



Mobility in the Internet

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Order of Presentation

The Problem

Requirements for Mobility in Internet

Mobile IPv4 – how it works

Mobile IPv6 – the better solution

Advantages of Mobile IPv6

Mobile IP in Standardization

Implementations



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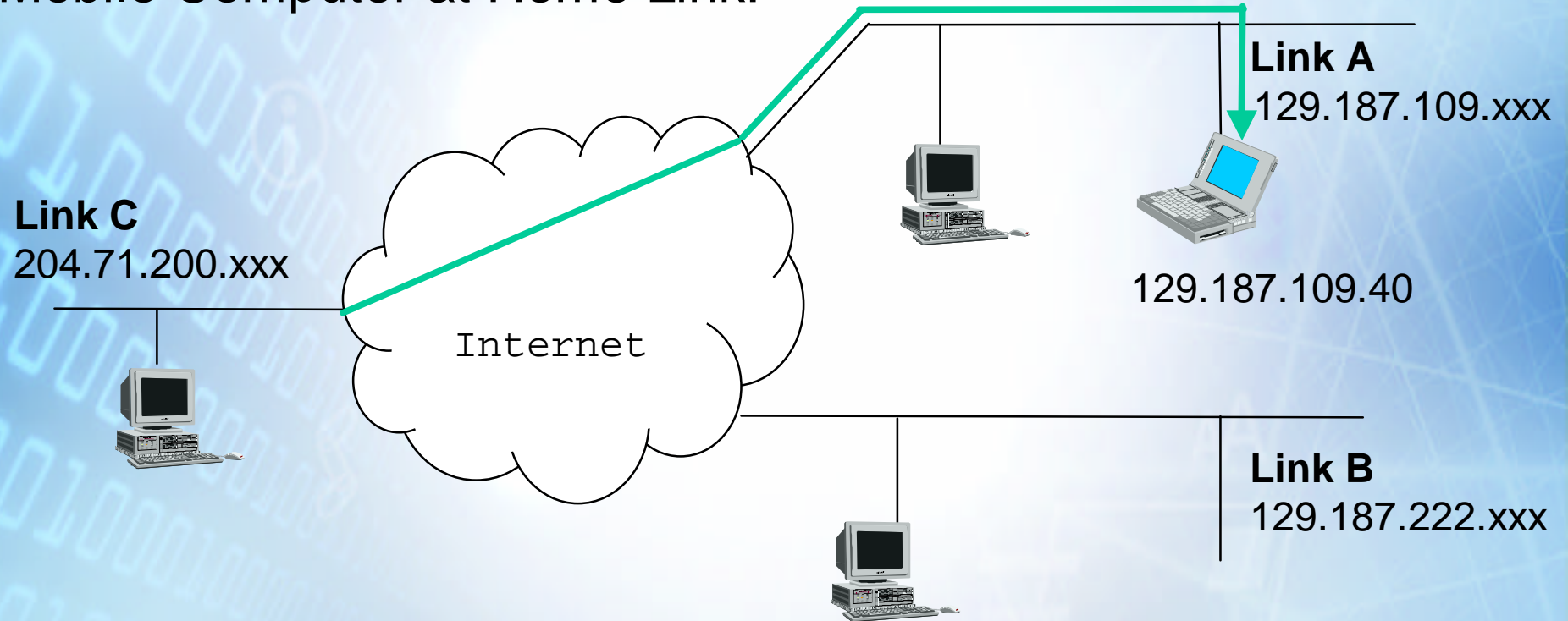
IP Mobility – the Problem

- Internet Protocol routes packets to their destination according to IP addresses
- IP addresses are associated with a fixed network location
- TCP Protocol uses IP addresses and port number to identify a session



IP Mobility Problem

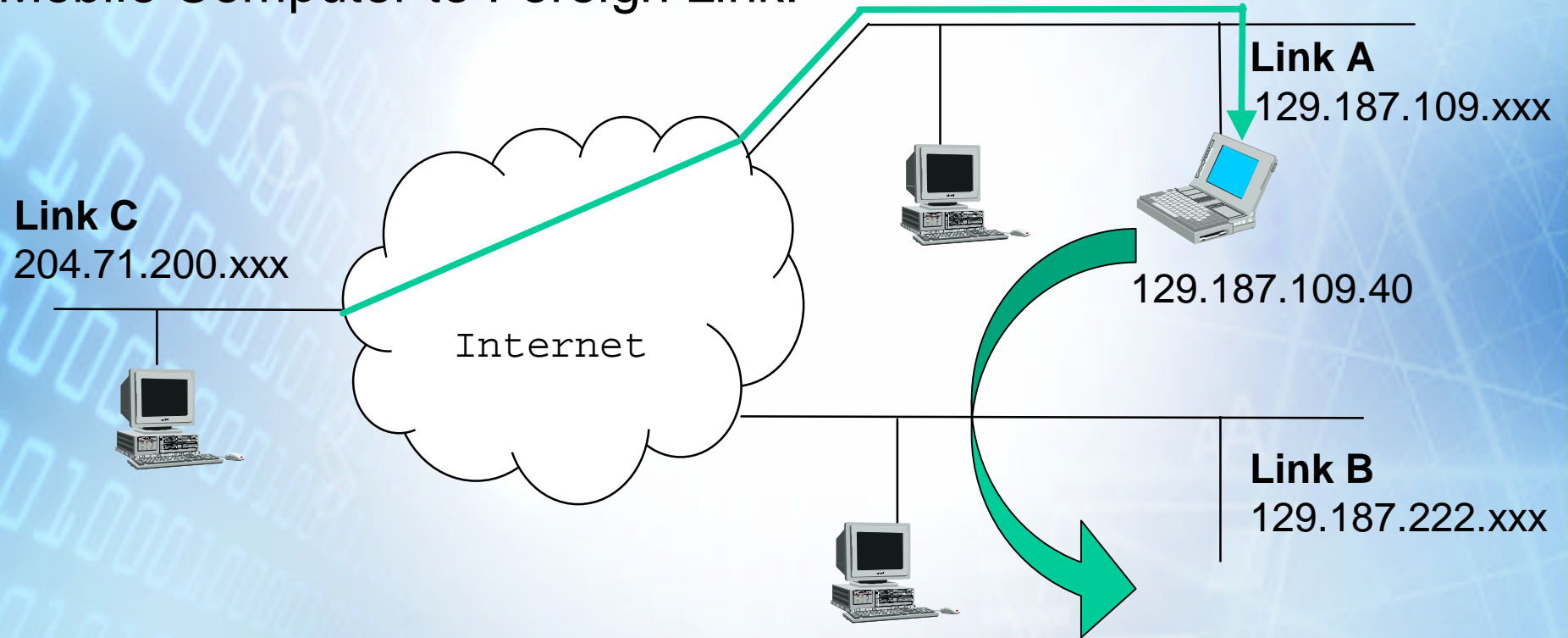
Mobile Computer at Home Link:





