LAN Addresses and ARP

32-bit IP address:

- *network-layer* address
- used to get datagram to destination network (recall IP network definition)

LAN (or MAC or physical) address:

- used to get datagram from one interface to another physically-connected interface (same network)
- 48 bit MAC address (for most LANs) burned in the adapter ROM

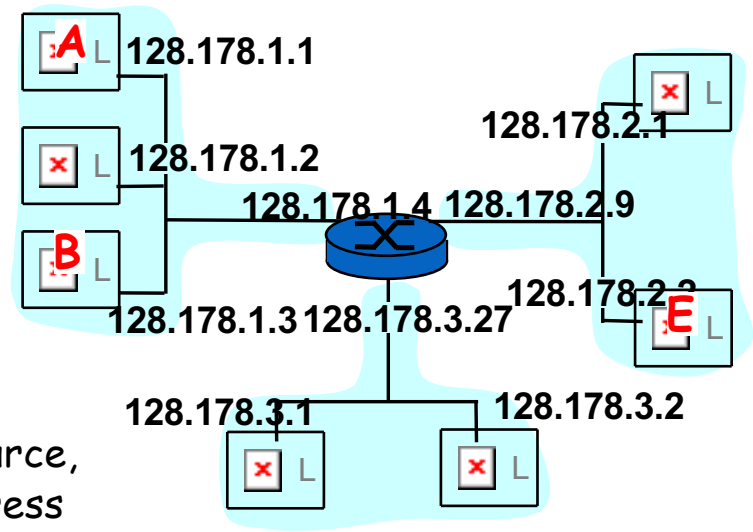
Why different addresses at IP and MAC?

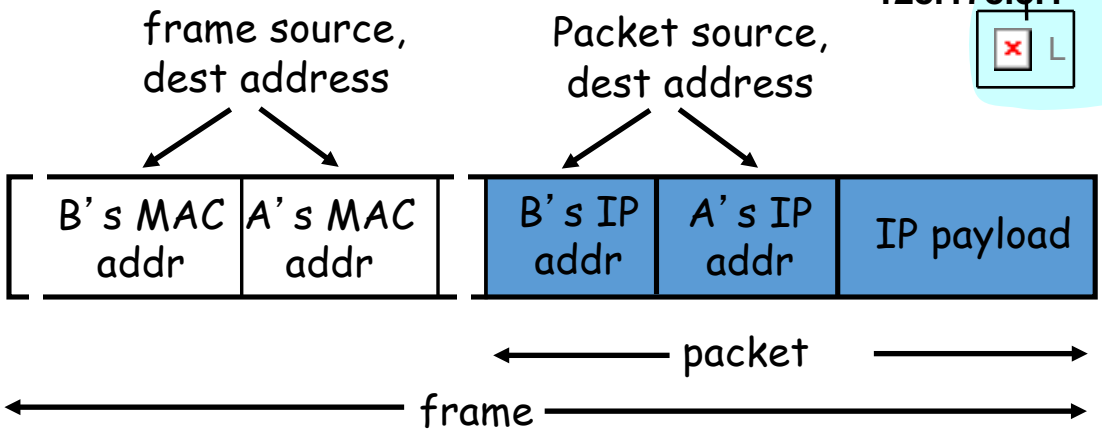
- LANs not only for IP (LAN addresses are neutral)
- if IP addresses used, they should be stored in a RAM and reconfigured when host moves
- independency of layers

