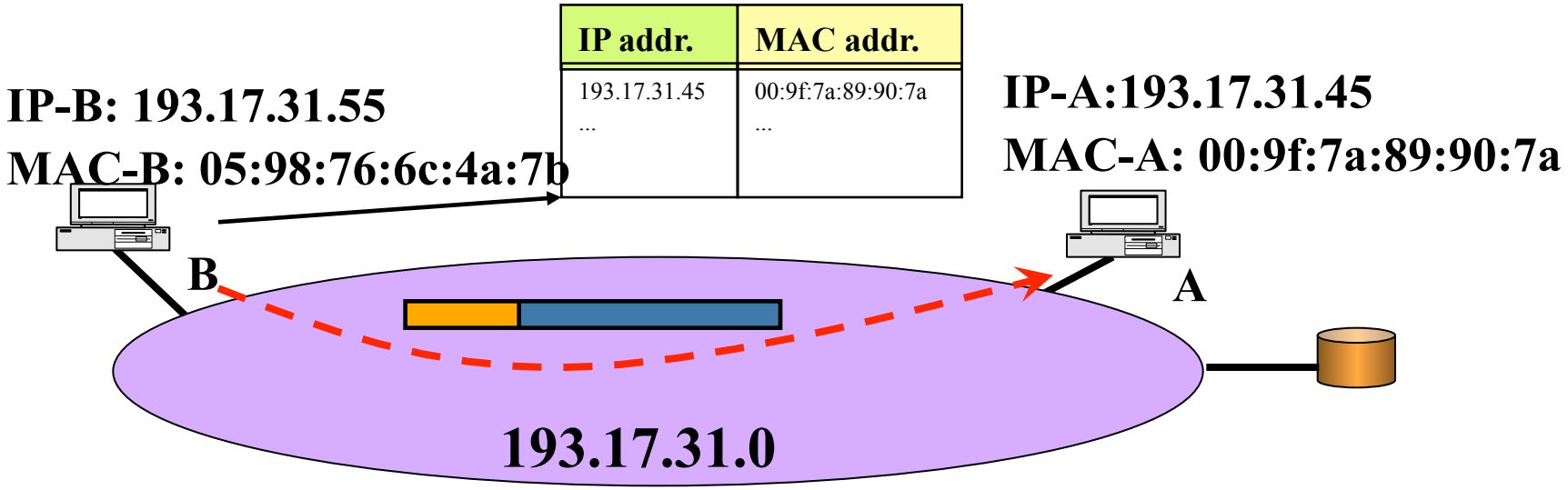
POLYTECH
PARIS-SUD

Address Management in IP Networks

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

IP Addresses and Physical Addresses

