Plug & Play

ICMPv6 & Neighbor Discovery

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Plug & Play

- It is one major feature of IPv6
- It reduces IP support and maintenance costs for enterprises
- Essential for areas of IP growth:
  - mobile systems
  - home networks
- It is zero configuration networking and automatic device and service discovery

Autoconfiguration

- Neighbor Discovery
  - Obtain a new usable IP address
  - Find and use a new router
    - Switch automatically from one router to another
  - Addresses with lifetime
- Complete autoconfiguration
  - Announce its name: Dynamic DNS updates
  - Advertise its capabilities when requested
  - Learn about the presence and capabilities of other devices
  - Server / Service discovery

Neighbor discovery services

1. First time plugging
2. Address resolution
3. Advanced features

1. First time plugging

- New (or initial) Home Subnet
- Store new home address
- Finding neighboring routers
  - Keeping track of routers
- Get forward & reverse DNS entries installed
  - subsequent times on current home network, verify DNS entries
  - (note that “stateless autoconfig” is stateless for the network, not necessarily for the host)
- Determining whether a neighbor has become unreachable

Autoconfiguration

- **Stateless** autoconfiguration
  - Creation of global and site-local addresses
  - Based on ICMPv6
  - Creation of link-local addresses
    - Assumes that each interface can provide a unique identifier
    - With duplicate address detection
  - Security to disable hackers plug and play
- **Stateful** autoconfiguration
  - Obtain network information from a server
  - Use DHCPv6
  - Servers maintain a database with
    - Hosts addresses
    - Other configuration information

IPv6 nodes have multiple addresses

- Link-local addresses
  - Valid only on a specific link (LAN)
  - To communicate among nodes of the same link
- Site-local addresses
  - Valid only within a particular organization
- Global scope addresses
  - Globally unique
  - Can be use anywhere

Autoconfiguration process

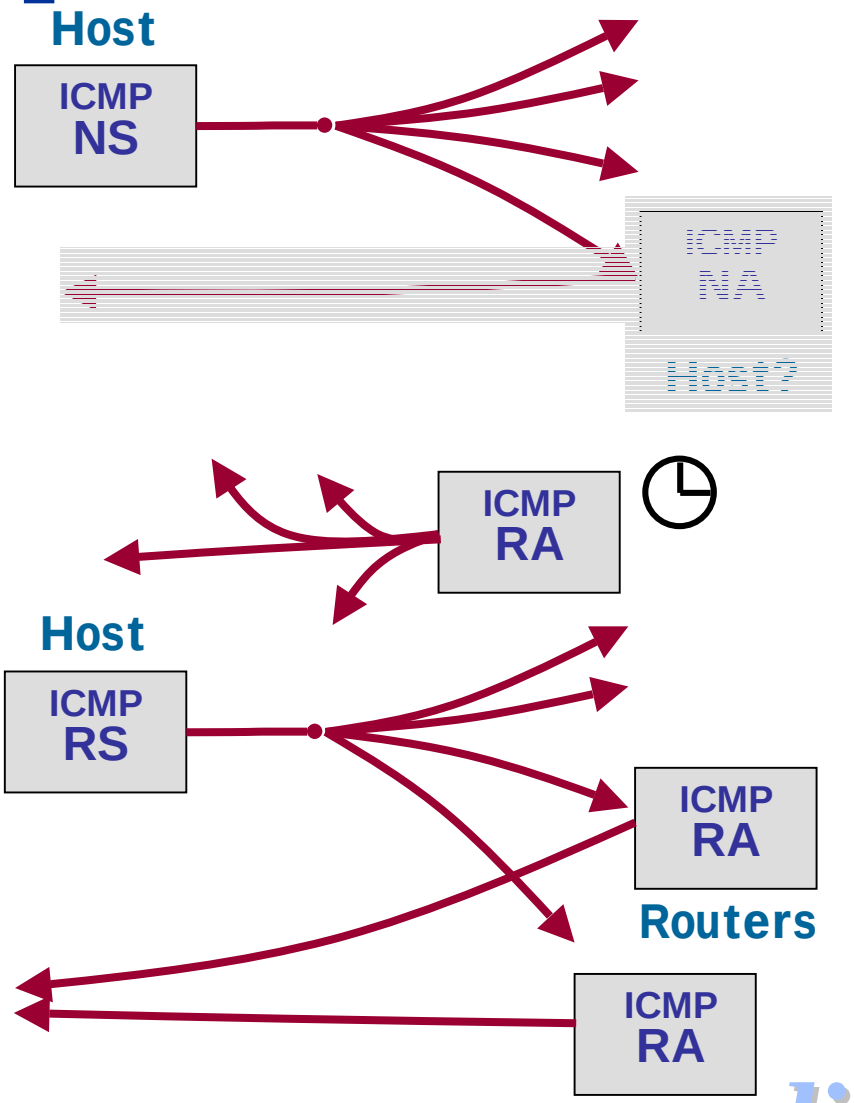
a. Assign link-local address
   - Duplicate detection