IP Mobility Problem

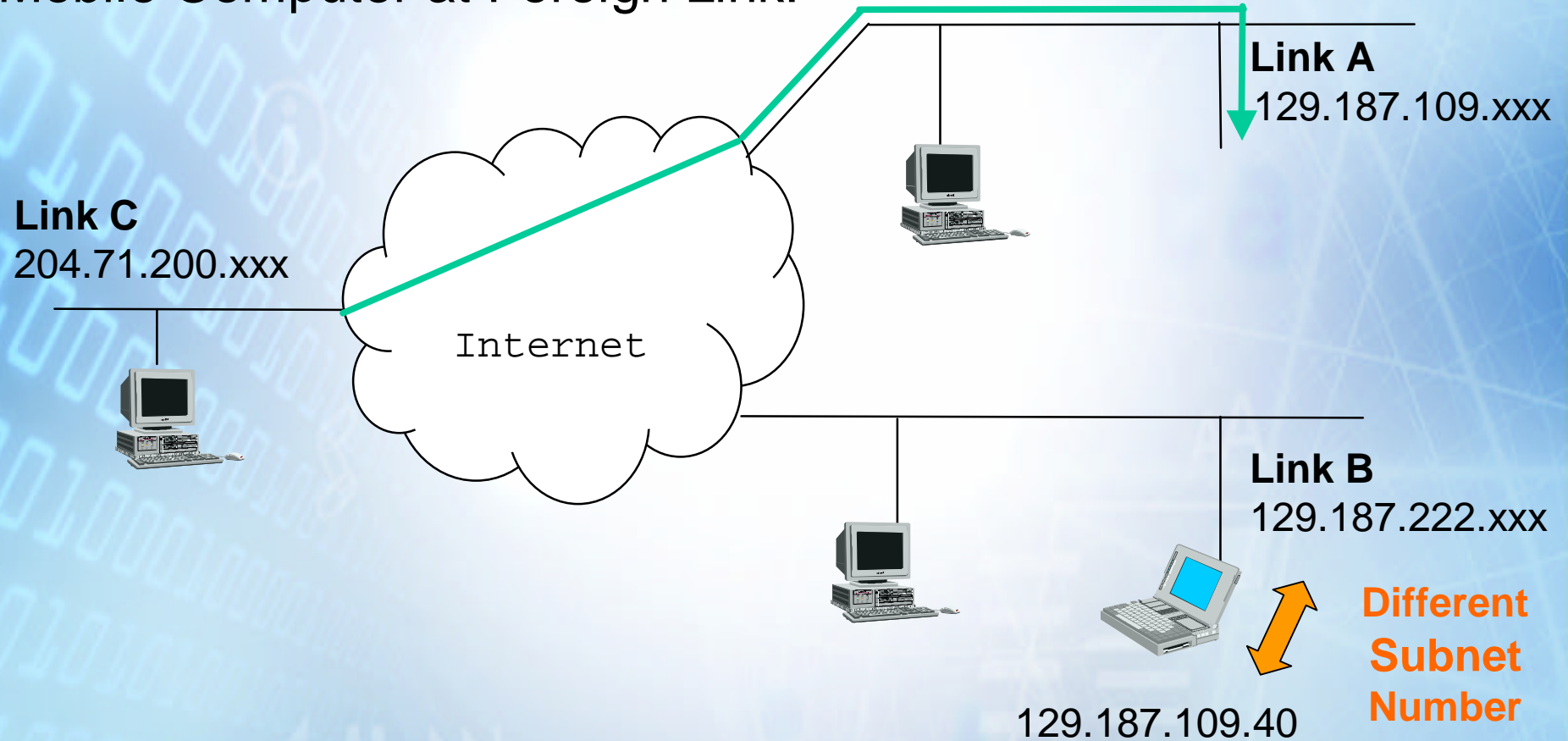
Mobile Computer to Foreign Link:





IP Mobility Problem

Mobile Computer at Foreign Link:



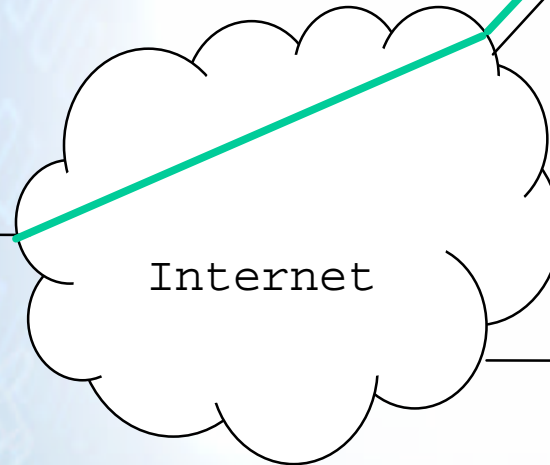


IP Mobility Problem

Mobile Computer at Foreign Link:



Link C
204.71.200.xxx



Link A
129.187.109.xxx

Link B
129.187.222.xxx



129.187.109.40

**Different
Subnet
Number**



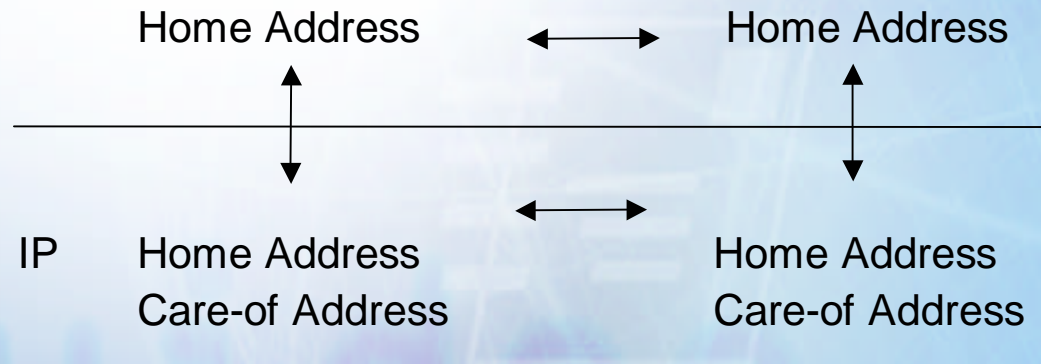
IP Mobility – Ideas behind Mobile IP

Dual Addressing

- One IP address for identifying a mobile node.
The original & permanent IP address at home link:
Home Address
- One IP address for locating a mobile node.
A temporary IP address at current (foreign) link:
Care-of Address

Transparency

- Transparency for higher layers (including applications)





Terminology in Mobile IP

Mobile Node

A Node that can move from Access Point to Access Point being always reachable for other nodes by his Home Address.

Home Agent

a Router at the Home Network where the Mobile Node can register its Care of Address.

