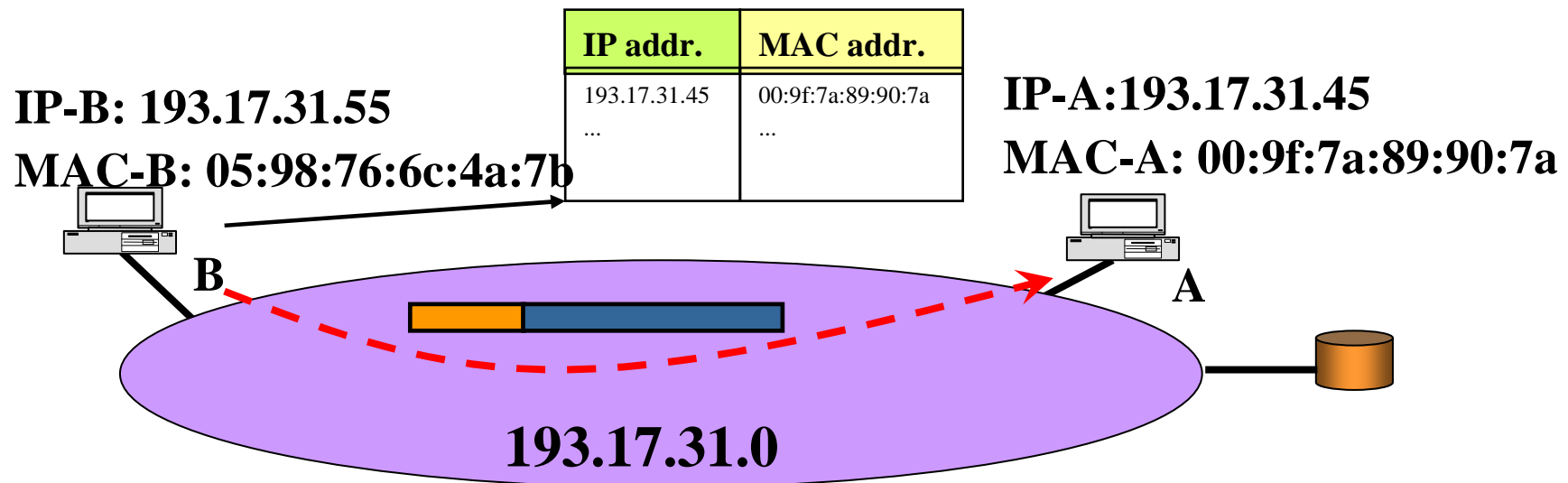


Address Management in IP Networks

- Address Resolution Protocol (ARP)
- Reverse Address Resolution Protocol (RARP)
- Dynamic Host Configuration Protocol (DHCP)

IP Addresses and Physical Addresses

- The Forwarding Tables (IP/Physical Address) are created and managed dynamically by the hosts through the *Address Resolution Protocol (ARP)*



Address Resolution Protocol (ARP, RFC 826)

- ❑ It is based on the broadcast addressing capabilities of the underlying technology
 - ❑ Whenever the destination MAC address is not in the *ARP-cache* an *ARP-request* message is generated
 - ❑ *ARP-requests* are sent broadcast (physically) with the indication of the IP address to resolve
 - ❑ The host recognizing its own IP address sends out an *ARP-reply* unicast (physically) to the inquiring station
-

ARP (Address Resolution Protocol)

IP addr.	MAC addr.
...	...