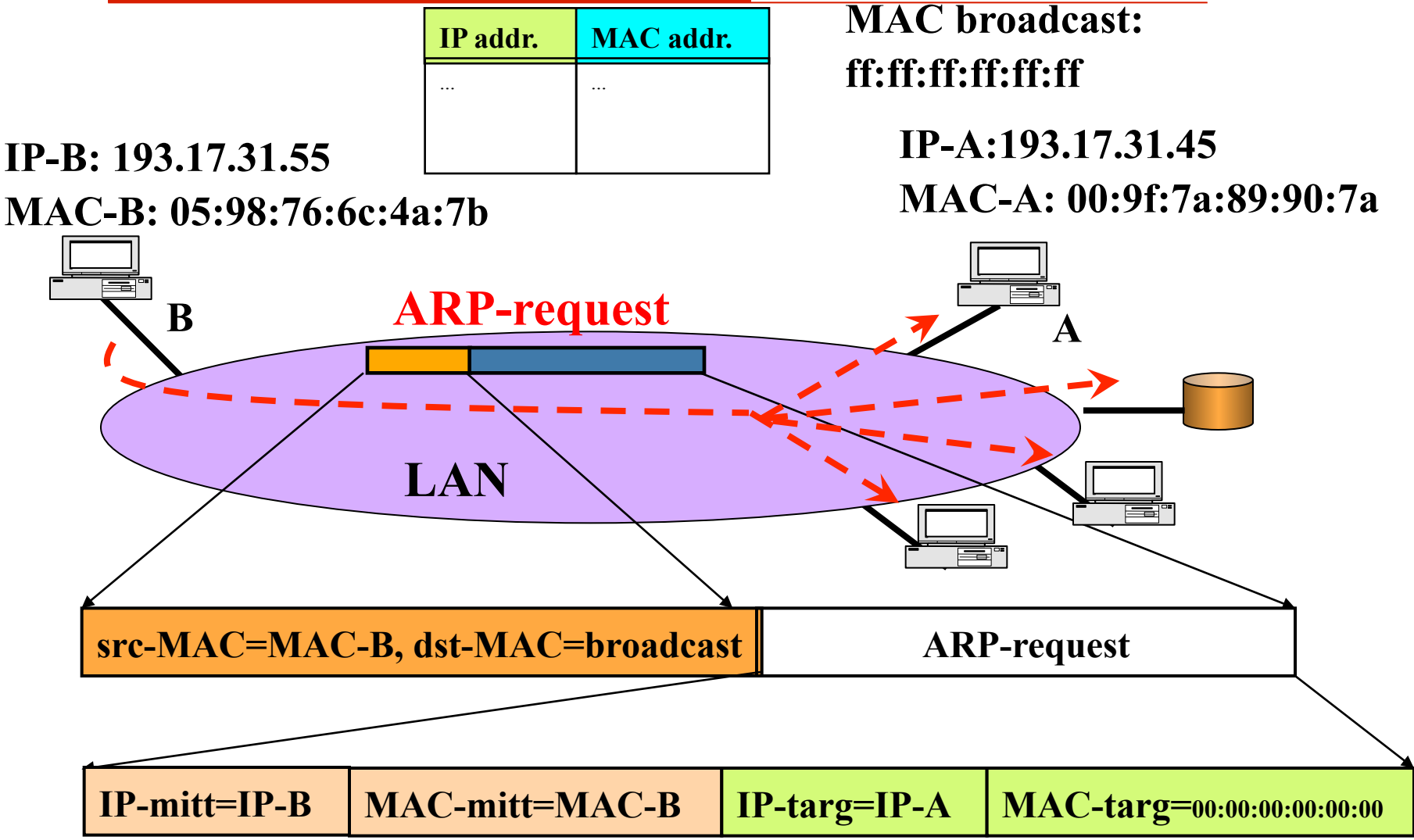
- The Forwarding Tables (IP/Physical Address) are created and managed dynamically by the hosts through the *Address Resolution Protocol (ARP)*