b. IF fails THEN
   Autoconfiguration stops

c. Find routers
   - Wait periodic RA
     (from few seconds
     to 30 minutes)
   - Send RS

d. IF no receive any RA
   THEN Isolated network

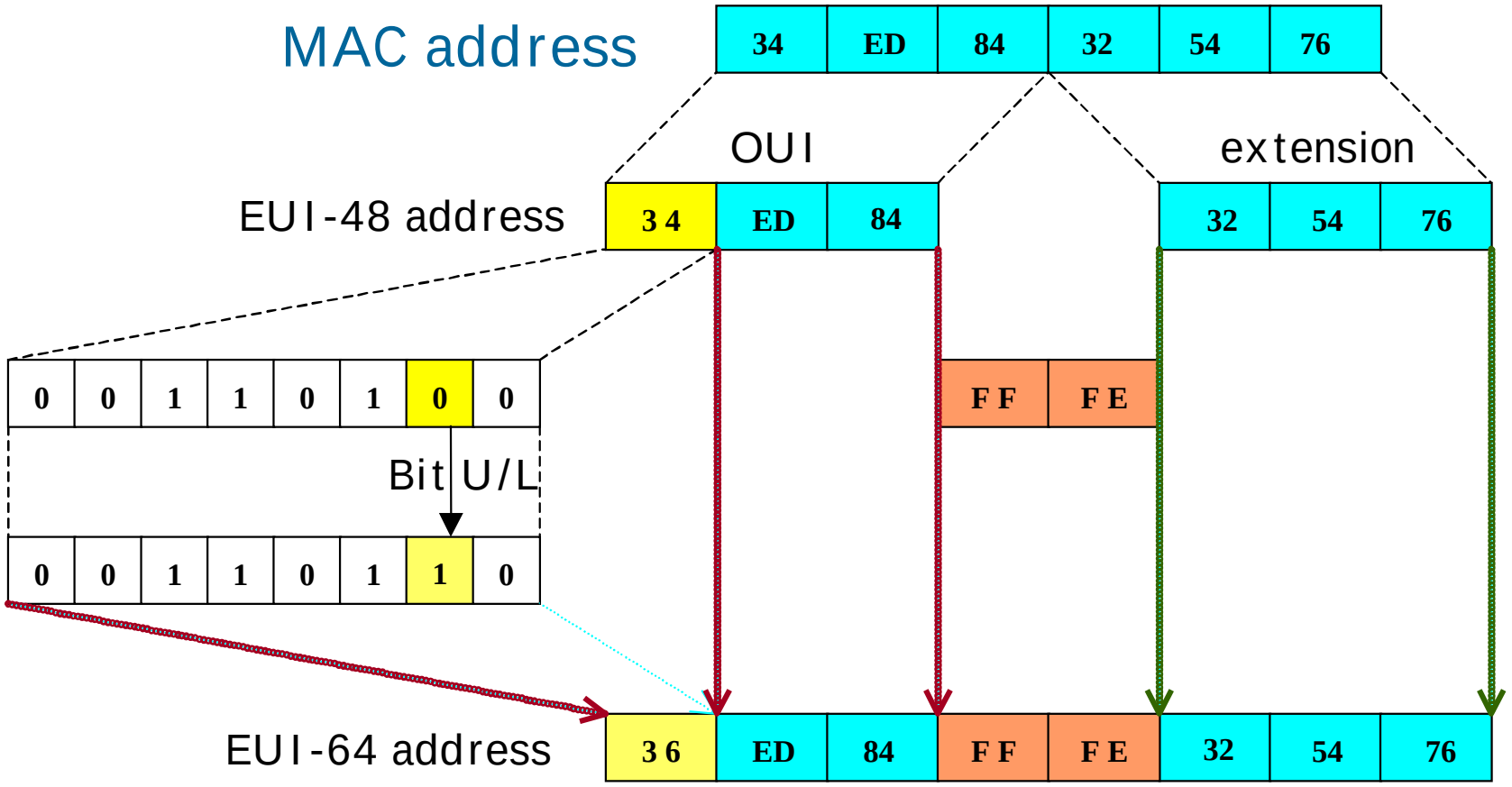
e. Finish autoconfiguration



a. Obtain a Link Local Address

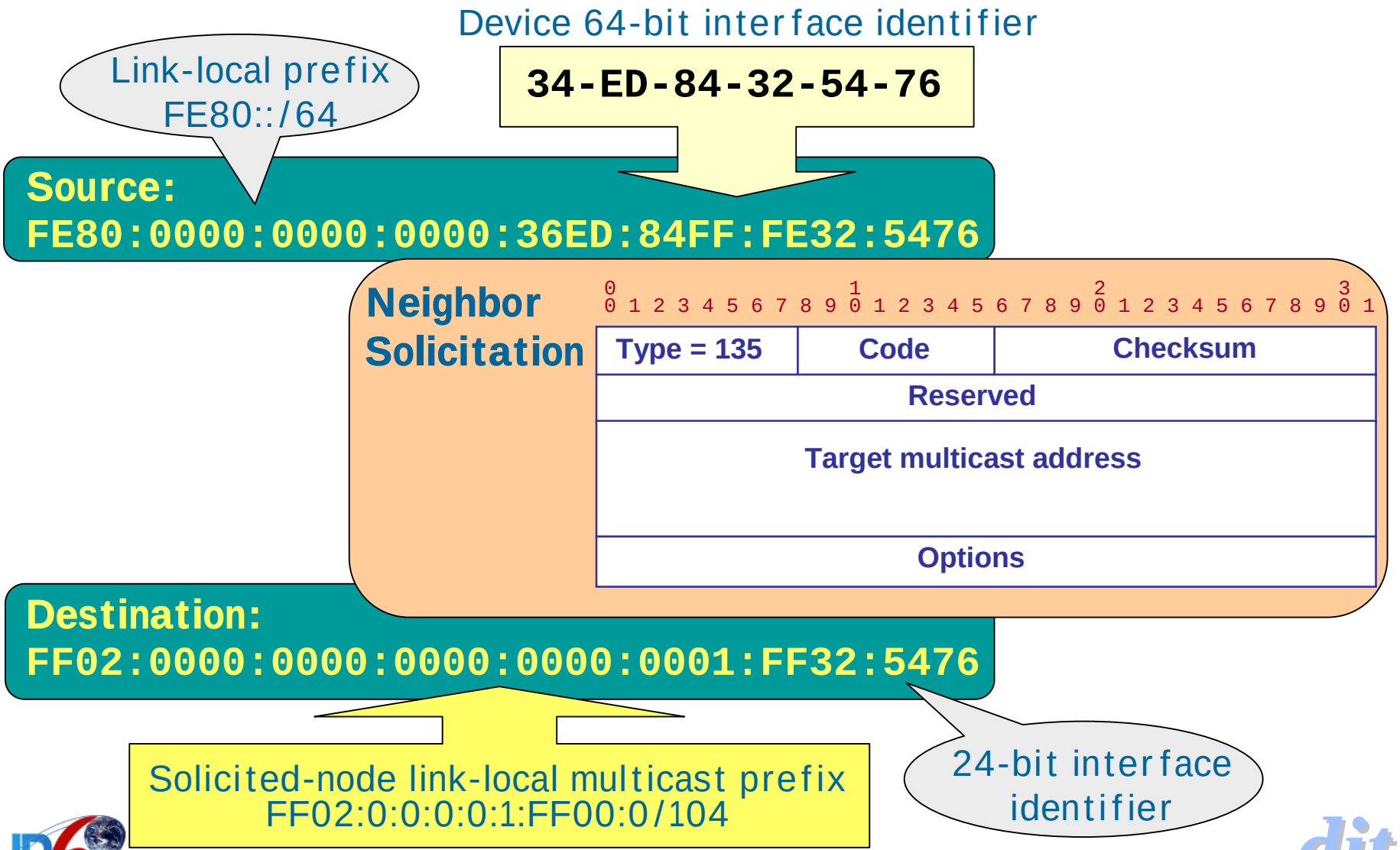
- Used only for communication among nodes attached to the same link.
- Definition using only information local to the node
  - Fixed 64-bit address prefix
  - 64-bit host address based on interface identifier
    - Use the MAC address
- The exact details of how an interface identifier are formed depend on the specific type of interface