Home Address

Static IP Address of the mobile Host in his Home Network (e.g. used to identify TCP connections)

Care-of Address

Temporary IP Address that identifies the Mobile Node in a visited Network (CoA)

Foreign Agent

The Router in the Foreign Network, that provides CoA for visiting Mobile Nodes

Correspondent Node

The node which is connected to the Mobile Node



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Requirements for Mobility in Internet

Mobility

- Increasing number of users asks for Mobility Support in Internet

Transparency

- Mobility shall be transparent to all Protocol Layers above IP

Easy to use

- Mobility shall be as easy to handle as with Mobile Phones in GSM

Routing

- Mobility shall be compatible to all Routing Protocols and shall optimize routes

Security

- Mobility shall not decrease security in Internet



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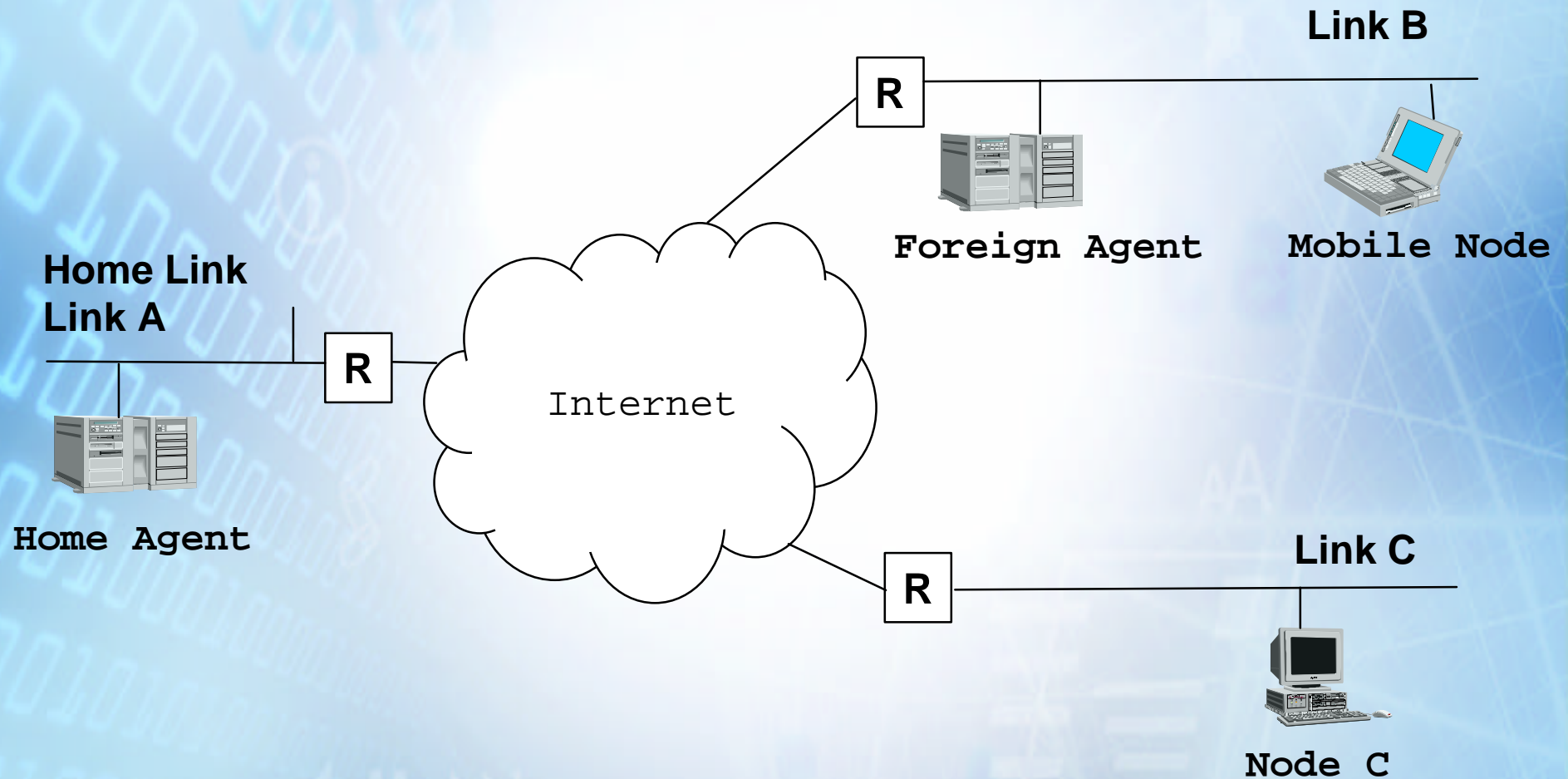


Mobile IP – Basic Mechanisms

1. Discovery of the Care-of Address (CoA) using Router Advertisements
2. Registering the Care-of Address
3. Tunneling to the Care-of Address