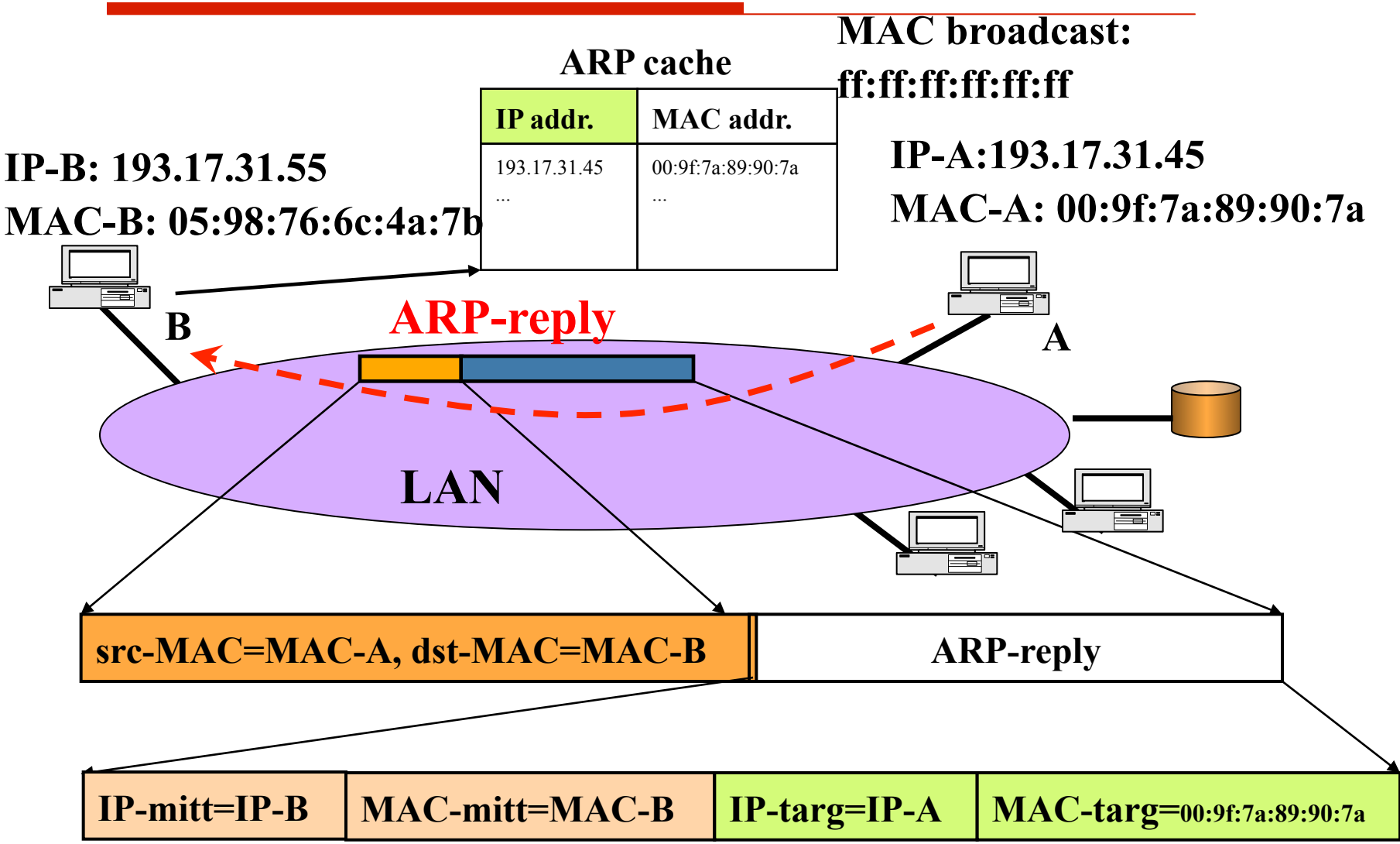
Address Resolution Protocol (ARP, RFC 826)