IPv6 over Ethernet : EUI-64

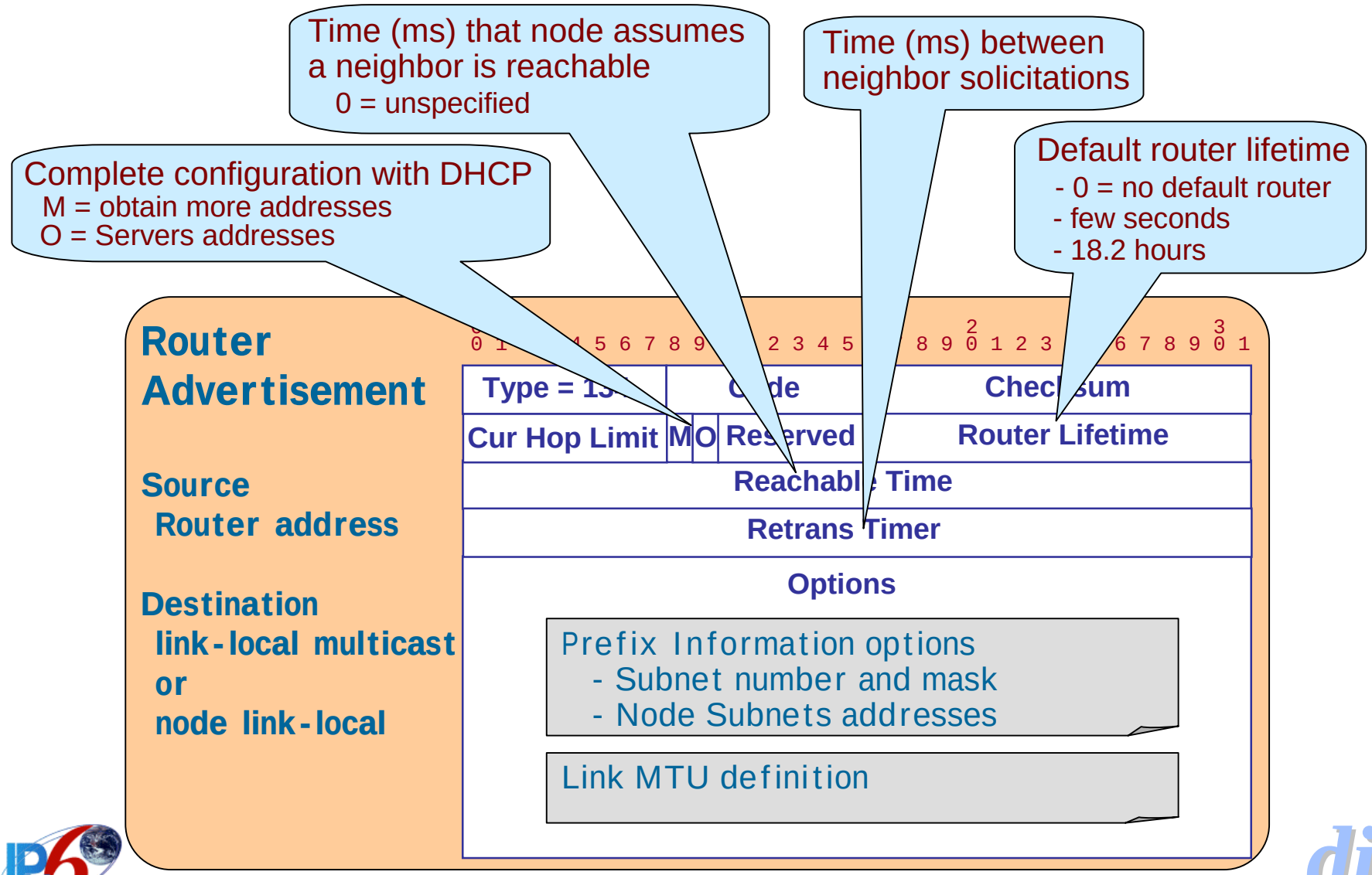


IPv6 host identifier 36ED:84FF:FE32:5476

