IPv6 Mobility

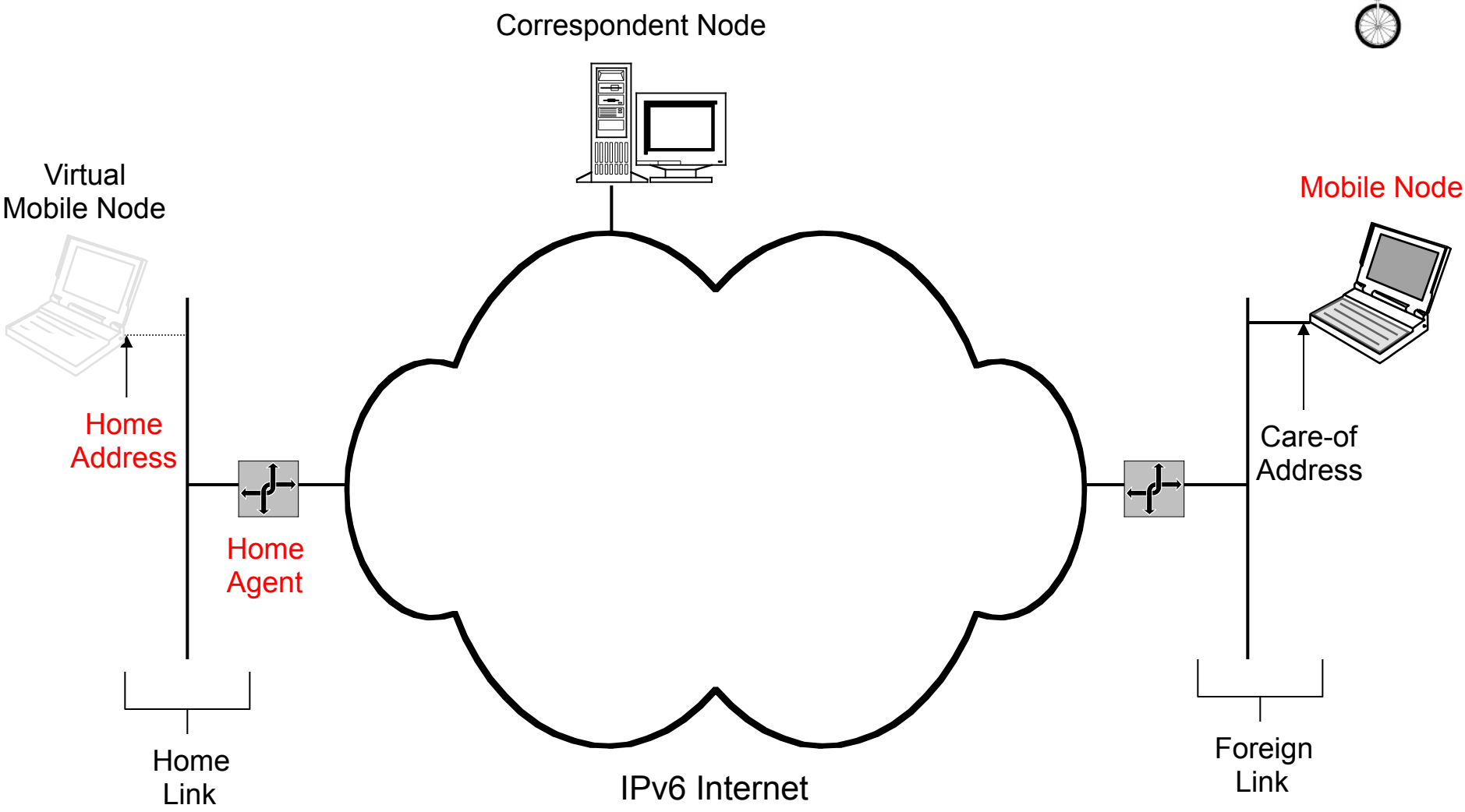
Outline

- Components of IPv6 mobility
- IPv6 mobility messages and options
- IPv6 mobility data structures
- Communication between the mobile node and the correspondent node
- Communication between the mobile node and the home agent
- IPv6 mobility processes
- IPv6 mobility changes to the host sending and receiving algorithms

IPv6 Mobility Overview

- **IPv6 mobility allows an IPv6 node to be mobile—to arbitrarily change its location on the IPv6 Internet—and still maintain existing connections**
- **Connection maintenance for mobile nodes is handled at the Internet layer**
  - **IPv6, Routers, Special Gateways**

Components of IPv6 Mobility



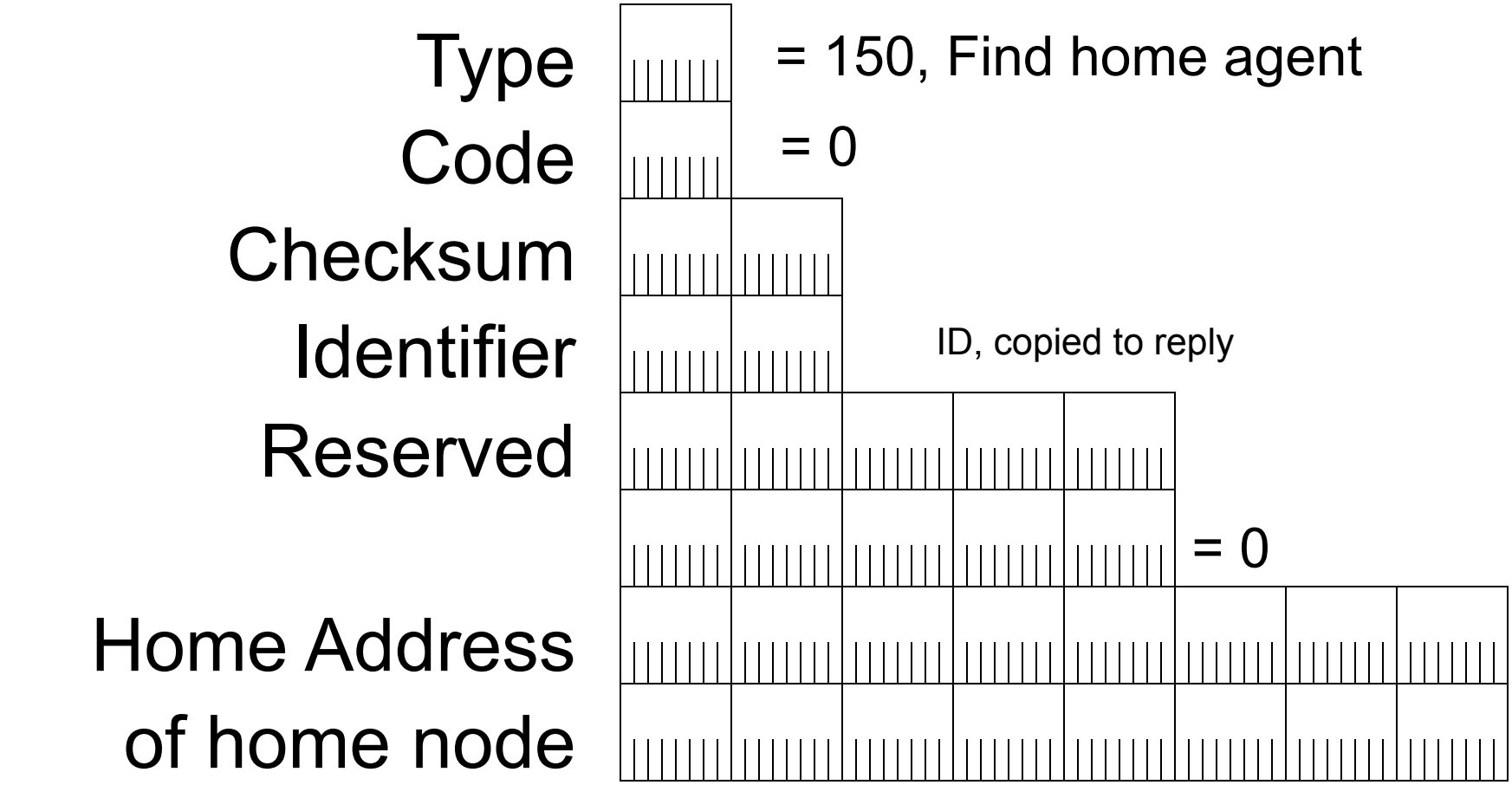
IPv6 Mobility

- **Questions**
  - **How do I get a Home Agent**
  - **How do I tell HA to act for me**
  - **How do I get home traffic**
  - **How do I get a care-of-address**
  - **How does traffic get to me at care-of-address**
  - **Timing for changes**
  - **etc**