MAC Address resolution

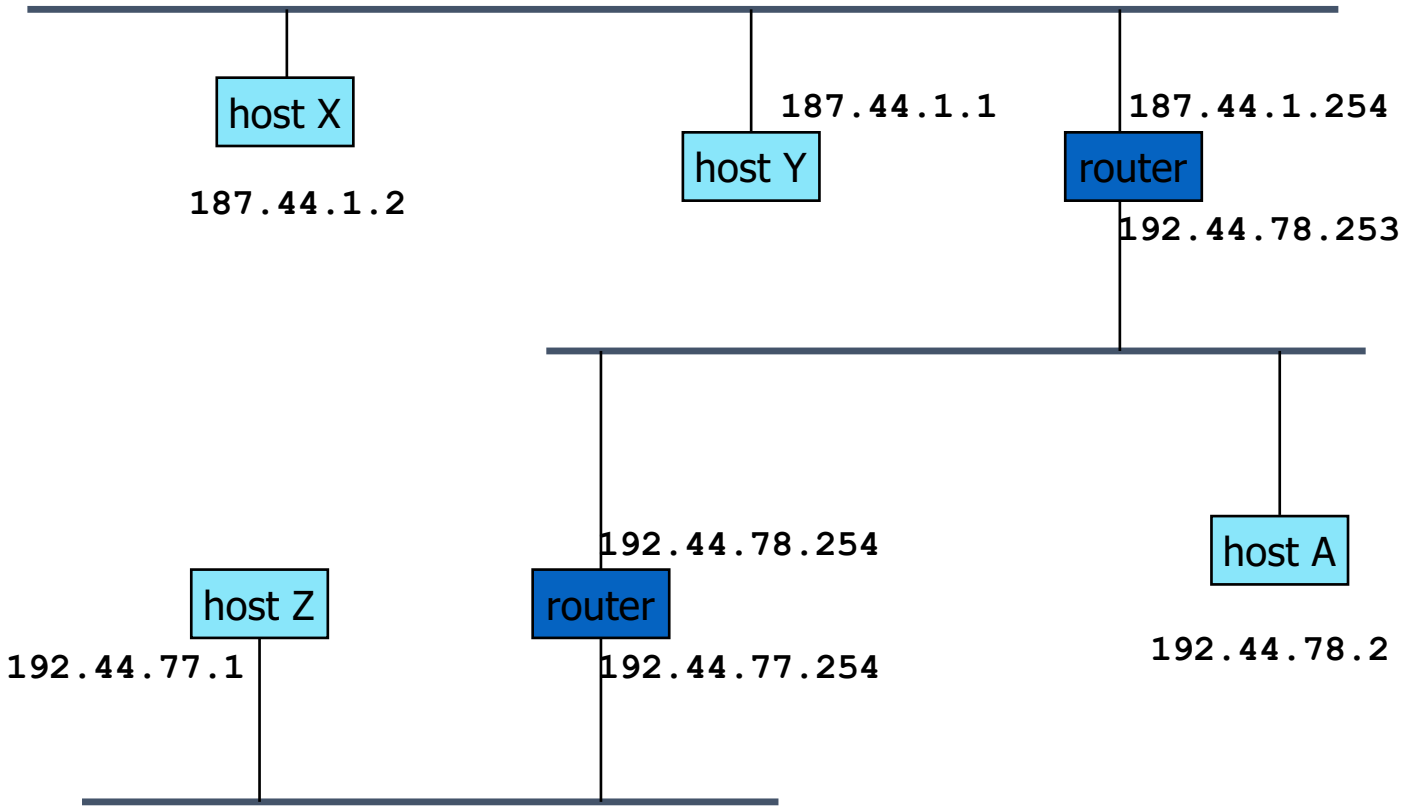
Starting at A, given IP datagram addressed to B:

- look up net. address of B, find B on same net. as A
- link layer sends packet to B inside link-layer frame





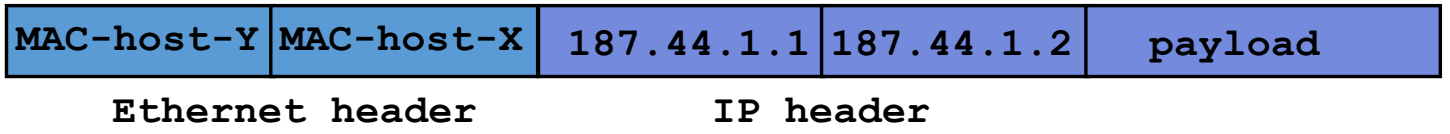
Example



- Host A is on subnetwork `192.44.78`

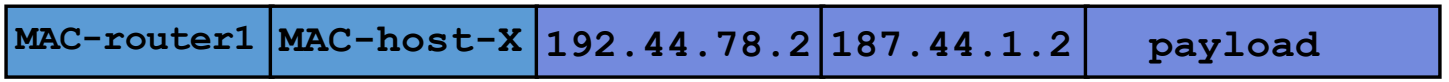
Packet delivery

Packet sent by `187.44.1.2 to 187.44.1.1`



X needs to know MAC address of Y (ARP)

