

Mobile IP

Home Agent - Foreign Agent  
Mobile Node

# The Mobile IP Protocol

*Mobile IP provides an efficient and scalable mechanism for mobility within the Internet. It is designed to help organizations easily enable their customers to benefit from seamless mobility between different networks in the entire Internet-connected world.*

An increasing amount of Internet users take advantage of wireless technology when accessing the Internet. This gives great benefits, but also has the drawback that connections are lost whenever a user moves to a new network. Mobile IP is the Internet standard for allowing users to seamlessly roam among wireless networks. Using Mobile IP, applications such as Internet telephony, media streaming and virtual private networking can be supported without service interruption when users move across network boundaries.

Interpeak's Mobile IP products are compliant with the WiMAX Forum standards for mobility in WiMAX networks, and the 3GPP2/3GPP standards for 3G cellular networks. In addition, the products implement Fast Handover ("make-before-break") for the support of Voice-over-IP and other real-time applications.

## Operation

Mobile IP support requires a Mobile Node in each mobile device and a

Home Agent in each such device's home network. Optionally, a Foreign Agent may be present in the network the device is visiting. Both Home Agents and Foreign Agents normally reside within routers in their network.

When a mobile device visits another network, IP datagrams destined for the device are intercepted by its Home Agent and tunneled to the visited network using a temporary IP address. If there is a Foreign Agent on the visited network, it receives the tunneled packets, unpacks them and forwards them to the Mobile Node; otherwise, the Mobile Node itself receives the tunneled packets and unpacks them. Finally, the Mobile Node reinserts the original datagrams into the stack, resulting in a transparent operation using only the original IP addresses.

Replies to the originating host can either be sent directly from the Mobile Node to the host, or tunneled back to the Home Agent, which in turn unpacks and forwards the replies to the host.

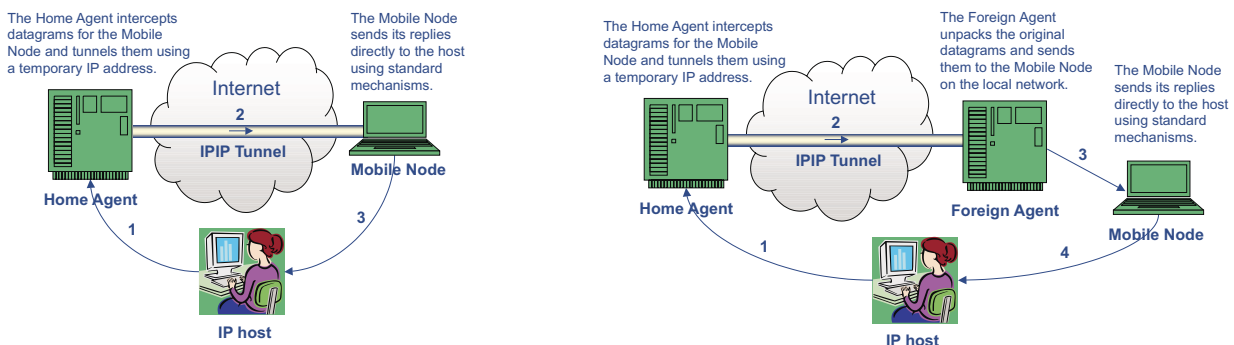
## Integrated with IPNET

Interpeak Mobile IP is fully integrated with Interpeak's IPv4/IPv6 TCP/IP stack IPNET. Consequently, no additional programming is required to get a Mobile IP solution up and running.

The Mobile IP components listen to both ICMP router advertisements and routing socket message from IPNET, allowing for fully automatic operation with no user handling required once initially configured. If manual intervention is required, the mobile IP modules may be shutdown, reconfigured or restarted using either a function API or simple shell command.

## Supports Industry-Standard RTOSs and Native Linux

Interpeak Mobile IP can be used with the entire range of industry-standard RTOSs supported by IPNET, such as INTEGRITY, OSE, VxWorks, Nucleus, and ITRON. It also supports all distributions of the Linux operating system with version 2.4 or 2.6 kernels.