IPv6 Mobility Messages And Options

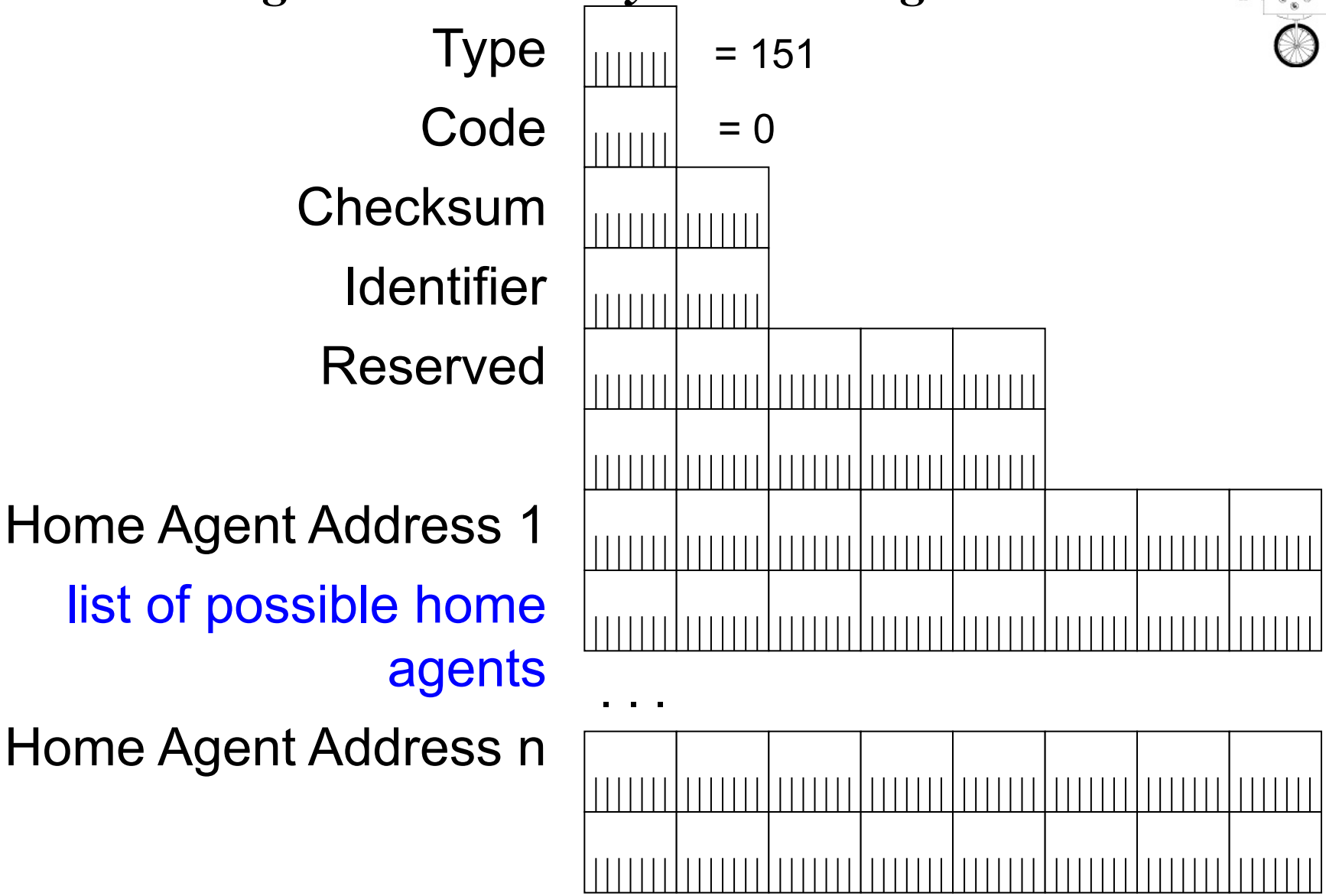
- **Destination Options Header options**
  - **Binding Update**
    - update Home Agent with new care of, and correspondent
  - **Binding Acknowledgement**
    - got your update
  - **Binding Request**
    - from Home Agent or Correspondent
  - **Home Address**
    - source address = care-of-address
- **ICMPv6 messages**
  - **Home Agent Address Discovery Request**
  - **Home Agent Address Discovery Reply**
    - sent to Mobile Home Agents anycast address...

ICMPv6 Home Agent Address Discovery Request Message –sent when mobile



v6 source addr =care of Address; v6 target address = mobile home agent anycast address

ICMPv6 Home Agent Address Discovery Reply Message – who can be your home agent



IPv6 Mobility Messages And Options

- **Neighbor Discovery messages and options**
  - **Modified Router Advertisement message, .5 to 1.5 sec**
    - **Home Agent (H) flag, on home link, indicates router is home agent capabl**
  - **Modified Prefix Information option**
    - **Router Addresses are in general Link Addresses**
    - **Router Address (R) flag**
    - **New definition of Prefix field, Router Global Address**
  - **New Advertisement Interval option**
    - **how often router will advertise**
  - **New Home Agent Information option**
    - **preference and lifetime as a home agent**

IPv6 Mobility Data Structures

- **Binding cache**
  - **Contains the current bindings for mobile nodes**
  - **Maintained by each correspondent node and home agent, so everyone knows addresses to use**
- **Binding update list**
  - **Lists the most recent binding updates sent for the home agent and correspondent nodes**
  - **Maintained by a mobile node, i.e., what I have told everyone else**
- **Home agents list**
  - **Lists the routers that sent a router advertisement with the Home Agent (H) bit set**
  - **Maintained by home agents and mobile nodes**
    - **So I can select my HA**

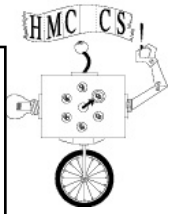
IPv6 Mobility Communication

- **Between a mobile node and a correspondent node**
  - **Data and Address Updates**
- **Between a mobile node and a home agent**
  - **Binding updates**

Communication Between a Mobile Node and a Correspondent Node

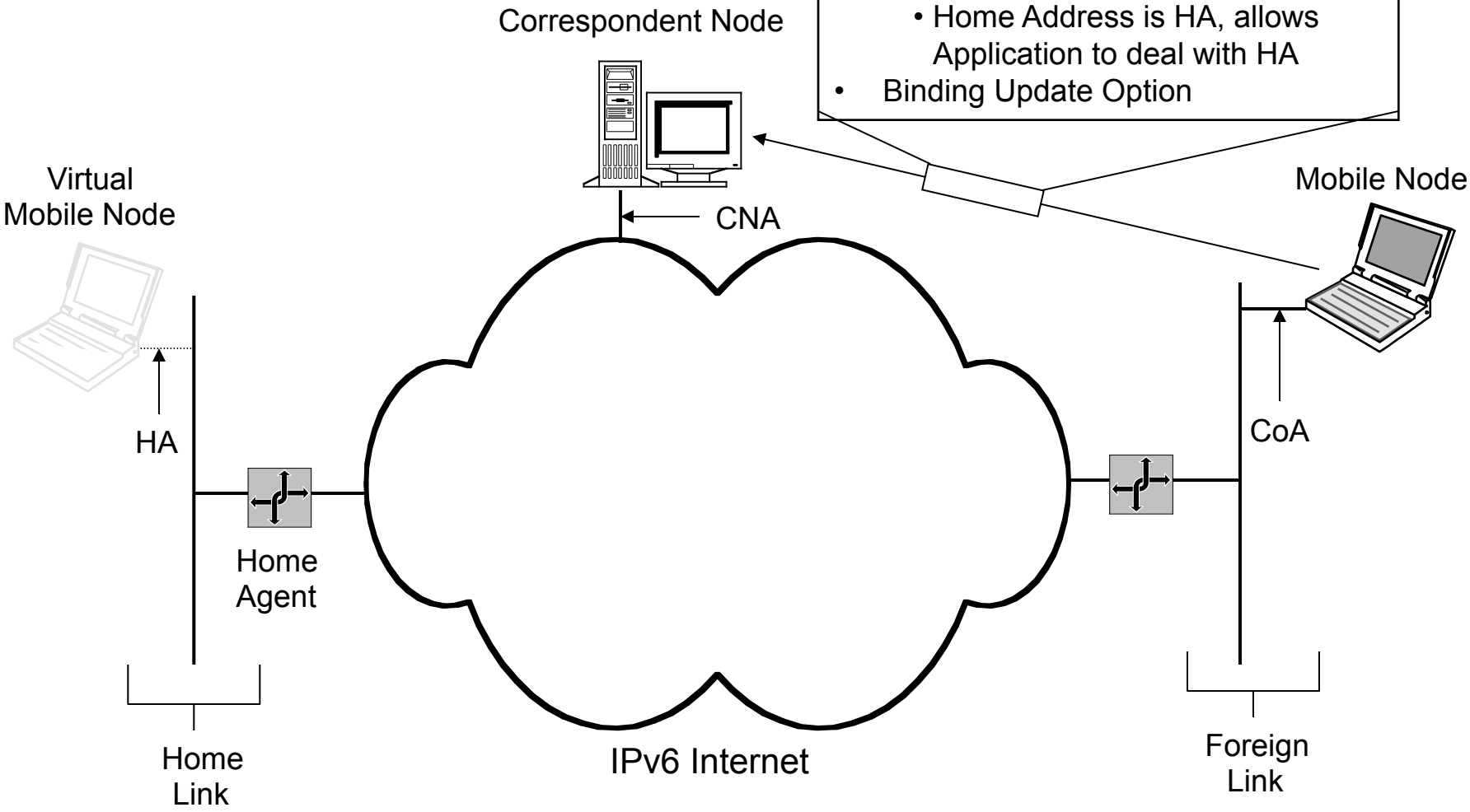
- **From the mobile node to the correspondent node**
  - **Binding updates – where Mobile Node really is.**
  - **Data**
- **From the correspondent node to the mobile node**
  - **Binding maintenance**
  - **Data**

Binding Update from Mobile Node to Correspondent Node

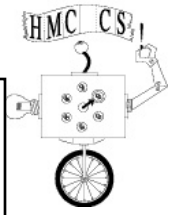


IPv6 Header
- Source Address is CoA, no outgoing router issue
- Destination Address is CNA

Destination Options Header
- Home Address Option
  - Home Address is HA, allows Application to deal with HA
- Binding Update Option



Data from Mobile Node to Correspondent Node



IPv6 Header
- Source Address is CoA
- Destination Address is CNA

Destination Options Header
- Home Address Option
  - Home Address is HA, given to Application

