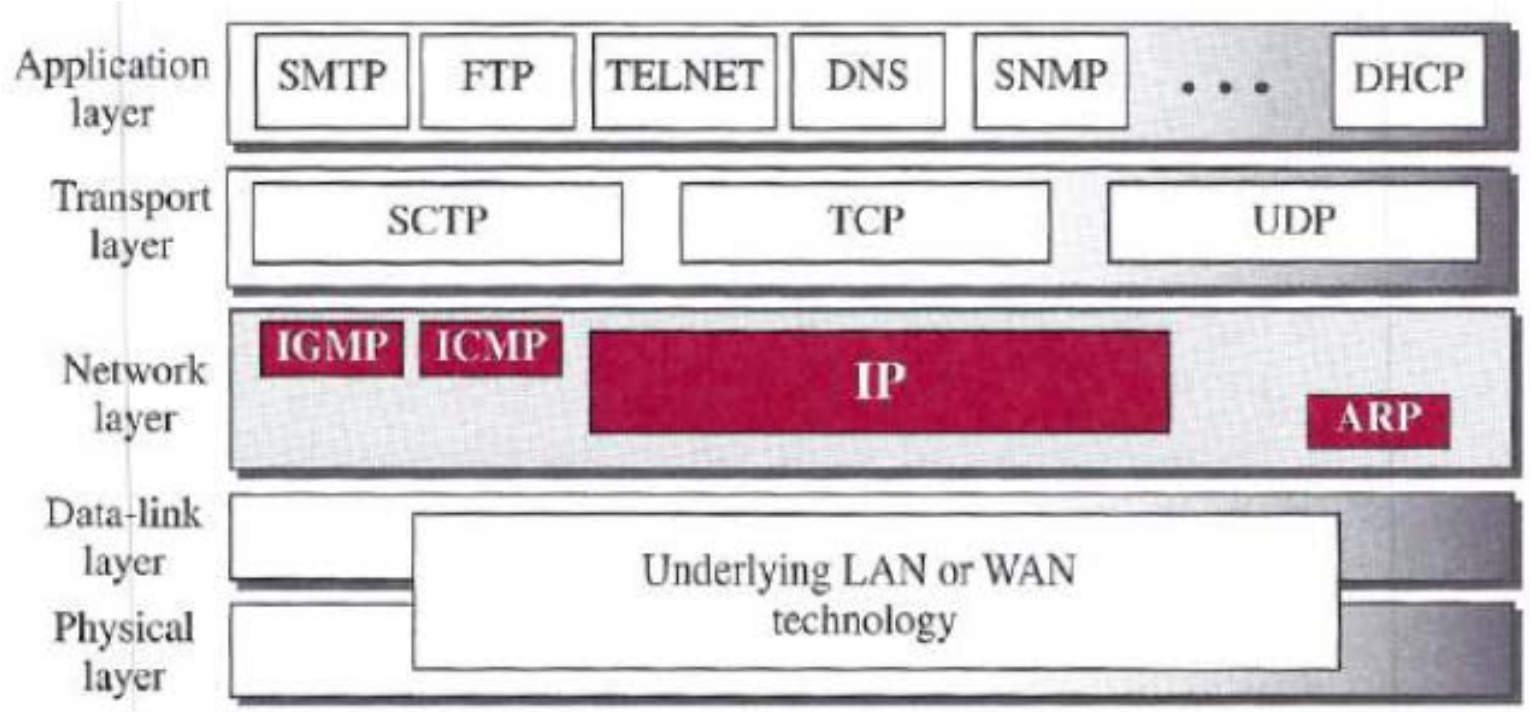
# CS321: Computer Networks

## DHCP, NAT, Packet Forwarding

Dr. Manas Khatua
Assistant Professor
Dept. of CSE
IIT Jodhpur
E-mail: manaskhatua@iitj.ac.in