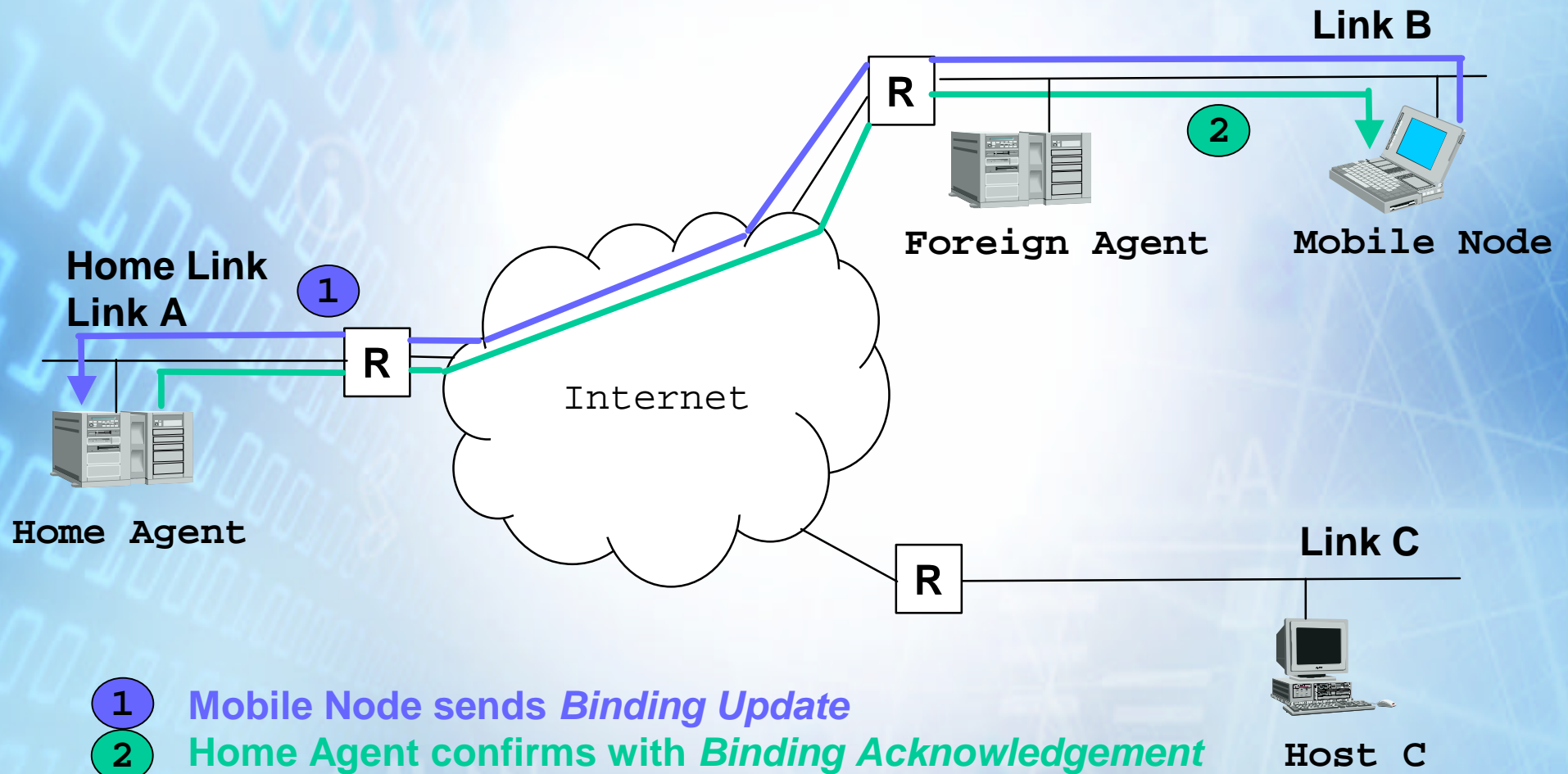


Mobile IP Scenario



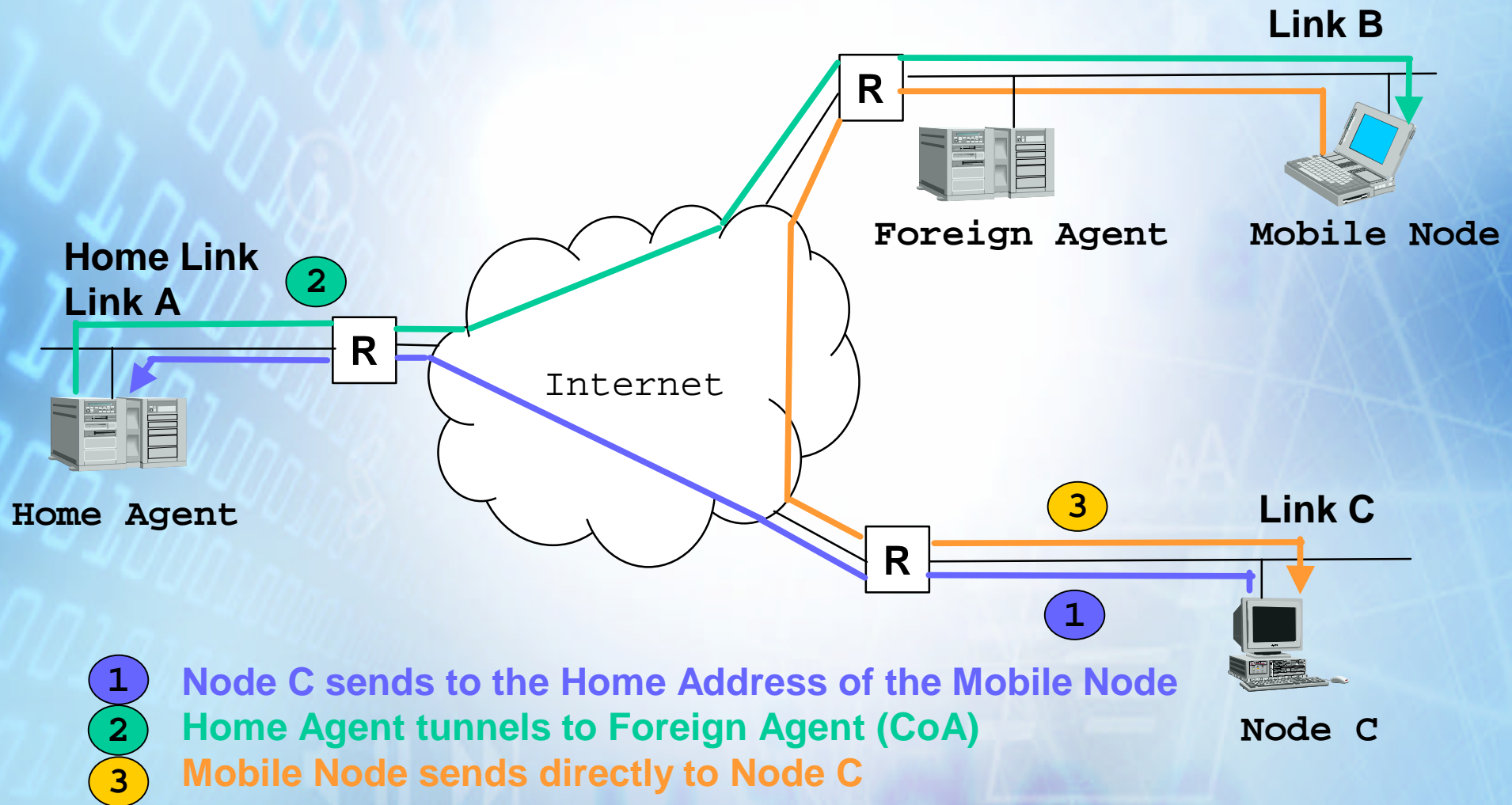


Mobile Node registers at its Home Agent





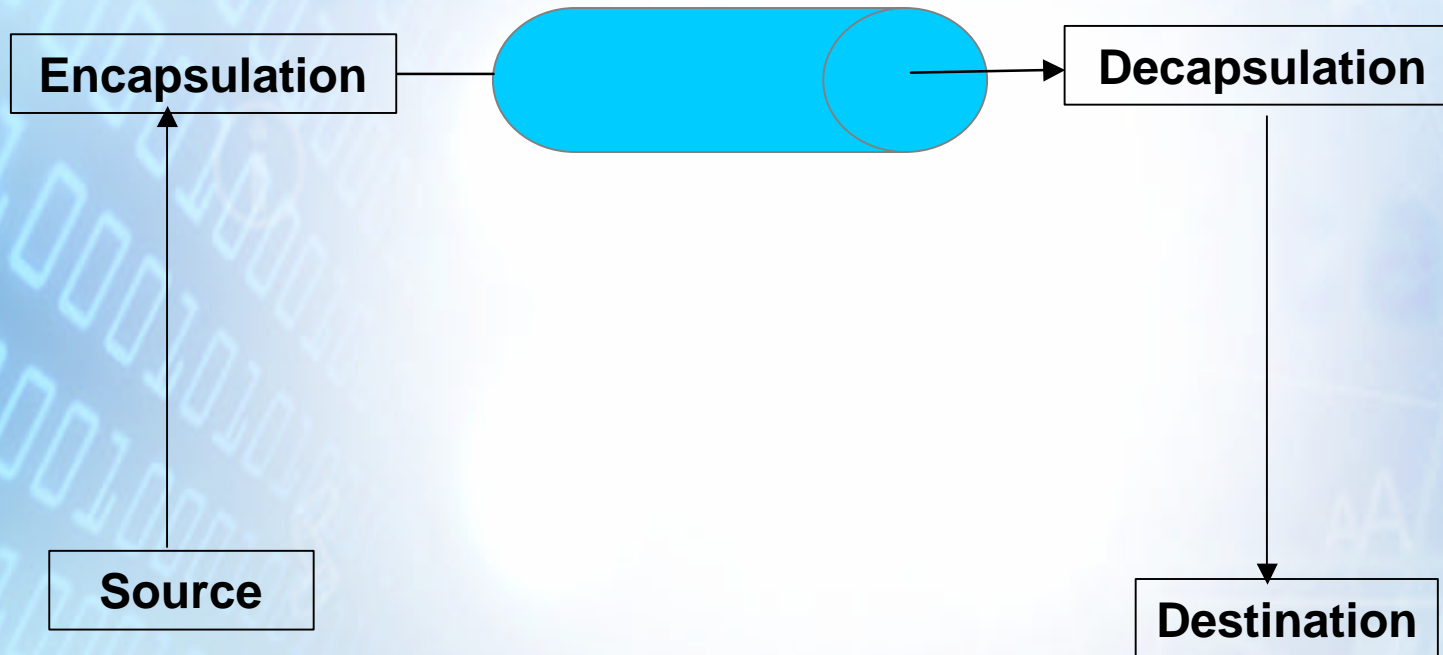
Packet Delivery



- 1 Node C sends to the Home Address of the Mobile Node
- 2 Home Agent tunnels to Foreign Agent (CoA)
- 3 Mobile Node sends directly to Node C