b. Duplicate detection



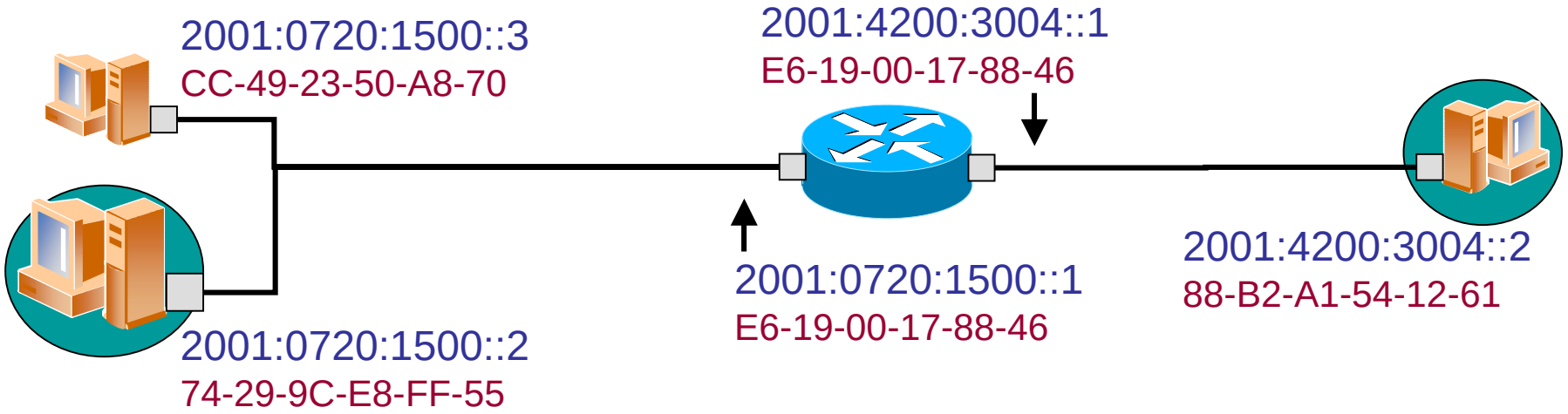
c. ICMP Router Advertisement



Neighbor discovery services