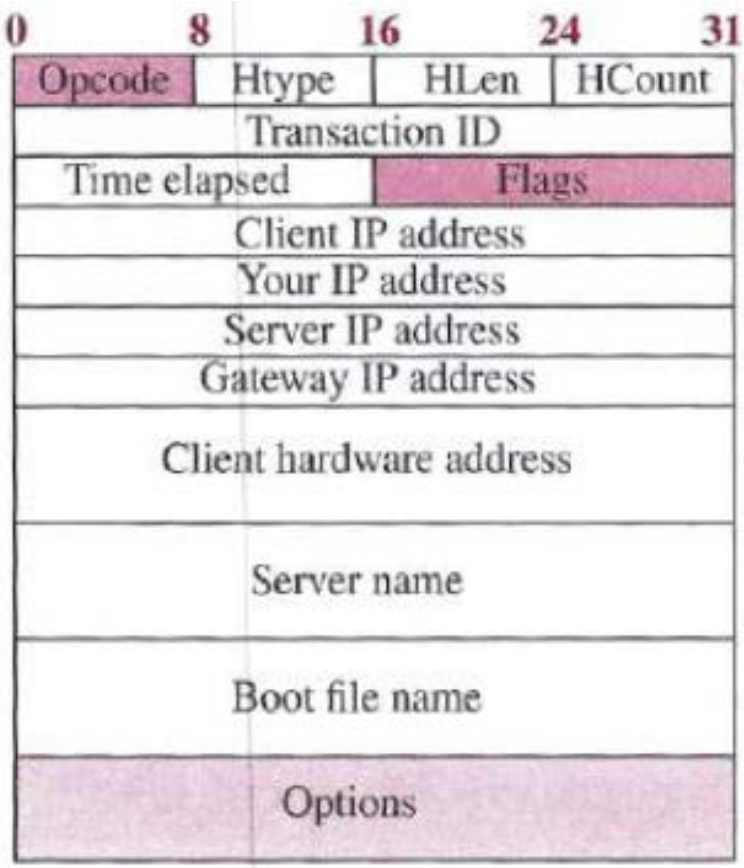
# DHCP in TCP/IP Suite




Dynamic Host Configuration Protocol (DHCP) is an application-layer program, using the client-server paradigm, that actually helps TCP/IP at the network layer.

- Automatically assigns IP addresses to the host and routers.

# DHCP Frame Format



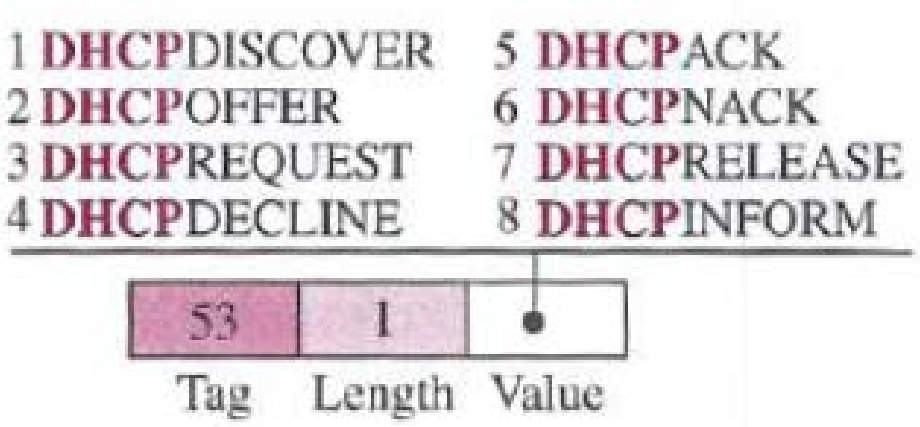

**Fields:**

Opcode: Operation code, request (1) or reply (2)
Htype: Hardware type (Ethernet, ...)
HLen: Length of hardware address
HCount: Maximum number of hops the packet can travel
Transaction ID: An integer set by the client and repeated by the server
Time elapsed: The number of seconds since the client started to boot
Flags: First bit defines unicast (0) or multicast (1); other 15 bits not used
Client IP address: Set to 0 if the client does not know it
Your IP address: The client IP address sent by the server
Server IP address: A broadcast IP address if client does not know it
Gateway IP address: The address of default router
Server name: A 64-byte domain name of the server
Boot file name: A 128-byte file name holding extra information
Options: A 64-byte field with dual purpose described in text

# Options Field

Options: 64 Byte

- 4 Byte magic cookie (99.130.83.99);
- 1 Byte Tag; 1 Byte Length; 0-58 Byte value