- 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

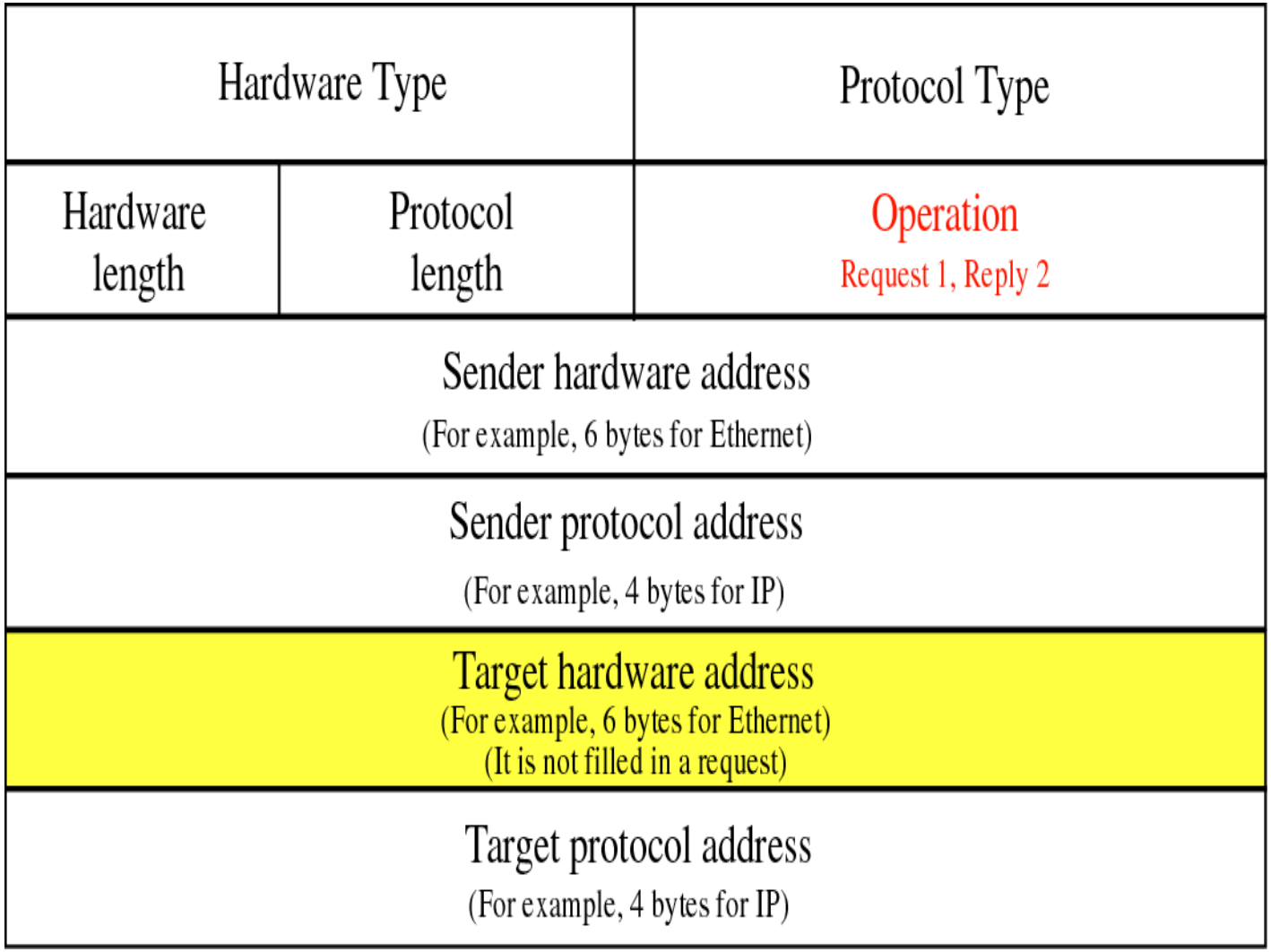
ARP (*Address Resolution Protocol*)



ARP (Address Resolution Protocol)