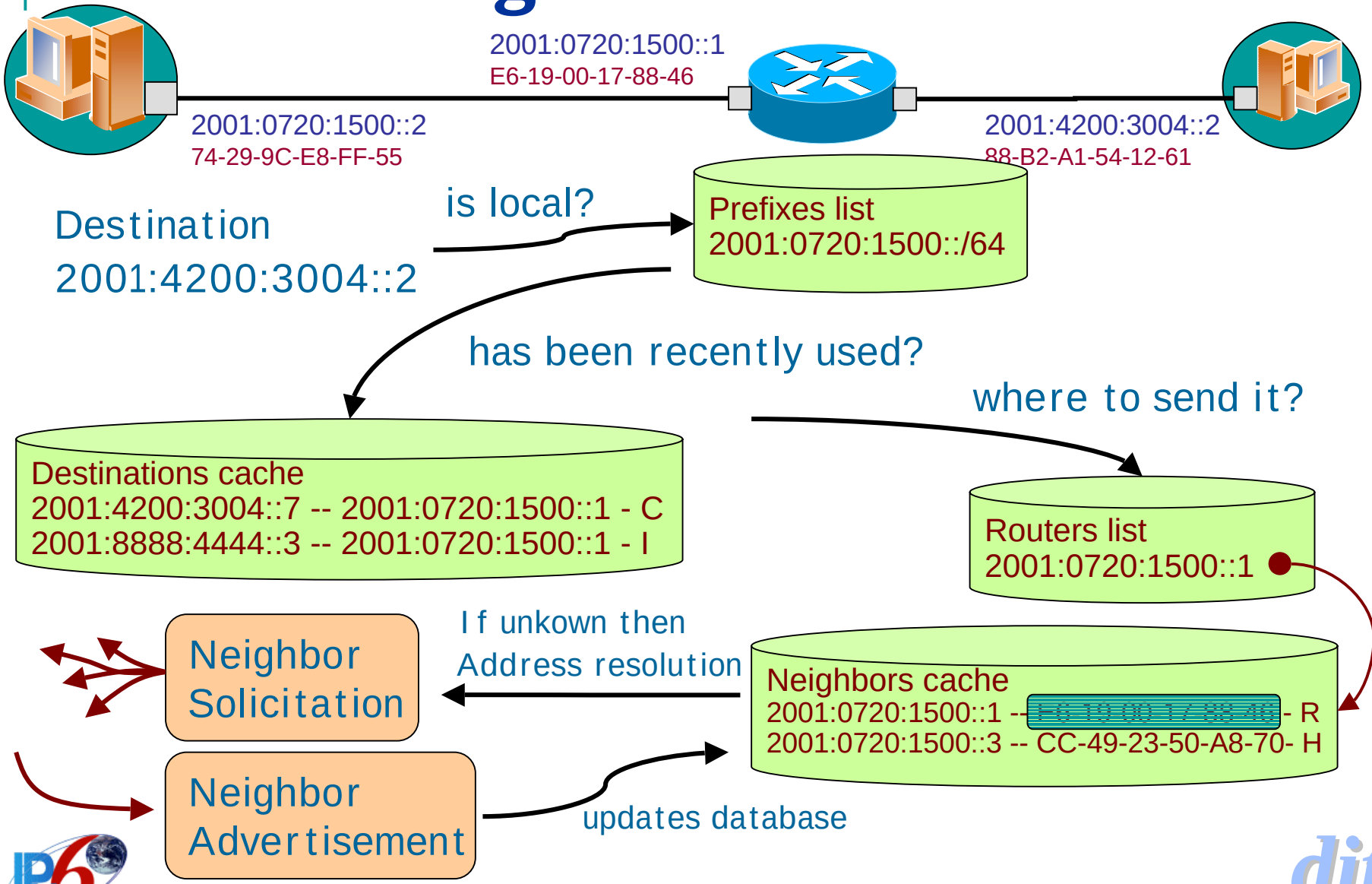
1. First time plugging
2. Address resolution
3. Advanced features