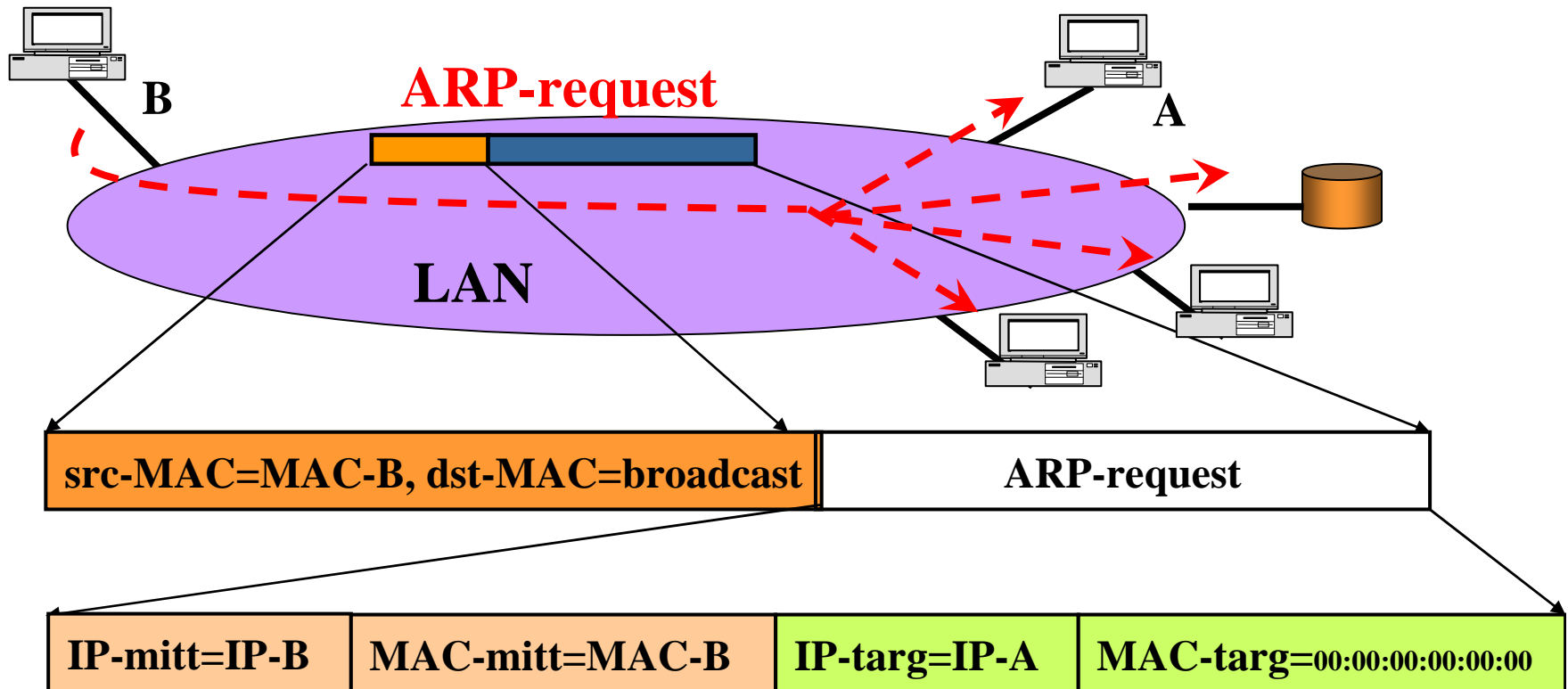
MAC broadcast:
ff:ff:ff:ff:ff:ff

IP-B: 193.17.31.55

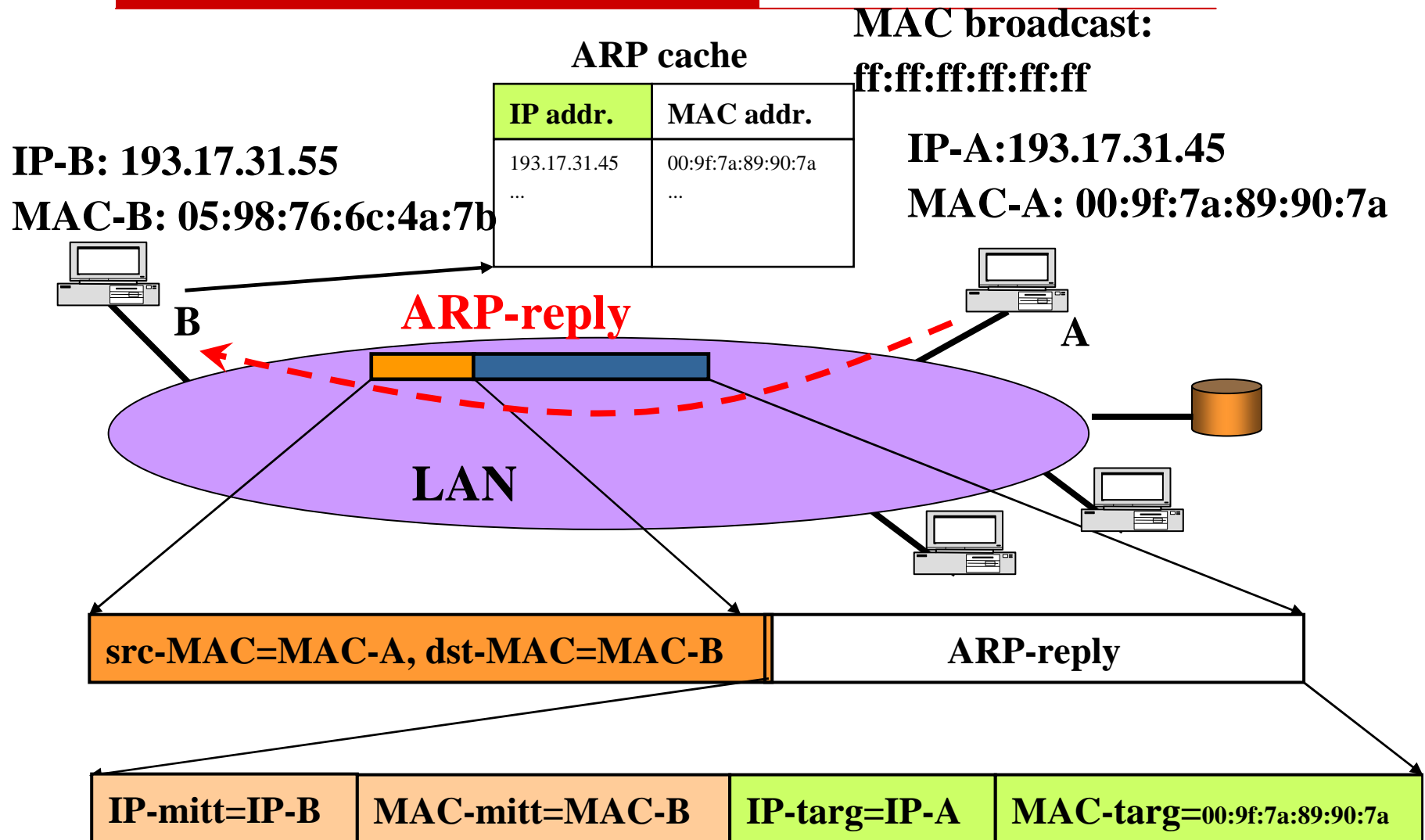
MAC-B: 05:98:76:6c:4a:7b

IP-A: 193.17.31.45

MAC-A: 00:9f:7a:89:90:7a



ARP (Address Resolution Protocol)

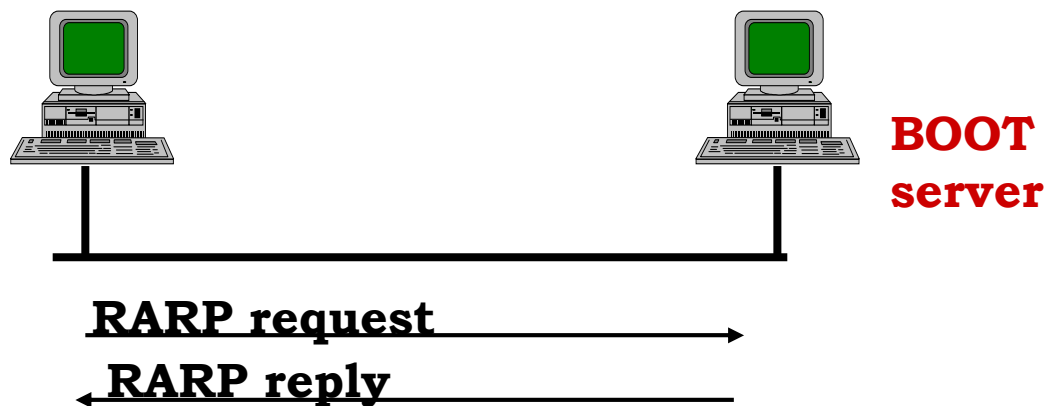


ARP Packet Format

Hardware Type		Protocol Type
Hardware length	Protocol length	Operation Request 1, Reply 2
Sender hardware address (For example, 6 bytes for Ethernet)		
Sender protocol address (For example, 4 bytes for IP)		
Target hardware address (For example, 6 bytes for Ethernet) (It is not filled in a request)		
Target protocol address (For example, 4 bytes for IP)		

