DHCP – Dynamic Host Configuration Protocol

Computer Networking: A Top-Down Approach

9th edition

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DHCP: Dynamic Host Configuration Protocol

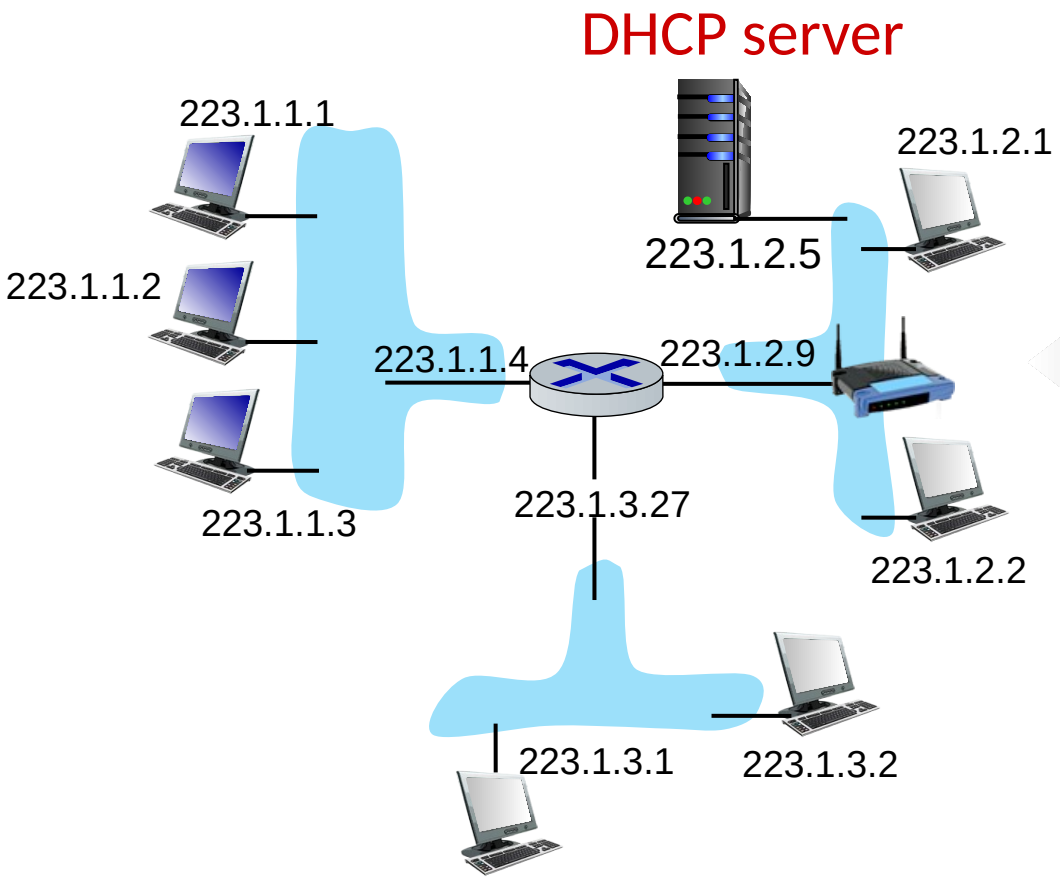
goal: host *dynamically* obtains IP address from network server when it "joins" network

- can renew its lease on address in use
- allows reuse of addresses (only hold address while connected/on)
- support for mobile users who join/leave network

DHCP overview:

- host broadcasts DHCP discover msg [optional]
- DHCP server responds with DHCP offer msg [optional]
- host requests IP address: DHCP request msg
- DHCP server sends address: DHCP ack msg