Upper Layer PDU

Correspondent Node

CNA

Virtual Mobile Node

Mobile Node

HA

Home Agent

CoA

Home Link

IPv6 Internet

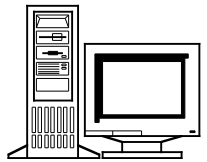
Foreign Link

Binding Maintenance from Correspondent Node to Mobile Node

IPv6 Header
- Source Address is CNA
- Destination Address is CoA

Routing Header
- Segments Left is 1
- Address 1 is HA, CN and MN use HA
- Game is to pretend MN is home

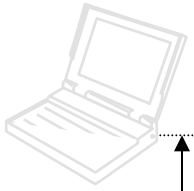
Destination Options Header
- Binding Acknowledgement or Request



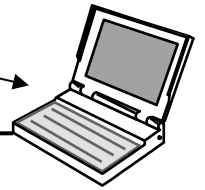
Correspondent Node

CNA

Virtual Mobile Node



Mobile Node



HA

Home Agent

CoA

Home Link

IPv6 Internet

Foreign Link

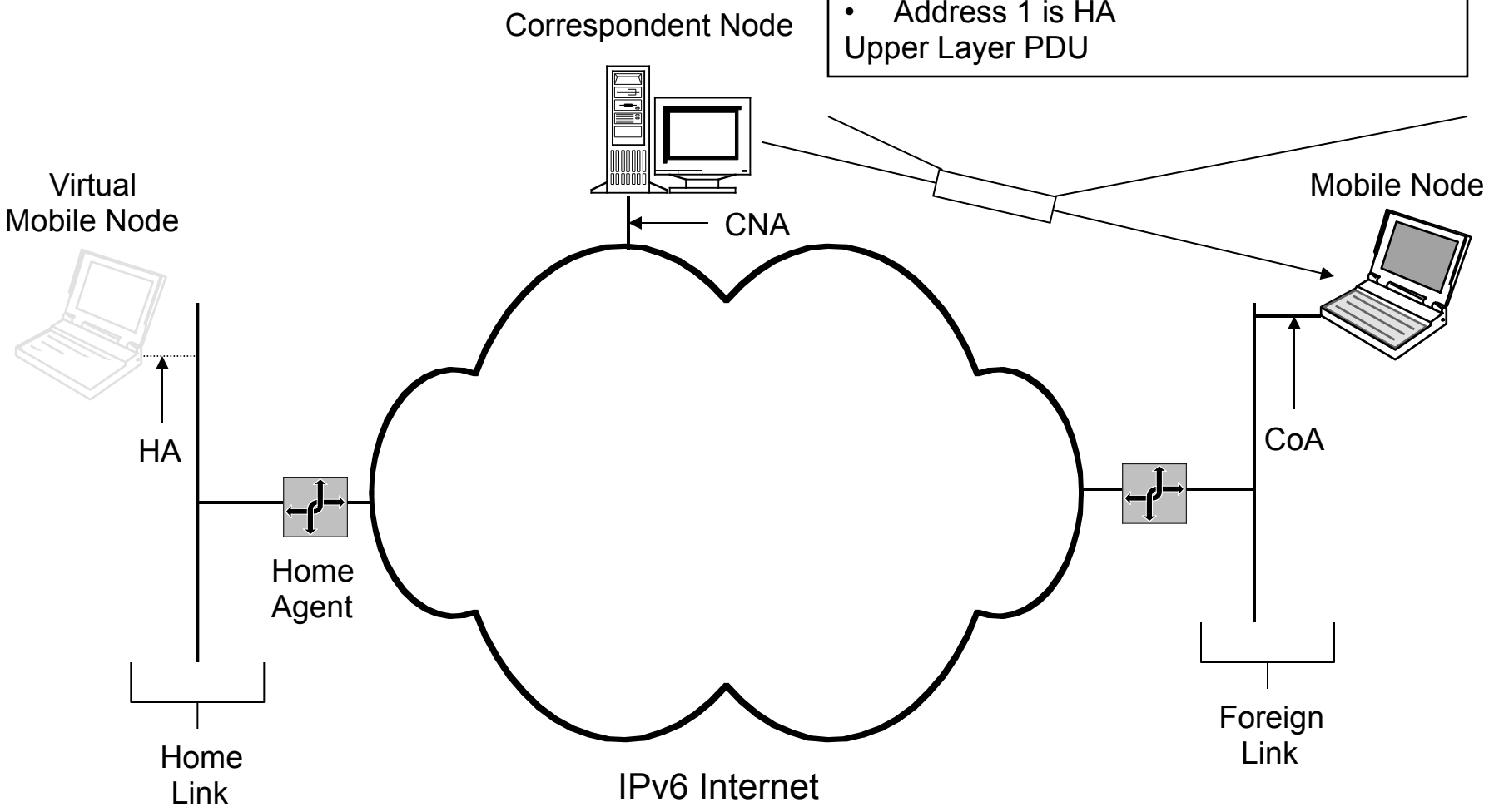
Data from Correspondent Node to Mobile Node-Binding Cache Entry Present

already know where you are

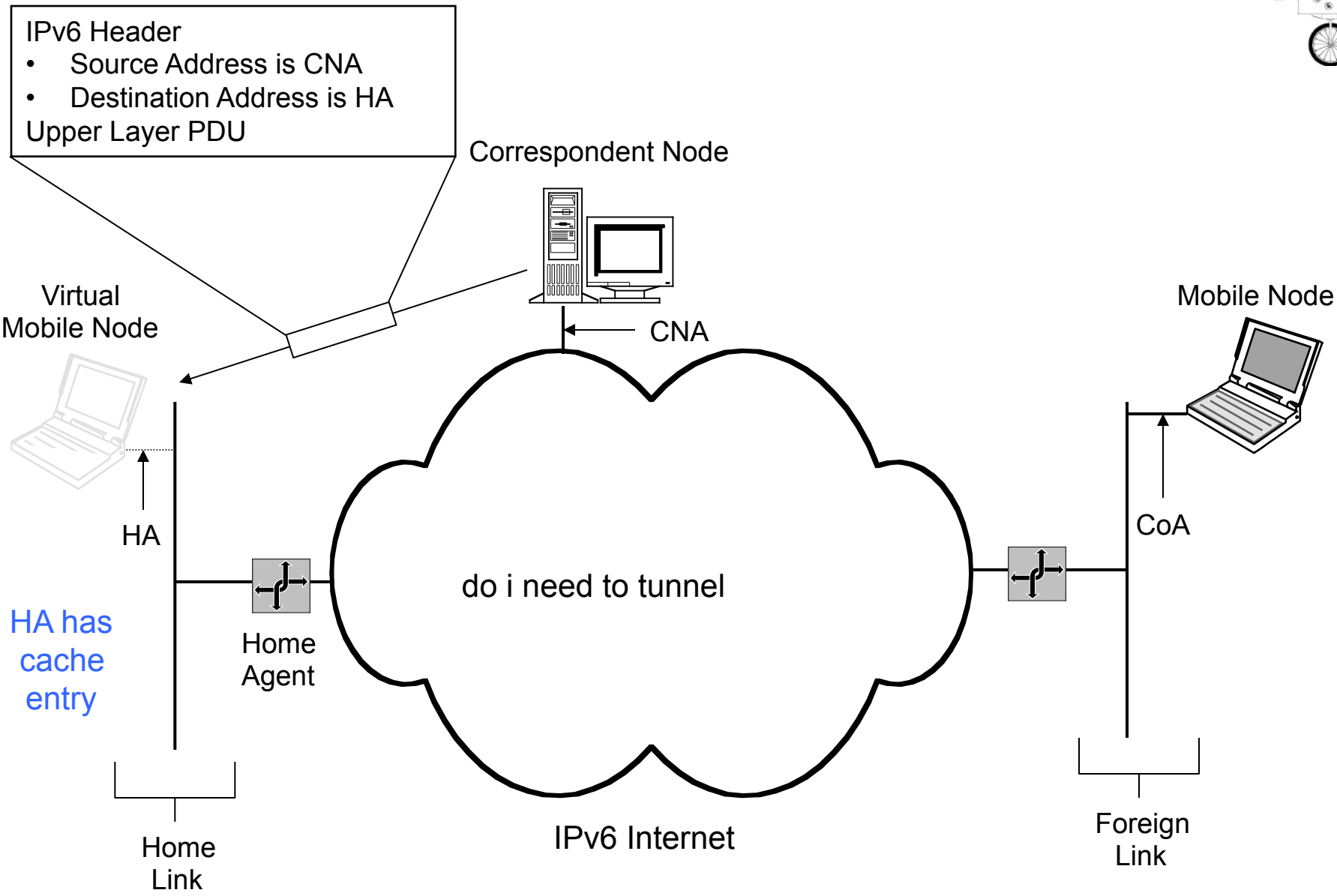
IPv6 Header
- Source Address is CNA
- Destination Address is CoA

Routing Header
- Segments Left is 1
- Address 1 is HA

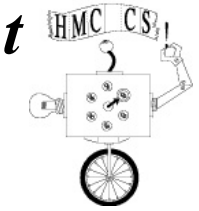
Upper Layer PDU



Data from Correspondent Node to Mobile Node-Binding Cache Entry not Present



Communication Between a Mobile Node and a Home Agent

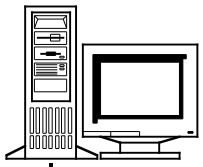


- From the mobile node to the home agent
  - Binding updates
    - I'm moving
  - ICMPv6 Home Agent Address Discovery Request message
- From the home agent to the mobile node
  - Binding maintenance
    - Acks or requests
  - ICMPv6 Home Agent Address Discovery Reply message
  - Tunneled data
    - data sent to MN from home link