*Mobile IP datagram flow in a network without a Foreign Agent. This requires the Mobile Node to have a public IP address in the visited network.*

*In a visited network that contains a Foreign Agent, the Mobile Node does not require any IP address. Furthermore, the Foreign Agent only requires one public IP address for all Mobile Nodes.*

# Interpeak Mobile IP Features

## Configuration

The Interpeak Mobile IP components can be configured at both build-time and run-time. Only minimal configuration is required to get them up and running. Configuration parameters for advanced operation can be left at their default values and revisited if required at a later time. Regardless what configuration needs to be changed, the mobile components can be reconfigured in runtime and then restarted using a single function call or shell command.

## Tunneling

IP datagrams to the mobile node are tunneled from the home network by the Home Agent to the Foreign Agent or Mobile Node directly. IP in IP tunneling, defined by RFC 2003, is the default and mandatory tunneling protocol and is supported by Interpeak's Mobile IP products. Generic Routing Encapsulation (GRE), an optional tunneling method that can be used with Mobile IP, is also supported. Mobile IP NAT support according to RFC 3519 "Mobile IP Traversal of Network Address Translation (NAT) Devices" is available upon request.

## Reverse Tunneling

The default operation with Mobile IP is to send packets from a mobile device to a host directly using standard IP routing, i.e. without tunneling or passing the datagram through the Home Agent. The effect is a triangular routing pattern where the host sends its datagrams to the Home Agent, which in turn tunnels them to the Foreign Agent or directly to the Mobile Node. Finally, the Mobile Node sends its datagrams directly to the original host, resulting in the triangle.

However, due to various security mechanisms like ingress filtering and firewalls, this mode of operation may not work because the datagrams from

- Fully RFC compliant Mobile IP Home Agent, Foreign Agent and Mobile Node.
- Compliant with the WiMAX Forum and the 3GPP/3GPP2 standards for mobility.
- Delivered in ANSI C source code.
- Build-time and run-time configuration.
- Optional co-located IP address support.
- MD5 authentication and integrity checks.
- Replay protection using timestamps.
- IPIP and GRE tunneling support.
- Support for reverse tunneling.
- Fast Handover ("make-before-break") to support Voice-over-IP.

*Interpeak Mobile IP features.*

the mobile node are discarded. The solution is to also tunnel and forward datagrams originating from the mobile node through the home agent. This mode of operation is called Reverse Tunneling (RFC 3024) and is also supported by Interpeak's implementation.

## Security

Registration messages exchanged between Mobile Nodes, Foreign Agents and Home Agents are always authenticated through the use of a shared secret, which is never sent over the net-

work. More specifically, the secret is used with keyed MD5 in prefix + suffix mode to create a 128-bit message digest of the complete registration message, not only serving to verify the sender but also protect the message from alterations.

Replay protection is realized with timestamps. The optional Reverse Tunneling feature may be utilized if firewalls are used. A positive side effect of reverse tunneling is that the whereabouts of the mobile node are hidden from the hosts it communicates with.

- RFC 1256 ICMP Router Discovery Messages
- RFC 2003 IP Encapsulation within IP
- RFC 2004 Minimal Encapsulation within IP
- RFC 2104 HMAC: Keyed-Hashing for Message Authentication
- RFC 2784 Generic Routing Encapsulation (GRE)
- RFC 2794 Mobile IP Network Access Identifier Extension for IPv4
- RFC 3012 Mobile IPv4 Challenge/Response Extensions
- RFC 3024 Reverse Tunneling for Mobile IP, revised
- RFC 3344 IP Mobility Support for IPv4
- RFC 3846 Mobile IPv4 Extension for Carrying Network Access Identifiers

*Interpeak Mobile IP supported RFCs.*

### **Interpeak Secure Networking Software**

Interpeak provides state-of-the-art networking solutions specifically designed for embedded systems. The company's embedded networking and security software is currently used in thousands of applications across the globe.

Headquartered in Stockholm, Sweden, Interpeak operates through a global network of distribution channels and has its own sales and field application force dispersed in strategic locations worldwide, including the USA, Europe, and Asia. For additional information, please visit our homepage [www.interpeak.com](http://www.interpeak.com).

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