RARP (Reverse ARP)

- ARP assigns a MAC address to an IP address
- RARP does the opposite:
 - Assigns an IP address to a known MAC address
 - Useful for diskless machines performing a network bootstrap
 - *Scarcely used !!!*



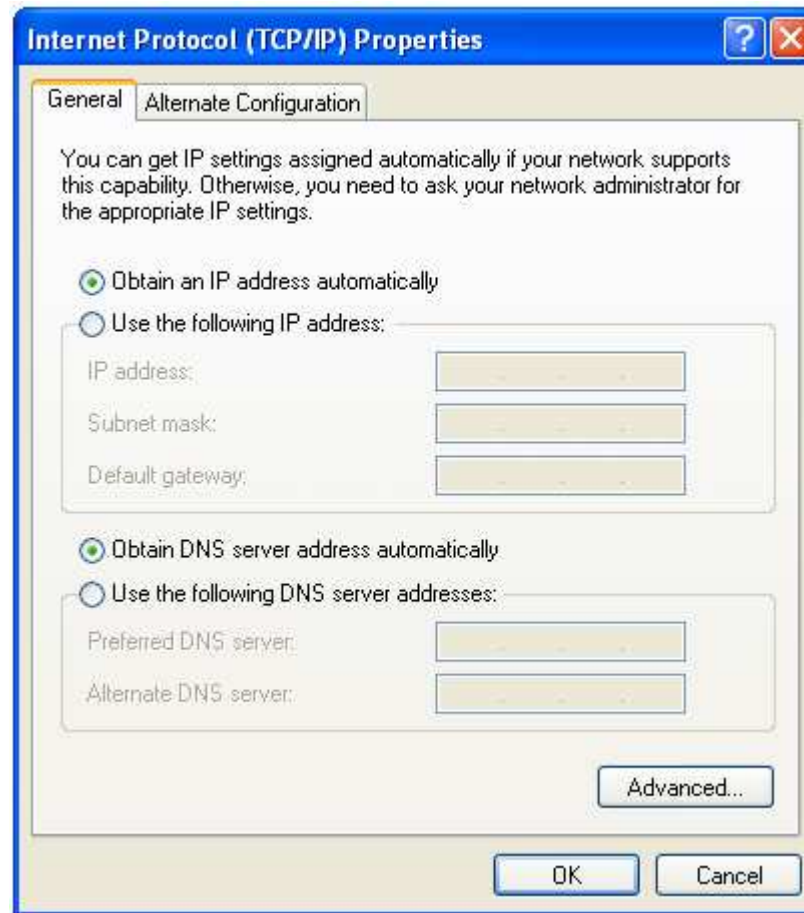
Dynamic Addresses Management

- ❑ Static procedures to assign IP addresses have low flexibility
 - ❑ The use of a central server to store the host configuration may help
 - ❑ In many cases a static binding between IP address and MAC address is not necessary (more hosts than available IP addresses):
 - host activity cycles (ex. Dial-up connections)
 - Underperforming hosts
-

Dynamic Addresses

- ❑ Assume we have a server to handle the IP address assignment upon request:
 - ❑ Different feasible solutions:
 - Static binding: the server handles a static correspondence table between IP and MAC addresses;
 - ❑ whenever it receives a request checks the table for the sender MAC address and assigns it the corresponding IP address
 - Dynamic binding: the IP addresses set may be narrower than the one of the hosts to serve.
 - ❑ The binding changes over time
-