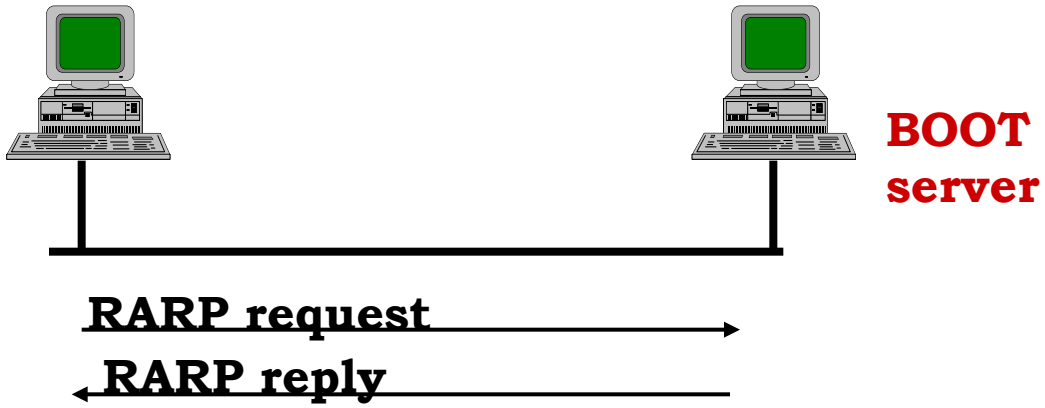


ARP Packet Format



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 !!!*



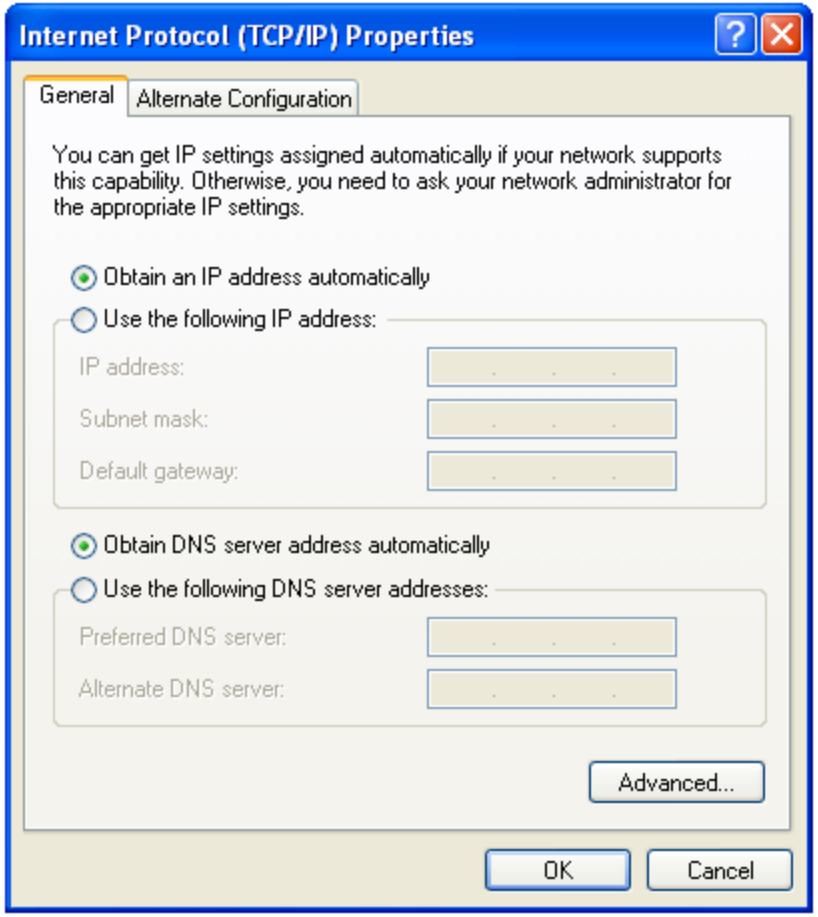
Dynamic Addresses Management

- 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

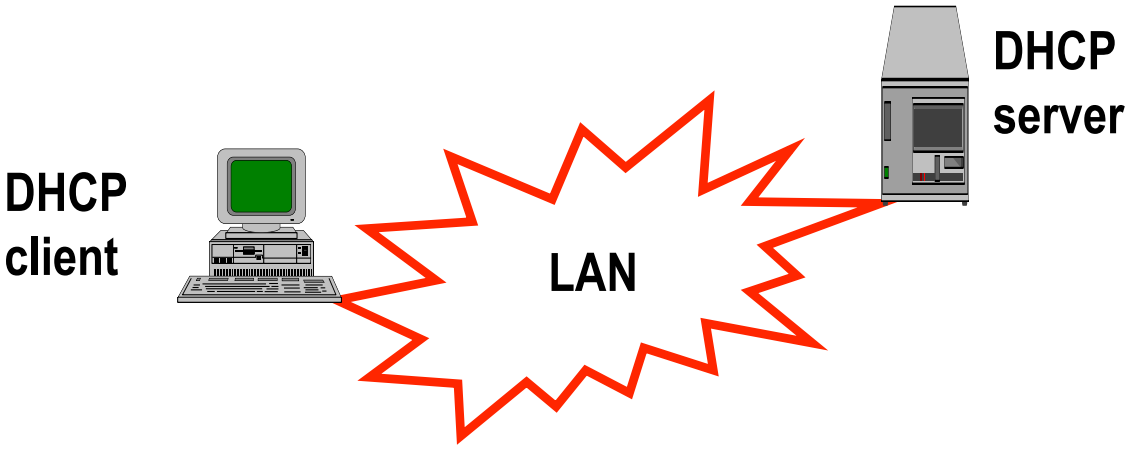