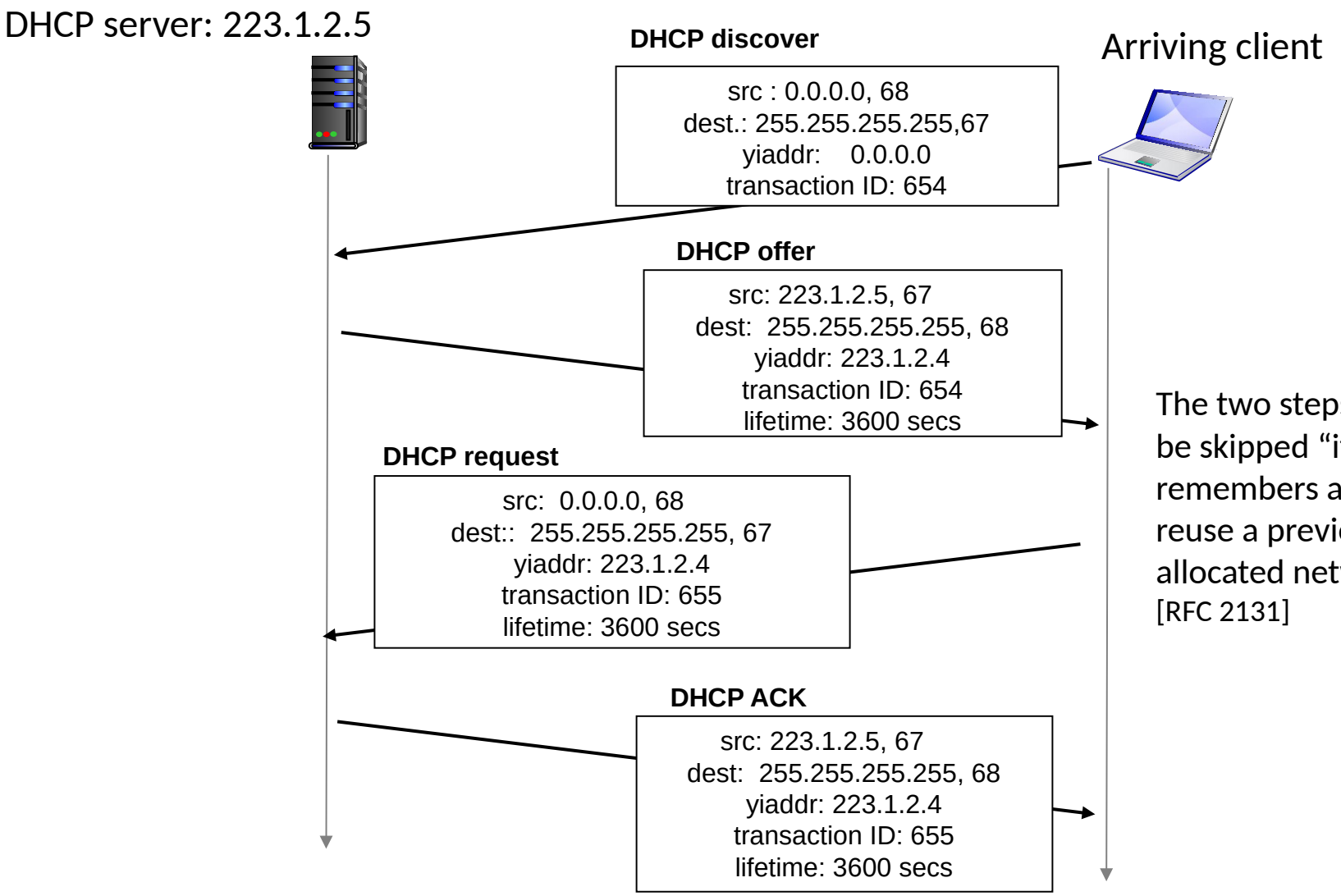
DHCP client-server scenario



Typically, DHCP server will be co-located in router, serving all subnets to which router is attached

arriving DHCP client needs address in this network

DHCP client-server scenario



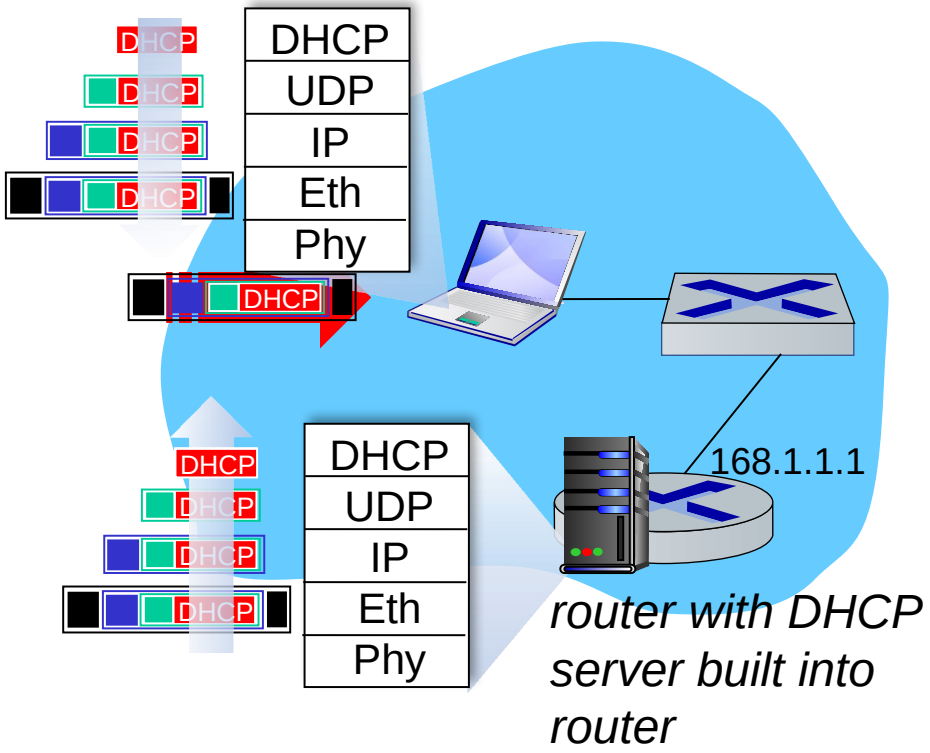
The two steps above can be skipped "if a client remembers and wishes to reuse a previously allocated network address" [RFC 2131]