Tunneling





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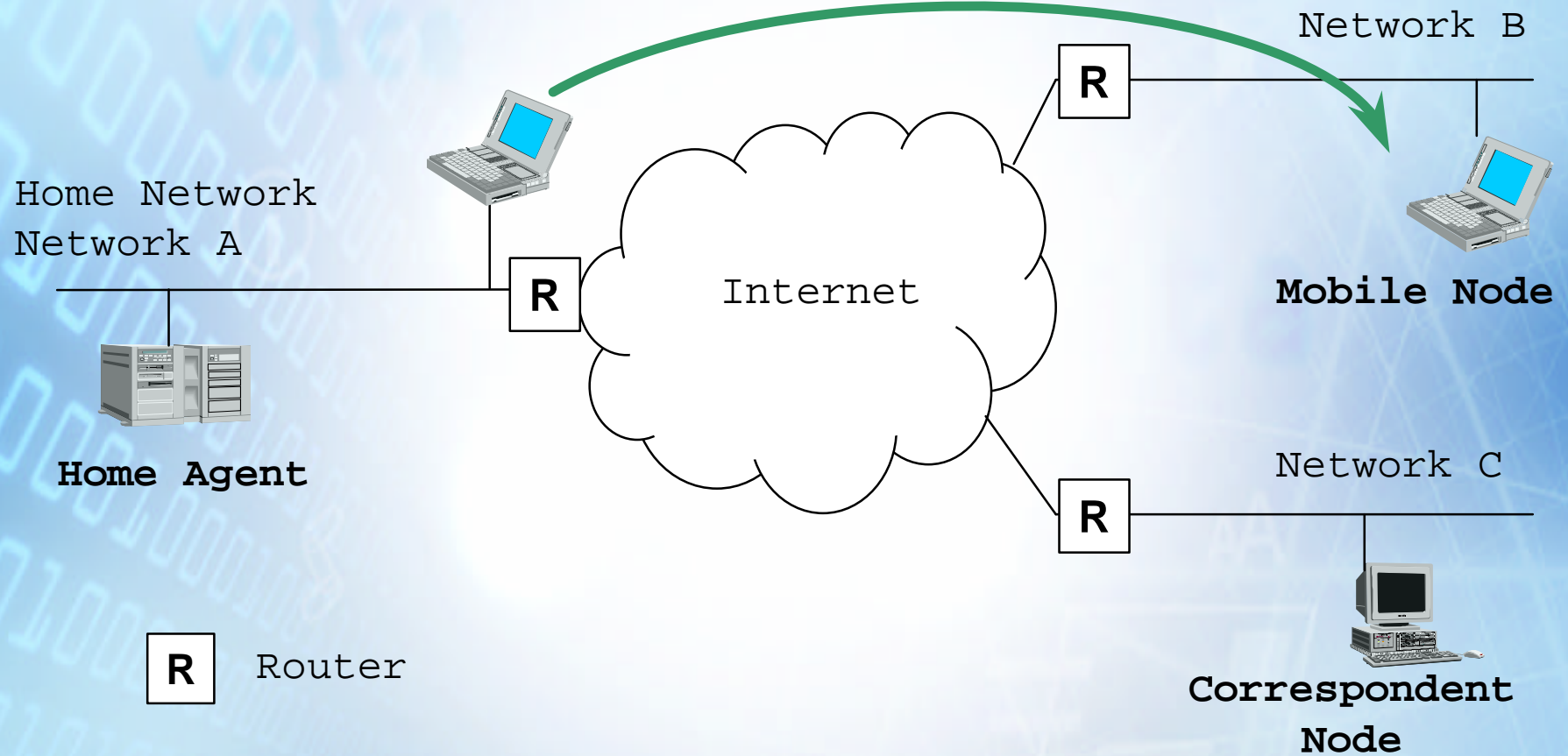
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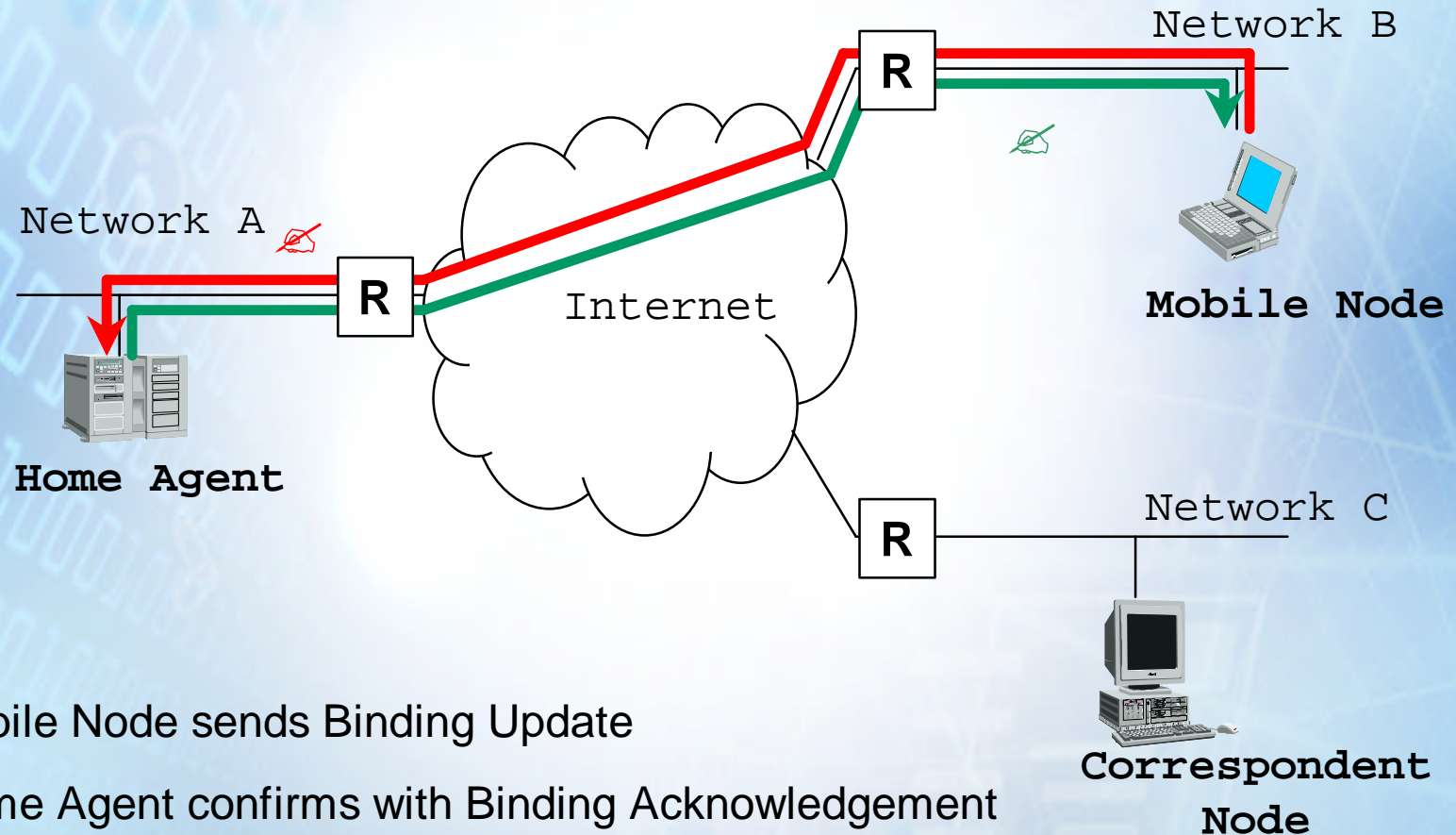
Implementations