# DHCP Scenario

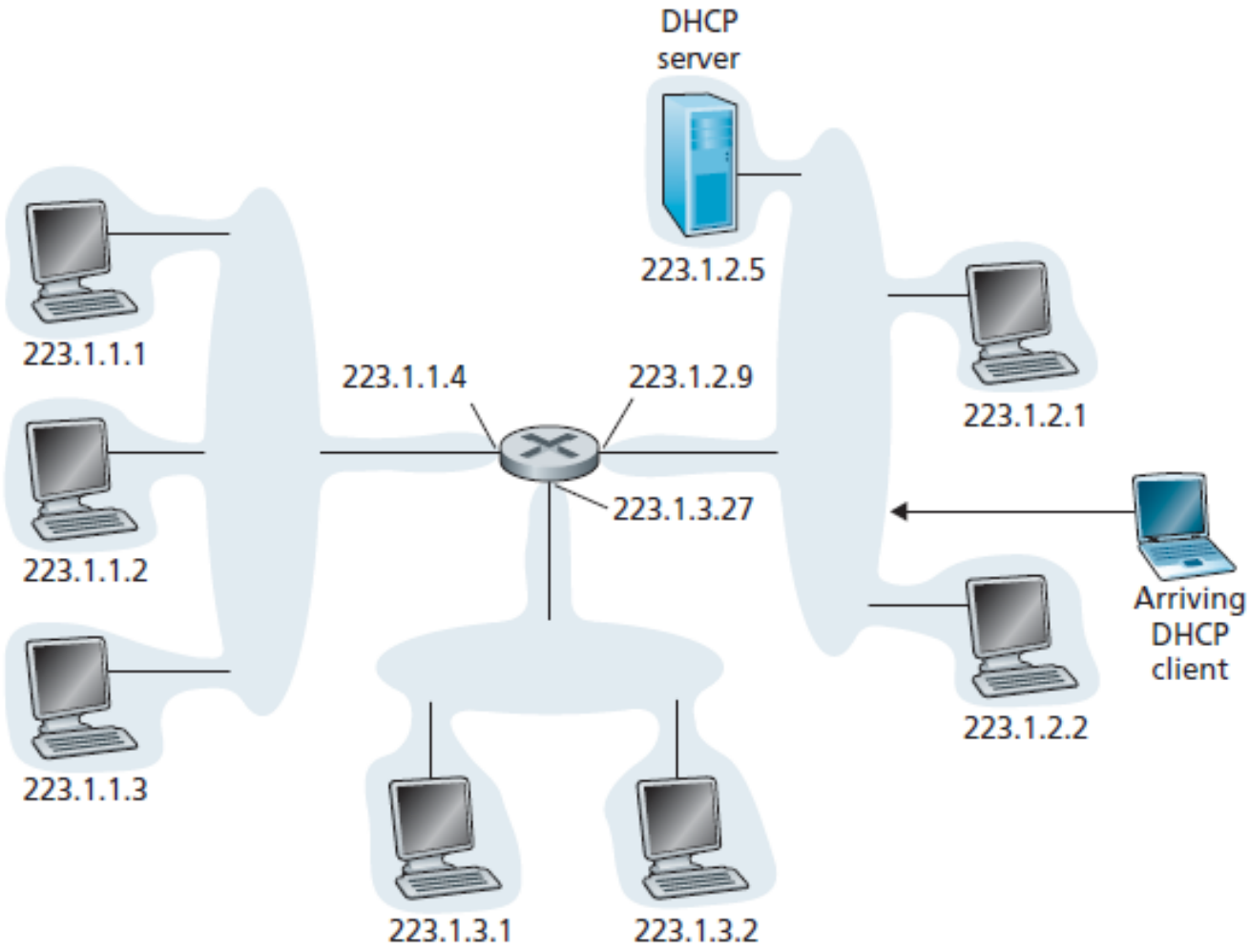



**Figure 4.20** ♦ DHCP client-server scenario

# DHCP Steps

4 step process

1. *DHCP server discover*

   UDP packet to port 67.