Packet sent by `187.44.1.2 to 192.44.78.2`



X needs to know MAC address of router (X knows the IP address of router - configuration)

Router needs to know MAC address of A

ARP: Address Resolution Protocol

ARP is used to determine the MAC address of B given B's IP address

- Each IP node (Host, Router) on LAN implements ARP protocol and has ARP table
- ARP Table: IP/MAC address mappings for some LAN nodes

  < IP address; MAC address>

  < ..... >

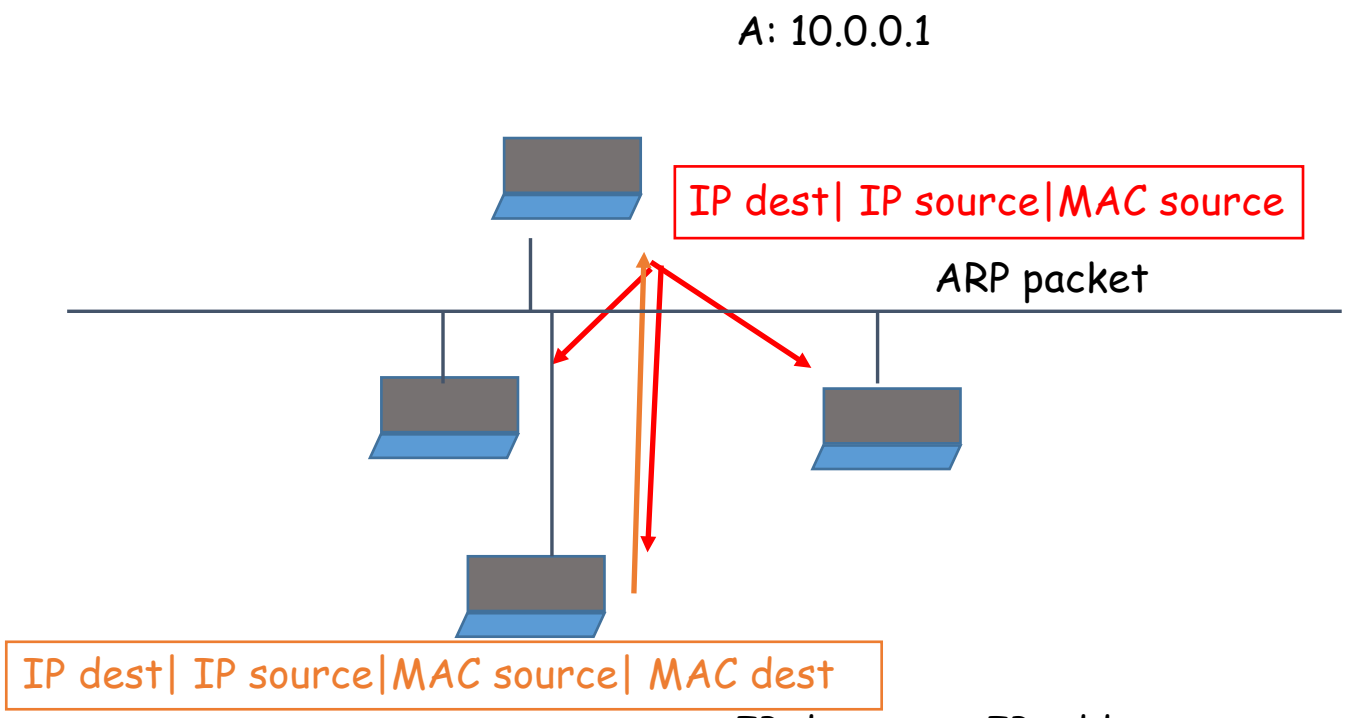
  - ARP table is a cache: after an interval (typically 20 min) the address mapping will be forgotten

