobile-router)# multi-path`	Enables the mobile router to request multiple path support. • Bandwidth is the default metric.
Step 13	**end** **Example:**	Returns to privileged EXEC mode.

Command or Action	Purpose
`Router(mobile-router)# end`	

What to do next

Routing Based on Policies and Selecting Roaming Interfaces

This section contains the following topics:

Before you begin

Policy-based application routing occurs only when an ingress interface is configured for a mobile policy.

Example:

```
interface ethernet 1/0
 ip mobile router-service roam
 ip mobile router-service link-type 802.11g
```

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip mobile router-service roam priority** *priority-level*
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface FastEthernet0/2`	Configures an interface and enters interface configuration mode.
Step 4	**ip mobile router-service roam priority** *priority-level* **Example:**	Enables the roaming interface and sets the priority level.

	Command or Action	Purpose
	`Router(config-if)# ip mobile router-service roam priority 101`	The roaming interface priority defaults to 100 if priority is not specified while configuring the **ip mobile router-service roam** command.
Step 5	**end** **Example:** `Router(config-if)# end`	Returns to privileged EXEC mode.

Enabling the Roaming Interfaces

You can enable the roaming interfaces after setting the roaming priority level. The MR registers on multiple roaming interfaces based on the roaming-interface configuration.

SUMMARY STEPS

1. **enable**
2. **configure   terminal**
3. **interface**   *type number*
4. **ip mobile router-service roam priority**   *priority-level*
5. **ip mobile router-service link-type**   *label*
6. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface FastEthernet0/2`	Configures an interface and enters interface configuration mode.
Step 4	**ip mobile router-service roam priority** *priority-level* **Example:** `Router(config-if)# ip mobile router-service roam priority 101`	Enables the roaming interface and sets the priority level. The roaming interface priority defaults to 100 if priority is not specified while configuring the **ip mobile router-service roam**command.

	Command or Action	Purpose
Step 5	**ip mobile router-service link-type** *label* **Example:** Router(config-if)# ip mobile router-service link-type 802.11g	Enables a link-type roaming interface.
Step 6	**end** **Example:** Router(config-if)# exit	Returns to privileged EXEC mode.

Defining the Traffic Policies

You can define the traffic policies by identifying the application traffic and selecting the path for routing based on policies. This section contains the following tasks:

Identifying the Application Traffic

You can use one or more extended named ACLs on both the MR and the HA to identify the application traffic. MR and HA named ACLs are used as templates at registration time to generate dynamic ACLs that are used in the dynamic route maps.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **ip access-list extended** *access-list name*
4. **permit udp any any eq** *port*
5. **end**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** Router> enable	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** Router# configure terminal	Enters global configuration mode.
Step 3	**ip access-list extended** *access-list name* **Example:** Router(config)# ip access-list extended WEB	Configures an extended named ACL.

	Command or Action	Purpose
Step 4	**permit udp any any eq** *port* **Example:** `Router(config-ext-nacl)# permit udp any any eq 8080`	Identifies the application traffic to be policy routed. These are used as templates at registration time to generate dynamic ACLs that are used in the dynamic route-maps.
Step 5	**end** **Example:** `Router(config-ext-nacl)# end`	Returns to privileged EXEC mode.

Selecting the Routing Path

You can use one or more mobile-map mobile policy templates on the MR and HA to select the routing path.

Multiple mobile policies can be configured on either the MR or the HA. On the MR, a separate dynamic route map is generated for each configured mobile policy. More than one MR ingress interface (mobile network interface) has a mobile policy and each interface has a different policy. On the HA there is only one dynamic route map generated, but it is applied on up to three ingress interfaces. If more than one mobile policy is configured on the HA, only one route map is dynamically generated and applied to the ingress interface(s).

You need to apply the mobile map to access interfaces. The mobile map is associated with a mobile network interface on the MR in the "mobile-network" configuration. The mobile-map configuration on the HA can specify up to three "ingress" interfaces.

When traffic from a mobile network is received by the MR, the traffic is compared against one of the ACLs. If there is a match, the MR finds the corresponding mobile-map entry that specifies the roaming interface on which to send the traffic. Similarly, on the HA when traffic for a mobile network is received on one of the specified ingress interfaces, it is matched against one of the ACLs and then against the corresponding mobile-map entry, which in turn decides the tunnel to send the traffic to.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **interface** *type number*
4. **ip mobile router-service roam priority** *priority level*
5. **ip mobile router-service link-type** *label*
6. **exit**
7. **ip access-list extended** *access-list-name*
8. **permit udp any any eq** *port*
9. **exit**
10. **ip mobile mobile-map** *map name*
11. **match access-list** *acl*
12. **set link-type** *label*
13. **set interface** *interface-type number*
14. **ip mobile router**
15. **exit**