   This host IP: 0.0.0.0, Port: 68

   Broadcast IP: 255.255.255.255

   Transaction ID

2. *DHCP server offer(s)*

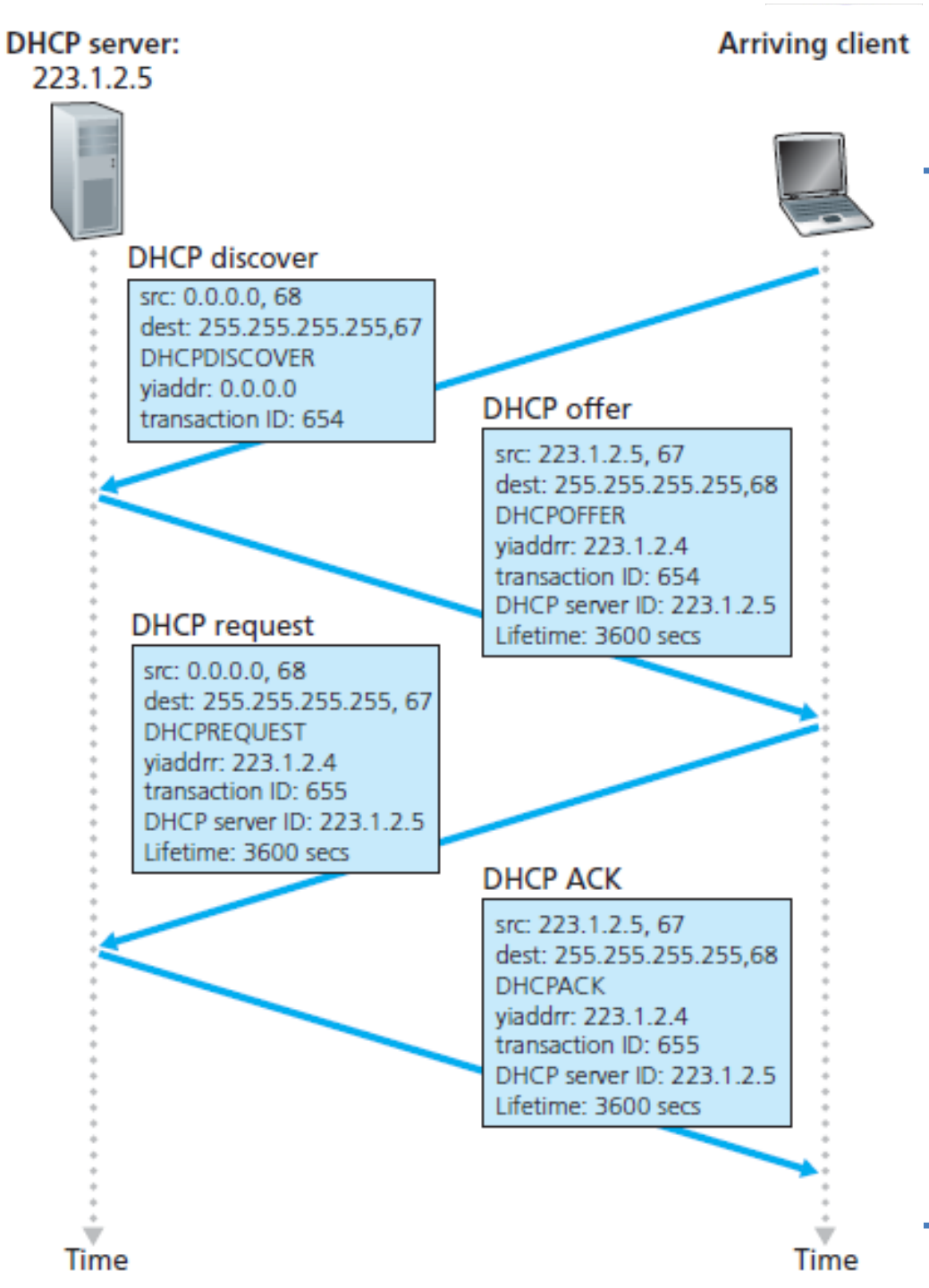
   Transaction ID, Client IP, mask, DHCP server IP, Lifetime