Mobile Node moves





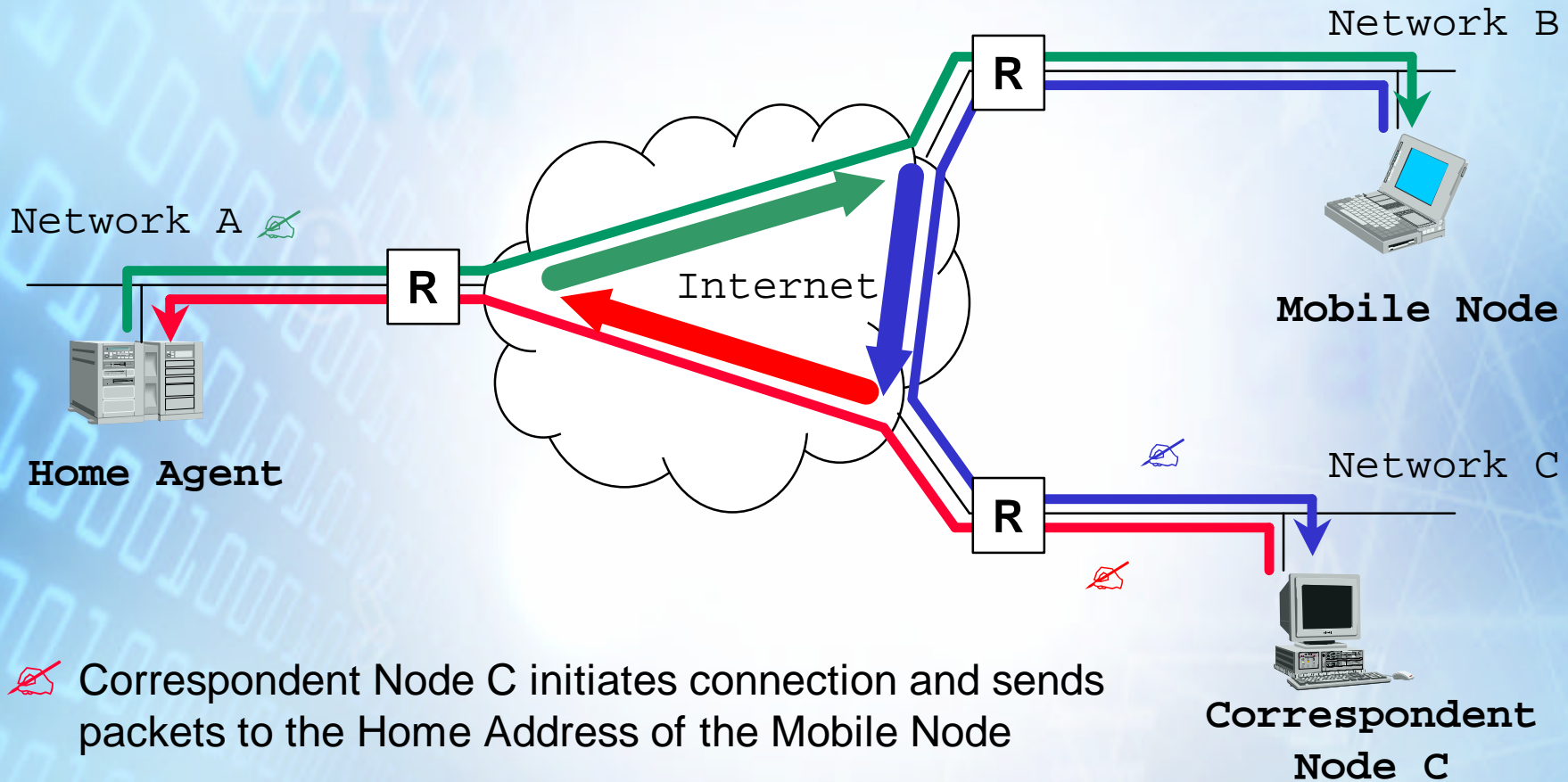
Mobile Node registers at its Home Agent






- Mobile Node sends Binding Update
- Home Agent confirms with Binding Acknowledgement