Binding Update from Mobile Node to Home Agent

IPv6 Header
- Source Address is CoA
- Destination Address is HAA

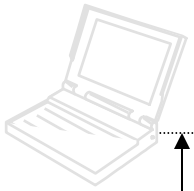
Destination Options Header
- Home Address Option
  - Home Address is HA
- Binding Update Option
  - Home Registration flag set
  - Be my HA still

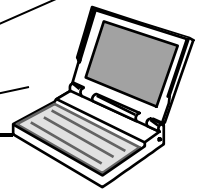


Correspondent Node

CNA

Virtual Mobile Node





Mobile Node

HA

CoA

Home Agent

HAA

Home Link

IPv6 Internet

Foreign Link

ICMPv6 Home Agent Address Discovery Request Message

IPv6 Header
- Source Address is CoA
- Destination Address is Mobile IPv6 Home Agents anycast address – possible many HA

ICMPv6 Message
- Home Agent Address Discovery Request

Correspondent Node

CNA

Virtual Mobile Node

HA

Home Agent

HAA

Home Link

IPv6 Internet

CoA

Mobile Node

Foreign Link

Binding Maintenance from the Home Agent to the Mobile Node

IPv6 Header
- Source Address is HAA
- Destination Address is CoA

Routing Header
- Segments Left is 1
- Address 1 is HA
- Again HA available to Apps

Destination Options Header
- Binding Acknowledgment or Request

Correspondent Node

CNA

Virtual Mobile Node

HA

Home Agent

HAA

Home Link

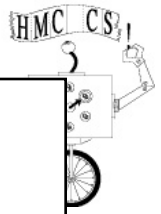
IPv6 Internet

CoA

Mobile Node

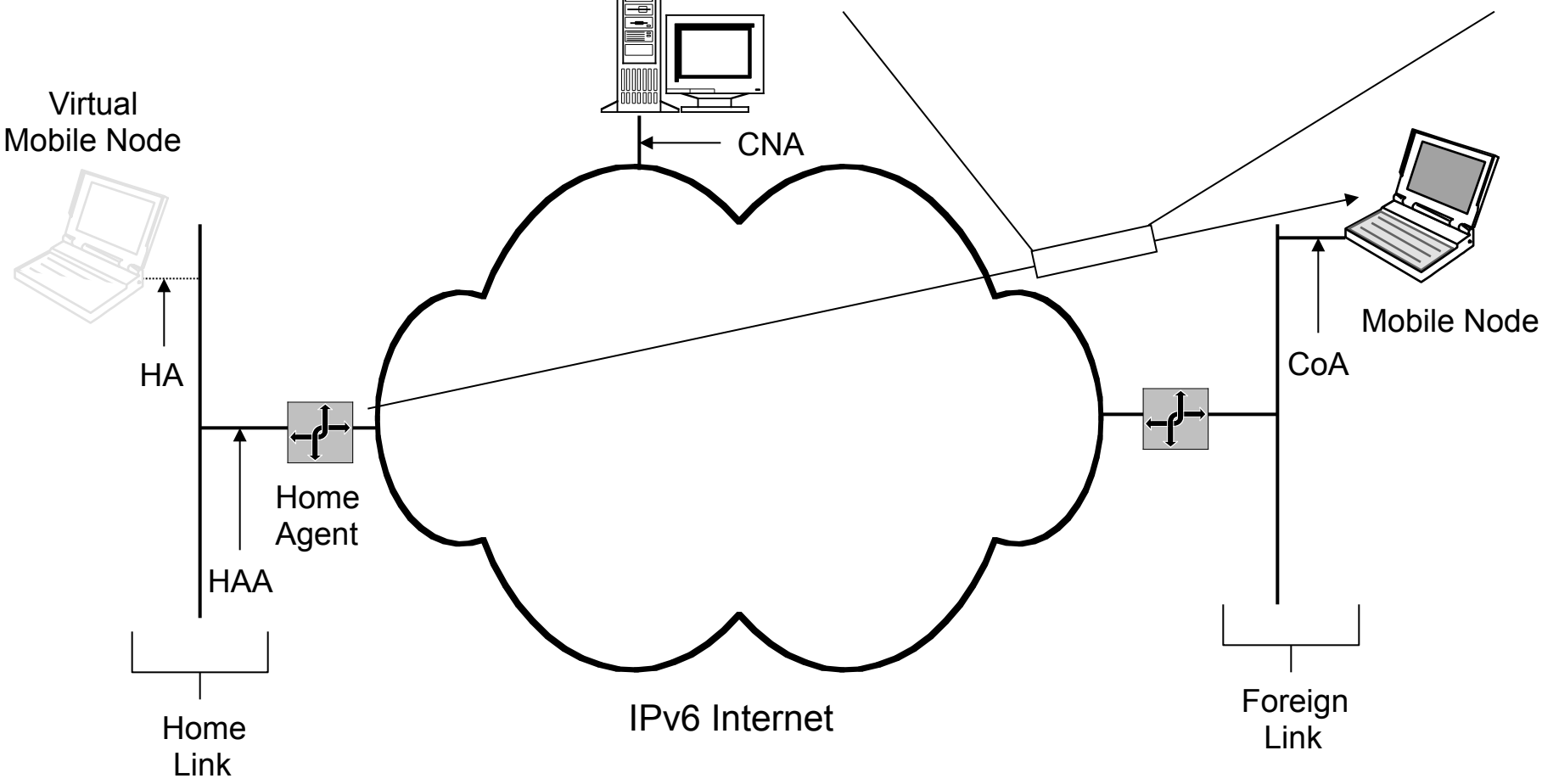
Foreign Link

ICMPv6 Home Agent Address Discovery Reply Message

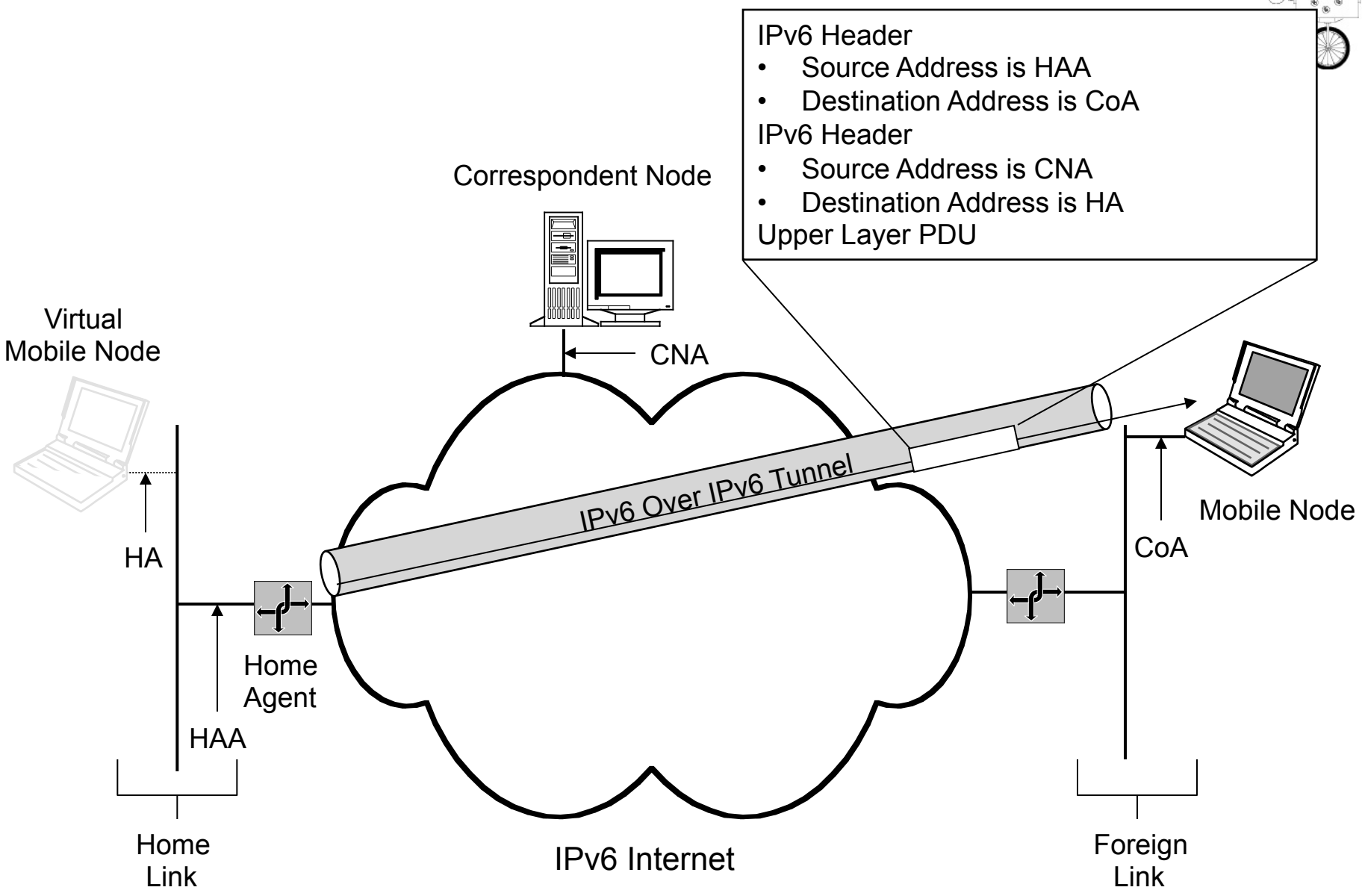


IPv6 Header
- Source Address is HAA
- Destination Address is CoA

ICMPv6 Message
- Home Agent Address Discovery Reply
  - list of HAs in preference