3. *DHCP request*

   Select one offer and request to grant

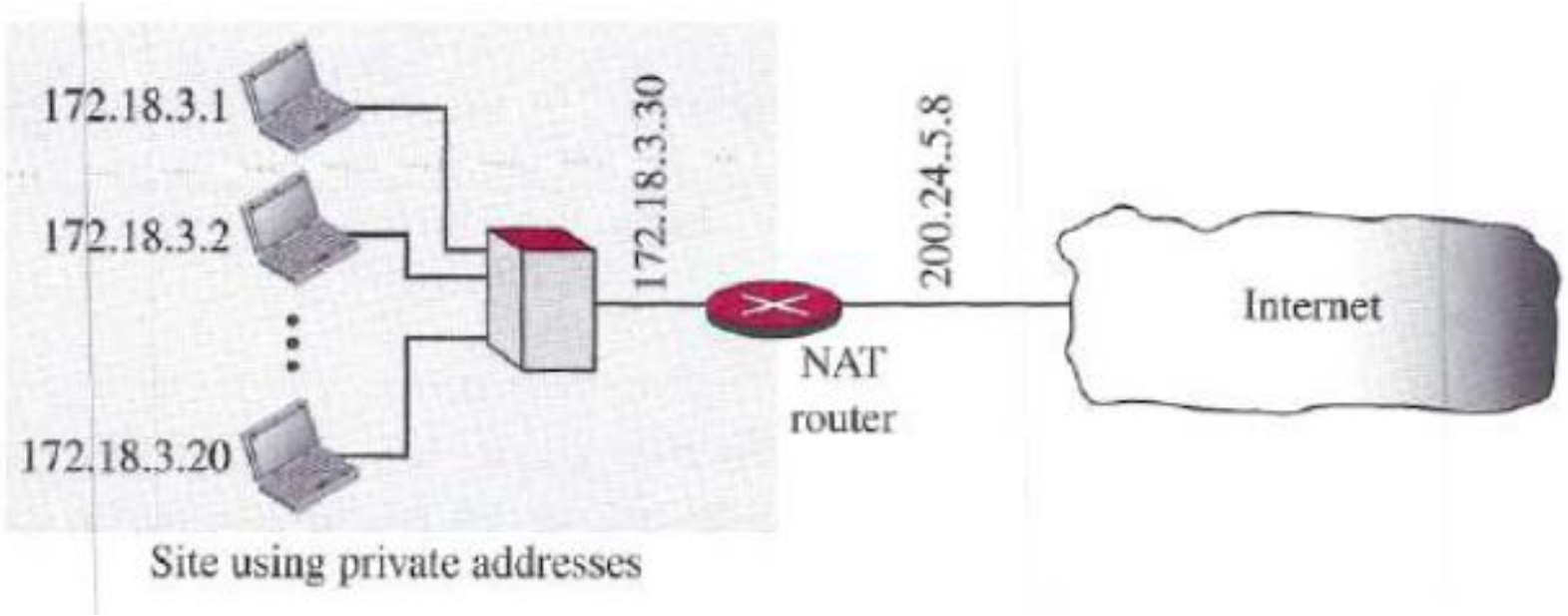
4. *DHCP ACK*

   Server confirms the request



# Network Address Translation (NAT)

- Problem: after a period, business grows or the household needs a larger range of IP
- Solution: NAT.
  - Allows to use a set of private addresses for internal communication and a set of global addresses (at least one) for communication with the rest of the world.