Dynamic Addresses

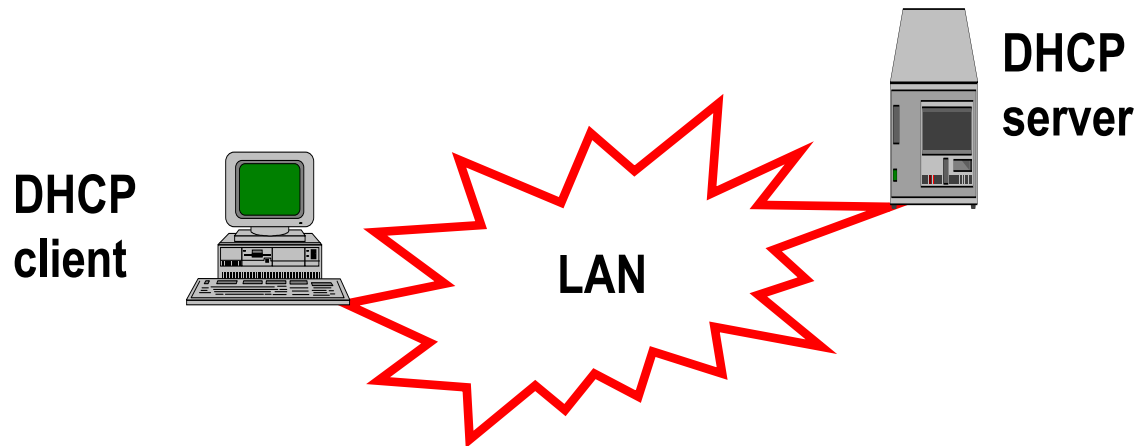


Dynamic Binding

- Useful if the host has various activity cycles
 - Binding must be temporary, use of
 - time outs and/or
 - explicit release procedures
 - Reject probability not null
 - The problem of dimensioning the IP addresses set is similar to the one of dimensioning telephone circuits
-

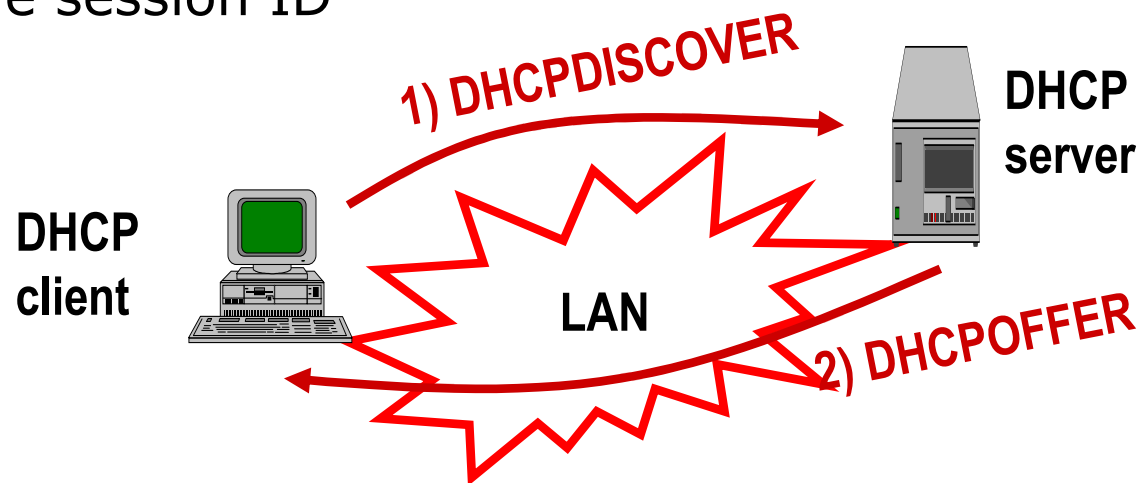
Dynamic Host Configuration Protocol (DHCP, RFC 2131)

- ❑ Evolved version of the BOOTP
- ❑ **Application level protocol** based on the *client-server* paradigm