Tunneled Data from the Home Agent to the Mobile Node



IPv6 Mobility In operation Processes

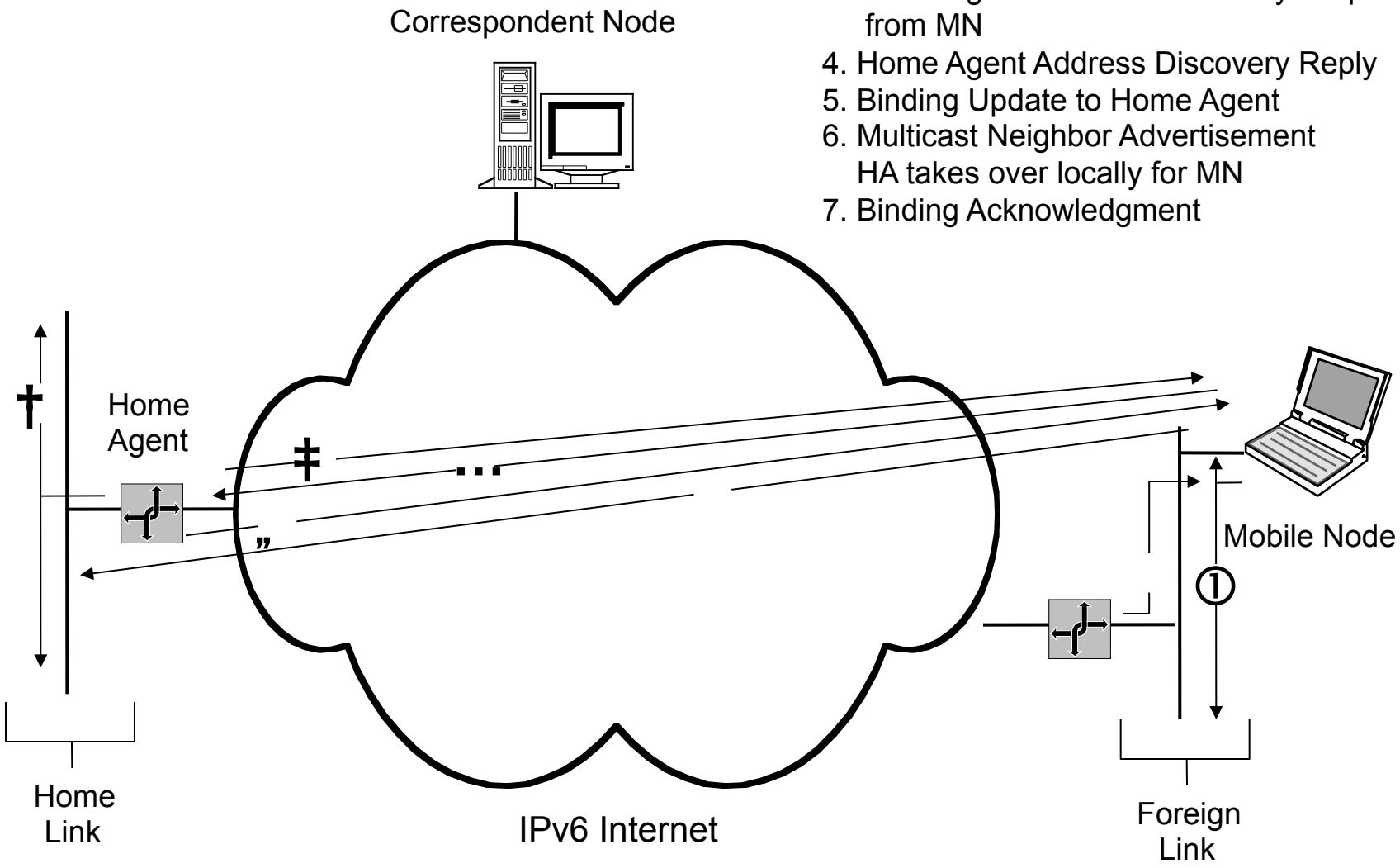
- **Attaching to the home link**
- **Moving from the home link to a foreign link**
- **Moving from a foreign link to another foreign link**
- **Returning home**

Attaching to the Home Link

- **Once on the home link, a mobile node can store:**
  - **Home subnet prefix**
  - **Home address**
  - **Global address of their home agent**
- **Methods of configuring mobile node for home link:**
  - **Manual configuration - keyboard**
  - **Pseudo-automatic configuration**
  - **Automatic configuration**
    - **Node listens – uses ‘security relationship’ to determine if really home.**

Mobile Node Attaches to its First Foreign Link

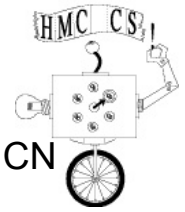
1. Multicast Router Solicitation
2. Unicast Router Advertisement
3. Home Agent Address Discovery Request from MN
4. Home Agent Address Discovery Reply
5. Binding Update to Home Agent
6. Multicast Neighbor Advertisement HA takes over locally for MN
7. Binding Acknowledgment



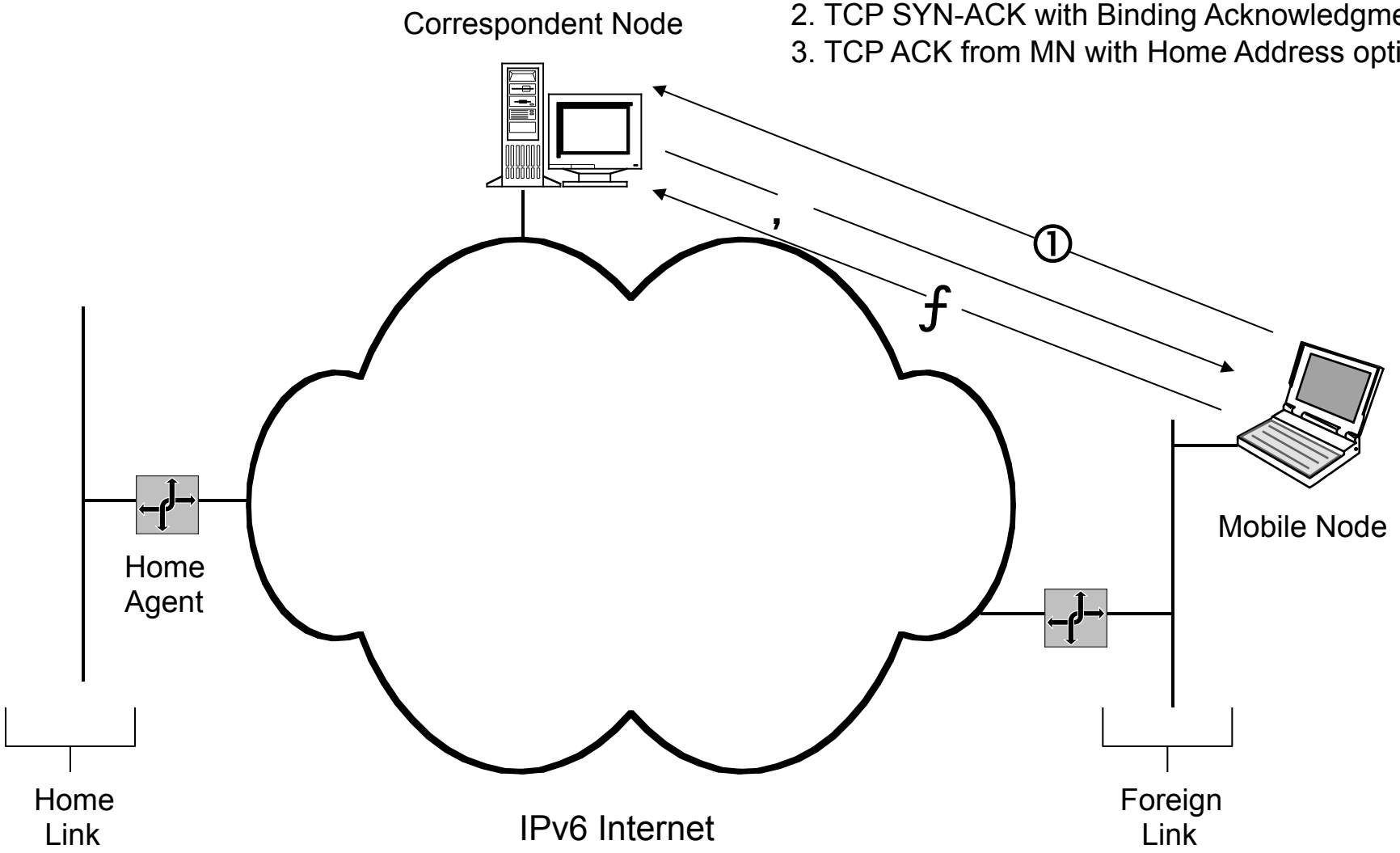
IPv6 Mobility Communication with Mobile Node - Moving Data

- **Mobile node initiates a TCP connection with a new correspondent node**
- **Mobile node initiates non-TCP communication with a new correspondent node**
- **New correspondent node initiates a TCP connection with a mobile node**
- **Home link host sends data to a mobile node**