DETAILED STEPS

	Command or Action	**Purpose**
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**interface** *type number* **Example:** `Router(config)# interface FastEthernet0/2`	Configures an interface and enters interface configuration mode.
Step 4	**ip mobile router-service roam priority** *priority level* **Example:** `Router(config-if)# ip mobile router-service roam priority 101`	Enables the roaming interface and sets the priority level. • The roaming interface priority defaults to 100 if priority is not specified while configuring the **ip mobile router-service roam**command.
Step 5	**ip mobile router-service link-type** *label* **Example:** `Router(config-if)# ip mobile router-service link-type 802.11g`	Enables a link-type roaming interface.
Step 6	**exit** **Example:** `Router(config-if)# exit`	Returns to global configuration mode.
Step 7	**ip access-list extended** *access-list-name* **Example:** `Router(config)# ip access-list extended WEB`	Configures an extended named ACL and enters interface configuration mode.
Step 8	**permit udp any any eq** *port* **Example:** `Router(config-ext-nacl)# permit udp any any eq 8080`	Identifies the application traffic to be policy routed. The extended named ACLs on both the MR and HA are used as templates at registration time to generate dynamic ACLs that are used in the dynamic route maps.
Step 9	**exit** **Example:**	Returns to global configuration mode.

	Command or Action	Purpose
	`Router(config-ext-nacl)# exit`	
Step 10	**ip mobile mobile-map** *map name* **Example:** `Router(config)# ip mobile mobile-map MPATH_1 10`	Configures mobile policy templates on the MR and HA.
Step 11	**match access-list** *acl* **Example:** `Router(config)# match access-list WEB`	Specifies an ACL name.
Step 12	**set link-type** *label* **Example:** `Router(config)# set link-type 802.11a GPRS`	Specifies up to three link-type labels.
Step 13	**set interface** *interface-type number* **Example:** `Router(config)# set interface Ethernet1/0`	Specifies the interface for dropping traffic.
Step 14	**ip mobile router** **Example:** `Router(config)# ip mobile router`	Applies the mobile map to ingress interfaces in the MR and to up to three ingress interfaces in the HA.
Step 15	**exit** **Example:** `Router(config)# exit`	Returns to privileged EXEC mode.

Configuring the Home Agent for Multipath Support

This task shows how to configure the HA for multipath support.

You can configure and unconfigure multipath support globally on the HA. Unconfiguring multiple paths takes the mobile router back to the existing single-path mode.

SUMMARY STEPS

1. **enable**
2. **configure terminal**
3. **router mobile**
4. **exit**
5. **ip mobile home-agent multi-path** [**metric** {**bandwidth** | **hopcount**}]
6. **ip mobile virtual-network** *net mask* [**address** *address*]

7. **ip mobile host** *lower* [*upper*] {**interface**name | **virtual-network** *net mask*}
8. **ip mobile mobile-networks** *lower* [*upper*]
9. **register**
10. **multi-path** [**metric** {**bandwidth** | **hopcount**}]
11. **exit**

DETAILED STEPS

	Command or Action	Purpose
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**configure terminal** **Example:** `Router# configure terminal`	Enters global configuration mode.
Step 3	**router mobile** **Example:** `Router(config)# router mobile`	Enables Mobile IP on the router and enters router configuration mode.
Step 4	**exit** **Example:** `Router(config-router)# exit`	Returns to global configuration mode.
Step 5	**ip mobile home-agent multi-path** [**metric** {**bandwidth** | **hopcount**}] **Example:** `Router(config)# ip mobile home-agent multi-path`	Enables the home agent to process registration requests with multiple path support for all mobile routers. • Bandwidth is the default metric.
Step 6	**ip mobile virtual-network** *net mask* [**address** *address*] **Example:** `Router(config)# ip mobile virtual-network 209.165.200.225 255.255.255.224`	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.
Step 7	**ip mobile host** *lower* [*upper*] {**interface**name | **virtual-network** *net mask*} **Example:** `Router(config)# ip mobile host 209.165.200.219 255.255.255.224 virtual-network 209.165.200.225 255.255.255.224`	Configures the mobile router as a mobile host. The IP address is in the home network. • The **interface** *name* option configures a physical connection from the home agent to the mobile router.

	Command or Action	Purpose
Step 8	**ip mobile mobile-networks** *lower* [*upper*] **Example:** Router(config)# ip mobile mobile-networks 209.165.200.219 209.165.200.225	Configures mobile networks for the mobile host and enters mobile networks configuration mode. The *upper* range can be used only with dynamically registered networks and allows you to configure multiple mobile routers at once. • The range must be within the range configured in the **ip mobile host** command.
Step 9	**register** **Example:** Router(mobile-networks)# register	Dynamically registers the mobile networks with the home agent.
Step 10	**multi-path** [**metric** {**bandwidth** | **hopcount**}] **Example:** Router(mobile-networks)# multi-path	Configures the global default setting and enables the home agent to process requests with multiple path support for a specific mobile router. Bandwidth is the default metric.
Step 11	**exit** **Example:** Router(mobile-networks)# no multi-path	Returns to privileged EXEC mode.