2. Address resolution



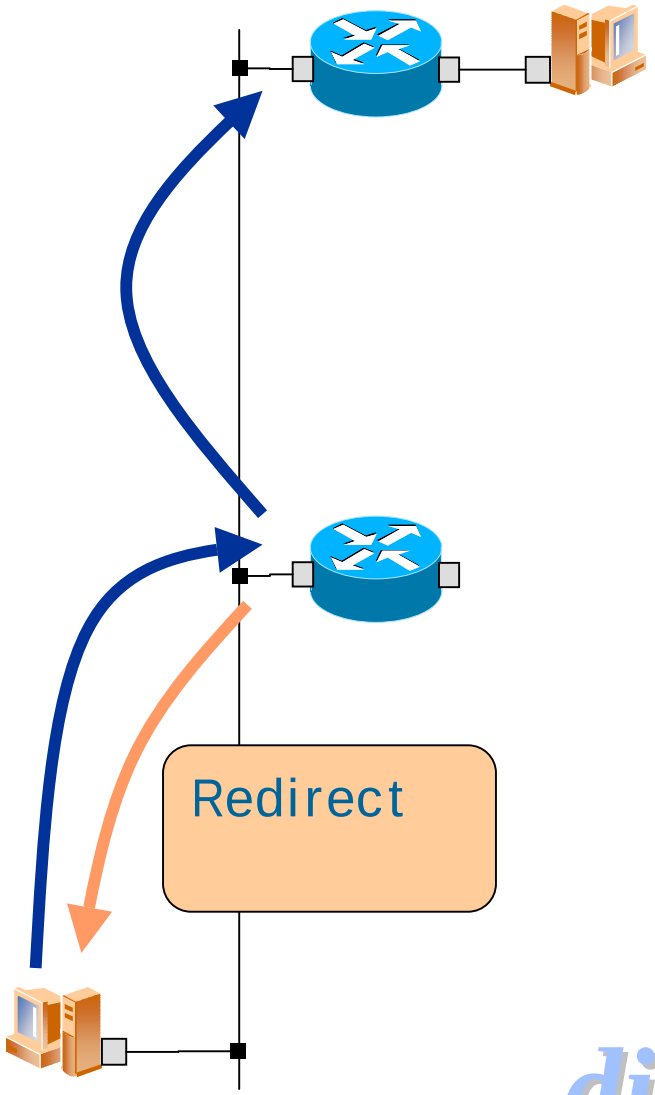
1) Source : 2001:0720:1500::2
   Destination : 2001:4200:3004::2
2) Routing
   It is not a local address
   Which router should be used? = **2001:0720:1500::1**
3) Address resolution
   How to obtain the router MAC address?

The basic algorithm



Redirects

- Sometimes hosts will pick the wrong next hop
  - there are several routers
  - Send to a router although destination is connected to the same link
- The router that receives the packet
  - will retransmit to the correct hop
  - send a Redirect Message
- Next message send to that destination travels only once to the correct router



Neighbor discovery services

1. First time plugging
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3. Advanced features

Point to point connections

- Networks with no multicast communication
  - They will not able to send NS messages
  - Require some manual configuration
- Serial links have only two stations
  - Whenever they must contact a new destination consider the next hop is always the router
- NonBroadcast Multiple Access (NBMA) network
  - Send all messages to the router
  - If destination is directly connected
    - The router will send back a redirect message

Anycast servers

- An anycast address may be served by several stations connected to the same link

1. Send a NS to an Anycast Address
2. All stations served anycast reply a NA
   - use regular address not anycast address
3. The solicitor will receive several NA
   - The first will be used to complete the cache
   - The rest will be ignored

- In theory the first is the nearest and fastest

Multi-homed hosts

- Hosts connected to the network by several interfaces
  - Multi-homed hosts are not routers
  - Multiple connections are used for better performance
  - Host connected to several providers
- To transmit a message
  - Select an outgoing interface
  - It can use prefix information on various interfaces
    - The best matching prefix result the best performance

References

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