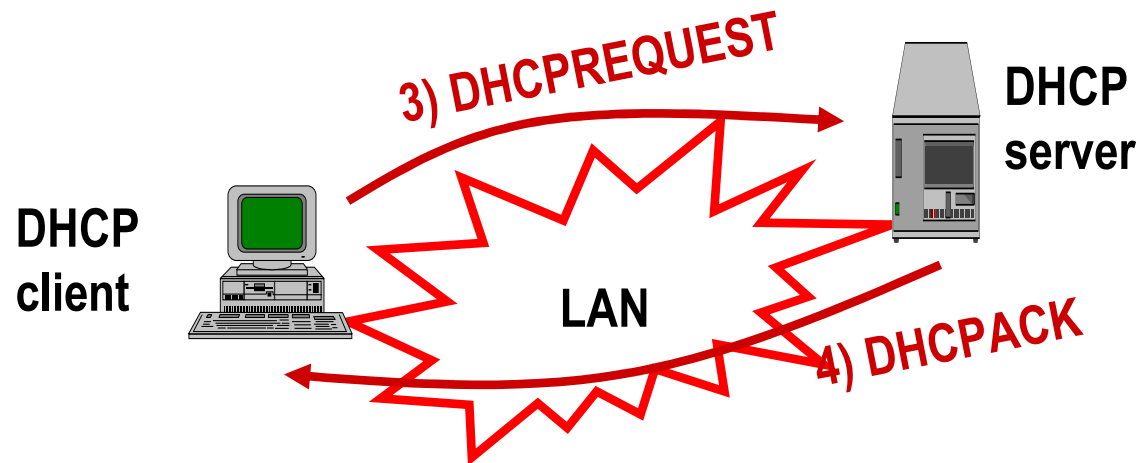
DHCP (1)

- A *client* sends out DHCP DISCOVER message in broadcast (IP) containing:
 - its own MAC address
 - A session ID
- The *server* replies with a DHCP OFFER message containing
 - the proposed IP address with Netmask
 - The lease time
 - The session ID



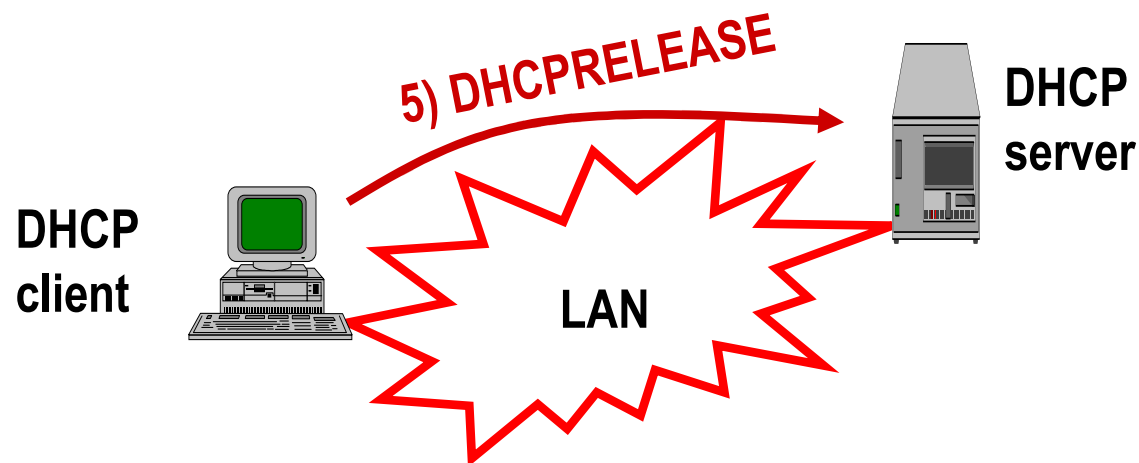
DHCP (2)

- The *client* may accept the proposal by sending a DHCP REQUEST message containing:
 - The session ID
 - The proposed parameters (IP address, netmask, lease time)
- The *server* binds the two addresses and replies with a DHCPACK message confirming the configuration.