ARP protocol

- A knows B's IP address, wants to learn physical address of B
- A broadcasts ARP query pkt, containing B's IP address
  - all machines on LAN receive ARP query
- B receives ARP packet, replies to A with its (B's) physical layer address
- A caches (saves) IP-to-physical address pairs until information becomes old (times out)
  - soft state: information that times out (goes away) unless refreshed

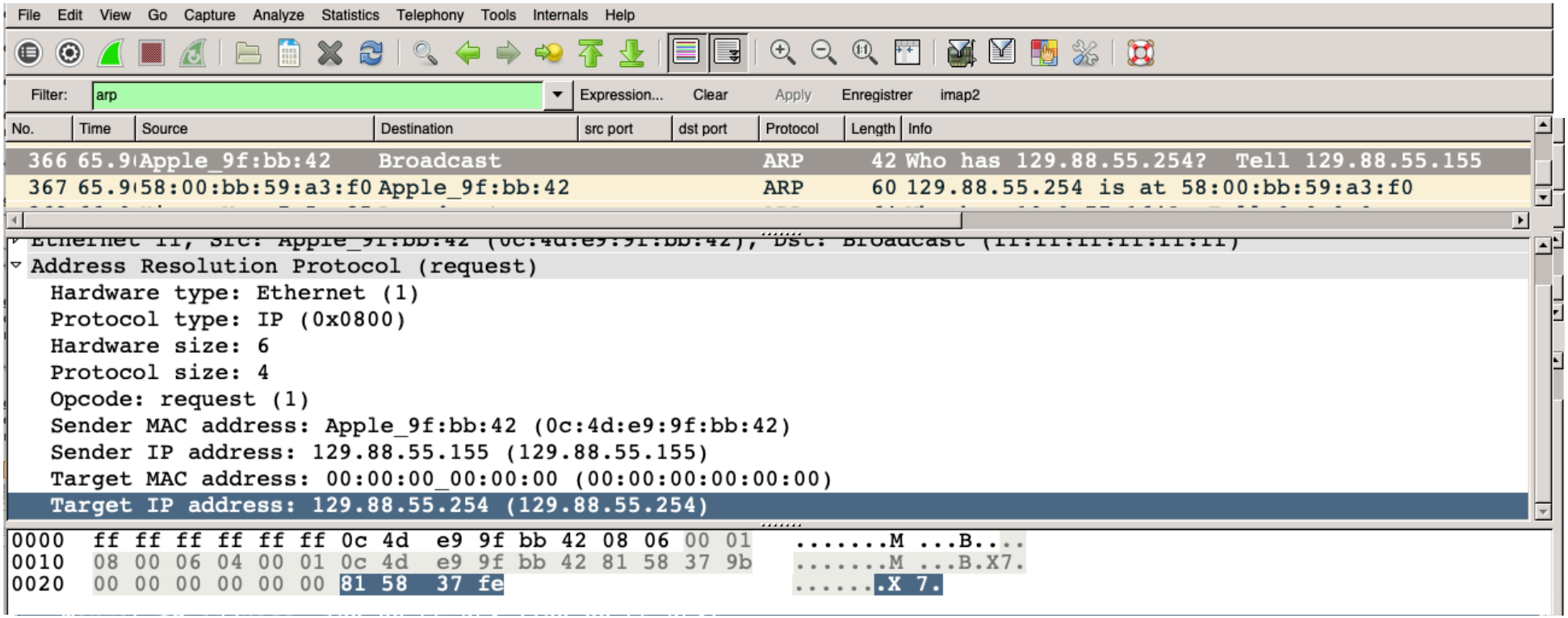
ARP protocol

IP address	MAC address	TTL
10.0.0.2	49:BD:D2:07:56:2A	6:00:00



ARP frames

- Request (**broadcast**)
  - sender Ethernet address
  - sender IP address
  - target Ethernet address ???
  - target IP address
- Reply (**unicast**)
  - sender Ethernet address
  - sender IP address
  - target Ethernet address
  - target IP address



Routing to another LAN

- Walktrough: routing trhough a router