Dynamic Binding

- 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

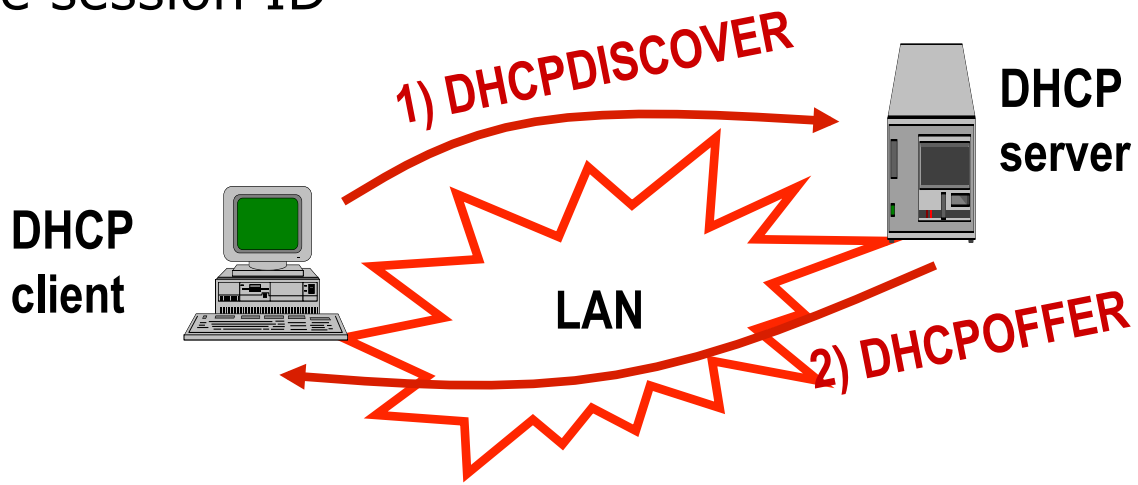
Dynamic Host Configuration Protocol (DHCP, RFC 2131)

- 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

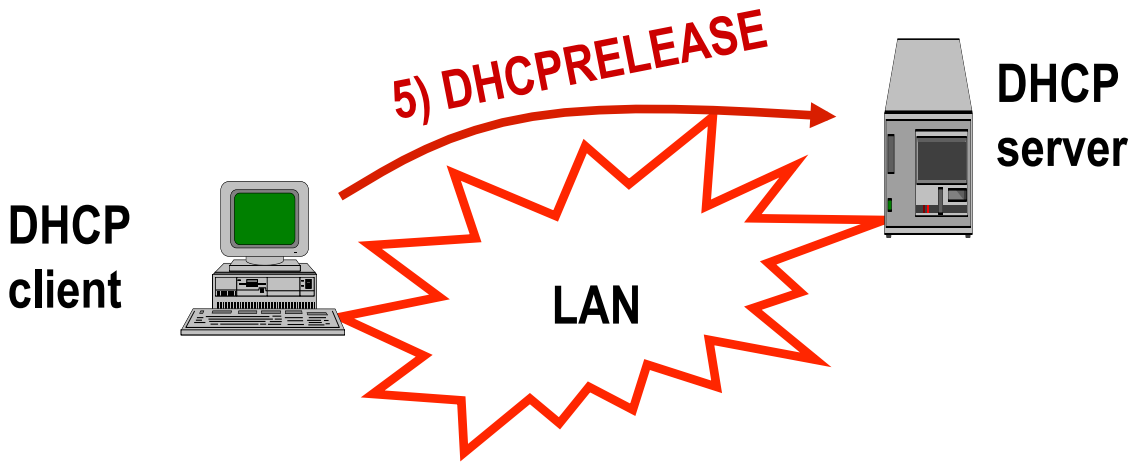


DHCP (2)