# NAT Operations

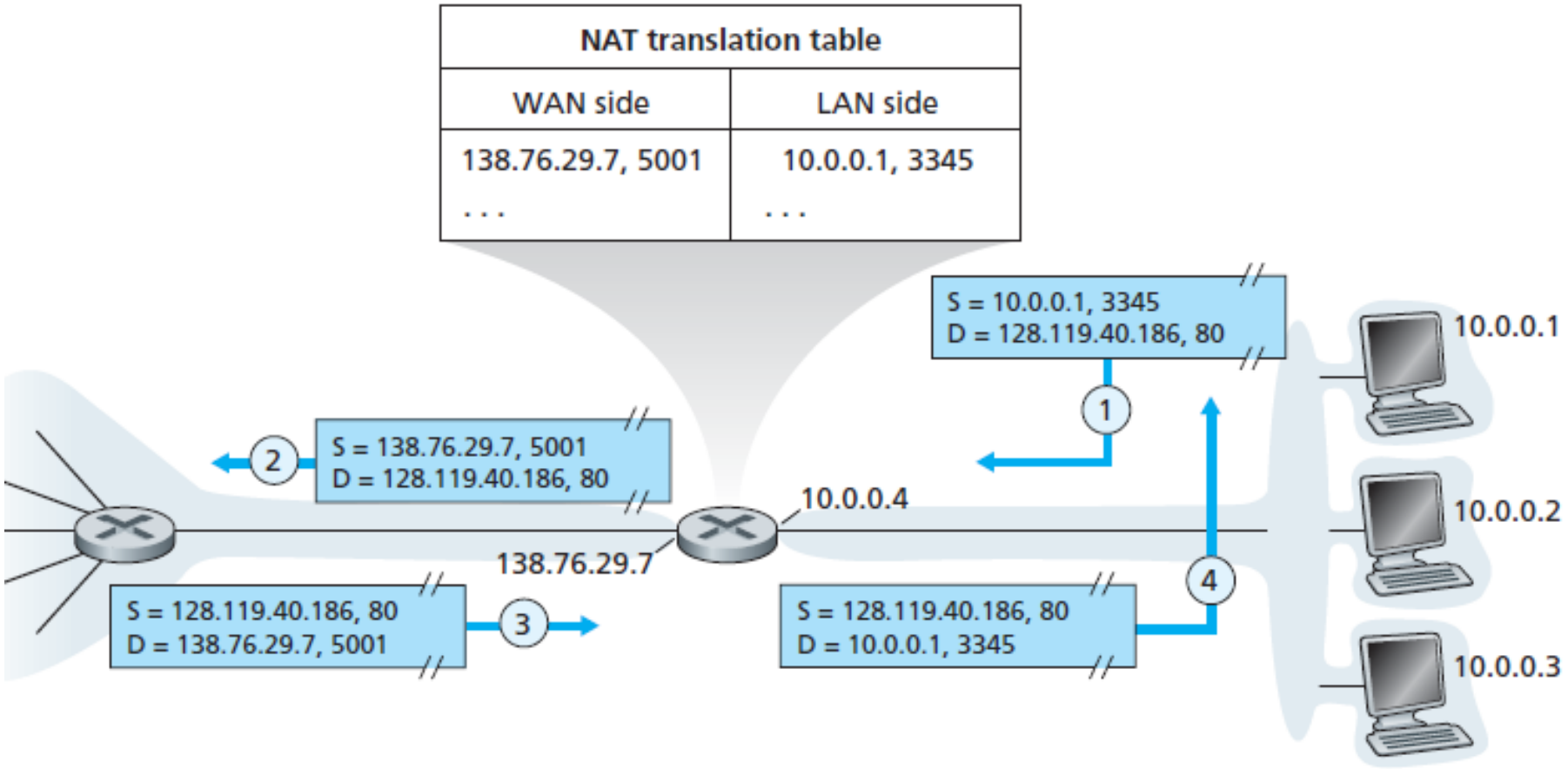
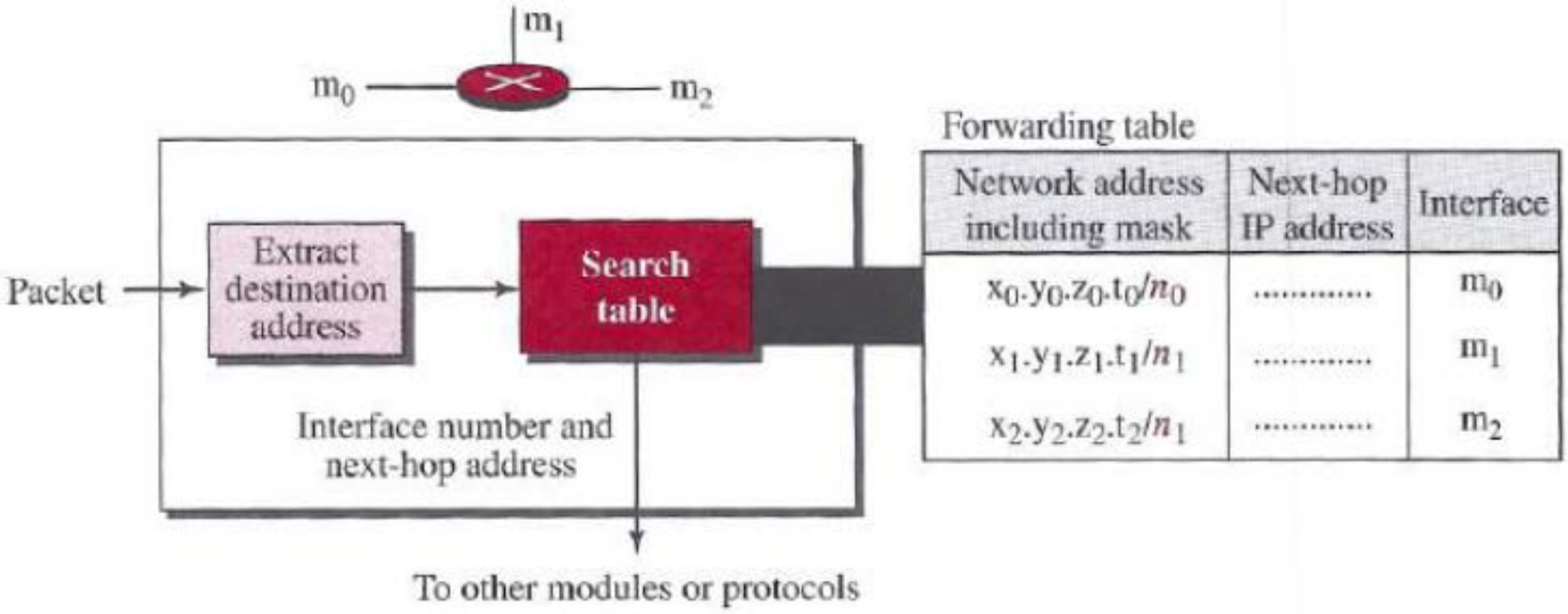