Mobile Node Initiates a TCP Connection with a New Correspondent Node

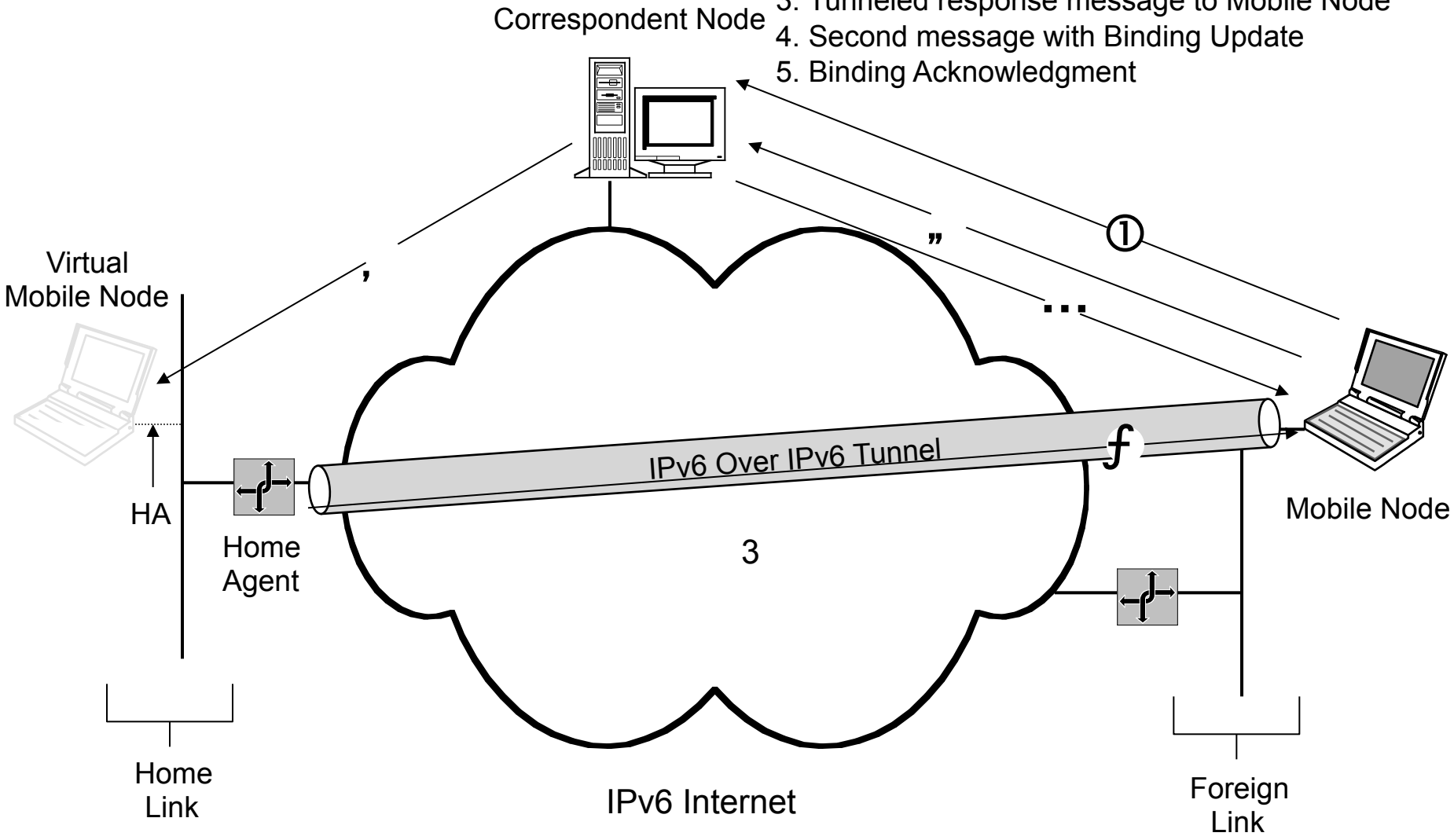


1. TCP SYN with Home Address and Binding Update options from MN to CN
   CN builds binding update cache
2. TCP SYN-ACK with Binding Acknowledgment
3. TCP ACK from MN with Home Address option

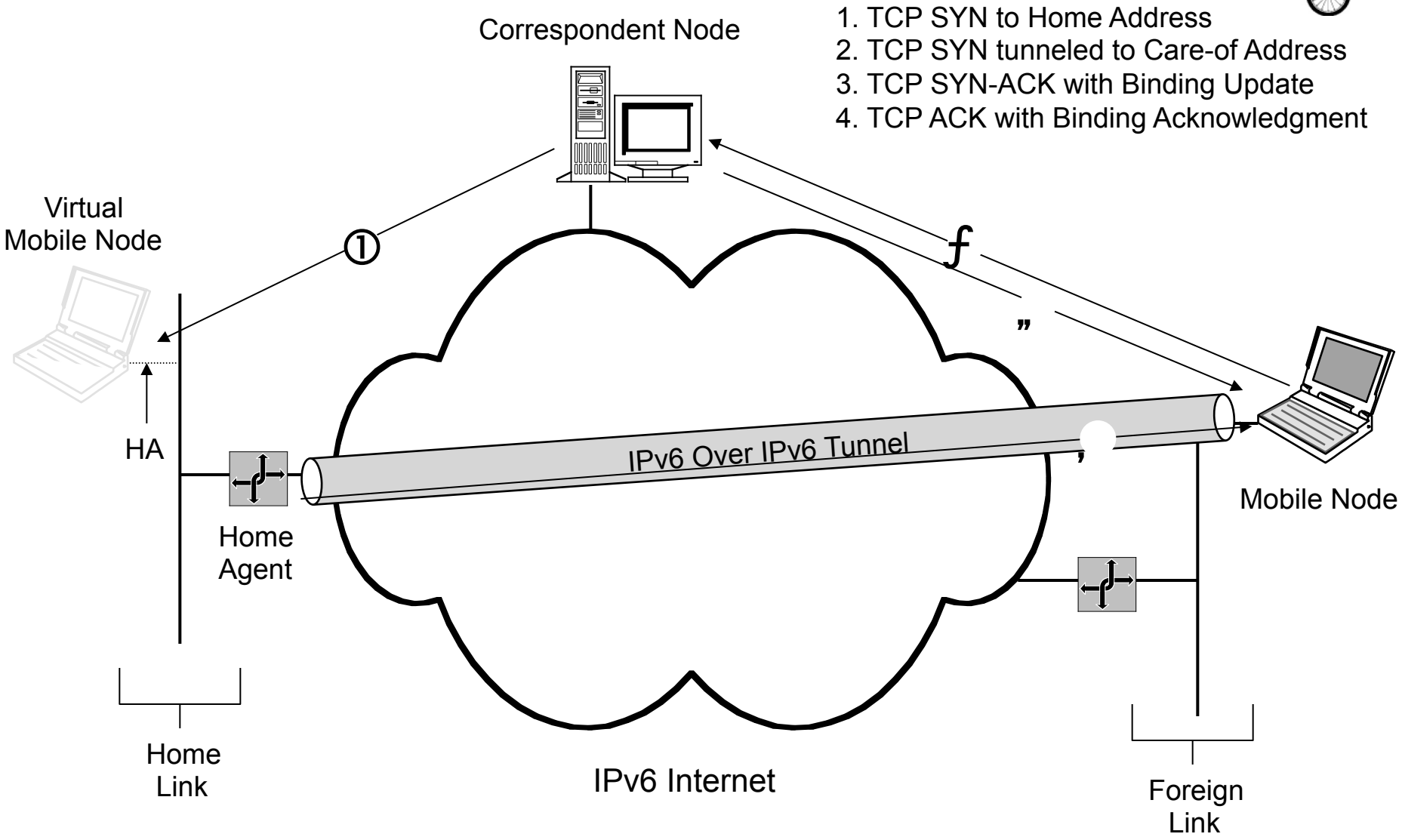


Mobile Node Initiates non-TCP Communication with a New Correspondent Node

1. Initial message with Home Address option
2. no binding yet
2. Response message to home address
3. Tunneled response message to Mobile Node
4. Second message with Binding Update
5. Binding Acknowledgment