What to Do Next

After you configure the HA you can define the traffic policies. This enables you to identify a particular traffic from the mobile networks and then select the tunnel for routing the traffic. This provides flexibility to control how the applications are routed over different mobile wireless networks based on a policy. See the "Defining the Traffic Policies, on page 9" for more information on how to define the traffic policies.

Clearing the Mobility Binding on the Home Agent

Perform this task to manually clear the mobility binding that is associated with the MR IP address and its care-of address.

Note Use this **clear** command with care, because it will disrupt any sessions that are being used by the MR. After you use this command, the mobile router will need to re-register to continue roaming.

>

SUMMARY STEPS

1. **enable**
2. **clear ip mobile binding** *mr-ip-address* [**coa** *care-of-address*]

DETAILED STEPS

	Command or Action	**Purpose**
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**clear ip mobile binding** *mr-ip-address* [**coa** *care-of-address*] **Example:** `Router# clear ip mobile binding 192.0.2.72`	Removes mobility bindings. • You can remove a specific care-of address or all care-of addresses associated with a mobile router.

Verifying Mobile Router Multipath Support

Perform this task to verify MR multipath support.

SUMMARY STEPS

1. **enable**
2. **show ip mobile binding** [**home-agent** *ip-address* | **nai** *string* [**session-id** *string*] | **summary**]
3. **show ip mobile global**
4. **show ip mobile mobile-networks**
5. **show ip mobile tunnel** [*interface*]
6. **show ip route**
7. **show ip mobile router**

DETAILED STEPS

	Command or Action	**Purpose**
Step 1	**enable** **Example:** `Router> enable`	Enables privileged EXEC mode. • Enter your password if prompted.
Step 2	**show ip mobile binding** [**home-agent** *ip-address*	**nai** *string* [**session-id** *string*]	**summary**] **Example:** `Router# show ip mobile binding`	Displays the mobility binding on the home agent.
Step 3	**show ip mobile global** **Example:** `Router# show ip mobile global`	Displays global information for mobile agents.

	Command or Action	Purpose
Step 4	**show ip mobile mobile-networks** **Example:** `Router# show ip mobile mobile-networks`	Displays a list of mobile networks that are associated with the mobile router.
Step 5	**show ip mobile tunnel** [*interface*] **Example:** `Router# show ip mobile tunnel`	Displays active tunnels.
Step 6	**show ip route** **Example:** `Router# show ip route`	Displays the current state of the routing table.
Step 7	**show ip mobile router** **Example:** `Router# show ip mobile router`	Displays configuration information and monitoring statistics about the mobile router.

Configuration Examples for Mobile Router Multipath Support

Multipath Support on the Mobile Router Example

The following example shows how to configure multipath support on the mobile router:

```
interface Loopback0
! MR home address
 ip address 209.165.200.225 255.255.255.224
interface Tunnel101
 keep 5 3
interface Ethernet1/0
! MR roaming interface
 ip address 209.165.200.239 255.255.255.224
 ip mobile router-service roam
interface Ethernet2/0
! MR roaming interface
 ip address 209.165.200.246 255.255.255.224
 ip mobile router-service roam
interface Ethernet3/0
 ip address 209.165.200.247 255.255.255.224
router mobile
ip mobile router
 address 209.165.200.251 255.255.255.224
 home-agent 192.0.2.12
 mobile-network Ethernet3/0
 tunnel mode gre
 multi-path
 template Tunnel101
ip mobile secure home-agent 192.0.2.16 spi 101 key hex 123456789012345678901234567890124
```

Multipath Support on the Home Agent Example

The following example shows how to configure multipath support on the home agent:

```
interface Ethernet 0/0
 ip address 209.165.200.251 255.255.255.224
!
router mobile
 exit
 ip mobile home-agent multi-path
 ip mobile virtual-network 209.165.200.252 255.255.255.224
 ip mobile host 192.0.2.10 192.0.2.15 virtual-network 209.165.200.254 255.255.255.224
 ip mobile secure host 192.0.2.20 192.0.2.25 spi 101 key hex  12345678901234567890123456789012
ip mobile mobile-networks 192.0.2.40 192.0.2.44
 register
ip mobile mobile-networks 192.0.2.57
 register
 no multi-path
```

Registering the MR Based on the Roaming Priority Example

The following example shows how roaming priority levels are selected during MR registration:

Consider the following four interfaces:

```
interface Fastethernet 1/0
   ip mobile router-service roam priority 200
   ip mobile router-service link-type 802.11g
interface Fastethernet 1/1
   ip mobile router-service roam priority 200
   ip mobile router-service link-type 802.11g
interface Fastethernet 2/0
   ip mobile router-service roam priority 100
   ip mobile router-service link-type 802.11g
interface Fastethernet 2/1
   ip mobile router-service roam priority 100
   ip mobile router-service link-type 802.11g
Fast Ethernet interfaces 1/0 and 1/1 have priority 200. Fast Ethernet interfaces 2/0 and
2/1 have priority 100. When you try enabling these four interfaces, the MR registers on
both the Fast Ethernet interfaces 1/0 and 1/1 because they have the highest roaming priority.
 But when the interfaces Fastethernet 1/0 and 1/1 are not available, the MR registers on
Fastethernet 2/0 and 2/1, the next available highest priority group.
```

Using mobile-map Mobile Policy Templates Example

The following example shows to use the mobile-map mobile policy templates on the MR and the HA to select the routing path.

```
ip mobile mobile-map MPATH_1 10
 match access-list WEB
 set link-type 802.11g UMTS
 set interface null0
```

Generating Dynamic Route Maps in an HA Example

The following example shows how the dynamic route maps are generated in an HA:

```
Router# show route-map dynamic
route-map MIP-10/24/06-04:18:15.243-1-MP-HA, permit, sequence 0, identifier 53856096
  Match clauses:
    ip address (access-lists): VOICE-to-192.0.2.0/24
  Set clauses:
    interface Tunnel0
  Policy routing matches: 0 packets, 0 bytes
 Current active dynamic routemaps = 1
Router# show ip access-lists dynamic
Extended IP access list VOICE-to-192.0.2.0/24
    10 permit icmp any 209.165.200.225 255.255.255.224 tos max-reliability
```

Additional References

The following sections provide references related to the Mobile IP-- Policy and Application-Based Routing for MR Multipath Support feature.

Related Documents

Related Topic	Document Title
Mobile IP commands: complete command syntax, command mode, command history, defaults, usage guidelines, and examples	*Cisco IOS IP Mobility Command Reference*

Standards

Standard	Title
No new or modified standards are supported by this feature, and support for existing standards has not been modified by this feature.	--

MIBs

MIB	MIBs Link
No new or modified MIBs are supported by this feature, and support for existing MIBs has not been modified by this feature.	To locate and download MIBs for selected platforms, Cisco IOS releases, and feature sets, use Cisco MIB Locator found at the following URL: http://www.cisco.com/go/mibs

RFCs

RFC	Title
No new or modified RFCs are supported by this feature, and support for existing RFCs has not been modified by this feature.	--

Technical Assistance

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

Command Reference

The following commands are introduced or modified in the feature or features documented in this module. For information about these commands, see the *Cisco IOS IP Mobility Command Reference* at http://www.cisco.com/en/US/docs/ios/ipmobility/command/reference/imo_book.html. For information about all Cisco IOS commands, use the Command Lookup Tool at http://tools.cisco.com/Support/CLILookup or to the *Cisco IOS Master Commands List, All Releases* , at http://www.cisco.com/en/US/docs/ios/mcl/allreleasemcl/all_book.html .

- **clear ip mobile binding**
- **debug ip mobile dyn-pbr**
- **ip mobile home-agent multi-path**
- **ip mobile router-service link-type**
- **ip mobile router-service roam**
- **multi-path (mobile networks)**
- **multi-path (mobile router)**
- **show ip mobile binding**
- **show ip mobile globals**
- **show ip mobile mobile-networks**
- **show ip mobile router interface**
- **show ip mobile router registration**
- **show ip mobile tunnel**

Feature Information for Mobile IP - Policy and Application-Based Routing for MR Multipath

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

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

Table 1: Feature Information for Mobile IP-- Policy and Application-Based Routing for MR Multipath

Feature Name	Releases	Feature Information
Mobile IP--Mobile Router Multipath Support	12.4(9)T	This Mobile IP--Mobile Router Multipath Support feature provides support for multiple paths, and thus multiple wireless technologies, between the mobile router and the home agent and allows user traffic to be load-balanced over all available interfaces.
Mobile IP-- Policy and Application-Based Routing for MR Multipath	12.4(24)T	This feature provides support for mobile router multipath registration based on roaming interface priority; application routing based on link or path type; and multiple registrations based on roaming interface priority. The following commands were introduced: **ip mobile router-service link-type**, **ip mobile router-service roam**. The following commands were modified: **show ip mobile binding, show ip mobile router interface, show ip mobile router registration, show ip mobile tunnel**

Glossary

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

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.

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.

home agent --A router on a home network of the mobile node or a router that tunnels packets to the mobile node or mobile router while they are away from home. The home agent 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.

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

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.

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 de-encapsulates the datagram and then correctly delivers it to its ultimate destination.