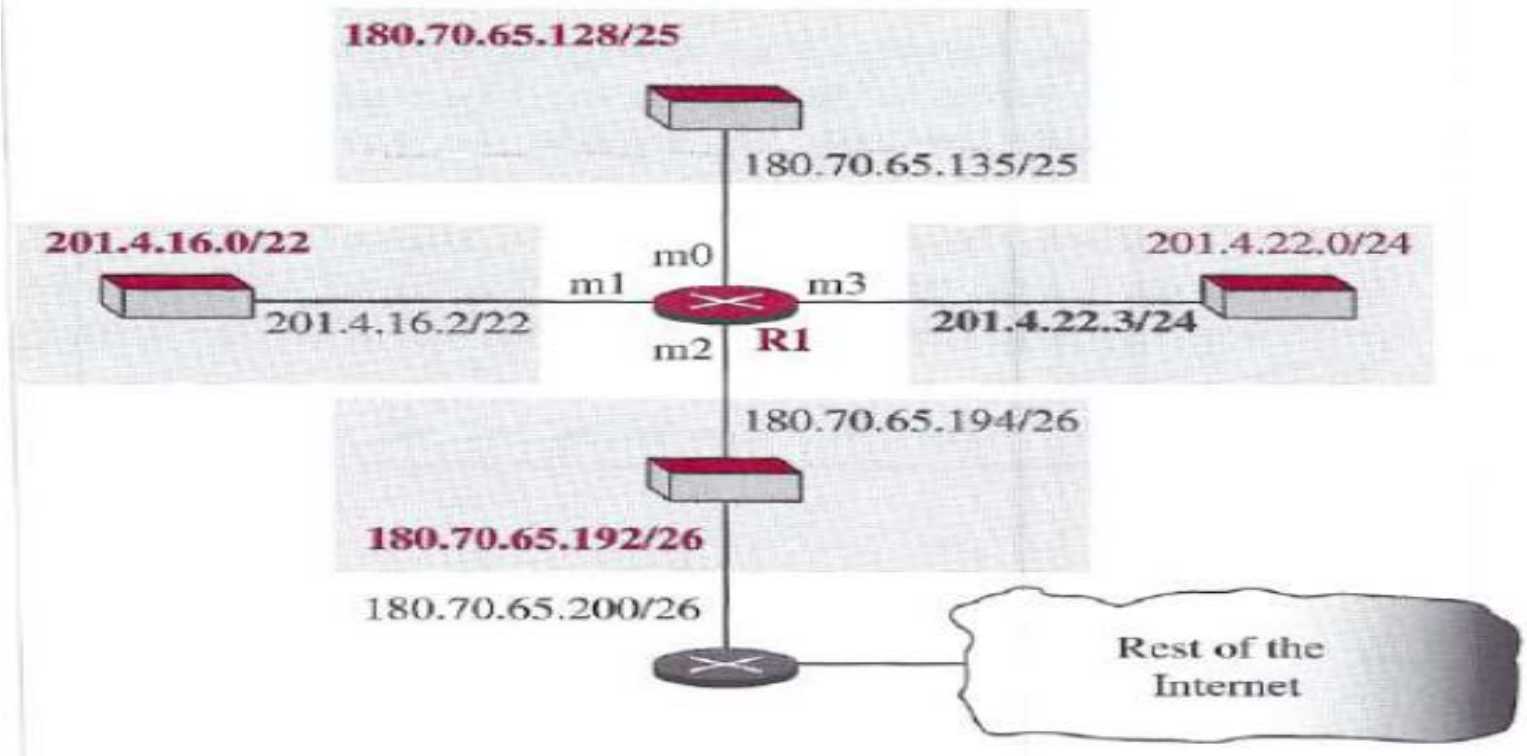

**Figure 4.22** ♦ Network address translation

# IP Packet Forwarding

- 2 Approaches:
  - Based on Destination IP
    - For connectionless protocol
  - Based on Label
    - For connection oriented protocol