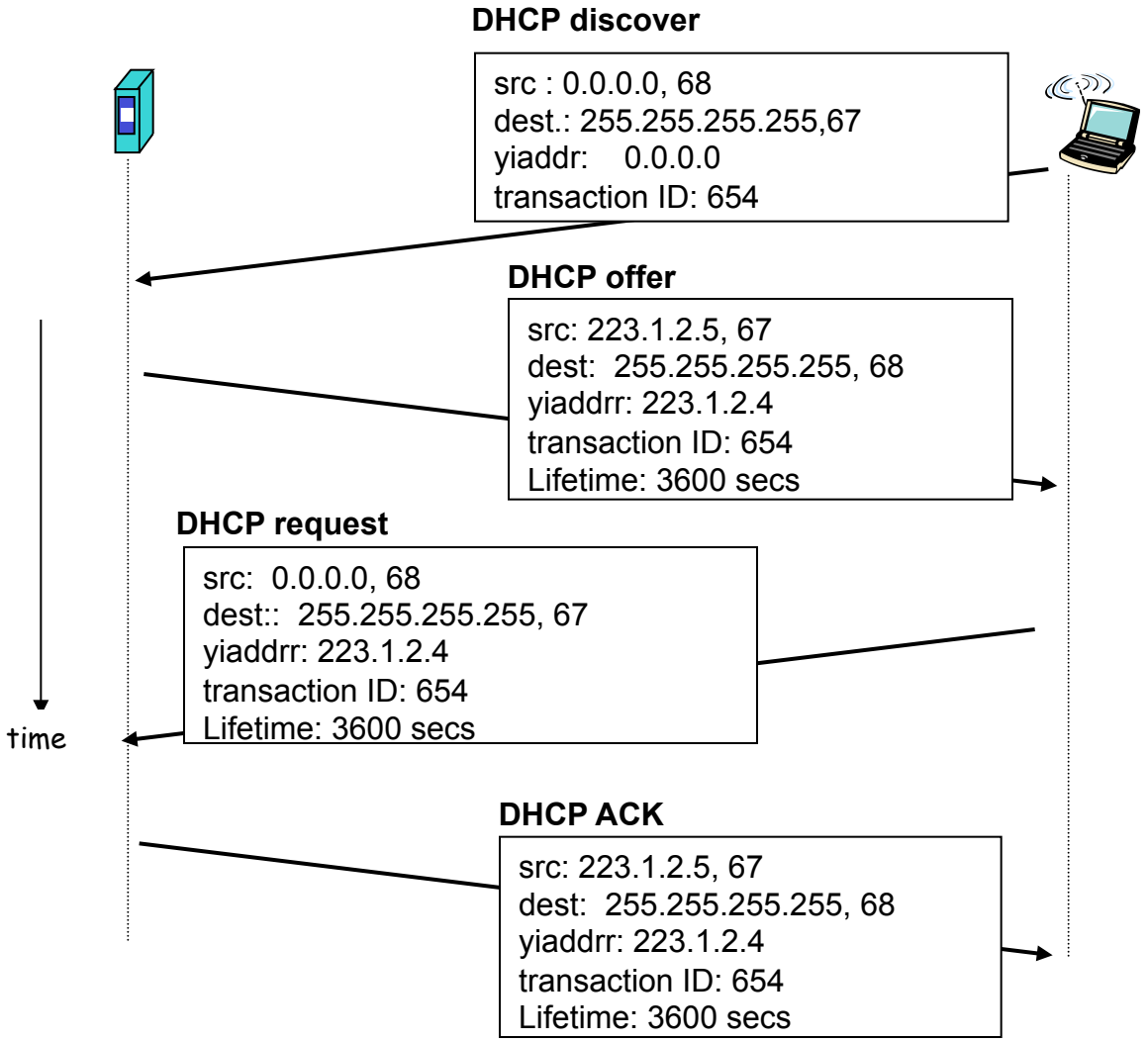
- The *client* may accept the proposal by sending a DHCP REQUEST message containing:
  - The session ID
  - The proposed parameters (IP address, netmask, lease time)
- The *server* binds the two addresses and replies with a DHCPACK message confirming the configuration.