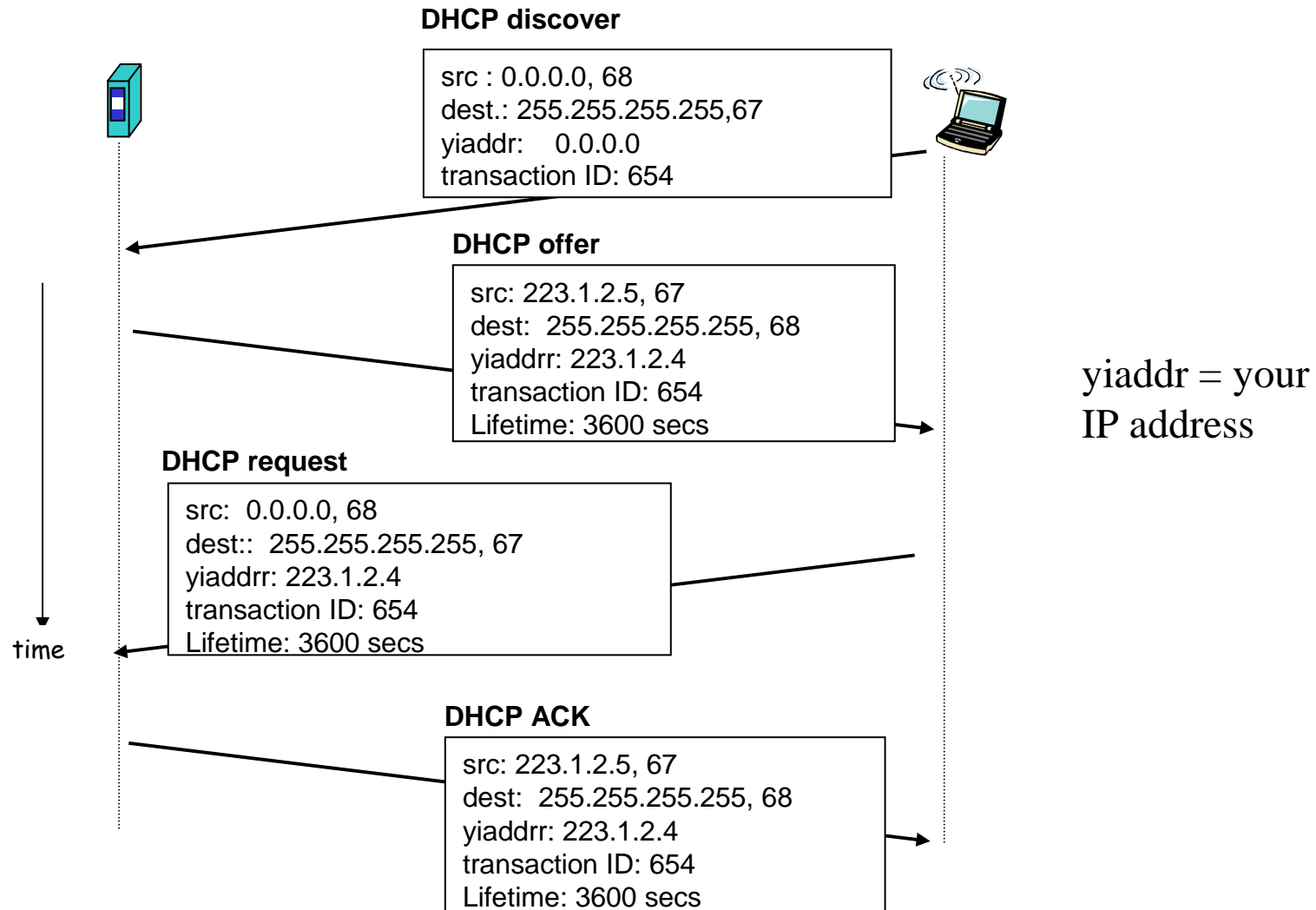


DHCP (3)

- Configuration parameters
 - IP address
 - Netmask
 - Gateway
 - DNS server
- The binding is broken through a DHCPRELEASE message from the client