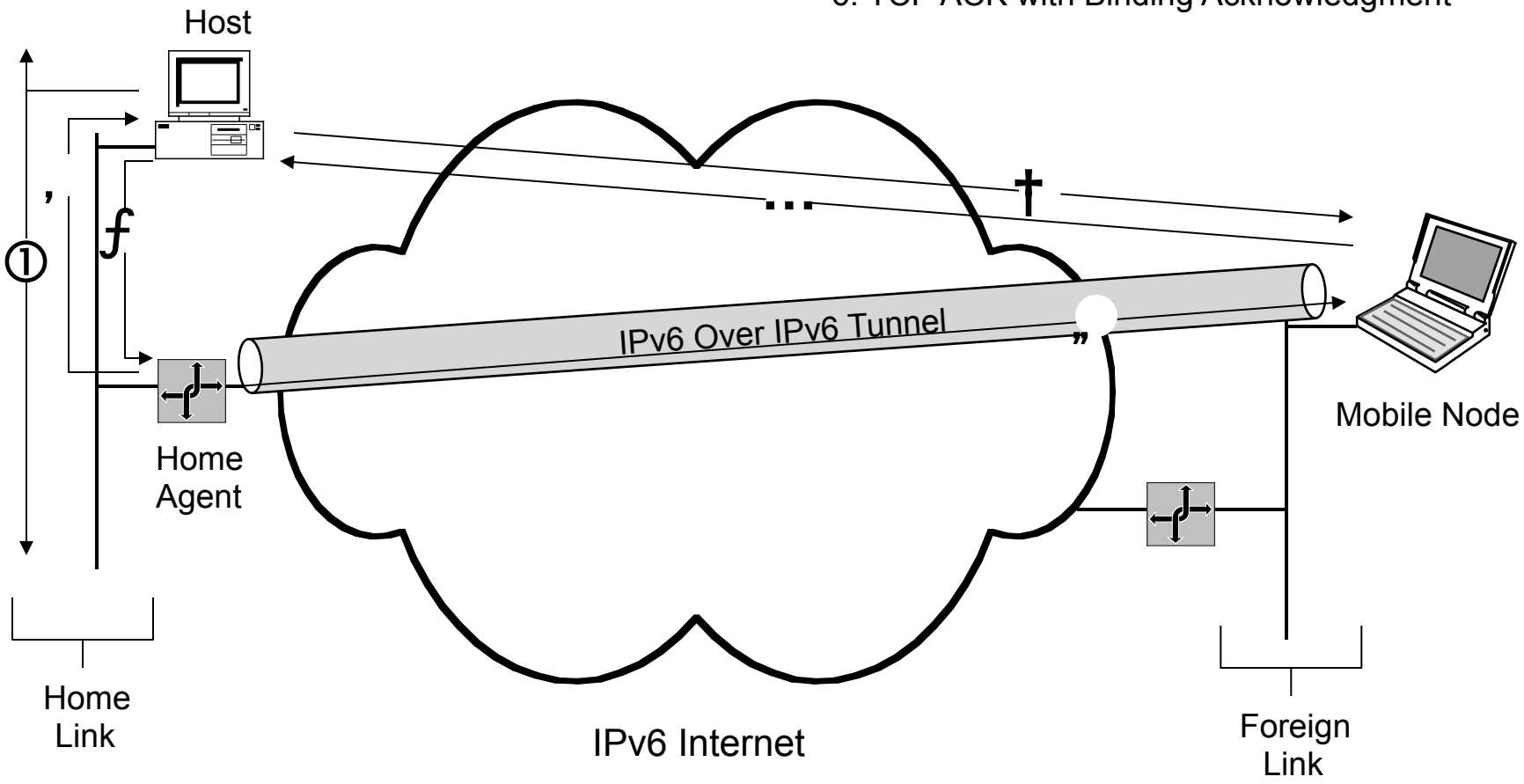


New Correspondent Node Initiates a TCP Connection with a Mobile Node

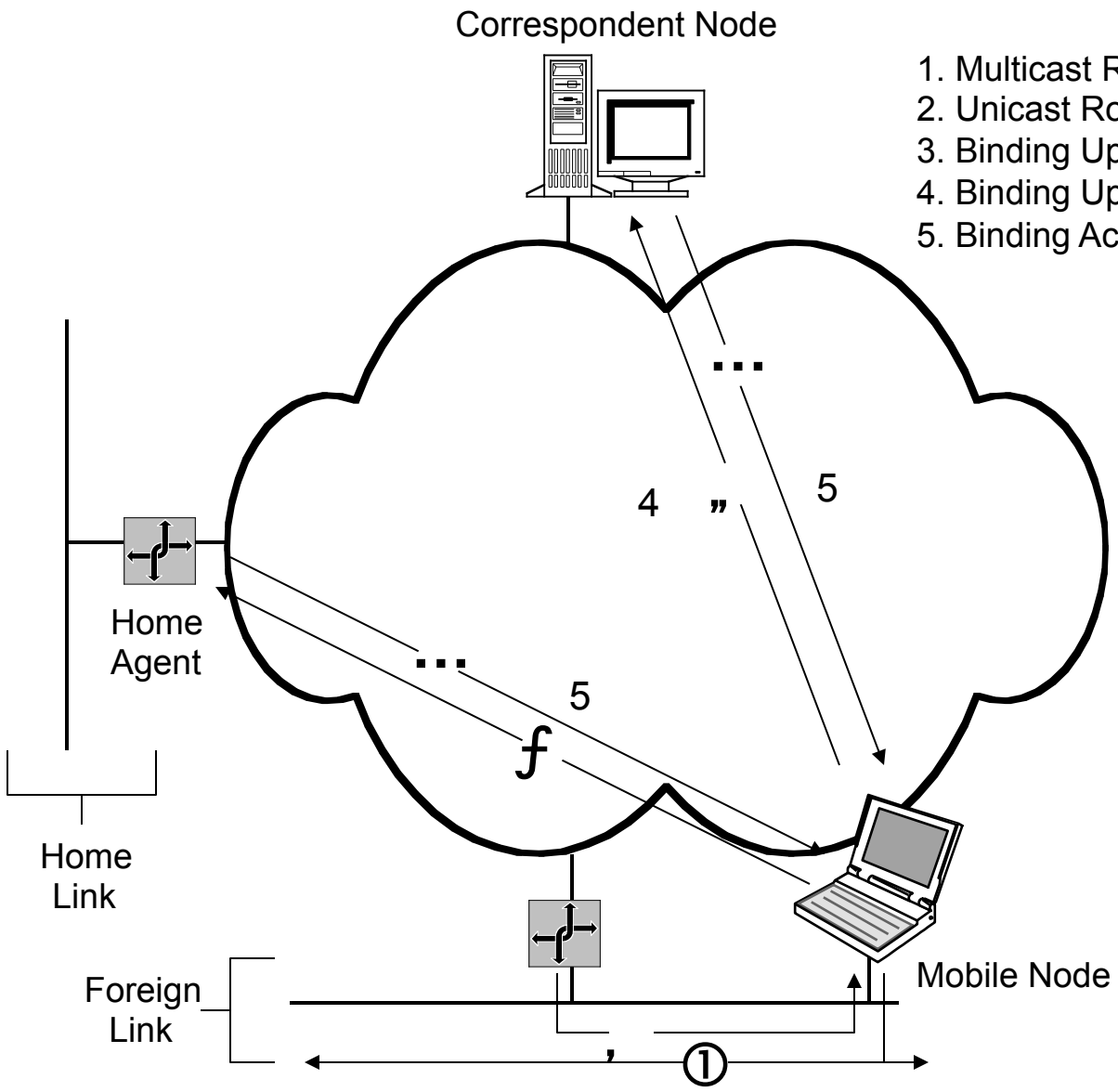


Home Link Host Sends Data to a Mobile Node

1. Multicast Neighbor Solicitation
2. Proxied unicast Neighbor Advertisement
3. TCP SYN to Home Agent's link-layer address
4. Tunneled packet to Mobile Node
5. TCP SYN-ACK with Binding Update
6. TCP ACK with Binding Acknowledgment