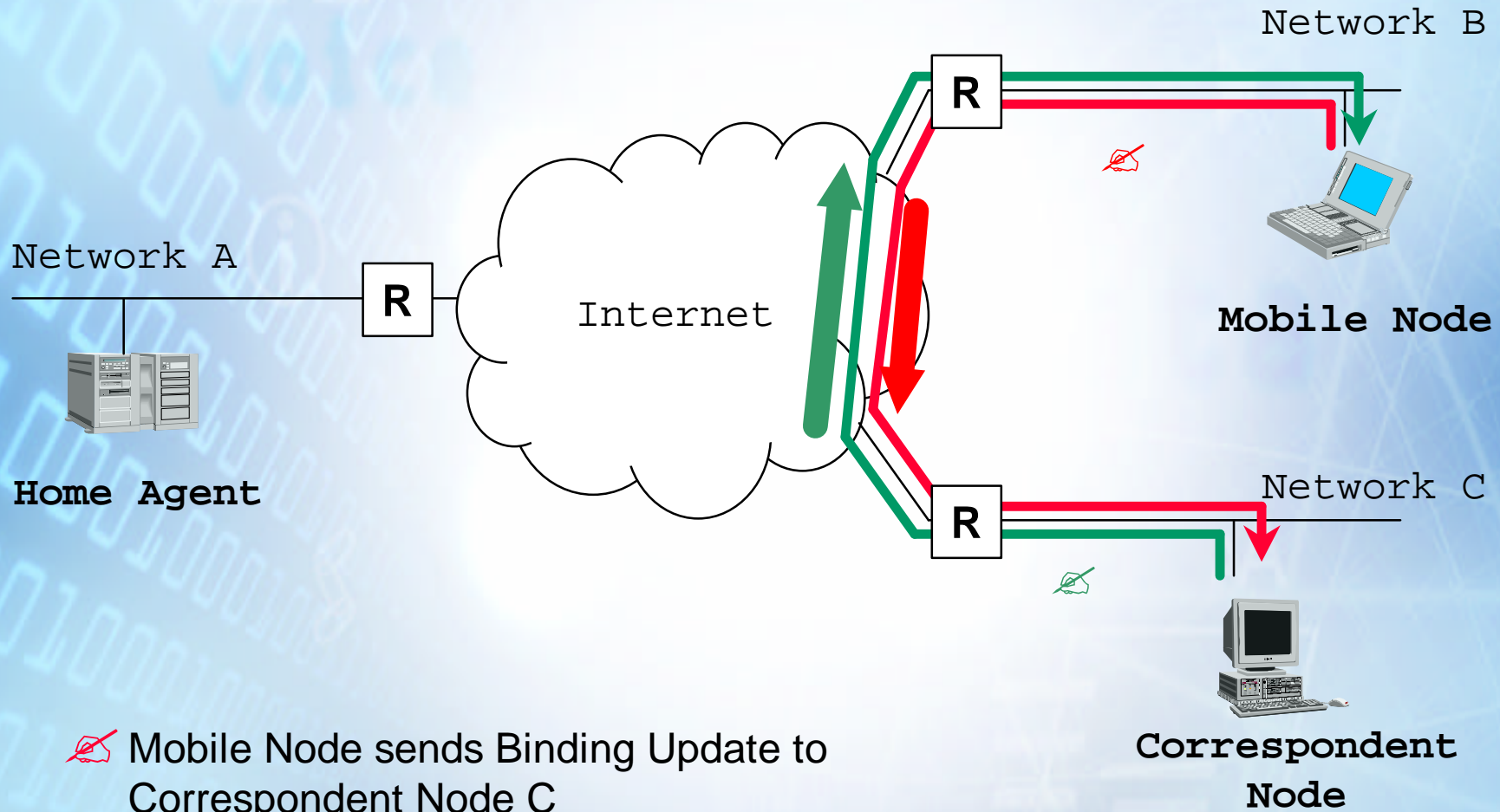
Triangular Routing during Initial Phase





-  Correspondent Node C initiates connection and sends packets to the Home Address of the Mobile Node
-  Home Agent intercepts packets and tunnels them to the Mobile Node
-  Mobile Node sends answer directly to Host C



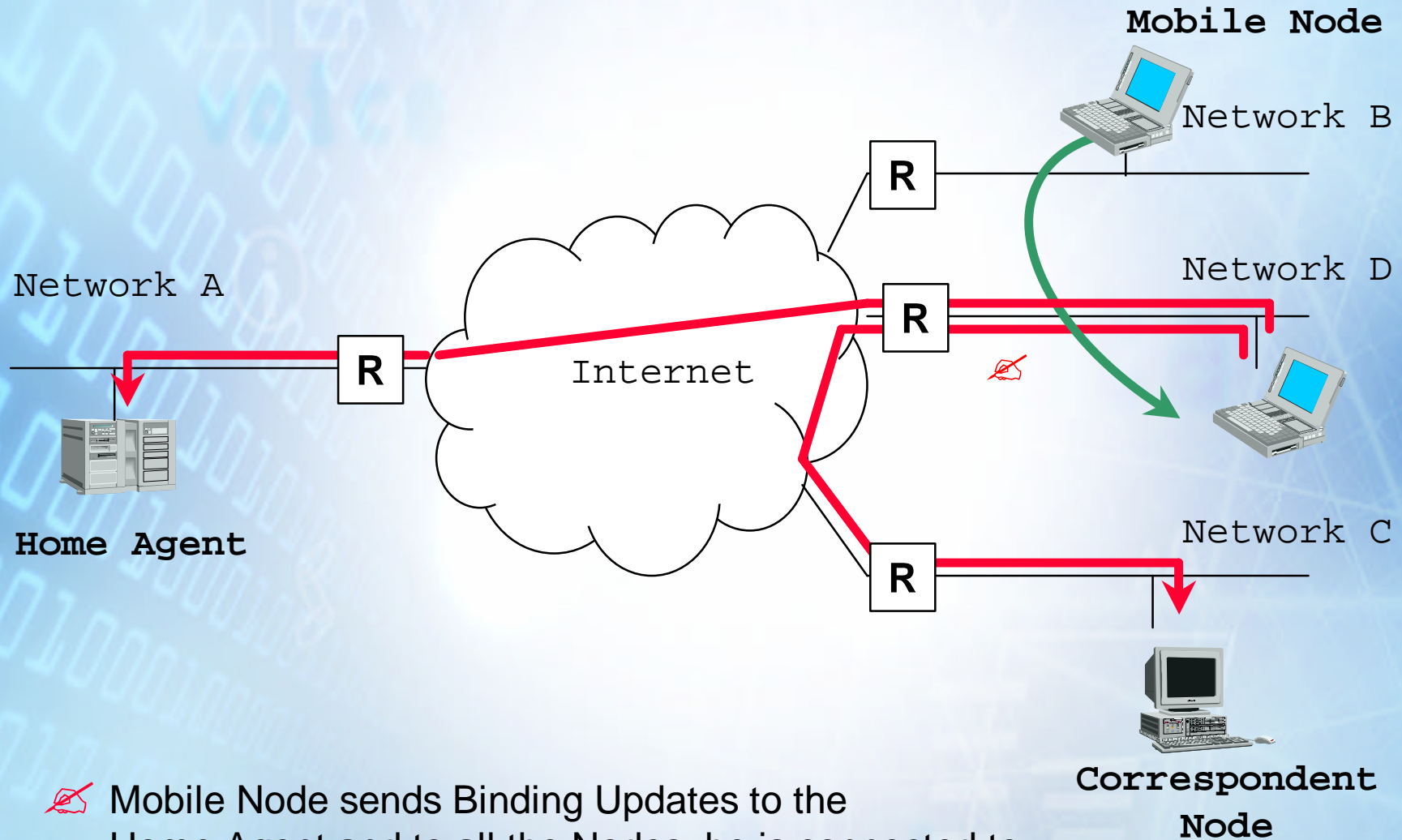
Normal Operation by Route Optimization



-  Mobile Node sends Binding Update to Correspondent Node C
-  Now Correspondent Node can address the CoA of the Mobile Node directly