DHCP: more than IP addresses

DHCP can return more than just allocated IP address on subnet:

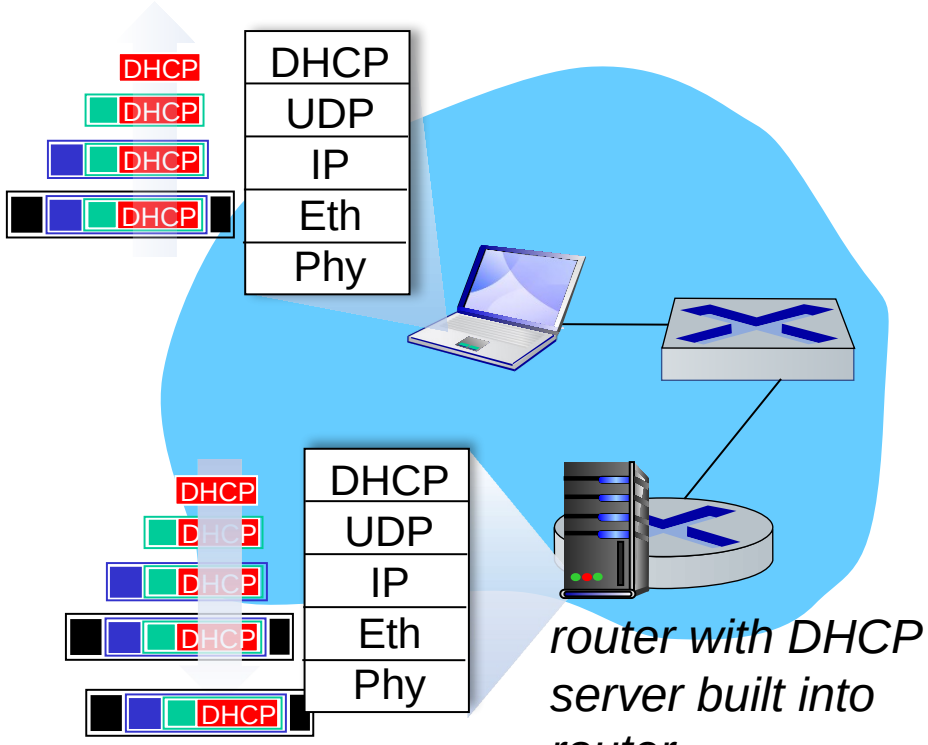
- address of first-hop router for client default gateway
- name and IP address of DNS sever
- network mask (indicating network versus host portion of address)

DHCP: example



- Connecting laptop will use DHCP to get IP address, address of first-hop router, address of DNS server.
- DHCP REQUEST message encapsulated in UDP, encapsulated in IP, encapsulated in Ethernet
- Ethernet frame broadcast (dest: FFFFFFFFFFFF) on LAN, received at router running DHCP server
- Ethernet de-mux'ed to IP de-mux'ed, UDP de-mux'ed to DHCP