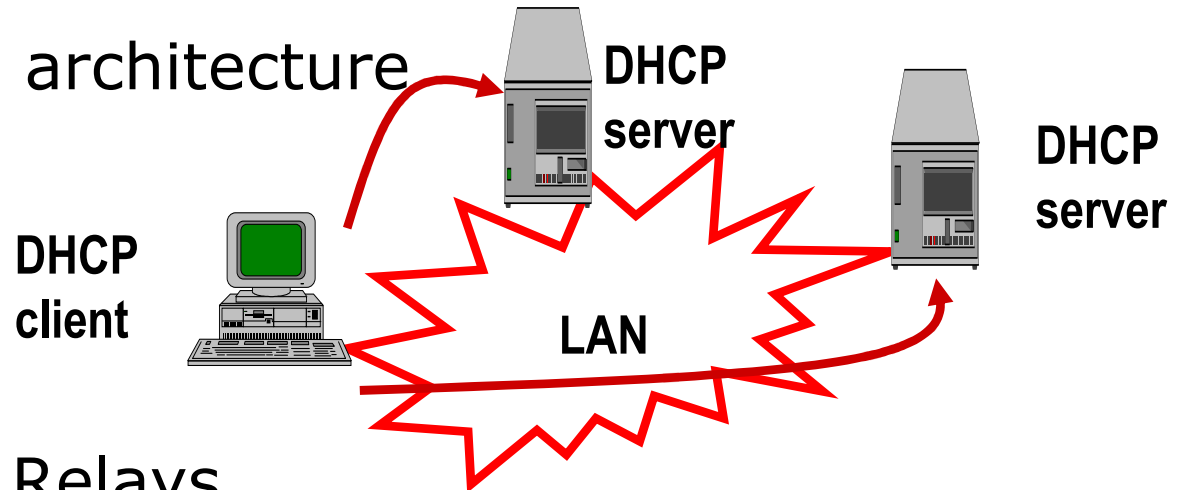


Complete Exchange

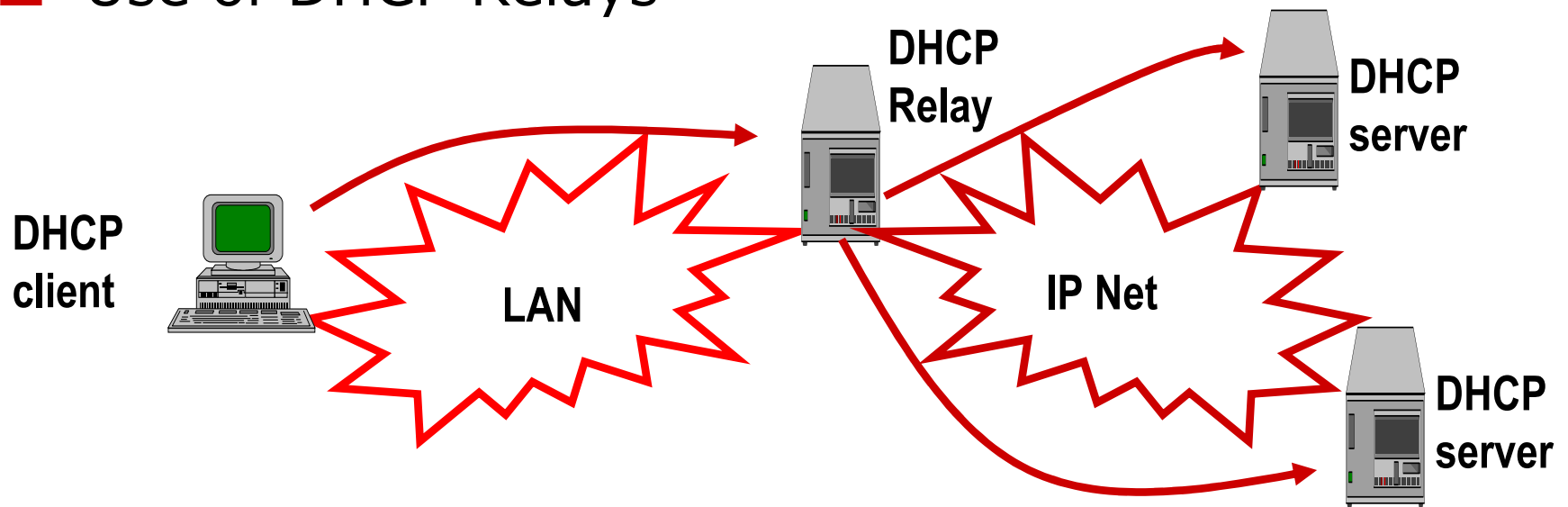


DHCP (4)

- Multi-servers architecture



- Use of DHCP Relays



DHCP Messages

- DHCP uses UDP at the transport layer
- During the set up phase (till the binding is created) the client messages have:
 - IP source address: 0.0.0.0
 - IP destination address: 255.255.255.255
 - Source port: 68
 - Destination port: 67