DHCP (3)

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



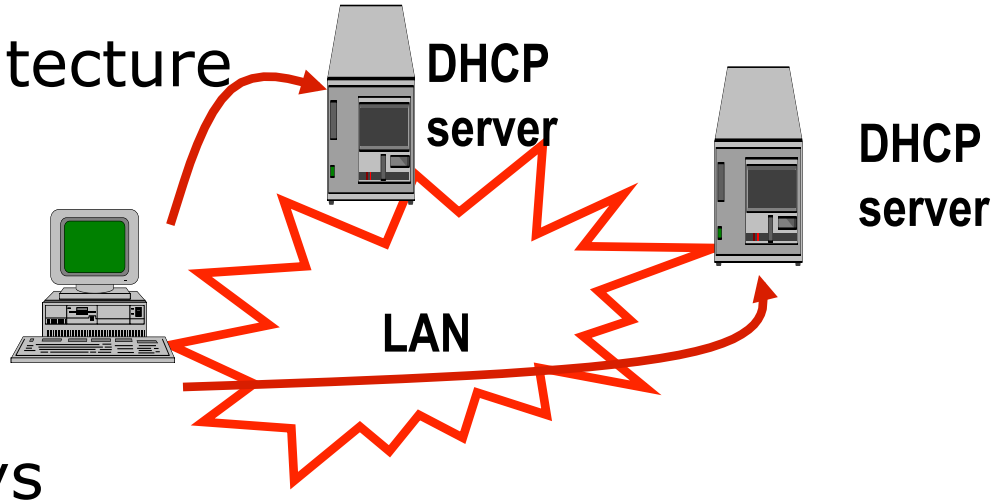
Complete Exchange



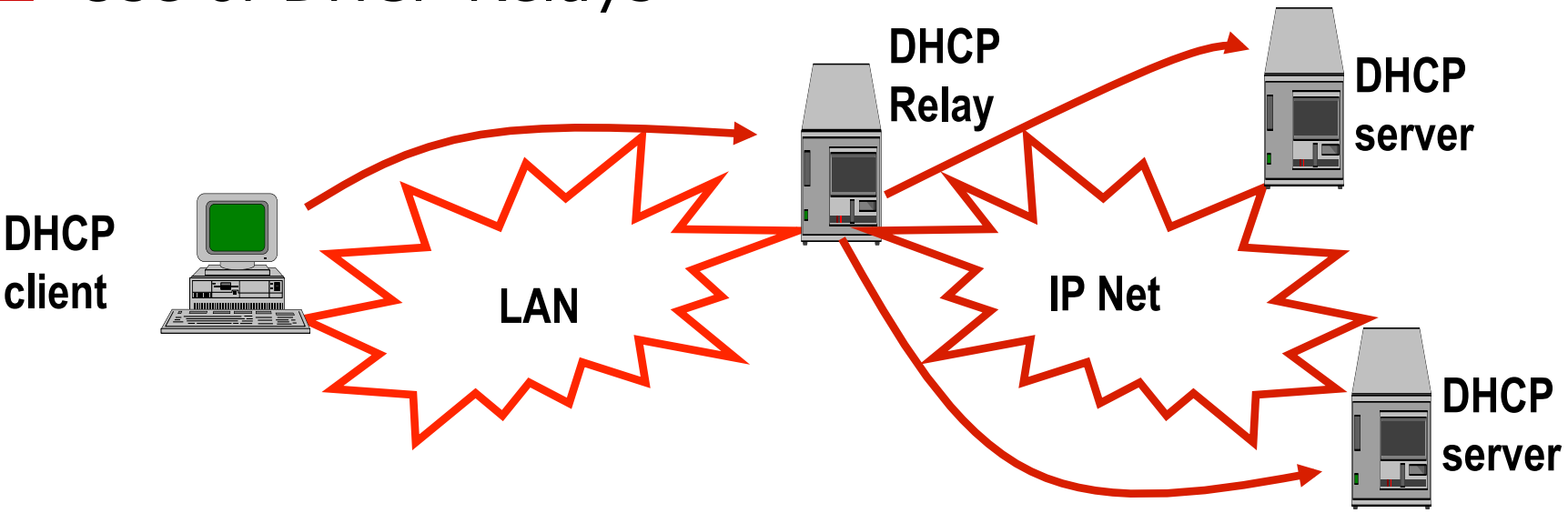
yiaddr = your IP address

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