DHCP: example



router with DHCP server built into router

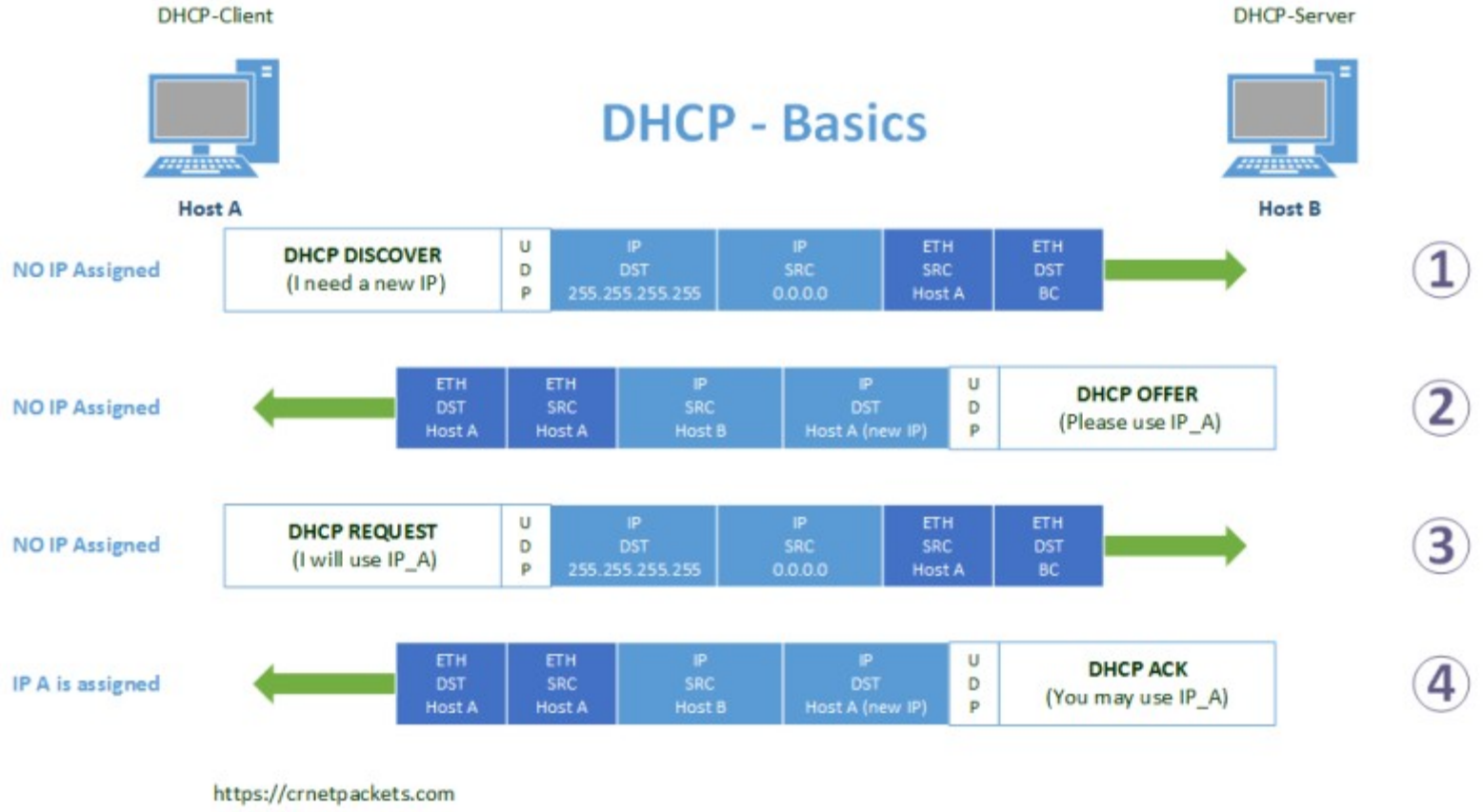
- DCP server formulates DHCP ACK containing client's IP address, IP address of first-hop router for client, name & IP address of DNS server
- encapsulated DHCP server reply forwarded to client, de-muxing up to DHCP at client
- client now knows its IP address, name and IP address of DNS server, IP address of its first-hop router

DHCP: Which layer protocol?

- Not a Network layer protocol
- Why not?
- Is a Application layer protocol.
- Why it is a application layer protocol?
  - Defines message formats

DHCP operates at the Application layer (Layer 7) of the OSI model because it provides network configuration services such as assigning IP addresses, subnet masks, gateways, and DNS information to hosts. It works as a client–server application and uses lower-layer protocols (UDP at Layer 4 and IP at Layer 3) only for message delivery. Since DHCP makes configuration decisions rather than handling data transport, routing, or framing, it is classified as an Application-layer protoco

DHCP: Layering



DHCP: Encapsulation

- A DHCP message is inside a UDP segment, which is inside an IP packet.
  - *Encapsulation layers:* The process follows the standard network model, with DHCP at the application layer.
    - DHCP messages are sent within a User Datagram Protocol (UDP) segment.
    - The UDP segment is then placed inside an Internet Protocol (IP) packet.
  - *Why this order:*
    - UDP: DHCP relies on UDP for speed rather than guaranteed delivery.
    - IP: The IP packet provides the source and destination IP addresses to route the message across networks.

DHCP: Encapsulation