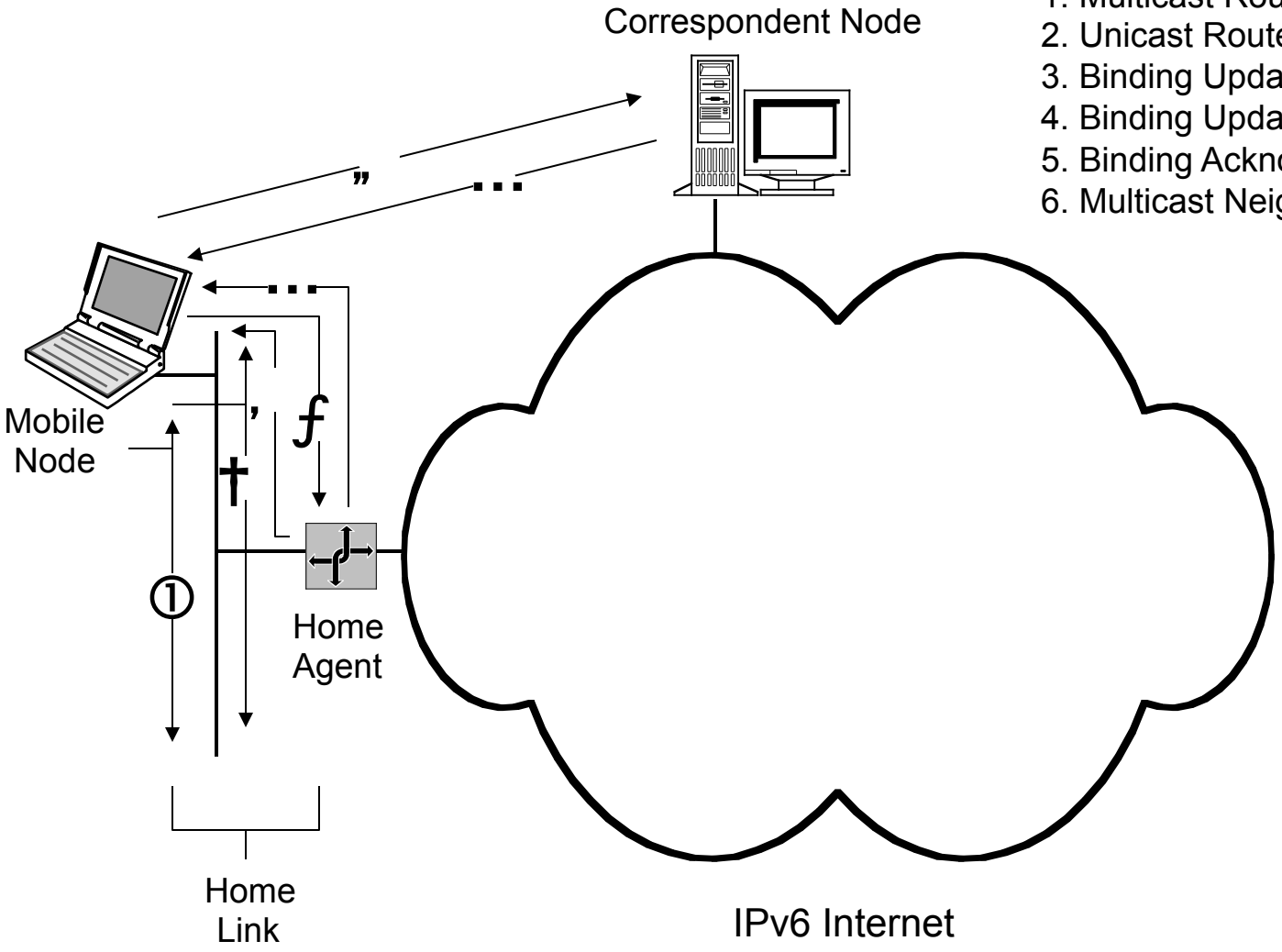


Mobile Node Changes to a New Foreign Link

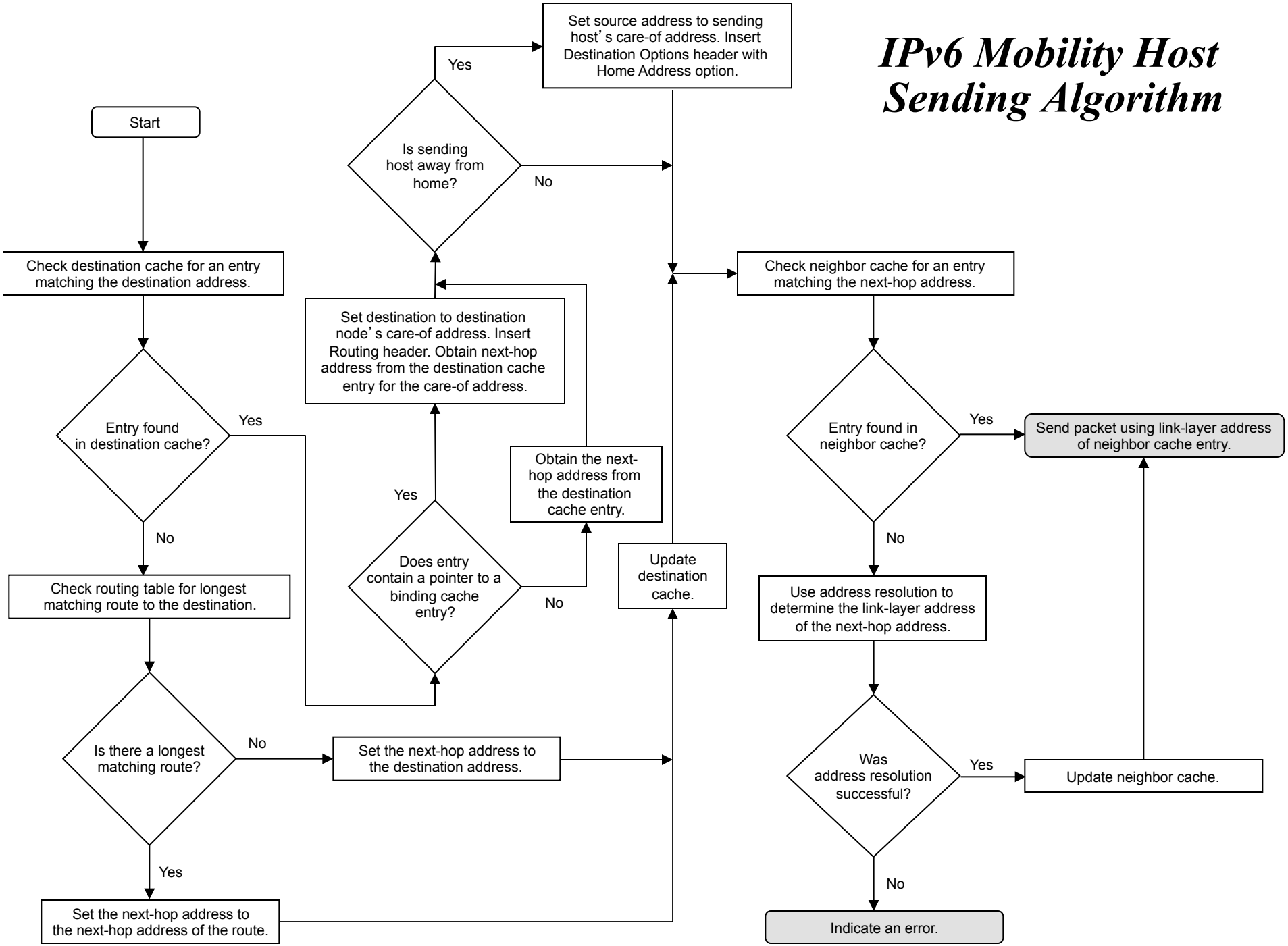


Mobile Node Returns Home

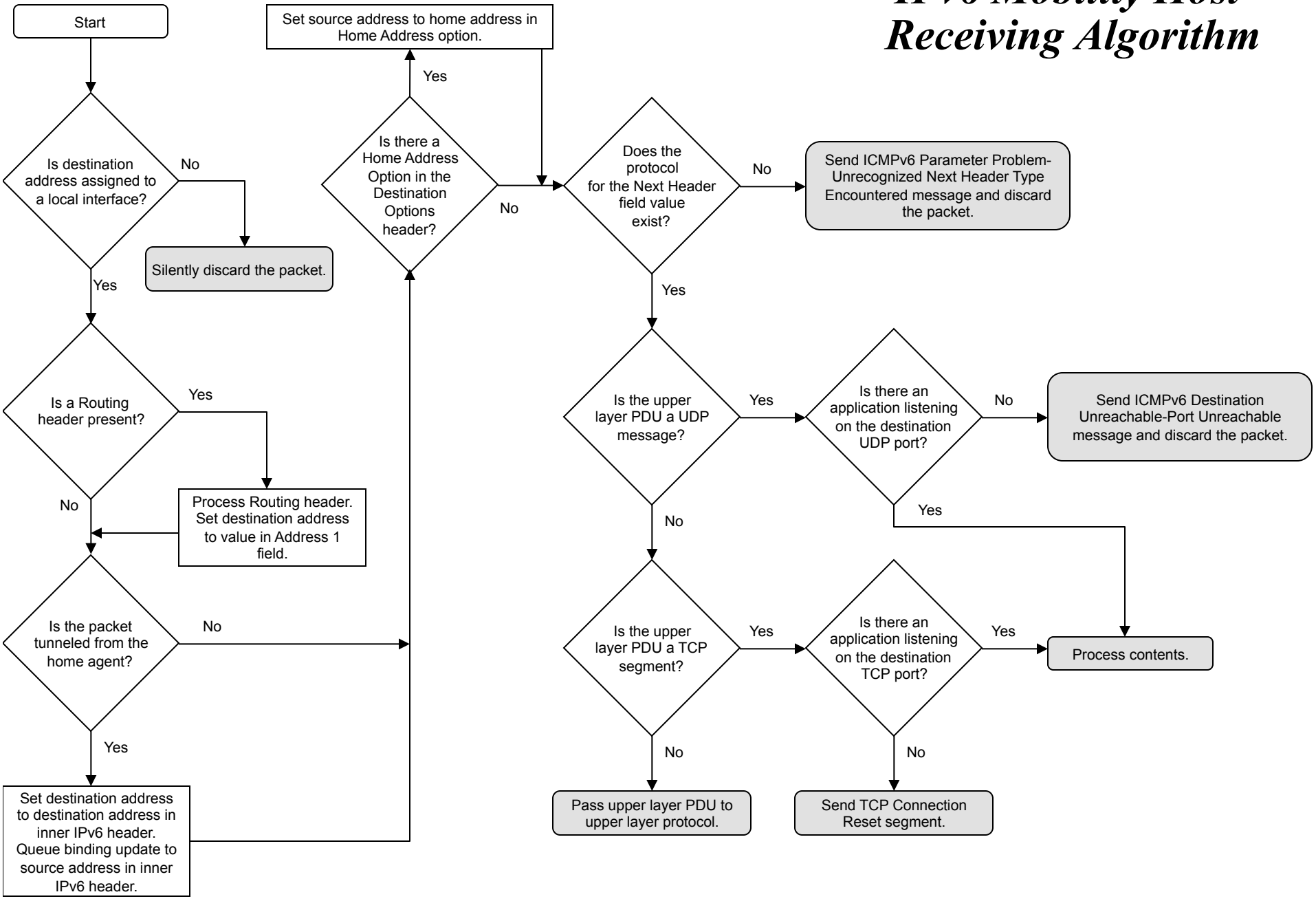
1. Multicast Router Solicitation
2. Unicast Router Advertisement
3. Binding Update to Home Agent
4. Binding Update to Correspondent Node
5. Binding Acknowledgments
6. Multicast Neighbor Advertisement



IPv6 Mobility Host Sending Algorithm



IPv6 Mobility Host Receiving Algorithm



Differences between v4 and v6 Mobility

- **IPv6 does not need foreign agents, on the visited network there is no support**
- **IPv6 incorporates route optimization as a required feature, I.e., few tunnels from mobile host and the correspondent**
- **IPv6 uses header extensions, not encapsulation in tunnels**
- **Neighbor Discovery handles many issues.**

Summary

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- Communication between the mobile node and the correspondent node
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- IPv6 mobility processes
- IPv6 mobility changes to the host sending and receiving algorithms