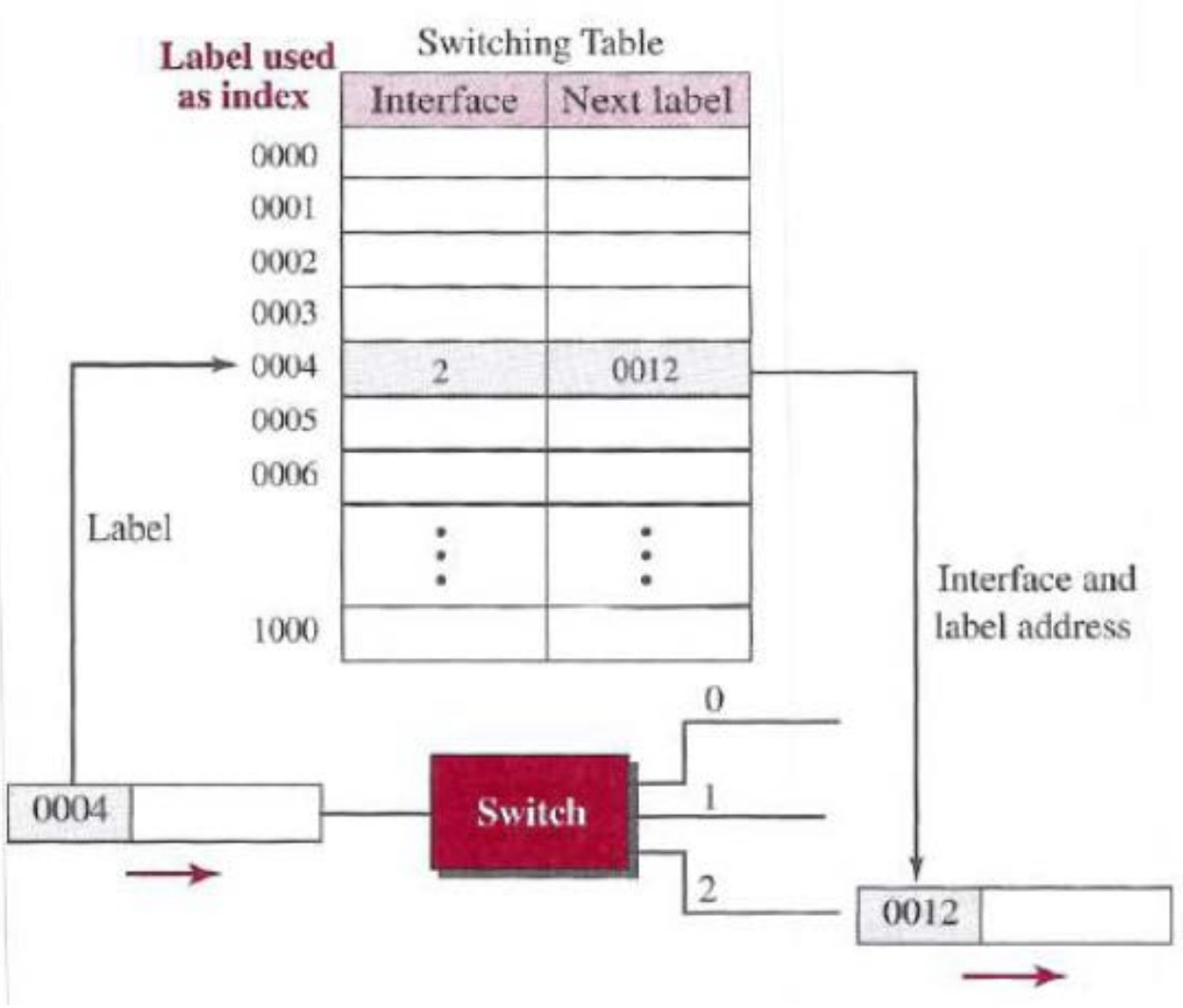


# Forwarding table for R1




| *Network address/mask* | *Next hop* | *Interface* |
|---|---|---|
| 180.70.65.192/**26** | — | m2 |
| 180.70.65.128/**25** | — | m0 |
| 201.4.22.0/**24** | — | m3 |
| 201.4.16.0/**22** | — | m1 |
| Default | 180.70.65.200 | m2 |

# Forwarding based on Label



# Thanks!