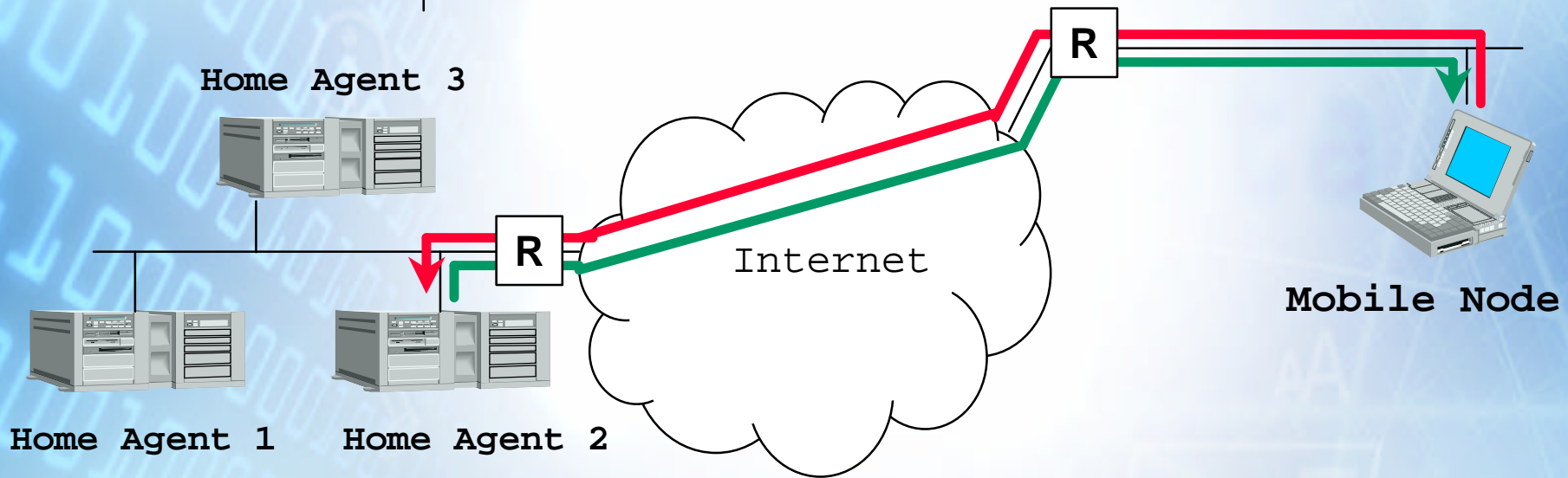
Mobile Node moves







Dynamic Home Agent Address Discovery

Home Agents List	Priority
Home Agent 3	9
Home Agent 1	2
Home Agent 2	-3

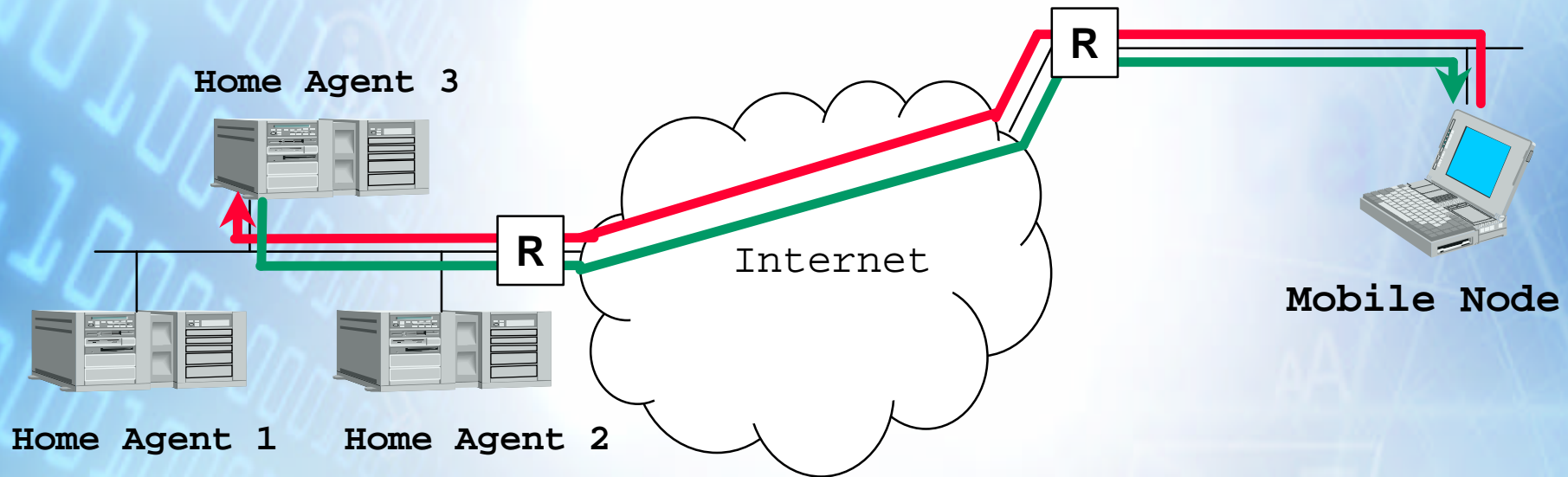



-  Mobile Node sends Binding Update to the Home-Agents Anycast Address of its Home Network.
-  A Home Agent answers with Binding Acknowledgement which contains the Home Agents List



Registration with selected Home Agent

Home Agents List	Priority
Home Agent 3	9
Home Agent 1	2
Home Agent 2	-3



 Mobile Node sends Binding Update to the first Home Agent from the Home Agents List

 Binding Acknowledgement; Registration OK



Packet Format Mobile IPv6

MN ✎ Correspondent Node

Correspondent ✎ Node MN

<p>IPv6 Source Address <i>Care-of Address</i></p>
<p>IPv6 Destination Address</p>
<p>Destination Options <i>Home Address Option</i> <i>Binding Update Option</i></p>
<p>Payload</p>

<p>IPv6 Source Address</p>
<p>IPv6 Destination Address <i>Care-of Address</i></p>
<p>Routing Header <i>Home Address</i></p>
<p>Payload</p>



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Advantages Mobile IPv6

- ✍ Mobility already considered in design of IPv6
- ✍ 128 bit IPv6-Addresses allows Mobile Node to derive CoA from Router Advertisement easily
- ✍ Stateless Address Autoconfiguration and Neighbor Discovery make FAs and DHCP-Server superfluous
- ✍ IPv6 supports dynamically finding of HA efficiently by means of Anycast Address
- ✍ Integrated IPSec-Functionality in IPv6 makes Authentication of Mobile IPv6 Packets easier (in MIPv4 IPSec is optional, in MIPv6 mandatory)



Advantages of Mobile IPv6 (ctnd.)

-  IPv6 Destination Option allows coexistence of Mobile IPv6 and Ingress-Filtering
-  IPv6 Routing Header allows efficient Route Optimization
-  Mobile IPv6 control messages can be sent *piggybacked* with other IPv6-Packets
-  It is possible to take into consideration special requirements of Mobile IPv6 within IPv6
-  ...

draft-ietf-mobileip-ipv6-14.txt



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RFC

-  IP Mobility Support (RFC 2002)
-  IP Encapsulation within IP (RFC 2003)
-  Minimal Encapsulation within IP (RFC 2004)
-  Reverse Tunneling for Mobile IP (RFC 2344)
-  ...

Internet Draft

-  Mobility Support in IPv6
-  Route Optimization in Mobile IP
-  Requirements on Mobile IP from a Cellular Perspective
-  ...

<http://www.ietf.org/html.charters/mobileip-charter.html>



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Mobile IP Implementations

Mobile IPv4

-  Solaris
-  4.4 BSD
-  FreeBSD
-  Linux
-  Windows 95
-  Windows NT4.0

Mobile IPv6

-  4.4 BSD
-  Linux*
-  Windows NT4.0

* *Implementation by Siemens AG available*

*Carnegie Mellon University, Helsinki University of Technology, IABG,
Portland State University, **Siemens AG**, Sun Microsystems, Thomson-CSF,
University of Lancaster, University of Singapore, ...*

USAGI: <http://www.linux-ipv6.org/>
and links given there



Innovating the Mobile World: Linux based MIPv6 from Siemens.



Questions ?